Westpower

Asset Management Plan 2014 - 2024

From 1st April 2014 to 31st March 2024

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Westpower

Contents

1.0 EXECUTIVE SUMMARY

1.1 Purpose of the Plan

The Asset Management Plan (AMP) is a foundation document that drives the planning for all work undertaken on Westpower's assets. In particular, it is a key element of Westpower's asset management framework and is used to demonstrate compliance with good asset management practice in terms of the international PAS-55 standard.

Each year, a comprehensive update of the plan is completed, including network changes that have taken place. Furthermore, the results of a formal, external peer review process are taken into account to ensure that this plan meets current disclosure requirements in terms of the Electricity Distribution Information Disclosure Determination Requirements 2012 and is continually improved, in terms of both content and layout.

1.1.1 Period Covered

This particular plan was completed in February 2014 and covers a planning period from 1 April 2014 through to 31 March 2024. The main focus is placed on the next three years, with updates being completed annually.

This Executive Summary is prepared for people who may not be involved within the business of electricity distribution networks and associated services, but who understand and have an interest in efficient management of Westpower's assets.

This plan was approved by Westpower's Board of Directors on 3 March 2014.

1.1.2 Objective of the AMP

The defined objective of the AMP is:

"To provide a systematic approach to the planning of programmes which are intended to ensure that the condition and performance of infrastructure assets are being efficiently maintained or improved to satisfy stakeholders requirements."

1.1.3 Company Mission and Statement of Corporate Intent

Westpower's mission is to be:

"A West Coast Company operating successful businesses which provide first class electrical and technology solutions, wherever our customers take us."

Westpower's vision is to be:

"Recognised for excellence in all links of the electricity value chain."

Salient statements from the Statement of Corporate Intent (SCI) that relate to management of Westpower's assets include:

- To continue to provide West Coast communities with a safe, secure, sustainable and cost-effective electricity distribution network;
- To ensure obligations under the Energy Companies Act 1992, the Electricity Act 1992, the Electricity Industry Act 2010 and their various amendments and regulations are met;
- To continue to lobby on behalf of West Coast consumers to ensure that a reliable transmission network is maintained into the West Coast.

1.2 Westpower's Network

This AMP includes Westpower's assets that transport electricity (owned by the electricity retailers) from Transpower's seven Grid Exit Points (GXPs) to over 13,000 electricity consumers on the West Coast of New Zealand's South Island.

The Westpower network consists of 110 kV, 66 kV and 33 kV subtransmission networks supplying 110/33/11 kV substations at Reefton and Logburn Road, 66/33/11 kV substations at Dobson and Hokitika, 66/11 kV substations at Greymouth and Kumara, and 33/11 kV substations at Globe, Blackwater, Pike River, Ngahere, Arnold, Rapahoe, Ross, Waitaha, Harihari, Whataroa, Wahapo, Franz Josef and Fox Glacier.

Transpower's seven GXPs supplying Westpower's networks are Reefton and Atarau at 110 kV; Greymouth, Kumara and Hokitika at 66 kV; Dobson at 33 kV and Otira at 11 kV.

Westpower has network assets throughout the 18,017 square kilometres of the West Coast from Lyell in the North to Paringa in South Westland with a total of some 40,000 assets in 76 classifications.

The distribution system comprises 2169 circuit kilometres of high-voltage Alternating Current (AC) distribution lines, 19 zone substations and switchyards strategically located throughout the network (which, in turn, provide an 11 kV supply for distribution to 2393 distribution substations), one control room and a telecommunications network. Figure 1.1 shows a map of the Westpower network area in relation to the other South Island ELBs. Table 1.1 shows the network summary as at 31 March 2014.

Westpower's distribution lines consist of varying line capacities, which are dependent upon local demands and geographical considerations. Operating voltages include 110 kV, 66 kV, 33 kV and 11 kV. These lines involve a large population of poles, transformers, disconnectors and other assets of varying types that are essential to the distribution of electricity. Figure 1.3 shows a diagram of Westpower's network.

Both the management and the maintenance of the network is carried out by ElectroNet Services (based in Greymouth) as the preferred contractor and a wholly owned subsidiary of Westpower. The Asset Management Division carries out all management of the assets and represents the asset owner. The Operations Division is contracted to undertake the inspection, servicing and testing, along with fault callout and fault repair work. Major line replacement, enhancement or development projects are also issued to ElectroNet Services as design build contracts. Figure 1.2 shows a photo of ElectroNet's head office in Tainui St, Greymouth.

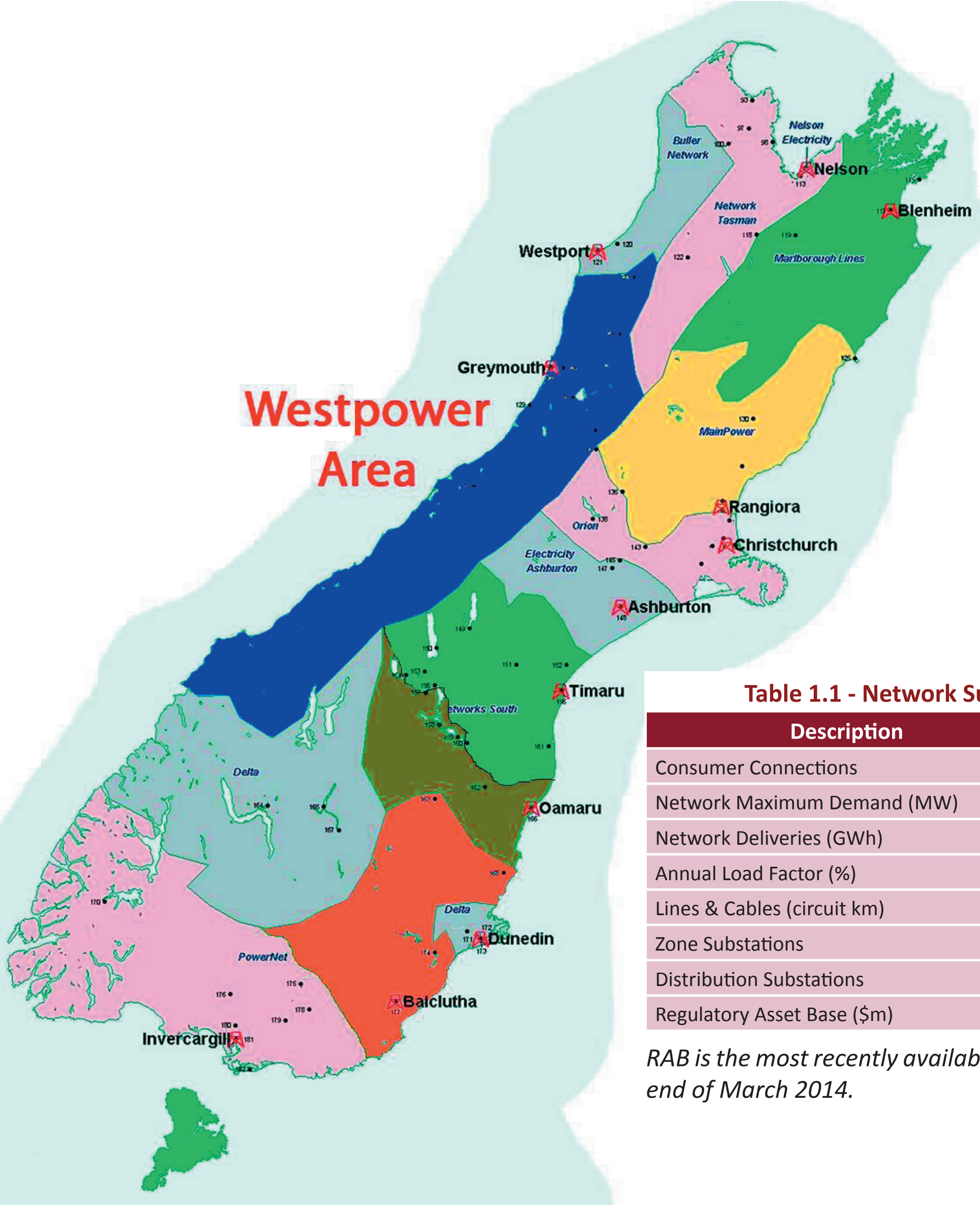

Fig 1.1 Map of Westpower's Network

Table 1.1 - Network Summary

Description	Quantity
Consumer Connections	13,186
Network Maximum Demand (MW)	48.14
Network Deliveries (GWh)	258
Annual Load Factor (%)	30%
Lines & Cables (circuit km)	2169
Zone Substations	19
Distribution Substations	2393
Regulatory Asset Base ($m)	114.5

RAB is the most recently available figure as at the end of March 2014.

Fig 1.2 Westpower's Greymouth Head Office

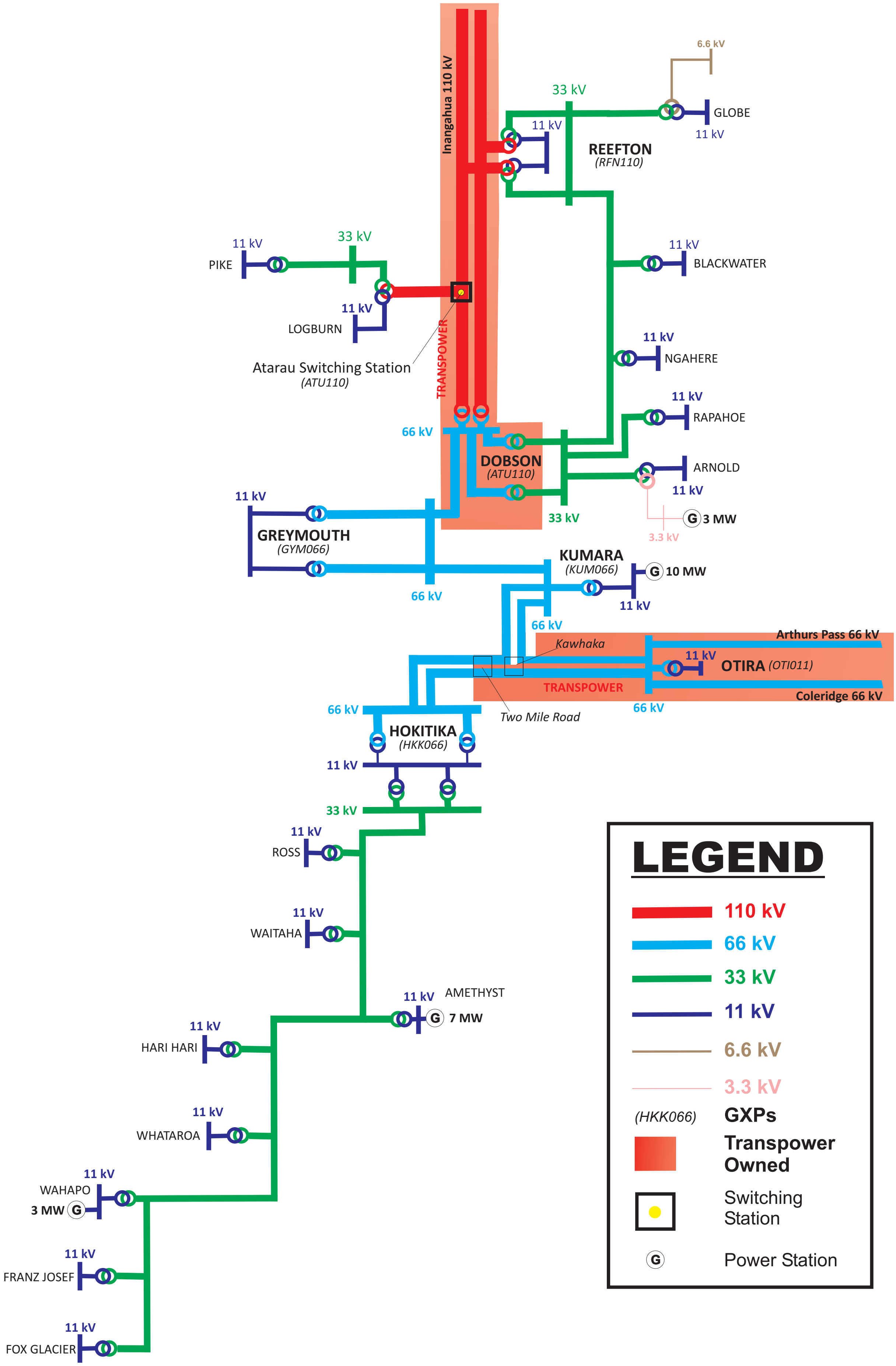

Fig 1.3 Westpower’s Network Diagram

1.3 Westpower's Asset Management Process

Figure 1.4 illustrates Westpower's asset management process. The asset management policy provides the key linkage between Westpower's strategic business plan and the asset management process. This is consistent with the SCI and is approved by the Board of Directors.

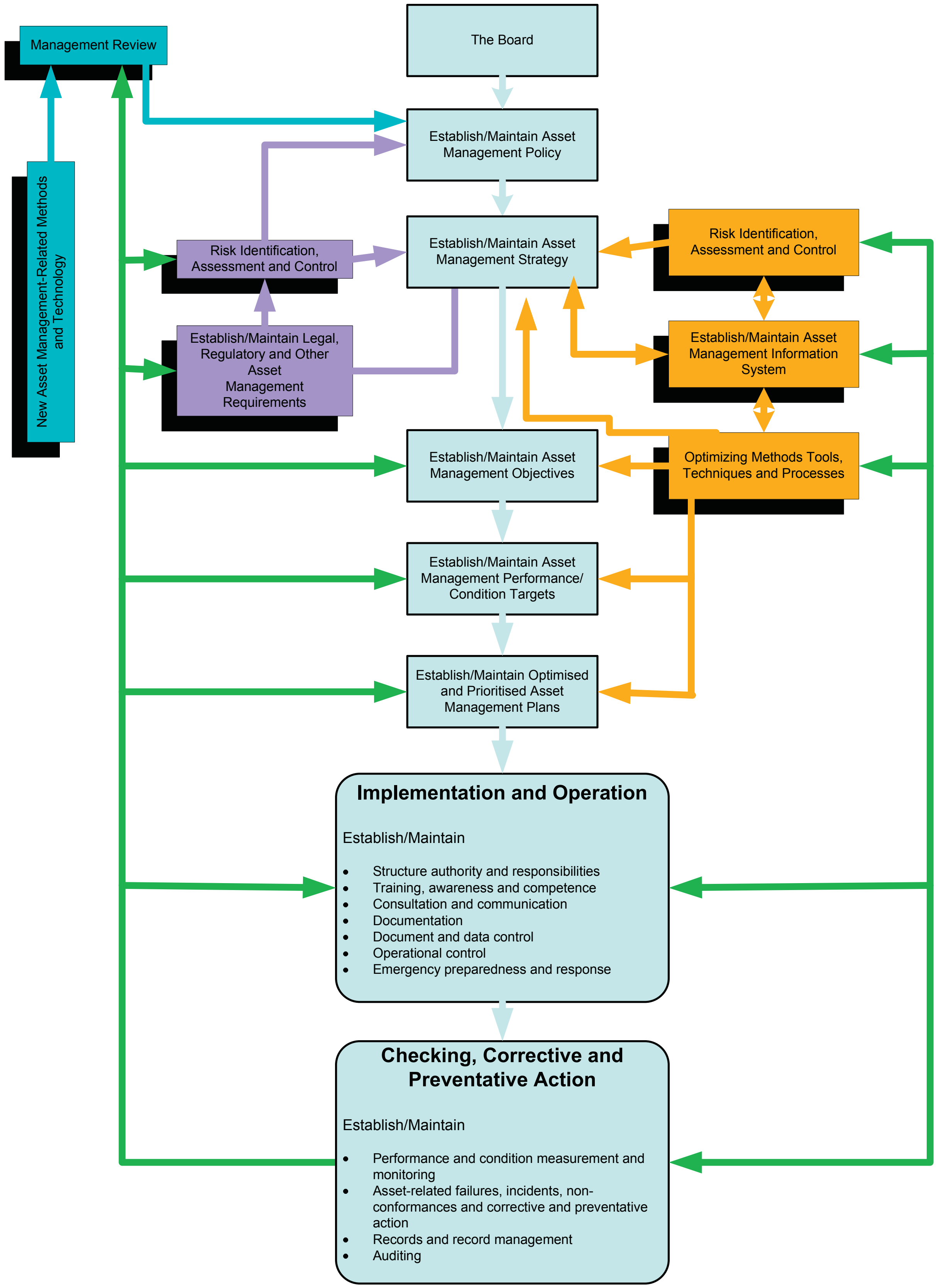

Fig 1.4 Westpower's Asset Management Process Flow Diagram

1.4 Assets Covered

Westpower owns electricity reticulation assets that are used to provide distribution and connection services to electricity retailers and generators. These assets generally comprise equipment that is common to all New Zealand ELBs and, wherever possible, industry standard assets have been employed. In particular, the AMP covers the electricity and associated systems owned by Westpower, comprising:

- Sub transmission assets – electric lines and cables, including associated easements and access ways operating at voltages of 33 kV and higher;
- Distribution assets – electric lines and cables, including associated easements and access ways operating at a voltage of 11 kV;
- Reticulation assets – 400 V electric lines and cables, including associated easements and access ways;
- Services – connection assets at any voltage owned by Westpower for the purpose of supplying a single customer (not including the line on the customer's premises).
- Zone substations – high-voltage substations connected to the sub transmission network. This includes all plant and equipment within the substations such as transformers, switchgear, structures and buswork, Supervisory Control and Data Acquisition (SCADA), protection and metering equipment, together with station land and buildings;
- Distribution substations – substations connected to the distribution network. This includes plant and equipment within the substations such as fuses, platforms, lightning arrestors and maximum demand indicators, together with land and fibreglass covers but excluding transformers;
- MV switchgear – circuit breakers, reclosers, sectionalisers, regulators and disconnecters used in the distribution and sub transmission systems;
- SCADA, communications and protection equipment – SCADA, communications and protection equipment, and associated facilities not installed at zone substations. This includes control room equipment, radio repeaters and fibre-optic systems installed, owned and maintained by Westpower;
- Distribution transformers – standard transformers used in distribution substations ranging from 5 kVA to 1000 kVA and generally having a primary voltage of 11 kV;
- Ripple control – ripple injection equipment;
- Embedded generation – generation units connected to Westpower's network but not necessarily owned by Westpower;
- Capacitor units – for voltage support;
- Mobile substation – allows improved maintenance access to existing substations and for emergency use in case of substation failure;
- Buildings – substation buildings within the Westpower network.

Westpower owns assets throughout the length of the West Coast of the South Island, this area extends about as far as the distance from Christchurch to Dunedin.

1.5 Asset Management Policy

We are committed to maximising our shareholders' investments in a legally and environmentally compliant and sustainable manner, without compromising the health and safety of our employees and consumers, or the public. We shall achieve this by adopting the following policy statement.

Safety

- Safety - Safety is of paramount importance in everything we do and will not be compromised for cost, time or any other reason.

Reliability

- Reliability of supply - Through continued investment in relevant technology and system configuration, reliability must meet approved targets at all times.
- Quality of supply - Quality of supply, commensurate with the load type and criticality, must meet Westpower's standards. Remedial action will be taken where standards are not met.

Security

- Security of supply – The desired level of security is defined by good industry practices, and long-term plans must be developed to achieve the required security.
- Transpower – We will work closely with Transpower to maintain and enhance security of supply for the West Coast.

Sustainability

- Maintain service potential - The future of Westpower's business is wholly dependent on the ability of the network to continue to provide services for the foreseeable future. Every effort must be made to maintain the ongoing service potential of the network where appropriate.
- Supporting economic growth - We recognise the electricity infrastructure as a key enabler of economic growth and will work with current and future developers to provide electricity with the capacity, security and quality required to support their business.
- Continual improvement – The asset management system will be reviewed on an annual basis and where weakness is found, improvements will be made. Compliance with PAS-55:2008 shall be supported.
- Strategic and long-term planning – Our infrastructure business involves long-term investments and we will ensure our decisions align with and support the organisation's strategic plan.
- New investment – Any new investment must meet the shareholders' expectations and, where necessary, prior approval.
- Communication – The requirements of the asset management system must be communicated to all stakeholders to enable them to be aware of their obligations and to ensure their expectations are considered in all aspects of planning.

Efficiency

- Cost-efficiency - All projects must compete for financial resources. Prudent asset stewardship requires careful budgeting and robust financial review processes to ensure maximum cost efficiency is assured. Opportunities for improved productivity through training, technology, process improvements or other means shall be constantly pursued.
- Energy-efficiency – Energy-efficiency is encouraged in all areas of Westpower's activities and will continue to be a key outcome from the design process. Where opportunities exist to enhance energy-efficiency for existing assets, these are actively pursued and implemented where technically and economically feasible.
- Technology - Technology is seen as a key enabler in providing improved service and value to our consumers. We will continue to keep abreast of developments in the field of new and emerging technology, and apply these to Westpower's network where appropriate.
- Fair pricing – The price of electricity to consumers must be transparent and fair to all users of the assets.
- Capital contributions – Any expense for network extensions to supply new loads will be met by a consumer contribution towards the costs involved.

Environmental Impact

- Environmental impact - Westpower is environmentally responsible and carefully considers the environmental impact of any of its actions. Furthermore, the company works hard to mitigate any negative effects and provide a net environmental benefit where this is practical.

Risk Management

- Risk Management – Westpower shall align its risk management practices with AS/NZS ISO 31000:2009 and shall maintain a group risk management plan that includes business impact analysis and business continuity planning. The asset management system shall include a risk management plan that is directly related to Westpower's distribution assets.

1.6 Levels of Service

Westpower's primary business is to provide a secure, high-quality electricity supply to its consumers in a cost-effective manner and to ensure that stakeholder's interests are met. To achieve these objectives, we are in continued consultation with consumers to ensure that their requirements are considered.

We believe this consultation has resulted in a strong focus on continuity of supply, which is reflected in the comparison of international reliability measures (e.g. the System Average Interruption Duration Index or SAIDI, with other ELBs).

Table 1.2 provides an overview of our performance in the key areas of service. A more detailed version of this table is shown in Section 4 (as Tables 4.1 and 4.2), which break down the SAIDI and SAIFI (System Average Interruption Frequency Index) figures into the urban, rural and remote rural categories.

The targets shown in Table 1.2 are the same as those set in the 2013-2023 AMP and are based on normalised data that exclude extreme events, according to the Commerce Commission's definition. This approach better represents the underlying performance of the network and provides for a more meaningful comparison with other ELBs.

Table 1.2 - Service Level Performance Summary

Service Criterion	Quality Group	Target Level of Service	Level of Service	Indicator	Measurement Process
Reliability	Faults/100 km of cct	5.76	5.09	Figures for total values disclosed in accordance with the Electricity Information Disclosure Requirements 2008	Westpower network faults, logged as outages occur
	Total SAIDI	175	213		
	Total SAIFI	1.99	3.12		
	Total CAIDI	88	68		

1.7 Reliability Trends

The harsh geographic nature and extreme weather conditions experienced on the West Coast can contribute to unpredictable supply outages. With this in mind, every effort has been made to mitigate these natural environmental factors by means of protection devices such as automatic reclosers on distribution lines and lightning arrestors on all distribution substations.

Historical reliability statistics indicate that a relatively high number of faults are incurred due to tree strikes. For this reason, an on-going and comprehensive tree-trimming programme has been instituted to reduce the number of outages from this source. Figure 1.5 shows the reliability trends based on “tree-related” issues only and the impact of the programme since 2004-05.

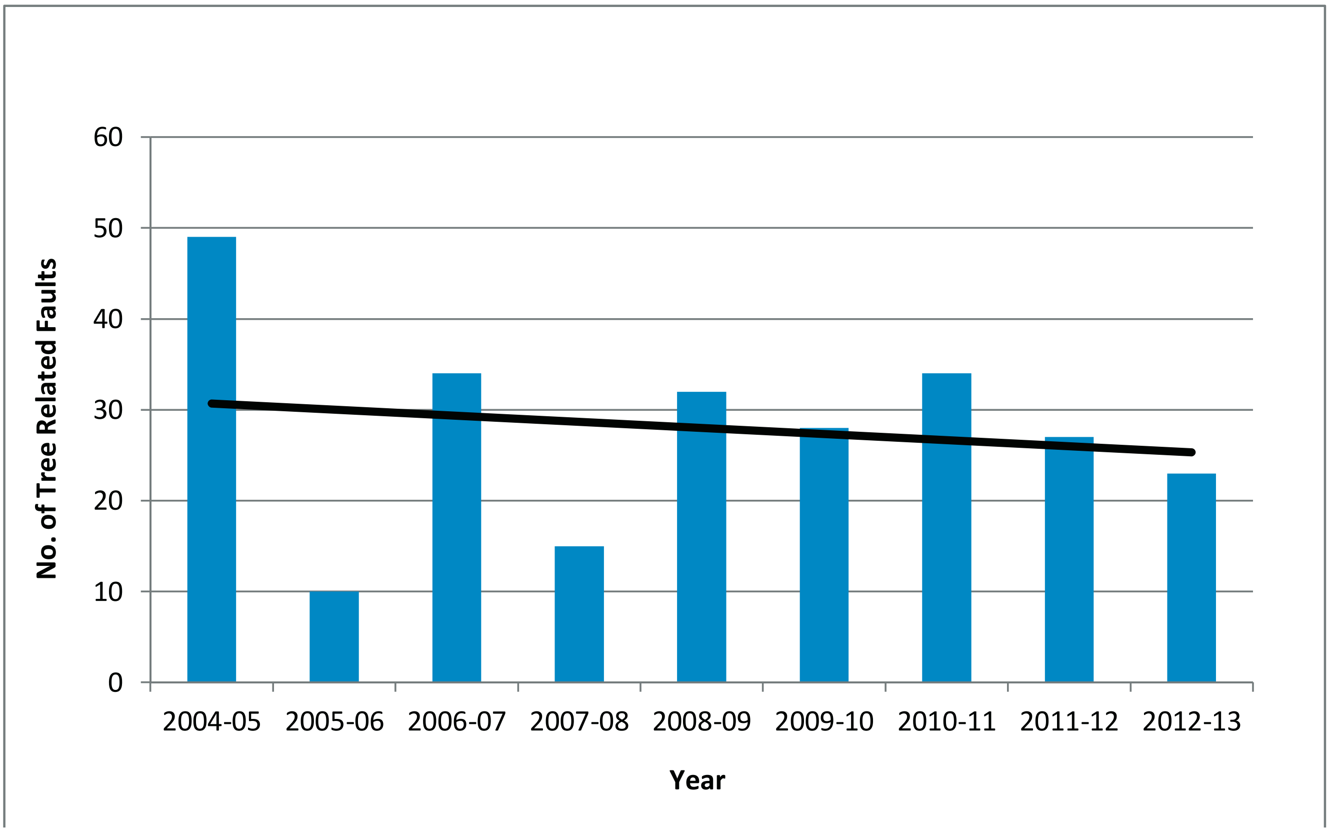

Fig 1.5 Number of Vegetation-Related Faults

To assist in preventing outages during planned maintenance, contractors are encouraged to employ live line techniques where practicable and safe to do so.

Figure 1.6 below depicts Westpower's reliability trend over the last five years excluding Major Event Days (MEDs) as defined by the Commerce Commission.

Fig 1.6 Westpower's Five-Year Reliability Trend (Excluding MEDs)

1.8 Security of Supply

In general, Westpower's security levels meet accepted guidelines for loads of this size and type.

For loads of 10 MW and above, an n-1 security level is maintained, so that supply can be maintained in the event of any single component failure. For small loads of less than 1 MW, no backup is specifically provided, except where there are conveniently available back feeds for tying 11 kV feeders together.

Supply to the central business districts of Hokitika and Greymouth is secure, with adequate redundancy built in, including diverse cable routes.

The major risk to the security of supply to the West Coast lies with the Transpower network. There are two long, exposed transmission corridors into the West Coast from Inangahua to the north via Reefton and from Coleridge to the east via Otira (see Figure 1.7), supported by local generation.

Local generation has greatly reduced the risk of major system outages when a Transpower fault occurs. Furthermore, the ability to use the Westpower mobile substation for planned outages or a major plant fault provides additional security.

A second 110 kV transmission line from Reefton to Dobson and its associated equipment was commissioned in late 2011, significantly improving the security of supply in the area.

Westpower losses, which stand at approximately 5% of energy delivered, are managed through optimising conductors and transformers in accordance with good industry design principles.

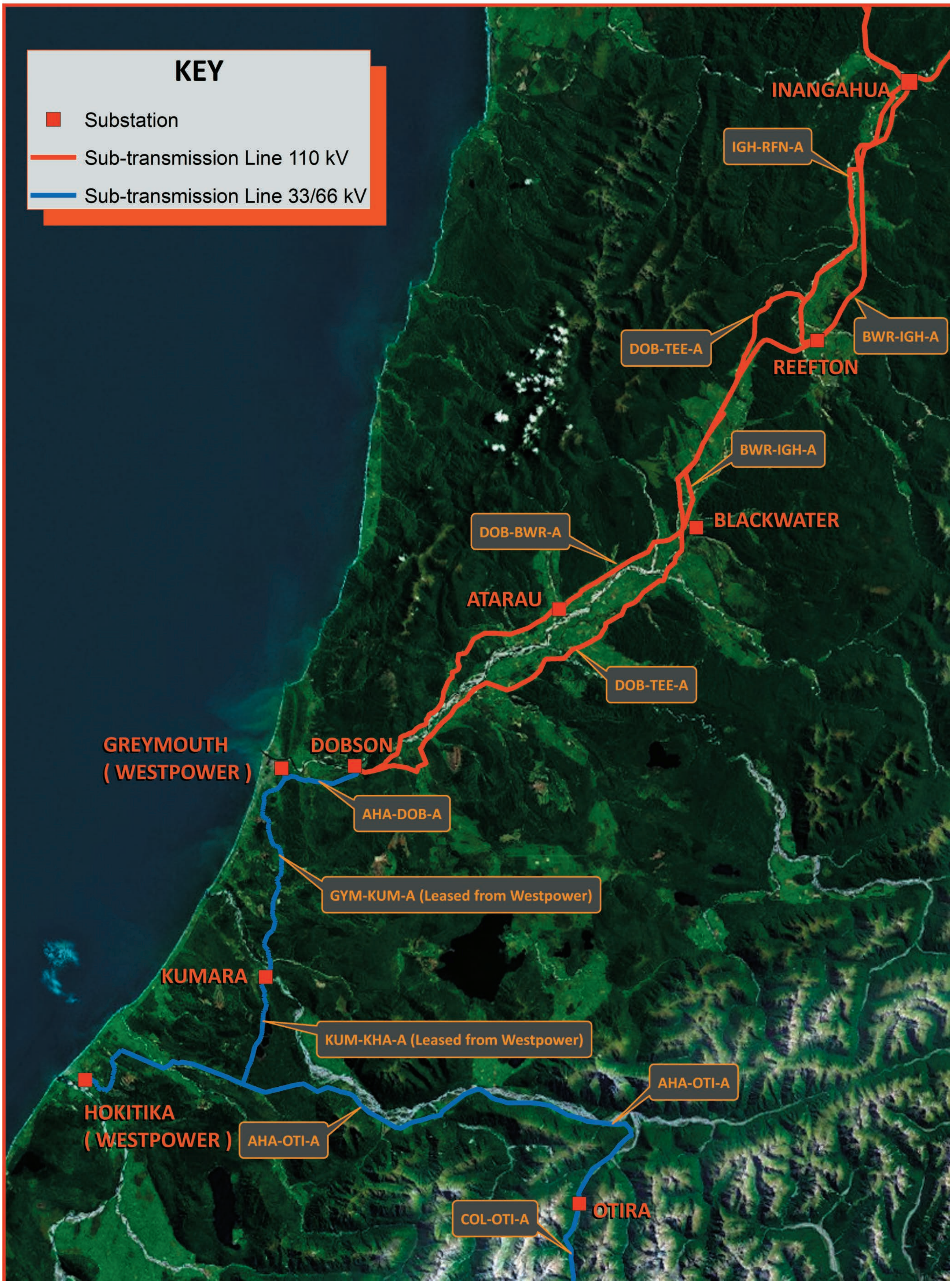

Fig 1.7 Transpower Lines and Substation Assets

1.9 Network Development

Although the key driver for development of the Westpower network is demand, system security is also a major factor. The West Coast area is currently experiencing relatively flat economic growth following a buoyant period over recent years. The Pike River mine disaster that occurred on 19 November 2010 and Solid Energy's 2012 decision to suspend all the work at its Spring Creek mine have had a significant impact on load growth forecasts. For the purposes of this plan, it is assumed that the mines will not restart within the next four to five years. Notwithstanding this impact, underlying growth in other industries continues to underpin economic performance in the area.

To identify the future impact of this driver, load forecasting is carried out at the zone substation level this is critical to ensure that sufficient capacity is available in Westpower's sub-transmission and zone substation infrastructure. These forecasts are developed using a zero-based approach from information and requests received directly from customers, including intelligence on future load trends such as proposed dairy farm conversions. A summary of the results by major zone substation is shown in Figure 1.8. This shows that the current after diversity maximum demand (ADMD) of around 50 MW will remain relatively flat in the short to medium term and will increase to

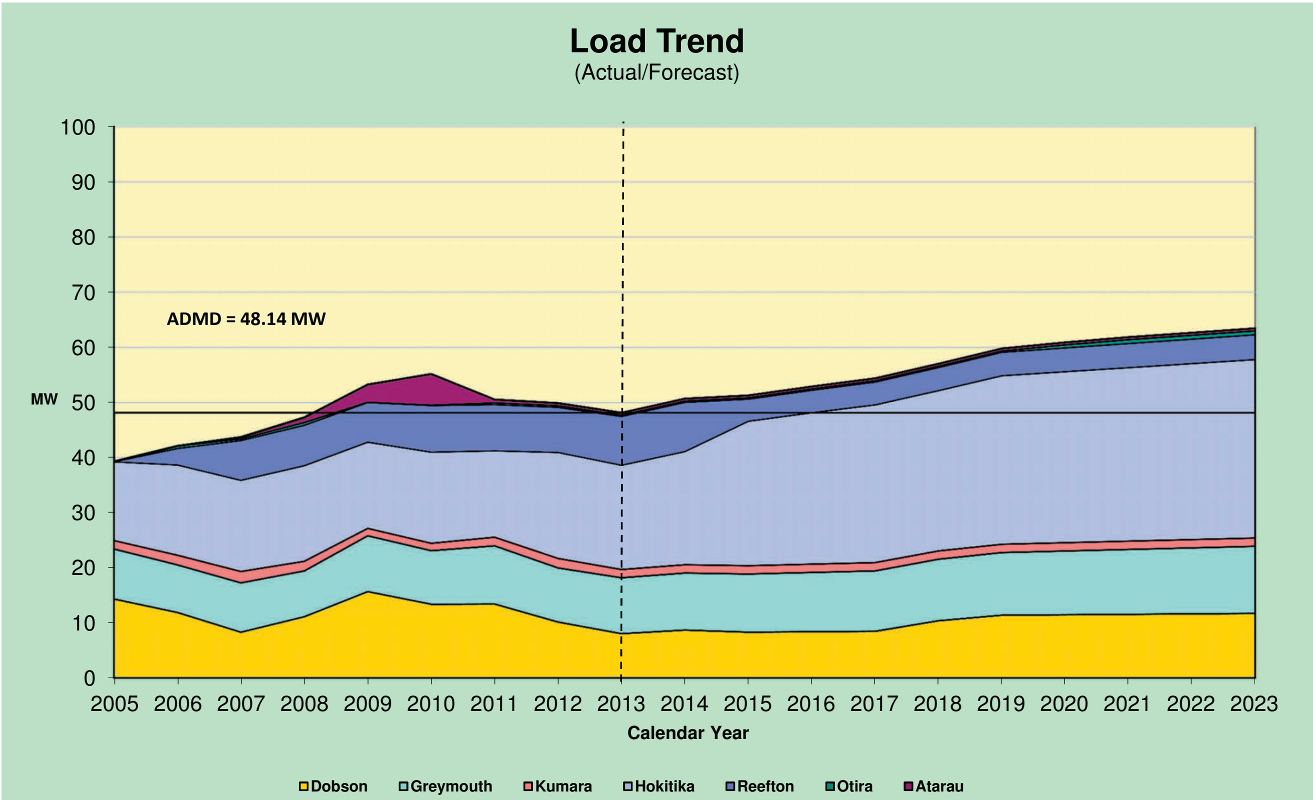

Fig 1.8 Load Trend - Actual and Forecast (Including Local Generation)

around 60 MW by 2022, depending on future economic growth.

In Westpower's case, most of the sub-transmission infrastructure has been built within the last 25 years and has been prudently designed to cater for likely future demand, which means that there is usually sufficient capacity to cater for marginal load growth. In the event of proposals for major new loads crystallising, each case will be considered both in isolation and in combination with other proposals, to make sure that any impacts on zone substation capacity are taken into account.

There is one major upgrade project in the pipeline, tentatively proposed for the second half of the planning period, to cater for increased generation in South Westland. This is the South Westland Grid Upgrade Project, which is contingent on a major generation project such as Westpower's proposed Waitaha Hydro Scheme proceeding, requiring additional subtransmission capacity.

This project involves upgrading a section of the Hokitika-Waitaha 33 kV line to 66 kV along with conversion of the Ross and Waitaha substations to 66 kV operation. A possible variation to this plan involves the option of supplying the relatively small Waitaha load at a lower voltage from nearby Ross.

Because of the poor condition of the existing asset, Westpower has already repoled and reconductored the existing 33 kV line from Hokitika to Waitaha, and this has been done in such a way as to facilitate future conversion to the higher operating voltage if and when this is required.

1.10 Lifecycle Management Plan

Westpower has adopted a programme to manage the lifecycle of its assets from design and planning through to disposal. The methodology used to prioritise projects is described in more detail in Section 6 of this AMP.

A typical lifecycle of any asset consists of the following stages:

- Design and planning,
- Acquisition and installation,
- Maintenance and operation,
- Disposal.

For planning purposes, Westpower now uses a decision support system that prioritises capital expenditure based on a number of key drivers such as reliability, equipment condition and asset criticality, and uses this expert system to prioritise future investments. The justification for using this approach is the need to have objective assessments of the relative importance of each project competing for limited capital resources.

As far as assessment of future reliability performance is concerned, probabilistic methods are used for distributed assets such as rural distribution lines, whereas a deterministic approach is still used for connection assets feeding large loads as discussed in Section 5.2.2.

All equipment acquired and installed within Westpower's network will be new, unless used equipment is accepted by Westpower on an item-by-item basis. Such equipment will be accepted only on conditions specified by Westpower.

Maintenance work is largely based on the condition of the assets. Life extension strategies are now being applied, and these provide a valid alternative to a policy of replacing older equipment, ensuring that a reasonable balance is maintained between these two approaches.

Decommissioned equipment or materials are only disposed of when they are not required as critical spares and there is a low likelihood of them being required in the future.

The main drivers for the decision-making process in developing the forward work programme are:

- Reliability/security and quality of supply, to meet customer levels of service and contractual obligations;
- Occupational health and safety, to establish a safe working environment and comply with public safety management requirements;
- Regulatory, to meet regulations imposed by external organisations;
- Environmental, to comply with emission regulations relating to air, land and water;
- Asset performance/condition, to use historical data to assess the performance and condition of the assets and to predict potential remaining life;
- Cost-efficiency, to ensure that maximum cost-efficiency is achieved in accordance with the asset management policy;
- Corporate image, to ensure that any activity carried out by the asset management team and subcontractors will not damage Westpower's image.

1.11 Financial Summary

Typically, 83% of current maintenance expenditure on network assets is scheduled in advance (i.e. planned work). Another 5% of maintenance is not planned but is required to be done as repairs to the network's assets. The remaining 12% of maintenance expenditure is for remedial work (i.e. fault repairs) to restore the network to its full initial service potential following the restoration of supply after a fault event.

Capital expenditure typically represents 30 % of the total AMP expenditure, while maintenance expenditure represents the remaining 70 %. Table 1.3 shows the summary of forecast expenditures for the 2015-2024 period.

No provisions for inflation have been made in these figures for the first 5 years of the planning period.

Table 1.4 has been broken down into the category sub-groups of Faults, Repairs and Inspection, Service and Testing (I, S & T) for maintenance expenditure; and replacement, enhancement and development for capital expenditure.

Table 1.3 - Summary by Category ($'000)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Capital Expenditure	2403	2487	2138	2093	2211	3645	2957	2813	2218	2166
Maintenance Expenditure	5538	5241	5136	5189	5270	5293	5413	5683	5823	5902

Table 1.4 - Summary by Activity ($'000)

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
IS&T	4744	4442	4338	4353	4421	4429	4531	4746	4868	4941
Faults	486	486	486	514	515	520	524	557	561	561
Repairs	308	312	312	322	333	344	358	380	394	400
Replacement	1212	1125	877	827	920	546	1580	1437	821	863
Enhancement	511	415	472	547	513	2209	534	466	442	489
Development	680	947	789	719	778	890	843	910	955	814

Actual capital expenditure for the year ending March 2014 is close to budget once a number of projects that were deferred because they were no longer required are taken into account. Baseline capital expenditure in future years is lower than previously forecast as a result of a new focus on component level replacement for some assets, where better condition assessment information shows this to be a more appropriate strategy. Most major replacement programmes are coming to an end after a sustained period of renewal, and the forward capital works programme reflects this.

1.12 Asset Management Practices

Westpower is constantly striving to find more efficient ways to carry out its daily functions, by reducing costs and improving productivity.

The benchmark of best commercial practice is constantly moving, as demonstrated through the industry information disclosure regime, which looks at factors such as price and supply reliability. Therefore, Westpower must be dynamic and innovative, and this culture starts with the Board of Directors, which includes significant commercial and financial experience.

A key strategic goal for the business is compliance with PAS-55, a global specification for good asset management practice. Considerable progress has been made in this area, with Westpower's asset management practices now assessed as being 95% compliant with the standard. Section 8 of this document outlines the compliance issues in detail, along with a gap analysis showing where further work is needed. Westpower expects to be fully compliant within the next 12 months.

Westpower encourages suppliers to improve their services and techniques continuously, and, at the same time, negotiates competitive supply and maintenance contracts. A fully commercial relationship exists between Westpower and its contracting subsidiary ElectroNet Services, which encourages price efficiency and high productivity through commercial discipline.

ElectroNet Services provides asset management services to Westpower through the asset management group. A number of systems are employed to optimise the management of Westpower's assets. These include:

- Maximo®, proprietary asset management software produced by IBM to record and analyse all of Westpower's assets. This provides work orders and financial tracking along with asset valuation modules.
- ArcMap® Geographic Information Systems (GIS), to represent Westpower's assets spatially, with tools available to provide information such as outage data. The GIS is interfaced to the Maximo system.
- RealFlex® SCADA, to allow real time data acquisition, automation and remote control of many of Westpower's outstations.
- ETAP® Loadflow software to analyse the effect of new connections and load changes on the network.
- Gentrack Velocity® (customer relationship management) software is used to interface to the energy retailers and Electricity Registry, ensuring Westpower is compliant with current legislation. All customer data are collected for mass market and time of use metering.

The condition of all equipment is regularly assessed, and equipment technical and condition data are stored in a comprehensive database. The GIS system is used to present these data geographically.

Good practice maintenance techniques are employed wherever possible and the company regularly exchanges information with other utilities. Furthermore, the technical awareness of staff is maintained through regular staff training programmes.

1.12.1 Asset Management Systems and Information

1.12.1.1 Technology

The basic technology involved in the transmission and distribution of electrical energy has changed little over the last 50 years. Nevertheless, small incremental changes continue to be made in the materials employed, leading to improved performance and higher efficiency. Westpower will continue to monitor these innovations and apply new technologies where appropriate.

The major impact of technology on Westpower's activities will be in the areas of information technology, SCADA operation of remote pieces of plant and the potential impact of distributed generation. By means of an ongoing distribution automation programme to support these technologies, Westpower intends to continually improve the reliability of its network by reducing fault restoration times.

In response to a lack of reliable disconnector actuator products available on the market, Westpower has used its in-house resources to develop an innovative actuator that delivers the key attributes of high speed, high torque and rugged reliability required for this specific application. Along with the SCADA and communications system, this allows remote disconnectors to be quickly operated from the control room over radio links (whereas it could previously have taken up to an hour or more for fault staff to reach the site), leading to greatly reduced power outage times.

Furthermore, a programme of replacing older, unreliable reclosers and sectionalisers with new, highly automated devices, supported, in many cases, by high-speed wireless radio connections, is substantially complete and is providing substantial benefits.

The next stage of leveraging this technology investment to move toward a smart-grid solution of self-healing networks is nearing implementation.

A GIS allows Westpower to visualise all aspects of the network spatially, including analysis of the asset condition and forward work commitments. In turn, this allows asset management staff to make informed decisions that are crucial to achieving optimal asset management outcomes. Additionally, the GIS has allowed Westpower to develop new applications such as viewing the location of lightning strikes within the network area in near real time, speeding up the recovery from lightning-related faults and helping to identify lightning-prone areas.

A computerised asset works management system (an IBM product called Maximo®) is a best-of-breed solution that has been introduced to maintain a complete maintenance history for each asset and to ensure that regular scheduled maintenance is carried out when needed. This includes a structured job costing system, which ensures that any costs incurred on the network are accurately allocated to the appropriate assets. This system divides network expenditure into appropriate activities (namely I, S & T; faults, repairs, replacements; enhancements and development), as well as asset type and location. Detailed reports including capital and operating expenditure may be generated at any time.

When maintenance is required, live line maintenance techniques will be used wherever possible to reduce the number and duration of power outages. Westpower's line contractor is trained in live line glove and barrier techniques, and has all of the specialist equipment needed to provide a high level of repair service. Many maintenance tasks involving voltages from 400 V to 33,000 V can now be carried out without taking the power off from customers.

New technologies will continue to be employed where asset management engineers are satisfied that it can cost-effectively and reliably be employed to improve service quality and performance.

1.12.1.2 Information

Adequate and accurate information is a fundamental need in order to manage assets efficiently. Historic information about the assets currently in place exhibited some gaps because previous records were inconsistent and lacked sufficient detail in areas such as equipment type.

Westpower now has practices established for contractors to improve this information by collecting "as-built" information on surrounding assets whenever significant work is carried out in the field. Moreover, an ongoing programme of collecting data to a finer level of granularity, including low voltage and service assets, is paying dividends.

Accurate records are also being obtained for all new and replacement work carried out on the network.

1.13 Risk Management

Westpower has a separate Risk Management Plan (RMP) completed as part of its overall business planning strategy. This includes business impact analysis and business continuity planning.

In addition, Westpower is actively involved in a regional Lifelines project looking at ways of managing the risks involved with major disasters and ensuring that plans are in place to deal with most of the likely scenarios.

Risk management practices have been embraced as a means of ensuring that all commercial risks are taken into account and appropriate strategies are in place to manage these risks. In this way, the long-term viability of Westpower is protected.

A full RMP has been completed after an in-depth look at Westpower's operations and environment in conjunction with risk management consultants.

The following general risk categories are considered:

- Future planning,
- Business development,
- Operations,
- Contractor management,
- Financial management,
- Staff management,
- Occupational health and safety,
- Public safety,
- Emergency management,
- Information systems,
- Information management,
- Environmental,
- Facilities management.

At all stages through the asset management planning process, Westpower's staff strive to reduce the impact of such risks.

1.13.1 Business Continuity Plan

The Business Continuity Plan is defined by each department and enables the re-establishment of normal processes and procedures following a major disruptive event which results in either the loss of business premises, resources or people.

1.13.2 Emergency Management Team

The Emergency Management Team (EMT) has Standard Operating Procedures that prescribe the appropriate processes and assign responsibilities for the conduct of the EMT in the event of a disaster of such proportions that requires coordinated command and control.

1.13.3 Health and Safety Management

Operating and maintaining an electrical network involves hazardous situations that cannot feasibly be eliminated entirely. Westpower is committed to providing a safe, reliable network and a healthy work environment by taking all practical steps to see that our operations do not place our staff, community or environment at risk. Hazardous situations are controlled through training, appropriate guidelines, and Westpower standards and operating procedures. We also require that any hazards, particularly electrical hazards, must be taken into account when new network installations are being designed and constructed.

Under the Electricity (Safety) Regulations 2010, Westpower has a positive obligation to operate a Public Safety Management System to ensure that hazards to the public are properly assessed and evaluated and that effective mitigation plans are put in place. Westpower has implemented a fully functional Safety Management System, based on NZS:7901, and this was successfully audited for the first time in by April 2012. Westpower will continue to improve its Safety Management System based upon experience and feedback from stakeholders.

1.13.4 Environmental Management

Westpower is committed to a policy of environmental sustainability, as discussed in its Environmental Policy.

The following topics are covered in this policy: stakeholder consultation, protection of the biosphere, sustainable use of natural resources, reduction and disposal of waste, wise use of energy, risk reduction, restoration of the environment, disclosure, commitment of management resources, assessment and annual auditing.

Oil spill management systems have been in place for many years now and, to date, have successfully managed any significant spills. A SF6 monitoring programme is also being actively pursued to reduce the risk of leakage of this greenhouse gas, which is used in most high-voltage switchgear.

1.13.5 Impact of Natural Disasters

Westpower commissioned a review of the West Coast Lifelines study in 2004 and again in 2006 to assess the impact of a natural disaster on the Westpower network. Earthquakes, storms and tornados are Westpower's major natural disaster risks. Overall, the studies have concluded that there is a very high dependency on communications as well as a clear need to have the airports and ports available after the event. An electricity supply would be essential for almost all service authorities in the restoration period following a natural disaster. Since the original study in 2004, further detailed studies and actions have been implemented to minimise the overall risk to the network in a cost-effective manner.

1.13.6 Asset Failure

The failure risk for all key assets has been assessed based on known past performance. Modern partial discharge detection technology has been employed to manage the risk of premature failure and to plan for an end-of-life replacement strategy, especially where 11 kV metal-clad switchgear is concerned. A regular Dissolved Gas Analysis (DGA) and Polarisation De-polarisation Current analysis (PDC) oil testing programme is carried out on Westpower's zone substation transformers to monitor their condition and highlight potential issues. The two major asset classes that present the highest risk of failure are the 33 kV and 11 kV motorised air-break switches and Dominion Drop Out (DDO) fuse links, and programmes are in place to upgrade these components progressively.

Insulators on critical overhead lines are now being checked with a corona camera. This is a new technology that can highlight excessive discharge on line insulators that is not normally detectable by other means. It is being used to detect faults and to assess the general condition of insulators.

All new assets that are proposed for use on the network are thoroughly vetted by an internal Change Management Group that considers issues such as safety, technical performance and longevity before approval for their use on Westpower's network is given.

1.14 Plan Outcomes

The major outcome of this plan is a ten-year expenditure forecast that is characterised by:

- A relatively constant level of investment in new connections and extensions to the network. This is based on an overall modest growth level with pockets of higher growth in specific areas;
- The ongoing maintenance cost of regulatory compliance with the tree regulations and additional requirements for tree worker safety;
- Material cost increases that are continuing to affect our construction costs because of the combined effect of raw material demand and exchange rate fluctuations;
- Increased Condition Assessment costs to meet Westpower's Safety Management System requirements of inspecting all assets over a five-year period.
- A move away from replacement strategies to a more focussed and proactive condition assessment regime, supported by repair and refurbishment programmes that reflect the very good overall condition of the existing assets. This is reflected in the reducing forward capital expenditure requirement.This document is publicly available, and we welcome constructive comments and suggestions.

Comments may be made in writing to:-

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2.0 INTRODUCTION

This is the 21st Asset Management Plan (AMP) to be produced for Westpower and it includes only minor changes from last year.

The AMP defines the service objectives and gives a clear focus on lifecycle management by presenting operations, maintenance and renewal policies, needs and programmes by asset type. The AMP processes adopted by Westpower have been chosen to integrate best practice features effectively. These establish the service standards and future demands to meet business, legislative and other needs, while developing optimum lifecycle asset management strategies, and resulting cash flow projections, based on assessing non-asset solutions, failure modes, cost/benefits and risk.

2.1 Background

2.1.1 Purpose Statement

The purpose of Westpower's AMP is to document the asset management practices employed by Westpower to strategically manage its assets and to meet the requirements of the Electricity Distribution Information Disclosure Determination 2012.

Determining of the level of compliance with the above requirements is assisted by Appendix B, which provides a cross-reference showing where the particular elements called for in the legislation may be found. This is important because the document is structured in such a way as to group asset types together, rather than the activity grouping used in the Handbook. All of the required information is provided to a high level of detail, but the compliance reviewer is referred to Appendix B as a means of navigating the various sections of this document to determine where the key elements may be found.

It is also intended for general viewing, assuring Westpower's stakeholders that the Westpower network continues to be managed in a professional and cost-effective manner. Figure 2.1 shows the basis for the asset management system used by Westpower.

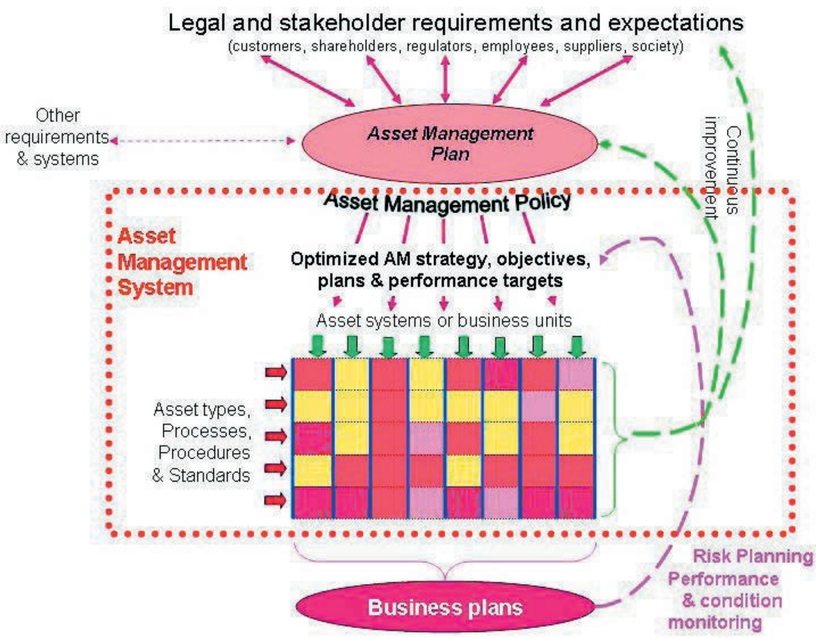


Fig 2.1 The Westpower Asset Management System

This AMP covers a period of ten years from the financial year beginning on 1 April 2014 until the year ending 31 March 2024. The main focus of analysis is the first three to five years; for this period, most of the specific projects have been identified. Beyond this time, analysis tends to be more indicative, based on long-term trends and it is likely that new development project requirements will arise in the latter half of the planning period. These project requirements may not be defined here.

To provide a framework for asset management within the planning period, it is necessary to determine the longer-term direction in which the network should be developed. For example, it would not be prudent to invest heavily in enhancing a system at a particular voltage if, beyond the planning horizon but well within the life of those assets, it is likely that they would be overlaid by a new higher voltage system. Furthermore, strategic development planning must be responsive to a range of scenarios that might occur.

This plan was approved by Westpower's Board of Directors on 3 March 2014.

The next plan will be prepared and published by March 2015.

2.1.2 Objective of the Plan

The defined objective of this Westpower AMP is:

"To provide a systematic and coordinated approach to the optimum management of Westpower's physical assets and their associated performance, risks and expenditures over their lifecycle for the purpose of achieving the organisational strategic plan and to satisfy stakeholders requirements."

2.1.3 Relationship with Other Planning Documents

It is important for stakeholders that the manner and the basis upon which this AMP is intended to operate are clearly understood. For the purposes of clarity, and in order to avoid any confusion, the following underlying assumptions need to be taken into account by the stakeholders in dealing with this AMP:

- This AMP interacts with other Westpower working plans. Of particular importance are the annual budgets, which set out the specific resources required for asset management activities. Those parts of the annual estimates relating to the management of the system are based on the annual AMPs.
- Authorisation of expenditure results from approval of the annual estimates by the Board of Directors and from specific approvals. This AMP does not represent an authorisation by Westpower for expenditure, nor does it represent a commitment on the part of Westpower to proceed with any specific projects or programmes.

Figure 2.2 below shows the interaction of the different Westpower plans and stakeholders involved.

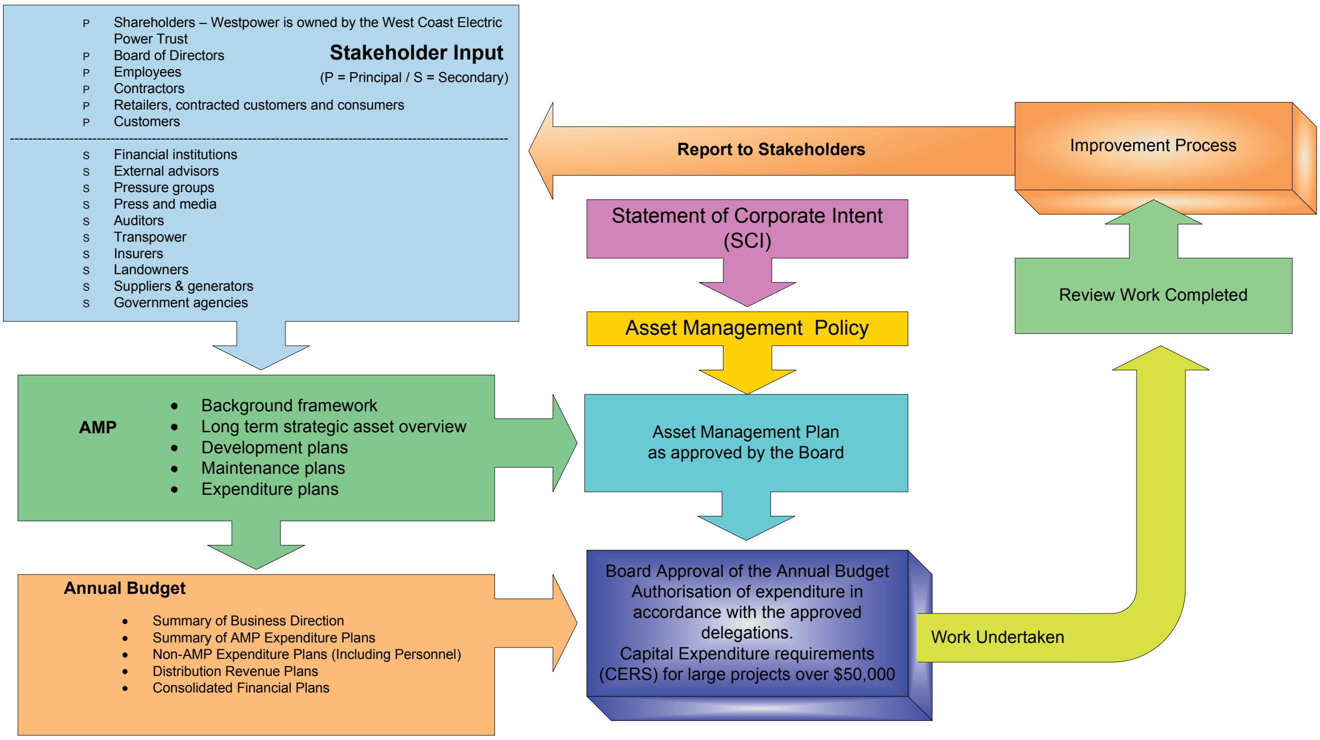


Fig 2.2 Relationship with Other Plans and the Approval Process

2.1.4 Assets Covered in this Plan

This AMP includes Westpower's assets that transport electricity (owned by the electricity retailers) from Transpower's seven Grid Exit Points (GXP) to over 13,000 electricity consumers on the West Coast of New Zealand's South Island.

The Westpower network includes 110 kV, 66 kV and 33 kV subtransmission networks. The 66 kV network is supplied from Transpower GXPs at Greymouth, Hokitika, Kumara; the 33kV network from Dobson and Hokitika. An 11 kV system is supplied from Transpower's Otira GXP whilst Reefton has a 110 kV supply from Transpower.

Westpower has network assets throughout the 18,017 square kilometres of the West Coast from Lyell in the north to Paringa in South Westland, with a total of around 40,000 assets in 76 classifications.

The distribution system comprises 2169 circuit kilometres of Alternating Current (AC) distribution lines, 19 zone substations and switch yards strategically located throughout the network which, in turn, provide an 11 kV supply for distribution to 2393 distribution substations, one control room and a telecommunications network.

Westpower's distribution lines consist of varying line capacities, dependent upon local demands and geographical considerations. Operating voltages include 110 kV, 66 kV, 33 kV and 11 kV. These lines involve a large population of poles, transformers, disconnectors and other assets of varying types that are essential to the distribution of electricity.

The maintenance of the network is carried out by ElectroNet Services as the preferred contractor, which is a wholly owned subsidiary of Westpower. They are contracted to undertake the inspection, servicing and testing (I, S & T), along with fault callout and fault repair work. Major line replacement, enhancement or development projects are also issued to ElectroNet Services as design build contracts.

2.1.5 Issues Facing Westpower

AMPs must address growth. Projections for the West Coast are continually studied by Westpower to ensure that the capacity and performance of the subtransmission and distribution networks are adequate for the demand and types of load connected. This plan projects that the current total load of around 50.5 MW will be around 65 MW in ten years' time.

This projection is dependent on proposed industry projects proceeding but in the current economic climate, there is no certainty of this. For this reason, this AMP is focussed on maintaining (or improving) the reliability of the network and catering for incremental growth on the basis that larger industrial developments will require project-specific augmentations that will only proceed once the various projects are committed and connection contracts are signed with developers.

Key asset management issues facing Westpower are:

- Maintaining network performance and reliability, including setting clearly defined service levels and backing these up with customer guarantees (refer to Section 4);
- The cost of environmental improvements and easements that need to be factored into planning;
- Decision-making between maintenance of assets and their renewal will be a major part of asset management (refer to Section 5);
- Acquiring revenue funding through a pricing structure at a level that is also acceptable to customers (refer to Section 7).

2.1.6 Westpower's Organisation Structure

Westpower Limited is a stand-alone Electricity Lines Business (ELB) with a contracting subsidiary, ElectroNet Services Limited. Westpower is essentially an electricity distribution company that is a shell or holding company; however, it will continue to own the infrastructure assets. The 100% owned subsidiary contracting company ElectroNet Services performs not only work on the Westpower infrastructure assets but also the asset management function under contract from Westpower. The structure of the Westpower Group is shown in Figure 2.3.

- Mitton ElectroNet is based in Christchurch and is the result of a merger between Mitton Consulting and the Christchurch office of ElectroNet Services. Mitton ElectroNet Limited is 100% owned by ElectroNet Services Limited.
- Amethyst Hydro Limited is a joint venture company between Westpower (88% ownership) and Harihari Hydro Limited (12% ownership) who, own and operate a 7 MW hydro scheme on the Amethyst River near Harihari.
- ElectroNet Transmission is transmission maintenance company.

Apart from the Board of Directors, a Chief Executive and the Westpower Asset Manager, who all work directly for Westpower, all other staff are employed by Westpower's subsidiary ElectroNet Services.

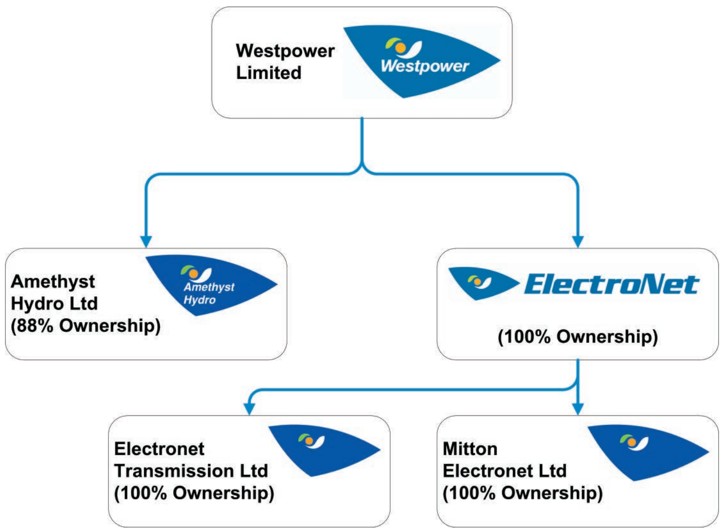


Fig 2.3 Westpower Group Corporate Structure

2.1.6.1 Governance and Board Approval Processes

The Board sets the high-level business goals and strategies, and the Chief Executive and Asset Manager are responsible for implementing them through ElectroNet Services. In particular, the Board approves the asset management policy that articulates the Board's overarching expectations for management of Westpower's assets and this provides a valuable governance framework within which all asset management activities must take place.

The AMP itself is approved by the Board each year and prior to the start of the financial year. This includes implicit approval for all included projects up to an individual value of $50,000.

All projects with a value greater than $50,000 are subject to a further and separate Board approval process involving the development of a separate business case using a pre-defined template. While financial measures such as Net Present Value (NPV) and Internal Rate of Return are appropriate Key Performance Indicators (KPIs) for some projects, many others involve the evaluation of key drivers such as reliability of supply or health and safety. More details are provided in Section 6 regarding the particular planning criteria that are applied. These projects may only proceed after specific approval is given.

Financial Reports are provided to the Board on a monthly basis and these include budgeted versus actual expenditure for all work rolled up to the overall activity level. In addition, individual job cost reports are provided for the major projects approved by the Board.

Exception reports are to be provided on all projects with a value of more than $50,000 that exceed, or are likely to exceed, the budgeted figure by more than 20%, including the reasons for the variance.

2.1.6.2 Board Report

The following additional reports are also provided to the board each month:-

- Billing statistics - This report shows the allocation of sales amongst the various retailers active on Westpower's network, by tariff category.
- Network delivery performance - This shows monthly peak demands in megawatts and consumption in megawatt hours for the current year to date and the previous two years for comparative purposes.
- SAIDI - A monthly progressive SAIDI report is provided in both tabular and graphical format, along with explanations of major events. This report shows both the raw SAIDI statistics and the baseline SAIDI result, excluding Major Event Days (MED's) using the 2.5 beta approach developed by Institute of Electrical and Electronic Engineers (IEEE).
- SAIFI - This report is produced in graphical format only and provides similar information to the SAIDI report but focuses on SAIFI.
- Legislative compliance - A review of legislative compliance is provided to the board each month and any non-compliances are noted.
- Public Safety Management System – A PSMS report is provided that shows KPI performace against targets on a montly bases

2.1.6.3 Westpower's Mission and Vision

Mission
A West Coast company operating successful businesses which provide first-class electrical and technology solutions, wherever our customers take us.

Vision
Recognised for excellence in all links of the electricity value chain.

2.1.6.4 *Statement of Corporate Intent*

Salient statements from the Statement of Corporate Intent (SCI) that relate to management of Westpower's assets include:

- To continue to provide West Coast communities with a safe, secure, sustainable and cost-effective electricity distribution network;
- To ensure obligations under the Energy Companies Act 1992, the Electricity Act 1992, the Electricity Industry reform Act 1998 and their various amendments and regulations are met;
- To continue to lobby on behalf of West Coast consumers to ensure that a reliable transmission network is maintained into the West Coast.

2.1.6.5 *Asset Management Policy Statement*

The key document linking Westpower's business objectives, as outlined in the SCI, with the asset management system is the Asset Management Policy, which defines the high-level policy objectives that the Board expects all asset management planning to achieve. As such, it is an overarching document that is embedded in the asset management system.

The policy follows:

We are committed to maximising our shareholders' investments in a legally and environmentally compliant and sustainable manner, without compromising the health and safety of our employees, consumers, or the public. We shall achieve this by adopting the following policy statement.

Safety

- Safety - Safety is of paramount importance in everything we do and will not be compromised for cost, time or any other reason.

Reliability

- Reliability of supply - Through continued investment in relevant technology and system configuration, reliability must meet approved targets at all times.
- Quality of supply - Quality of supply, commensurate with the load type and criticality, must meet Westpower's standards. Remedial action will be taken where standards are not met.

Security

- Security of supply – The desired level of security is defined by good industry practices, and long-term plans must be developed to achieve the required security.
- Transpower – Every effort must be made to focus Transpower on security of supply for the West Coast.

Sustainability

- Maintain service potential - The future of Westpower's business is wholly dependent on the ability of the network to continue to provide service for the foreseeable future. Every effort must be made to maintain the ongoing service potential of the network where appropriate.
- Supporting economic growth - We recognise the electricity infrastructure as a key enabler of economic growth, and will work with current and future developers to provide electricity with the capacity, security and quality required to support their business.
- Continual improvement – The asset management system will be reviewed on an annual basis and where weakness is found, improvements will be made. Compliance with PAS-55:2008 shall be supported.
- Strategic and long-term planning – Our infrastructure business involves long-term investments, and we will ensure our decisions align with and support the organisation's strategic plan.

- New investment – Any new investment must meet the shareholders' expectations and approval where necessary.
- Communication – The requirements of the asset management system must be communicated to all stakeholders to enable them to be aware of their obligations and to ensure that their expectations are considered in all aspects of planning.

Cost-efficiency

- Cost-efficiency - All projects must compete for financial resources. Prudent asset stewardship requires careful budgeting and robust financial review processes to ensure maximum cost-efficiency is assured. Opportunities for improved productivity through training, technology, process improvements or other means shall be constantly pursued.
- Energy-efficiency – Energy-efficiency is encouraged in all areas of Westpower's activities and will continue to be a key outcome from the design process. Where opportunities exist to enhance energy-efficiency for existing assets, these are actively pursued and implemented where technically and economically feasible.
- Technology - Technology is seen as a key enabler in providing improved service and value to our consumers. We will continue to keep abreast of developments in the field of new and emerging technology and apply these to Westpower's network where appropriate.
- Fair pricing – The price of electricity to consumers must be transparent and fair to all users of the assets.
- Capital contributions – Any expense for network extensions to supply new loads will be met by a consumer contribution towards the costs involved.

Environmental impact

- Environmental impact - Westpower is environmentally responsible and carefully considers the environmental impact of any of its actions. Furthermore, the company works hard to mitigate any negative effects and to provide a net environmental benefit where this is practical.

Risk management

- Westpower has a separate Risk Management Plan (RMP) completed as part of its overall business planning strategy. This includes business impact analysis and business continuity planning.
- In addition, Westpower is actively involved in a regional Lifelines project looking at ways of managing the risks involved with major disasters and ensuring that plans are in place to deal with most of the likely scenarios.

Legislation

- Legislative compliance –The Asset Management System (AMS) must meet all relevant legislation. Where non-compliance issues are identified, these will be dealt with promptly and transparently.

The asset management and planning processes discussed throughout the rest of the AMP have been developed to directly support this policy and must adhere to it.

The asset management division holds the requisite technical knowledge and is responsible for technical decisions regarding the asset. In addition, this division is effectively the "custodian" of the assets, and their duties include taking responsibility for all performance and safety issues.

2.1.6.6 Corporate Structure

The company structure is shown in the Figure 2.5 and also in Figure 2.6, detailing the asset management division.

The key functions of the groups are:

- Board of Directors

The Board provides overall governance of the Westpower group of companies and ensures that the following four pillars of good governance are maintained (Figure 2.4 shows the process for “Sign-off” by the Board).

1. Determination of purpose – Drives the company’s purpose, goals and strategy.
2. Governance culture – Ensures operation within a high-performance culture that deals effectively with the right issues in the right manner and encourages debate and candour. It maintains effective relationships with shareholders and other stakeholders.
3. Holding to account – Holds management to account through informed, astute, effective and professional oversight.
4. Compliance – Ensures the company is and remains solvent, and ensures the probity of financial reports and compliance with regulatory environments.

- CEO

The CEO oversees the financial performance of Westpower, management, the company secretariat and maintenance of revenue streams.

- General Manager – Assets and Engineering Services

The General Manager oversees the network to maximise system availability. His/her duties include developing maintenance strategies, setting and managing priorities, controlling standards and issuing work orders to ensure reliability at minimum cost. He/she also acts as the key contact point with energy and generation companies wishing to use the Westpower network for the distribution of electricity.

2.1.6.7 Asset Management Roles

The asset management department is under the overall control of the General Manager – Assets and Engineering Services.

A series of team leaders are responsible for the various activities carried out by the asset management divison. The roles of each of these team leaders are discussed below.

- Senior Electrical Engineer

The Senior Electrical Engineer is responsible for setting engineering policy as well as overseeing all engineering design. He/she is also responsible for reviewing non-conformance in the network and ensuring that the appropriate standards are in place.

- Asset Support Officer

The Asset Support Officer is responsible for all matters surrounding the collection of metering data and billing of retailers. This includes reconciliation activities.

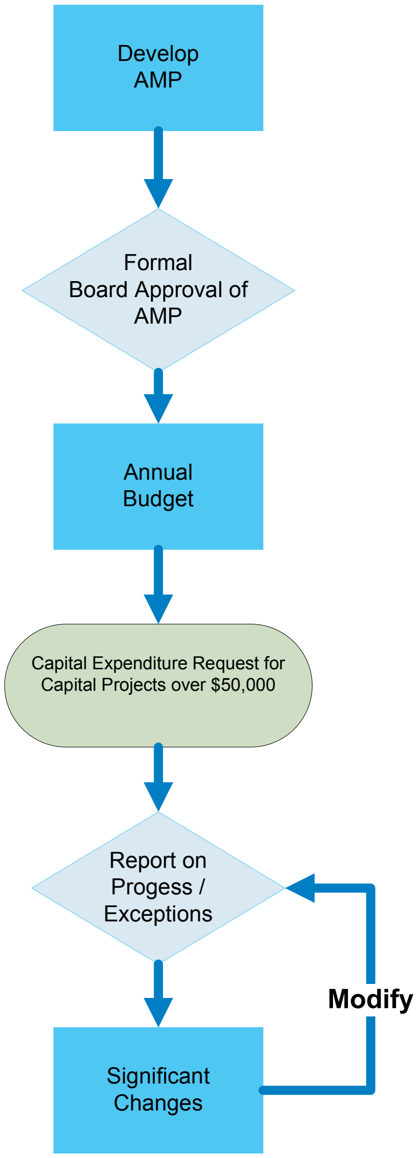


Fig 2.4 Process for Board Sign-off

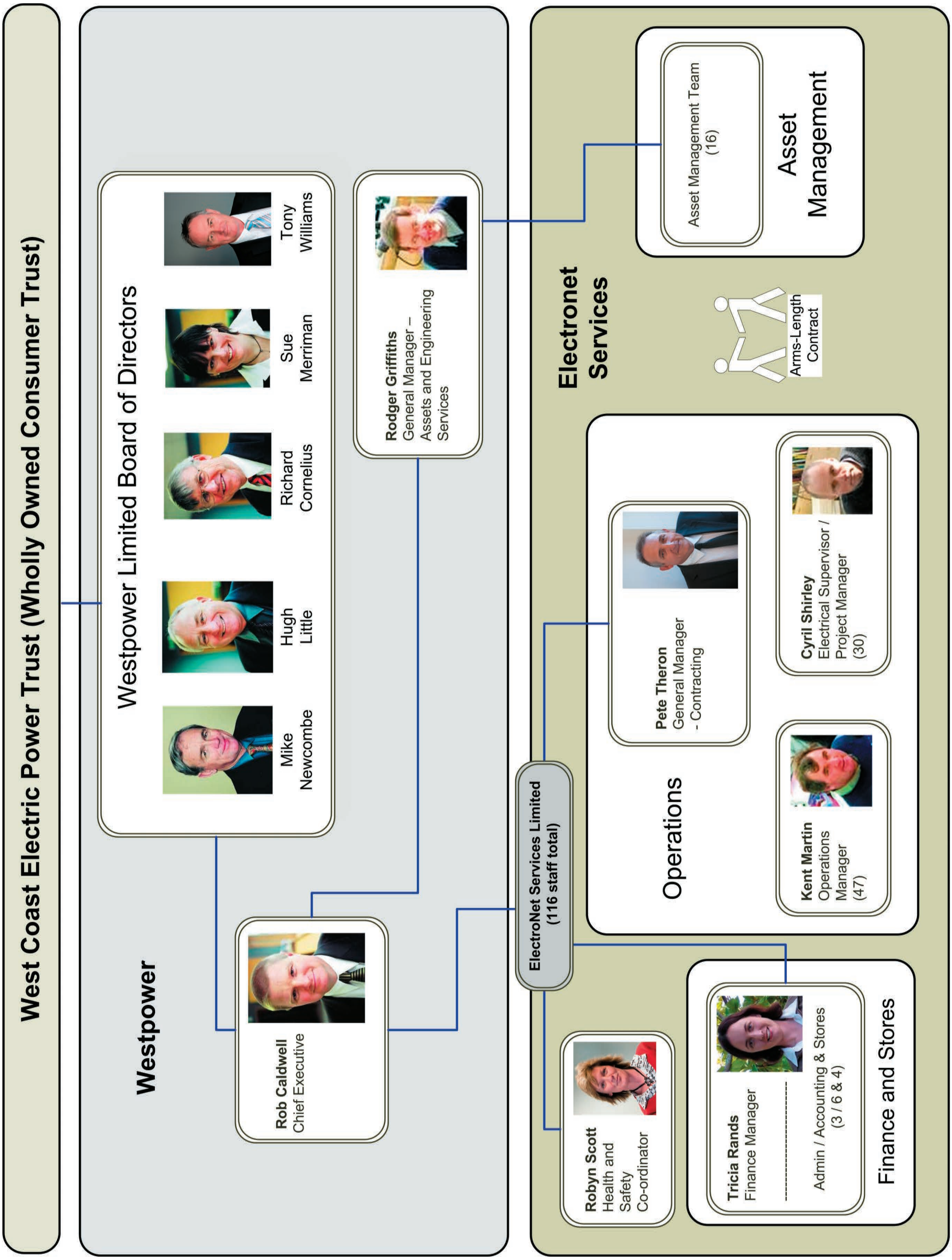


Fig 2.5 Westpower Limited Organisation Chart

ASSET MANAGEMENT DEPARTMENT

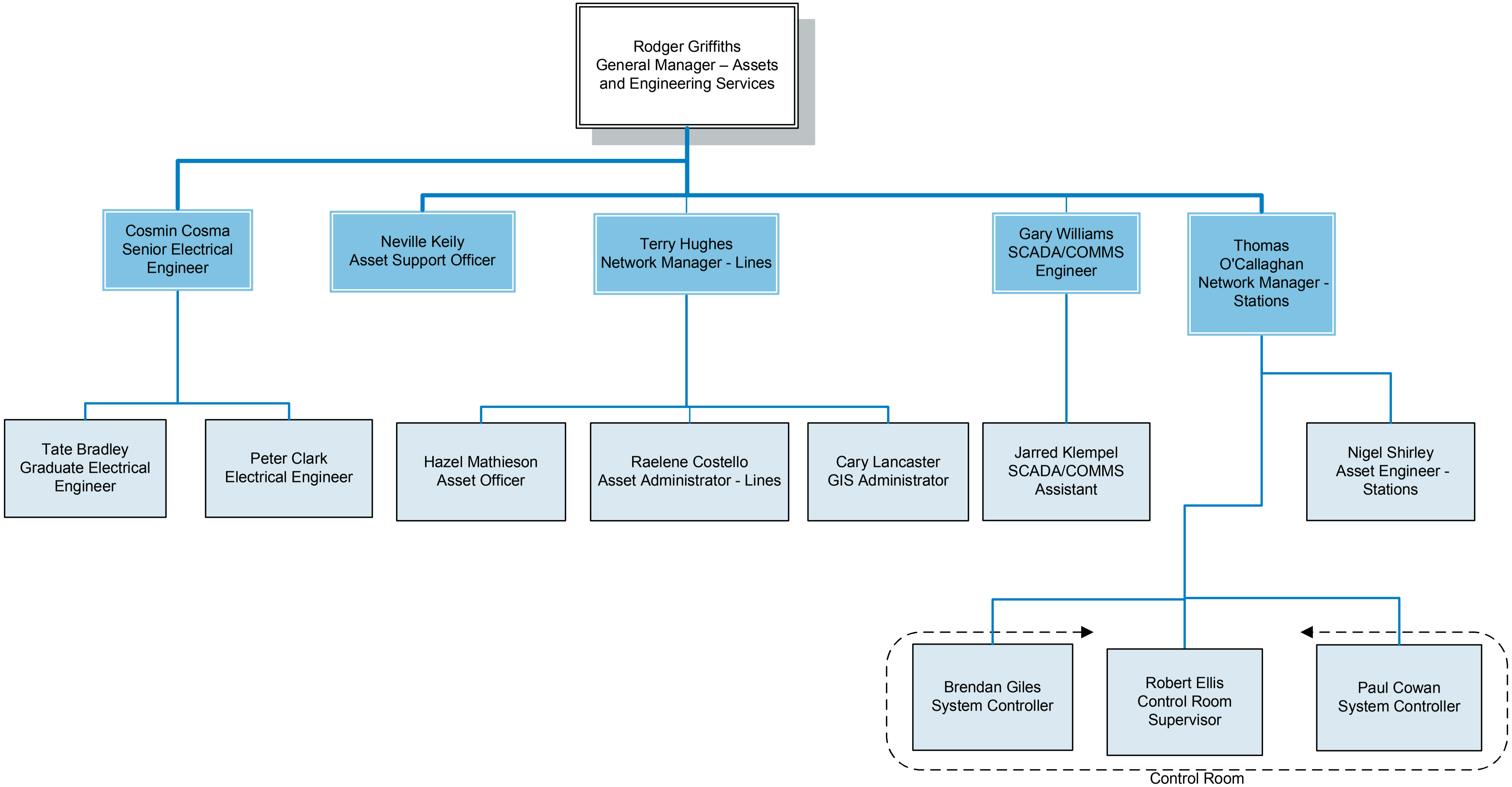


Fig 2.6 Asset Management Department

- Network Manager - Lines

This role involves the management of all high-voltage (HV) and low-voltages (LV) lines assets owned by Westpower, including control and management of the Geographic Information System (GIS) and vegetation management programmes.

- SCADA/Communications Engineer

The SCADA/Communications Engineer is responsible for all of Westpower's Supervisory Control and Data Acquisition (SCADA) and communication assets, including data communication in the network, and SCADA control of substations and switching assets.

- Network Manager - Stations

The Network Manager - Stations looks after all the zone substations and network switching assets, including maintenance and development, and applies the policies developed by the Senior Electrical Engineer. This role also includes responsibility for the control room and the day-to-day operations of the network.

2.1.6.8 Relationship between Asset Management and Operations Divisions

The asset management division assumes the role of the asset owner and is responsible for managing the interests of Westpower and, in particular, maintaining the service delivery potential and performance of Westpower's assets.

The operations division fulfils the role of the service provider and is responsible for carrying out all maintenance and development on the assets at the physical level.

The relationship between asset management and the operations and finance division is based on an arms'-length contract between Westpower and the operations division of ElectroNet Services, with asset management effectively acting as Westpower's agent and being directly under the control of the Westpower asset manager.

*2.1.6.9 **Operations Division Roles***

Within the operations division, managers are responsible for particular areas of work as follows:

- General Manager Contracting

This role has overall responsibility for all operational matters.

- Electrical Supervisor/Project Manager

This role is responsible for the test room, electricians and electrical fitters within zone substations.

- Operations Manager

The Operations Manager is responsible for all line staff, including line mechanics and fault staff, along with a small number of fitters who work on distribution substations.

- Finance Manager

This role manages the back office functions of ElectroNet as well as stores and procurement.

2.1.7 Westpower's Stakeholders

Stakeholders are defined as those parties with an interest in Westpower's asset management. The principal stakeholders are:

- Consumers;
- Shareholders (Westpower is owned by the West Coast Electric Power Trust, a wholly owned consumer trust);

- The Board of Directors;
- Employees;
- Contractors;
- Retailers.

The secondary stakeholders that may have an interest or opinion in the affairs of Westpower are:

- Auditors,
- Government agencies,
- Suppliers and generators,
- Transpower,
- Landowners,
- Insurers,
- Financial institutions,
- External advisors,
- Pressure groups,
- Press and media.

2.1.7.1 *Identification of Stakeholder Interests*

Retailers and Customers

Westpower has liaised closely with energy retailers to determine the expectations of their customers and quantify these in terms of desirable reliability indices. Westpower has conducted its own consultation with its 25 largest customers and discussed alternative combinations of price and quality that may be available to customers who commit to a commercial contract.

Mass market customers have not expressed any dissatisfaction in the status quo combination of price and reliability. Some of the 25 largest customers have expressed an interest in paying for additional reliability, mainly based on the criticality of their operations.

The main interests for retailers and customers have been identified as reliability in terms of continuous availability of supply, restoration of supply and adequate shutdown notification, as well as receiving timely and up-to-date information if an outage occurs on the network so that they can plan accordingly.

Other interests are that Westpower is cost-effective in its service delivery and provides a good quality of service in terms of both maintenance and power quality.

Finally, stakeholders wish to be charged a fair price, with supporting information being made available to justify that price.

These interests are accommodated in the plan by:

- The SAIDI reliability target;
- The gap analysis on asset segments to ensure each customer is receiving the promised standard of service, and the targeting of expenditure accordingly;
- Reinvestment in asset renewals;
- Strong customer consultation commitment;
- Direct customer billing, including a move away from energy-based to demand-based charges for all customers;

- Supply-point and-density-based pricing structure;
- Customers' expectations of good service at a fair price, as well as a continued distribution by shareholder trusts;
- The efficiency of the company as judged by customers by the size of the distribution.

Retailers' interests are identified through communication and direct discussion. Retailers are interested in selling energy to customers with little barriers to competition. Their interests are accommodated in the plan by Westpower's direct billing programme.

Shareholders

Westpower shareholder's wish to ensure, as owners of the assets, that their financial capital is protected in the long term by ensuring that the operating capability of the system is protected and that the system is maintained efficiently so that they earn an acceptable return on their investment.

The shareholders also have an interest in how Westpower provides customer service and how it meets its obligations to other parties (as described below).

The interests of Westpower's shareholders are identified through the SCI process and consultation with shareholders. Shareholders are interested in:

- An acceptable return being earned from the assets;
- An acceptable cash return from the network;
- The business being sustainable in the long term;
- A reasonable standard of service being provided to customers;
- The price to customers being equivalent to that charged in other rural areas;
- Customer satisfaction;
- A network that meets acceptable industry safety standards.

It is noted that the above interests are not necessarily achievable in totality if revenues are limited to below an acceptable return.

The above interests are accommodated in the plan by:

- The requirement that any customer-driven development work covers at least its cost of capital;
- Funding development work that is expected to produce future revenue by debt, rather than reducing cash returns to existing customers;
- The SAIDI reliability target, i.e. strong, but targeted re-investment in asset renewals to provide a long-term safe and sustainable network.

Westpower's ability to earn an acceptable return on assets is constrained by the need for price stability. The organisation can either limit investment in new customer-driven work if acceptable returns cannot be earned or, alternatively, require a capital contribution from the customer to cover any shortfall. Investment in existing assets is, however, a sunk cost.

Board of Directors

Westpower's shares are held by the West Coast Electric Power Trust (WCEPT) on behalf of the capital beneficiaries who comprise the electors within Westpower's area. As such, the WCEPT is treated as the nominal shareholder, or owner of the business, which is administered by a Board of Directors.

The WCEPT is regularly kept informed of key matters through the annual issue of an SCI, six-monthly financial reports, and shareholders' newsletters. Each year, Westpower and the WCEPT meet together after their respective Annual General Meetings to discuss issues of mutual interest. Additionally, the Chief Executive or Chairperson will often attend regular WCEPT meetings when invited to promote good communication and answer any concerns that may arise.

The above interests are accommodated in the plan by providing direct reporting to the Board of Directors in terms of annual budget proposals, major project approvals, monthly financial reports, project exception reports and the AMP.

Employees and Contractors

Other parties with a potential interest in Westpower's asset management include workers (including contractors) who physically work on the system; the public, through whose land the distribution system is built; and any agencies with which Westpower comes into regulatory contact.

ElectroNet Services' asset management team has responsibility for the day-to-day management of the company and its assets, and for carrying out company policies. Westpower is the "owner" of the plan, who is responsible for its creation and for using it as a tool for improving the efficiency and effectiveness of managing Westpower's assets.

The interests of our employees are identified through direct discussion with them and their representatives. Our employees are interested in:

- Advanced knowledge of work requirements so that they can plan their lives;
- A safe network and safe working practices so that they are not harmed;
- Fair remuneration;
- Enjoyable work.

The above interests are accommodated in the plan by:

- The high priority given to eliminating or mitigating hazards;
- Advanced planning of work;
- The recognition that our staff have unique skills;
- Creating a positive work environment that creates a high level of self-worth.

Contractors' interests are identified through direct discussion. Currently, they are interested in having:

- A secure work programme known sufficiently in advance that they can plan their resource allocation;
- A safe network and safe working practices, so that their staff are not harmed;
- A profitable work stream.

The above interests are accommodated in the plan by:

- The high priority given to eliminating or mitigating hazards;
- Advanced planning of work, including commitment to a long-term asset renewal programme.

The secondary stakeholder interests are as follows:

Auditors

- Systems and processes must be suitable to meet legislation requirements.

Government Agencies (this includes District and Regional Councils and Central Government).

- Processes are in place to meet compliance requirements and reporting systems in place to meet disclosure requirements.
- District Council interests are identified through direct discussion. Currently, they are interested in having sufficient infrastructure available so that growth in their local community is not hampered.
- The above interest is accommodated in the plan by the requirement that any customer-driven development work we undertake produces at least our cost of capital.
- Regional Council interests are identified mostly by correspondence and written information. Regional Council interests include protecting the environment and emergency response.
- Central government interests are identified mostly by correspondence, written information and legislation. Central government interests include ensuring that a reliable, fairly priced supply of electricity is available to the West Coast region and that the network is safe.
- The interests of Government agencies are recognised through compliance and submissions.

Suppliers and Generators

Westpower provides a reliable network through which to transport energy, so that the network has sufficient capacity to accommodate the required transfers of energy. The charges imposed in using Westpower's network are acceptable and there is adequate access to Westpower's network.

Suppliers and generators' interests are identified through communication and direct discussion. Currently, these groups are interested in protecting their connected equipment and the electricity system from harm caused by the network and load customers who are connected to the Westpower network. Westpower is also interested in receiving revenue and being charged a fair market price for transmission services.

The above interests are recognised in the plan by the sums we have programmed for expenditure due to anticipated growth in distributed generation and load. A significant proportion of this is to ensure the protection of the grid.

Transpower

Westpower provides adequate maintenance standards to keep the network operational. The network must be reliable, and sufficient communication should be maintained between Westpower and Transpower.

Transpower's interests are identified through communication and direct discussion. Currently, Transpower is interested in protection of its grid and the electricity system from harm caused by generators and load customers who are connected to the Westpower network. Another of Transpower's interests is receiving regulated revenue from us.

The above interests are recognised in the plan by the sums we have programmed for expenditure due to anticipated growth in distributed generation and load. A significant proportion of this is to ensure the protection of the grid.

Landowners

Issues are identified through discussion with their representatives (e.g. Federated Farmers) and the pre-access notification process. Currently, they are interested in protecting areas of heritage value, protecting amenity value, having their property treated with respect, protecting property values and having an electricity supply at a competitive rate which is suitable for the activities on their land. These interests are recognised directly and managed through standard customer relationship approaches.

Insurers

The interests of insurers are for Westpower to provide adequate risk management to meet the insurance requirements and to minimise risks where possible. These interests are met by Westpower having adequate insurances in place for identified risks and liabilities to employees, assets and the general public.

Financial Institutions

Westpower should provide sufficient financial performance to cover borrowings and to maintain their corporate identity to a consistent standard. These interests are met by Westpower through reporting regularly on financial performance and through regular audits.

External Advisers

The interests of external advisors include continuity of work, contractual relationships (if applicable) and safety. These interests are met by Westpower through communication with relevant parties as necessary.

Pressure Groups

Relevant interests include policy, reliability, pricing and safety. These interests are met by Westpower through publicly issued reports, and press and media releases.

Press and Media

The interests of the Press and other media relate to news, public relations, alternative energy sources, the environment, information channels and crises. These interests are met by Westpower through publicly issued reports, and via press and media releases.

2.1.7.2 Management of Conflicting Stakeholder Interests

Clearly, there will be times when the individual interests of various stakeholders may create potential conflicts, and Westpower takes a consultative approach by listening to the concerns of the parties involved and taking these into account when making decisions.

The overarching drivers of providing a safe and reliable supply of electricity at a reasonable cost, while ensuring that, wherever possible, all stakeholders are treated equitably, form a framework within which the best-case outcomes are determined. Of course, this will often involve some form of compromise, except where health and safety issues are concerned.

Where a good case is made that requires a change in the AMP, this can either be reviewed during the year if urgent, subject to budgetary approval from the Board, or included in the following year's AMP. In support of this, the asset management division maintains a register of recommended changes that are incorporated into the AMP each year.

Westpower's policy is that new connections to Westpower network should not be subsidised by its existing customer base, and therefore new customers are charged the full cost of new connections. This is taken into account when determining the best solution to supply new or increased loads.

Communication is the key tool used to manage residual conflict between stakeholders. It is our experience that when stakeholders have all the facts before them, they are willing to adopt the solution that is for the best overall good. Our task is to ensure that stakeholders have the required level of information.

Examples of how conflicting interests are managed include the following:

1. Asset renewal

Our shareholders require investment to return Westpower's cost of capital. They are not willing to lower cash returns received in order to fund network upgrades. On the other hand, consumers are unwilling to meet high price increases. Both groups want a sustainable network and improvements in reliability. This conflict is met through a targeted renewals programme, which ensures that the network does not receive over-investment, and a targeted reliability programme to ensure that reliability continues to improve without a significant increase in network investment. Innovative practices also play a major part in aligning these interests.

2. Network capacity charges

Historically, networks have based charges on transported energy, a fixed component and, perhaps, demand. The cost of transporting energy always has a demand and fixed component. Westpower has changed the structure of all line charges to better reflect costs by having separate demand and dedicated asset components. In the medium term, energy passing through the meter is used to estimate demand using a complex algorithm. In the long-term, it is proposed that demand meters shall be used on all installations.

3. Contractor resource constraints

The isolation of the West Coast means that Westpower is directly reliant on the capabilities and resources of its main contractor for all work on the assets. At times, the contractor may be over-committed due to other work when large external projects are under way. This dichotomy between maintaining Westpower's assets to a high standard and maximising financial performance of the contractor is resolved through careful supervision of the annual AMP progress and regular discussion of forward work commitments at the management team level, including staff from both the asset management and operation divisions. Moreover, the Chief Executive retains the power to direct that priority be given to asset work as required, as a result of his/her dual role of managing both Westpower and the contracting subsidiary, ElectroNet Services.

4. Safety improvements

Experience has shown that all of Westpower's stakeholders want a safe network. Determining what is safe or unsafe is not black and white. The definition of what is safe and unsafe is constantly evolving as time goes on. As events occur and expectations advance, safety codes are repeatedly rewritten and redrafted. This means that equipment that was considered safe when installed, is over time, eclipsed by changed and improved equipment.

When growth occurs in a network, equipment is constantly replaced and updated. In the Westpower network, much of the old legacy equipment has not been replaced as part of the natural growth cycle. This leads to conflict between funding safety improvement work and other renewal and Capital Expenditure (CAPEX) work, along with decisions on the definition of safe and unsafe. Fortunately, much of the renewal associated with safety also improves security, reliability and general network capacity. Available resources tend to dominate the conflict as to how much can be done at once. The conflict between what is safe and unsafe is based on:

- Observations of obvious problems;
- Industry accident reports;
- The various Acts, Regulations and Codes that control the industry;
- The application of ongoing principles to how equipment operates and the risks that come about when things go wrong;
- Experience from investigating and being involved with various industry incidents.

5. Conflict between customer interests as customers and shareholders

As shareholders, customers recieve a return. Some customers would prefer lower upfront charges or to see the money reinvested in the network. We believe that it is the responsibility of the Trustees, who are elected by our customers, to resolve this conflict by consultation and advise the company through the SCI process.

2.2 Asset Ownership Justification

2.2.1 Westpower Yesterday

In the late 1800s to the early 1900s, private power generating schemes were being built throughout the West Coast region, mainly to supply gold claims. Reefton was the first public supply connected in the Southern Hemisphere in December 1887. Other supplies were at Dillmanstown and Kaniere in the Hokitika area.

2.2.2 Westpower Today

Westpower is a combination of a number of the early power companies and generators on the West Coast. In 1972, the West Coast Electric Power Board was formed by the amalgamation of the Amethyst, Grey and Westland Electric Power Boards.

2.2.3 Westpower Tomorrow

AMPs must address growth. Projections for the West Coast are continually reviewed by Westpower to ensure that the sub transmission and distribution network is adequate for the demand.

2.3 Justification of Assets

The sub transmission and distribution components of the Westpower network have evolved over a number of years, with the increase of customer demand in the region being the primary driver. The large area of the West Coast for which Westpower is responsible, coupled with the diverse geology encountered, has resulted in strategically placed assets throughout the region, that generally provide a reliable supply and offer scalability for the future.

Many of Westpower's lines can be very long and traverse extremely rugged terrain, often to supply very lightly populated areas. To ensure that supply meets customers' requirements, these lines have been designed to reduce line losses, and voltage support has been strategically employed.

The continual load increases in "remote" areas such as the Glacier townships (Fox and Franz), and the growth in industrial loads such as mining and dairy farming are considerations when a subtransmission or distribution asset is refurbished, with refurbishment costs sometimes being shared with larger commercial entities.

The last 10 to 15 years have seen a push to ensure that assets are up to the task expected, with an extensive renewal and replacement programme upgrading the vast majority of subtransmission and distribution assets.

2.3.1 Justification of GXPs

Connection/Supply Points

Westpower owns three distinct classes of sub transmission assets running at 110 kV, 66 kV and 33 kV, emanating from seven GXP points, with an additional GXP at Otira providing an 11 kV supply. The primary GXPs can be found at Dobson (33 kV), Greymouth (66 kV), Hokitika (66 kV), Kumara (66 kV), Reefton (110 kV) and Atarau (110 kV). Details of the capacity and load profile for each of the GXPs can be seen in Table 3.1 in Section 3.

The justifications for each of these GXPs are described below:

2.3.1.1 *Dobson GXP*

Fig 2.7 Dobson GXP

The Dobson 33 kV supply point provides capacity to supply the Westpower network northwards to Ngahere Substation, the main supply point for the Ngahere Gold Dredging operation and the Roa Coal Mine. East of Dobson is the Arnold substation, which supplies the CMP Kokiri Meatworks and a large farming area, and also allows for the connection of Trustpower's 3 MW Arnold generation. The northwestern section of the Dobson GXP connects to the Rapahoe substation, which supplies Solid Energy's Spring Creek Mine and the Coast Road area. These substations are supplied by the Dobson GXP's three 33 kV feeders.

The Dobson GXP also consists of two 11 kV feeders providing supply to Dobson, Kaiata, Taylorville, Stillwater and Coal Creek.

This GXP was the primary GXP for the Greymouth area, but was situated too far from Greymouth to supply the growing load in that area; the Greymouth GXP was therefore constructed in the late 1970s.

Fig 2.8 Greymouth GXP

This GXP is essential for security of supply in the aforementioned areas as well as supporting the Greymouth GXP from time to time.

2.3.1.2 *Greymouth GXP*

Supplying the greater Greymouth distribution network from seven 11 kV feeders, the Greymouth 66 kV GXP is supplied primarily from the GYM-KUM 66 kV cct and the Transpower's DOB-GYM 66 kV cct. This GXP is required to supply the largest domestic load on the West Coast, as well as significant industrial loads such as engineering, fishing and timber milling.

As the Greymouth load has grown significantly in the last 30 years, an independent GXP is required to satisfy the demand present in this area.

Fig 2.9 Hokitika GXP

2.3.1.3 *Hokitika GXP*

As well as supplying the greater Hokitika domestic load, there are large number of industrial, dairy farming and tourism-driven loads emanating from the Hokitika GXP. Included in these is the Westland Milk Products Hokitika processing factory. This GXP is geographically the largest in the Westpower area, supplying the South Westland area to Paringa (some 200 km away) and the flats of the Kokatahi-Kowhitirangi area. The Hokitika GXP consists of ten 11 kV feeders and one 33 kV feeder that supplies South Westland.

Fig 2.10 Kumara GXP

Constructed in 2002, the Hokitika GXP was commissioned due to the increasing demand in the area and the decommissioning of Transpower's Arahura substation. With this in mind, coupled with the distance between GXPs, the Hokitika GXP was deemed to be essential.

*2.3.1.4 **Kumara GXP***

The Kumara GXP is mainly required to provide a Grid Injection Point (GIP) for Trustpower's 10 MW Kumara hydro scheme, but also supplies local load, via two 11 kV feeders, in the area between Gladstone in the north to Jacksons in the east and to Duffers in the south. Apart from the significant generation, the load type is mainly farming and rural residential, although the IPL Plywood mill at Gladstone demands significant load.

The close proximity of Trustpower's hydro scheme is the primary reason that the Kumara GXP exists. Without this injection, the Kumara area could possibly be supplied from an alternate GXP.

2.3.1.5 Reefton GXP

The Reefton GXP supplies load via two 11 kV feeders between Lyell in the north, Berlins in the east and Blackwater to the south. The load is characterised mainly by dairy farming and domestic load, although there is some mining and commercial load in the town of Reefton.

The Reefton GXP also supplies Blackwater substation to the south and the Oceana Gold Globe mine to the east via two 33kV feeders.

The distance from an alternate GXP deems the Reefton GXP necessary, and this GXP is integral in supplying Westpower's northern network.

*2.3.1.6 **Atarau GXP***

The Atarau GXP is primarily to supply Solid Energy mining operation, with one 110 kV feeder supplying Logburn substation.

The Atarau switching station is owned by Transpower, with other connection assets, including transformers, being supplied by Westpower.

*2.3.1.7 **Otira GXP***

The load at Otira is totally isolated from other GXPs, and, apart from a small hotel and a few houses, the majority of the load consists of the fan motors for the Otira rail tunnel. This load is supplied from a single 11 kV feeder.

Although the load in Otira is relatively small, the isolation of the area from other parts of the distribution network means that the Otira GXP is critical to supply the area. This includes the critical tunnel load needed to support the coal export trade from Solid Energy's West Coast operations, with no alternative source being available.

The Otira substation is owned by Transpower. An upgrade of this GXP was completed in 2010/11.

In addition to the seven GXPs listed above, Westpower has a further 14 zone substations.

Fig 2.11 Blackwater Zone Substation

2.3.2 Justification of Zone Substation Assets

The justification for each of these zone substations is as described below:

2.3.2.1 Blackwater Zone Substation

Commissioned in December 2009, the two 11 kV feeders at Blackwater zone substation primarily supply the Solid Energy coal load-out facility at Ikamatua as well as the area from Mawheraiti down to the Ahaura Plains, which predominantly includes dairy farming. The Blackwater zone substation has been built due to the increased demand from the coal load-out facility, which could not be supplied from either the Reefton or Ngahere 11 kV networks.

An older refurbished transformer of optimum capacity was used for this project to allow for future growth while being cost-effective.

The Blackwater substation can also provide backup supply to Ngahere and Reefton, when required for maintenance and faults.

2.3.2.2 Ngahere Zone Substation

The two 11 kV feeders at Ngahere zone substation supply an area from Ahaura in the north, down the Grey Valley including Roa and Blackball, and inland east as far as Nelson Creek. Ngahere zone substation primarily supplies the Ngahere gold dredge operation and the Roa Coal Mine, as well as the Ngahere processing mill, Nelson Creek abattoirs and numerous dairy farms. The Ngahere zone substation is ideally located due to its proximity to its primary loads.

Fig 2.12 Arnold Zone Substation

2.3.2.3 Arnold Zone Substation

Situated next to Trustpower's Arnold power station, the two 11 kV feeders at Arnold zone substation supply the CMP Kokiri Meatworks and a large farming area including several Landcorp dairy farms, covering an area from Kokiri in the west, from Moana township to Inchbonnie in the east and as far as Haupiri to the north. Arnold zone substation also provides Trustpower a connection for their generation (3 MW) into Westpower's network. Due to further growth in dairy farming, especially Landcorp's farms, development in Moana township and the ability to provide a connection point for Trustpower's Generation, the Arnold zone substation is a necessary asset.

Fig 2.13 Rapahoe Zone Substation

2.3.2.4 Rapahoe Zone Substation

Covering an area along the Coast Road area to Punakaiki in the north down to Coal Creek in the south, including the townships of Barrytown, Runanga, Rapahoe and Dunollie, the two 11 kV feeders at Rapahoe zone substation's primary supply is to Solid Energy's Spring Creek Mine at Dunollie and the abovementioned townships. The distance and high costs associated with supplying the Coast Road area from Dobson via an 11 kV line and the demand at Spring Creek deem the Rapahoe zone substation to be critical to supply this area.

2.3.2.5 Ross Zone Substation

The Ross zone substation was built in 1995 due to the 66 kV line between Arahura and Harihari being changed to a 33 kV line. Primarily supplying Birchfield's Ross mining operation and Ross township, the two 11 kV feeders also supply a number of farms in the area, covering an area that runs from just south of Ruatapu, including Totara Valley, as far south to Mikonui. Because of the distance and high costs associated with supplying the Ross area from Hokitika via an 11 kV line, the Ross Substation is ideally located.

2.3.2.6 Waitaha Zone Substation

Supplying primarily a farming area, the one 11 kV feeder at Waitaha zone substation covers the areas of Fergusons Bush, Kakapotahi, Waitaha Valley and Pukekura, which includes the Pukekura Hotel, the Wilderness Tourist Centre and Kordia's radio site. Like the zone substation at Ross, the Waitaha zone substation was built in 1995. The remoteness and high costs associated with supplying the Waitaha area from Ross or Harihari via an 11 kV line makes the Waitaha zone substation necessary at its current location.

Fig 2.14 Harihari Zone Substation

2.3.2.7 Harihari Zone Substation

The Harihari zone substation was built in 1995 due to the decommissioning of the Transpower switchyard on Wanganui Flat Road. Supplying primarily a farming area, the two 11 kV feeders at the Harihari zone substation cover an area from Lake Ianthe in the north to the Poerua Valley in the south, including the township of Harihari. Due to the remoteness and high costs associated with supplying the Harihari area from Waitaha or Whataroa via an 11 kV line, the Harihari zone substation is required.

2.3.2.8 Whataroa Zone Substation

Also supplying primarily a farming area, the one 11 kV feeder at the Whataroa zone substation covers the areas of Te Taho, Whataroa Flat and Whataroa township. The remoteness and high costs associated with supplying the Whataroa area from Harihari via an 11 kV line and isolation requirements for faults/maintenance on the 33 kV circuit between Harihari and Wahapo make the Whataroa zone substation necessary.

Fig 2.15 Whataroa Zone Substation

2.3.2.9 Wahapo Zone Substation

The Wahapo zone substation is located next to Trustpower's Wahapo power station. Its one 11 kV feeder primarily supplies the Okarito area and allows Trustpower to have a connection for their 3 MW Wahapo generator into Westpower's network.

2.3.2.10 Franz Josef Zone Substation

Primarily supplying the tourism industry in the Franz Josef township and the farming industry in the area, the two 11 kV feeders at the Franz Josef zone substation cover an area from Waiho Flat in the south to Lake Mapourika in the north. Franz Josef Zone Substation is necessary to cater for the expansion of the Franz Josef township due the growth in the tourism industry in the Glacier region.

Fig 2.16 Fox Zone Substation

2.3.2.11 Fox Zone Substation

The Fox 33 kV zone substation was built in 2003 due to the expansion of the Tourism Industry in Fox Glacier Township. The one 11 kV feeder at the Fox zone substation covers a large area from the Fox Township and Cook Flats in the north to Lake Paringa in the south. Like that of Franz Josef, Fox zone substation primarily supplies the tourism industry in the Fox Glacier township and the farming industry in the area. With the tourism industry still expanding, the vastness and remoteness of the area deems the Fox zone substation to be necessary.

Fig 2.17 Globe Zone Substation

2.3.2.12 Globe Zone Substation

The three 11 kV feeders and one 6.6 kV feeder at the Globe zone substation are for supplying the Oceana Globe Gold Mining operation outside of Reefton. Due to the demand of the Oceana Globe Gold Mine and the distance from Reefton, the Globe zone substation is critical.

Fig 2.18 Logburn Zone Substation

Fig 2.19 Pike Zone Substation

2.3.2.13 Logburn Zone Substation

The three 11 kV feeders at Logburn zone substation primarily supply the coal processing plant, bath-house and workshop for Solid Energy, and also supply a 33 kV supply to the Pike zone substation. As well, Logburn zone substation also covers the predominantly dairy farming area of Atarau from Craigeburn to Moonlight. The demand from Solid Energy and the expanding dairy farming in the Grey Valley area deems the Logburn zone substation to be necessary.

2.3.2.14 Pike Zone Substation

The seven 11 kV feeders at the Pike zone substation are for the supply associated with Solid Energy's site operations.

2.3.2.15 Spring Creek Zone Substation

The Spring Creek 33 kV substation supplies Solid Energy's coal mining operations at Spring Creek. The substation has two 6.6 kV and one 3.3 kV feeders. The substation is supplied by a 33 kV feeder from Dobson GXP.

The Spring Creek zone substation is owned by Solid Energy.

2.3.3 Justification of 110 kV Sub-transmission Lines

Asset	Use	Length	Optimum	Justified
ATU-LGN	Supplies the Logburn Substation from Transpower's Atarau GXP. Subsequently supplies the Pike River Coal Mine	9 km	Yes	Yes

2.3.4 Justification of 66 kV Sub-transmission Lines

Asset	Use	Length	Optimum	Justified
GYM-KUM	Single cct supplies Greymouth GXP. Westpower owned Transpower operated. Required to provide N-1 security to the Greymouth area.	23 km	Yes	Yes
KUM-KAW	Double cct. One cct supplies Kumara GXP from Transpower, the other HKK GXP from Kumara. Required to supply Hokitika south to Paringa	11 km	Yes	Yes
HKK-TMR	Double cct. One cct supplies HKK from Transpower, the other HKK from Kumara GXP. Required to supply Hokitika south to Paringa	8 km	Yes	Yes

2.3.5 Justification of 33 kV Sub-transmission Lines

Asset	Use	Length	Optimum	Justified
HKK-HHI	Spur line from Hokitika to Harihari. Vital supply to South Westland which will be upgraded to 66 kV	69 km	Yes. To be upgraded to 66 kV	Yes
HHI-WAT	Spur line Harihari to Whataroa. Supplies Whataroa township - south	29 km	Yes	Yes
WAT-FRZ	Spur line – Whataroa to Franz Josef. Supplies Franz Josef township – south. Is used for injection from Trustpower's Wahapo Hydro Scheme	28 km	Yes	Yes
FRZ-FOX	Spur line – Franz Josef to Fox Glacier. Supplies Fox Glacier township – south. Upgraded to 33 kV in 2003	20 km	Yes	Yes
ALD-DOB	Arnold Substation to Dobson Substation. Used primarily for injection of Trustpower's Arnold Hydro Scheme. Also supplies the Rotomanu, Moana, Haupiri area.	17 km	Yes	Yes
DOB-RFN	Dobson Substation to Reefton Substation	71 km	Yes	Yes
DOB-RAP	Spur line -Dobson Substation to Rapahoe Substation. Supplies Spring Creek Mine and Rapahoe Substation. Essential for Coast Road supply	14 km	Yes	Yes
LGN-PIK	Spur line – Logburn Rd Sub to Pike River Mine substation. Supplies the Pike River Coal Mine. Significant environmental factors justified the use of Hendrix insulated cable.	6.5 km	Yes	Yes

2.3.6 Justification of Distribution and Reticulation Lines

These lines have been installed historically to supply consumers, both as individuals and groups, and the generic justification is customer demand.

2.4 Asset Management Drivers

The factors that drive asset management activities and their relationship to Westpower's performance are derived from the external performance required of Westpower by its customers, workers (including contractors), shareholders and the public.

The drivers for this plan are as follows (these are covered in more detail in Section 4 - Levels of Service):

- Safety,
- Customer service,
- Capacity (i.e. adequacy of service),
- Reliability (i.e. continuity of service),
- Economic efficiency,
- Environmental responsibility,
- Corporate profile,
- Legislation and compliance.

2.5 Asset Management Linkage with Westpower Performance

Figure 2.20 shows the relationship between asset management and Westpower's performance.

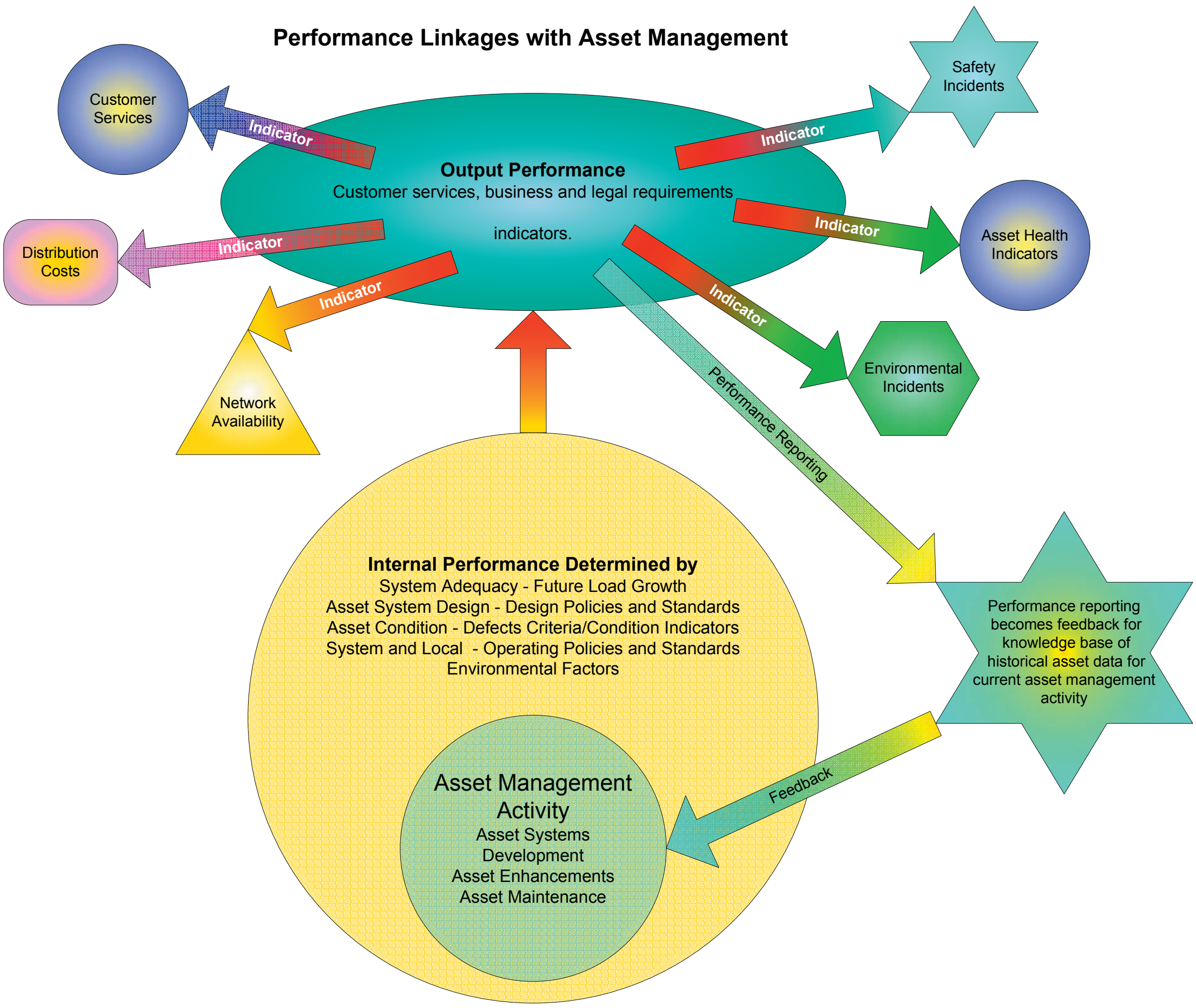


Fig 2.20 Performance Linkages with Asset Management

These relationships serve as a framework for focussing on the reasons why particular asset management activities are required.

Ultimately, Westpower's performance is judged externally and the drivers outlined in Section 2.4 are the parameters by which this performance is measured.

Different asset management and operational responses can be used to meet Westpower's external performance requirements. These may include maintenance to improve the condition of the asset, development to install assets in a new configuration, enhancements to the existing system or changes to the way in which the assets are operated. Effective management of the business involves selecting the most appropriate asset management or operational responses, as proposed in this plan.

2.6 Plan Structure and Approach

This plan uses a consistent set of defined activities and asset types to categorise work programmes and their associated expenditure. Budgeting and financial reporting within Westpower allows actual programme achievement and expenditure outcomes to be compared with the plan. Consistent use of this framework will facilitate comparisons over time.

It should be noted that the activity and asset definitions are independent of accounting classifications of expenditure (i.e. between maintenance and capital expenditure). Therefore trends over time should not be altered by any changes in the application of accounting policies regarding the treatment of expenditure. However, it should also be noted that, under the current application of accounting policies, all activities are classified as either entirely operating expenditure (OPEX) or entirely capital expenditure (CAPEX).

Similarly, the activity and asset type definitions are also independent of Westpower's organisational structure and responsibilities, although they are closely aligned with the present structure. In the long run, adherence to the definitions will ensure that the plan remains meaningful in spite of any changes in organisational structure or responsibilities.

The asset and activity planning categories are defined in Appendix A. It is obvious that not all asset type and activity combinations are used. In addition, maintenance activities can generally be planned at the detailed asset level (e.g. servicing of transformers, circuit breakers), whereas development projects or programmes, which typically involve a combination of different asset types (e.g. lines, transformers, circuit breakers, protection, communications and network management) are kept intact rather than attempting to allocate the expenditure against the component asset types.

A further definitional distinction between projects and programmes is made throughout this plan. The word "programme" is used to define a generic activity with a generic justification, but which may apply at a number of different sites. Replacement of defective insulators, fitting vibration dampers to lines and upgrading connectors are therefore classed as programmes. On the other hand, "projects" are site (or asset) specific, e.g. adding a second circuit to a particular line or upgrading a particular transformer bank.

2.7 Core and Advanced Asset Management

2.7.1 Outline of Core and Advanced Approach

Westpower is well advanced in aligning its asset management system to the British Standard PAS-55:2008, Asset Management.

PAS-55 defines the systematic and coordinated activities and practices through which Westpower optimally and sustainably manages its assets and asset systems, and our approach to performance, risks and expenditure over the lifecycle of the assets for the purpose of achieving Westpower's strategic plan.

Good asset management considers and optimises the conflicting priorities of asset utilisation vs. asset care, of short-term performance opportunities versus long-term sustainability, and capital investment vs. subsequent operating costs, risks and performance.

"Lifecycle" asset management is more than simply the consideration of capital and operating costs over the asset's life. Truly optimised, whole-life asset management includes risk exposure and performance attributes, and considers the economic life as a result of an optimisation process.

2.7.2 Limitations of this AMP

This AMP outlines Westpower's intended activities over the next ten years but should not be relied upon as any form of guarantee that such actions will occur within the timeframes stated. People wanting certainty of any actions for development should contact the company for further information.

This AMP does not cover:

- Details of Westpower's network pricing derivation and application (these are available on our website);
- Vehicles, non-network related land, buildings, furniture or general office computer equipment;
- The overhead costs of operating the network control centre and other indirect overhead costs.

Fig 2.21 Flowchart for the Development of the AMP

2.8 Asset Management Systems and Processes

Several systems and processes are used in Westpower's asset management to facilitate routine maintenance and inspections, planning for network development and measuring network performance.

Network data collection and reporting is performed and represented by GIS (spatially) and Maximo (the asset infrastructure framework). Although they are independent, GIS and Maximo share location and asset data via a series of synchronisations and system views. These data are used to evaluate risk, inform managers and provide the framework for preventative maintenance, all of which improve overall management of the Westpower network.

These systems, and the accurate and timely information they provide, support the cost/benefit effect of maintenance. This results in better maintenance optimisation and predictions of long-term effects.

This section outlines the following systems and process:

- New connections,
- Preventative maintenance,
- Asset maintenance and inspections (condition assessment programme),
- Network development,
- Network performance.

2.8.1 New Connections

Workflow is an integral part of Westpower's asset works management system and enforces Westpower's business processes. Figure 2.22 describes the workflow used for new connections. The key elements of the workflow include notification to the customer and electrician so they are informed, and the acknowledgement from the retailer ensuring that all customers have a retailer contract before they are livened.

All new connection requests are maintained on the asset management system, and supporting documentation showing connection points, connection agreements, and livening sheets are attached to these requests.

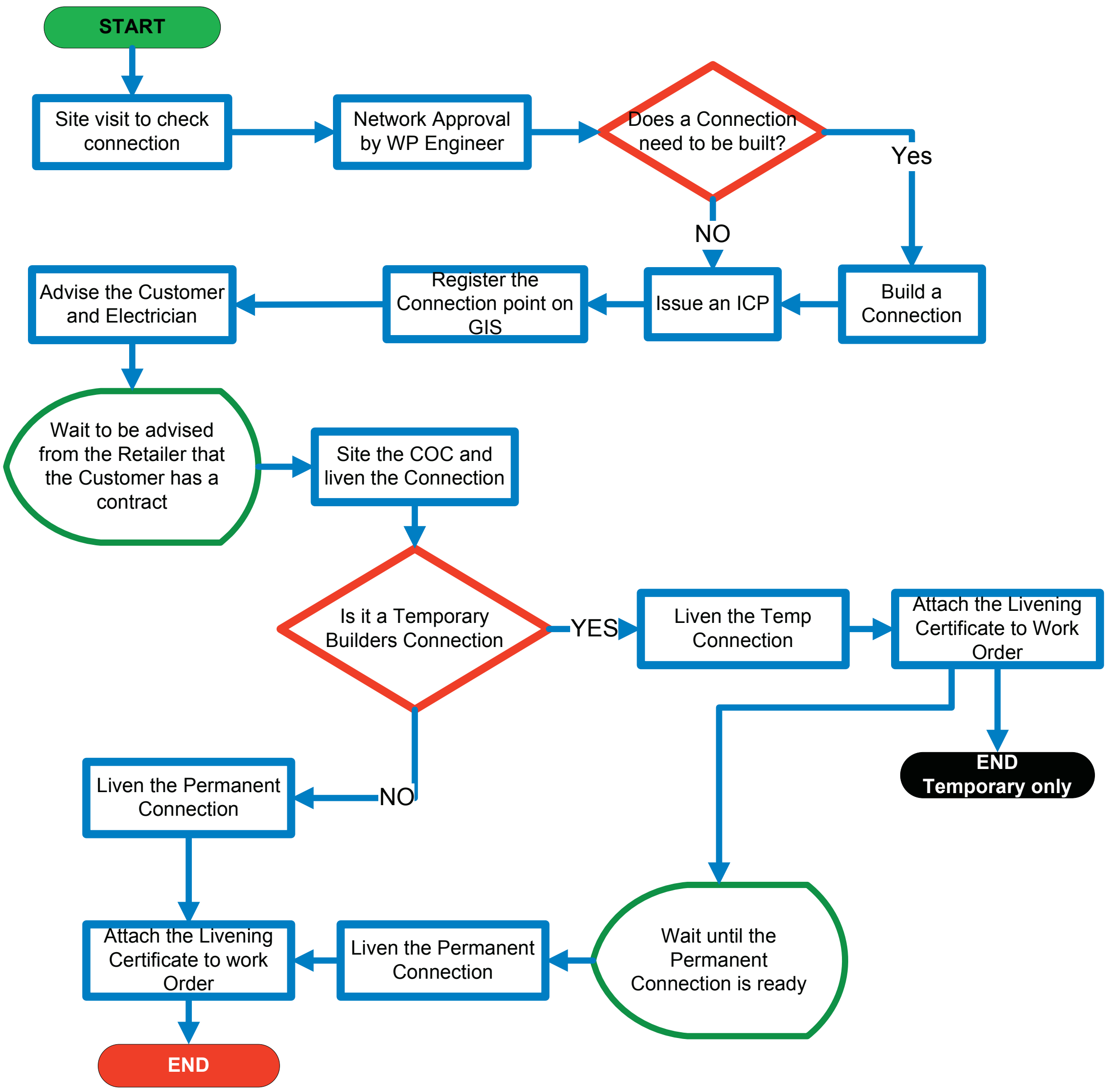


Fig 2.22 Process for New Connections

2.8.2 Preventative Maintenance

Westpower has employed Preventative Maintenance (PM) plans which are performed regularly, based on elapsed time or meter readings. PMs are being developed for each asset/location that is active within the network and where condition assessment does not apply.

The time-lapsed PMs are based on the manufacturer's specifications/recommendations or engineering assessments subject to the nature of the equipment, its importance to the network and the environmental conditions it may be exposed to.

As these PMs are developed, job plans are attached that dictate the nature of maintenance required on a task-by-task basis. Where relevant, the task sequence is also determined on the job plan. Any photos or manufacturer's manuals of the equipment or location are also attached to the PM.

Where appropriate, routes are applied to PMs which organise work packages into a logical and efficient order.

In addition to elapsed time or meter reading-based preventative maintenance initiation, Westpower is optimising outages and coordinating maintenance during these periods.

2.8.3 Condition Assessment Programme

Field data collection initiatives, in conjunction with work audit processes, will ensure that accurate data are collected in a timely fashion, which, in turn, will instil confidence in reporting historical asset data.

The first stage of the data collection programme was the upgrade of the condition assessment programme, which provides direct integration of the ArcPad field data collection system with the ArcSDE database. This information is then passed to Maximo on a nightly schedule. Assets are inspected on at least five-yearly intervals, and changes are recorded on completion of any work carried out. The spatial and aspatial data collected provide an accurate reflection of the network at any one time.

Audits carried out at work completion assist with the closing off of the process.

The processes outlined above have been activated and are proving to be very successful.

Processes have been initiated to ensure all assets are recorded. This financial year will see the collection of both spatial and aspatial data pertaining to LV pillar and link boxes. It is envisaged that all assets, including LV line, will be recorded within two years. This will enable more accurate tracking of work history and will align with the Maximo hierarchy.

2.8.3.1 Westpower Condition Assessment Specification

To enable Westpower to assess the condition of its network accurately, a condition assessment programme has been initiated. This programme involves the collection of relevant data on primarily lines and associated equipment. This data are then used, via GIS, to forecast required maintenance and capital works, and also to identify areas which may pose health and safety risks.

Collection is performed using Motion Tablet computers, complete with the Environmental Systems Research Institute's (ESRI) ArcPad software, which eliminates the need for manual data entry into the GIS.

All wooden poles are scanned using a Nuclear Density Meter (PortaSCAN) to give a true indication of the density of the wood and determine if there is any hidden rot or faults in the wood that cannot be seen by the inspector. The results from these scans are imported into the GIS system for analysis.

Twenty percent of each line (feeder) is assessed in a year, allowing the total network to be completed in a five-year cycle.

Network components to be assessed will be divided into categories, namely:

- Poles,
- Pillar boxes,
- Linkboxes,
- Crossarms,
- Fittings (brace bars, insulators, shackles, pole steps, LV fuses etc.),
- Stays,
- Disconnectors,

- Transformers,
- Drop-out fuses and lightning arrestors,
- Earthing systems,
- LV Conductors,
- HV conductors,
- Cables LV,
- Cables HV,
- Other (reclosers, sectionalisers, capacitors, etc.),
- Vegetation.

All categories are assessed using the same terminology as follows:

Excellent

Component is near new, less than two years old, and/or still in excellent condition;

Good

Component still has greater than a ten-year life expectancy and is generally in good condition;

Fair

Component has a less than ten-year life expectancy, but will last longer than five years;

Poor

Component could last up to five years but is generally in poor condition;

Needs replacing

Component is considered condemned but will last up to two years;

Red tagged

Component is in urgent need of replacement, and poses a health and safety risk.

2.8.3.2 Methodology

The process for each component will be completed as described below.

Pillar boxes

All pillar boxes shall be thoroughly inspected and earth resistance tests carried out. The condition of fuses, cables and the box shall also be recorded.

Poles

All wooden poles shall be thoroughly inspected below ground (to 600 mm). A standard probe test shall be carried out, along with a hammer test. Any knot-holes or splits above ground shall be probed and assessed accordingly. In addition to this a nuclear density scan will also be conducted to assess the internal structure of the wood.

All poles shall have a detailed visual inspection performed. This includes the recording of any spalling or cracking found on concrete poles.

Crossarms

All crossarms shall have a detailed visual inspection performed. Any suspect LV or service crossarms shall be probed and assessed accordingly. Any suspect HV or sub-transmission crossarms shall be noted for future inspection.

Fittings

Fittings, such as brace bars, insulators, shackles, pole steps, LV fuses, bolts etc., are to be assessed collectively using a detailed visual inspection. The worst-case condition of fittings shall be recorded. If any fitting is assessed as 'poor' or 'needs replacing', notes describing relevant details of the fitting shall be recorded.

Stays

The condition of stays and their associated fittings are to be assessed collectively using a detailed visual inspection. This will include the condition of stay wire, stay insulators, stay dead-end, hoses, eyebolts etc. The worst-case condition of stays and their fittings shall be recorded.

Transformers

Transformers shall have a detailed visual inspection performed, including checks on oil levels, cracked bushings, deterioration of gaskets and any signs of oil discharge.

Dropout Fuses and Lightning Arrestors

Dropout fuses and lightning arrestors shall have a detailed inspection performed, with their condition to be assessed collectively. The worst-case condition of dropout fuses and lightning arrestors shall be recorded.

Earthing System

The earthing system for transformers, disconnectors etc. shall be assessed by means of a detailed visual inspection. Only exposed components of the earthing system need to be inspected, with the worst-case condition of the earthing system being recorded.

LV Conductors and HV Conductors

General condition of overhead conductors shall be recorded. Conductors shall be assessed by voltage. The worst-case condition of the conductors shall be recorded in the case of multiple conductors of the same voltage.

LV Cables and HV Cables

General condition of underground cables shall be recorded. Only exposed components of underground cables need to be inspected, with the worst-case condition of the cables being recorded in the case of multiple cables of the same voltage.

Vegetation

While assessing the condition of Westpower's network, the assessor shall note any vegetation that may be encroaching the line, or any access to equipment that may be hindered by excessive vegetation.

General Comments

The assessor will be required to note any general comments that could provide information to assist the overall security of Westpower's network.

Work Required

Any maintenance work identified should be recorded in the work required text box. Photos must be taken where work is required and the number recorded in the photo ID box. All work required descriptions should be as detailed as possible, with a description of the defect and recommended actions. An electronic copy of all photos must be supplied to the asset management division in Greymouth on completion of the assessment.

Field data are then uploaded into the Spatial Database Engine (SDE). All condition codes are updated instantly as these data are uploaded, changing the status of the asset's last condition and date of assessment. All work required is then separated and analysed using ArcGIS, and work orders raised where needed.

These data can now be audited for analysis and further assessment when needed. Figure 2.23 shows the condition assessment process.

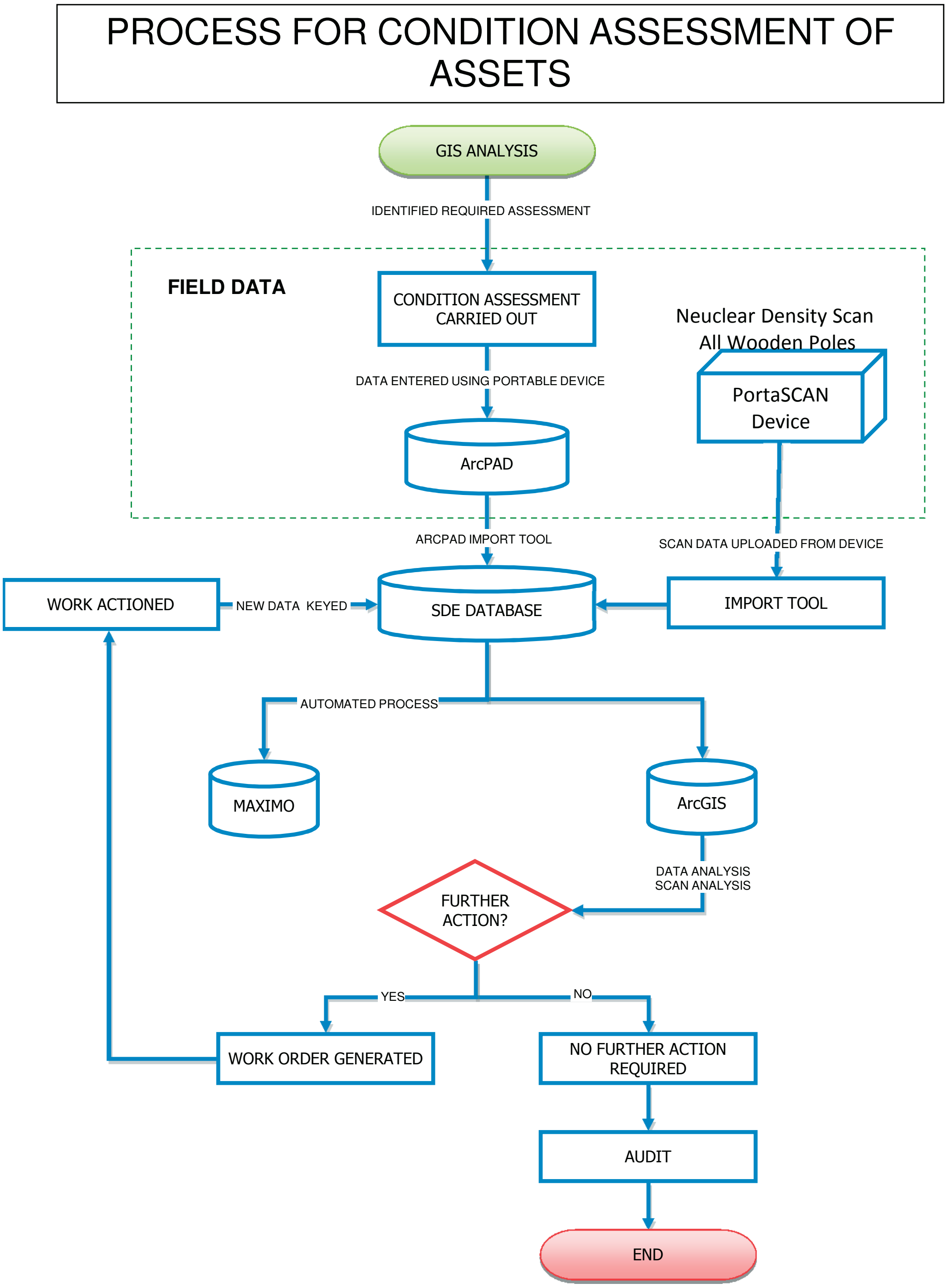


Fig 2.23 Condition Assessment Process

2.8.3.3 *Condition Assessment Data Retrieval*

All asset data collected in the field are uploaded to the GIS from the hand-held device updating certain fields and tables in the database. The condition assessment date is also updated so these assets can be assessed again within five years.

Density Scan Data

The scan data is uploaded from the PortaSCAN devise and brought into the GIS database for further analysis, any issues found as a result of this analysis are raised immediately for resolution.

Work Required Table

The work required table uploaded from the hand-held device is split into two categories: urgent and non-urgent.

Urgent work is grouped into areas. A work order is then generated for this area, including any assets marked as needing replacement or red tagged in the condition attribute of the asset data. Any asset that requires instant action will have a separate work order raised in order to rectify this issue as soon as possible.

Non-urgent work is also grouped into areas and is set aside for action during planned outages or when time allows.

The data retained in this table also enables the asset team to design efficient maintenance programmes by being able to identify specific asset types and their location.

Condition Codes

All asset data are returned with an updated condition code, and these codes are separated and analysed for action where required.

Excellent condition

No further action is required on these assets before the next scheduled assessment;

Good condition

These assets have more than ten years' life expectancy and will be assessed again within this term;

Fair

These assets have less than ten years' life expectancy, but will last longer than five years and will be assessed again within this term;

Poor

This asset could last up to five years; however, as it is in poor condition, future assessment will be required during this term;

Needs replacing

Any assets with this condition code are grouped into areas along with any other urgent work required and a work order is raised for the asset(s) to be replaced as soon as possible;

Red tagged

All red tagged assets are urgently in need of replacement and work. Using the network analysis toolbar in the GIS, the asset team is able to flag a disconnector that is planned for future outage, and to identify any of the work required in the affected area.

Work orders are then raised for this work to be done during the planned outage.

2.8.4 Network Development

A network development plan is required to maintain, enhance and develop the operating capability of the Westpower network, and while there is no separate document published as a result of this process, it is nonetheless embodied in the replacement, enhancement and development activities contained within the AMP. The following activities are key elements in the development of the plan:

1. Develop and update a ten-year period load forecast following the recording of the summer or winter maximum demands and future development information. These load growth projections are used as a basis for determining the likely timing for those projects.
2. Evaluate network limitations and select the best development/configuration to alleviate each system limitation.
3. Complete the identification of the necessary major project on the basis of repeatedly evaluating the network limitations and selecting the best developments for each year of the forecast period, assuming completion of the projects in the design and construction phase and of the projects identified in earlier years of the forecast period.
4. Collect any relevant data relating to the network's performance or capability. These includes data on switchgear condition, transformer condition, poorly performing feeders, operational limitations, etc.
5. Identify areas where future substation sites and/or future circuits may be required.
6. Revision may be required in the period between the annual reviews if new projects are identified in that area or existing projects are significantly changed.

There are two different planning types considered by Westpower when developing a network development plan:

- HV planning,
- LV planning.

HV planning incorporates a list of zone substations and associated subtransmission feeders, a list of strategies for network development, recommendations for the acquisition of future substation sites, and HV circuit easements grouped by area to ensure that sufficient capacity is available in Westpower subtransmission and zone substation infrastructure.

LV planning is developed to ensure that adequate voltage levels are maintained for all customers along a LV distribution at all times throughout the life of the LV network. In order to achieve this, accurate voltage drop calculations are carried out at the design stage.

Figure 2.24 shows the process to determine development options.

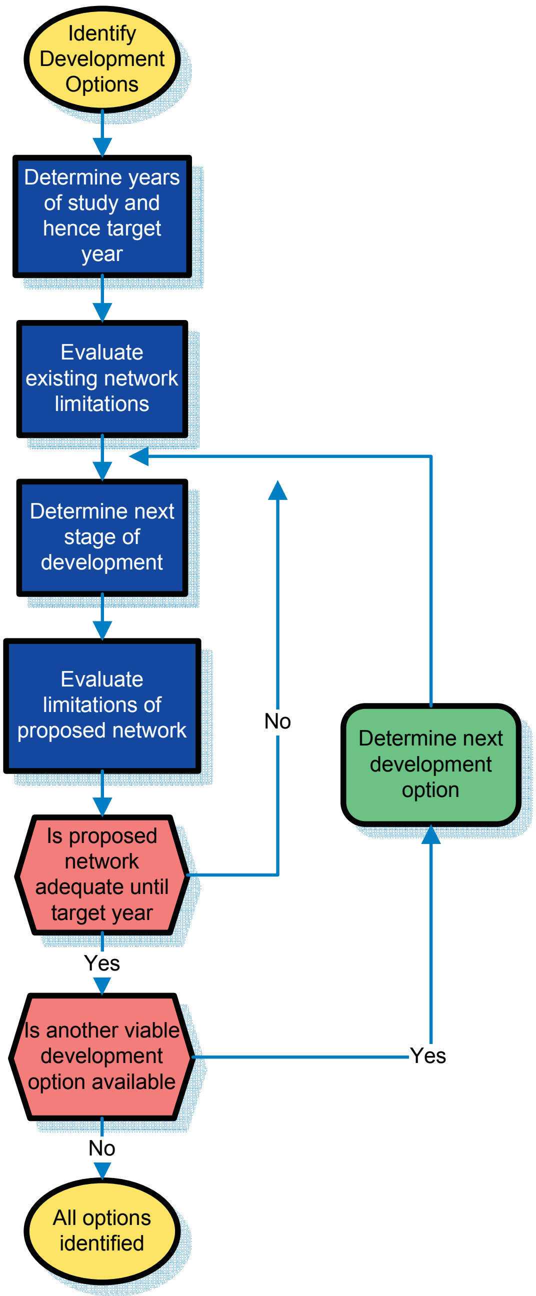


Fig 2.24 Process to determine development options

2.8.5 Asset Data Collection

Historically, asset data were collected through as-built drawings and recorded on hard copy files. The inception of the GIS allowed these data to be electronically recorded; however, much of these data were initially still captured on paper and manually transferred to the electronic format. Advances in technology have seen electronic data being collected in the field and automatically transferred to the GIS, creating a more accurate and efficient data collection system than was employed in the past. These data are now utilised for a number of tasks including asset condition monitoring, asset valuation, work scoping, outage planning and a number of regulatory tasks. Confidence in the integrity of the data has grown with the current data collection methods used and high levels of accuracy are now being achieved.

As mentioned, much of the data relating to Westpower's assets have been collected. However, in some cases, data are missing or incomplete. Programmes such as condition assessment and pillar box inspections have been initiated to ensure all field data are included in the GIS and Maximo systems via the synchronisation process. The various asset types and plans in place to ensure data accuracy are listed below.

2.8.5.1 Poles and Spans

New or replacement poles and spans are recorded during the design phase of each job and transferred from design software to GIS with a status of "Not Ready". Once the line construction is completed, the status is changed to "Active" and all relevant attribution is populated.

Any pole or span replacements not requiring design are updated on the GIS by electronic means or the manual pole data form.

Pockets of poles and spans on the network are yet to be recorded; however, these assets are rapidly being identified and corrected, primarily via the condition assessment programme.

2.8.5.2 Underground Cables

Although many underground cables have been electronically recorded, there is still a large number to yet be included. Programmes such as pillar box identification and inspection will assist to identify those cables not currently included in the GIS.

A programme to record missing cables and relevant data was initiated in 2010 and will continue, with each area having cable data systematically recorded.

As with spans, the spatial recording of underground cables is integral to utilising GIS functions such as network tracing (connectivity), which asset management staff are becoming increasingly dependent on for a number of tasks.

2.8.5.3 Pillar Boxes

An identification and inspection programme was initiated in 2008 to record all pillar boxes on the Westpower network electronically. Both spatial and aspatial data are recorded, along with a series of tests. Any defects found are recorded at the time of inspection and are automatically uploaded to the GIS with the core inspection data to be actioned. This programme was completed in February 2010. Any new pillar box additions to the network are spatially recorded either via locality plans or global positioning system (GPS) readings. Similar to pole data collection, attribution data can be gathered electronically or by completing the manual pillar box data form.

2.8.5.4 Transformers and Switchgear

There are a number of methods for collecting data for transformers and switchgear. As these components generally consist of a location (earths, fuses etc.) and an asset (transformers, disconnectors etc.), data are recorded independently. The transformer or switchgear is recorded only in Maximo, with the location data being recorded in the GIS and becoming available to Maximo upon nightly synchronisation. Although they are stored in a different database, the asset data are viewable on the GIS when querying a location.

Asset histories recorded in Maximo include information such as asset moves, servicing history (via work orders) and asset specifications, whereas the location data are recorded in the field either by hand-held electronic devices or manual data entry forms. A very high level of confidence is awarded to the transformer and switchgear data, with records being periodically audited.

*2.8.5.5 **Summary***

Processes previously unavailable are now in place to ensure any network additions, deletions or asset moves are recorded in the appropriate repositories. Maximo workflows and auditing processes allow asset management staff to audit each work order, and to check that all documentation and data entry is completed before closing off the job. With this in mind, the integrity of the data can be assured and can be utilised with a high degree of confidence.

2.8.6 Measuring Network Performance

The following section outlines the process by which Westpower records its outage data to comply with disclosure requirements.

All interruptions to Westpower's network are recorded, including those on the Transpower grid. For disclosure purposes, all relevant outage data are reported on and grouped by class (i.e. Class A, B, C and D. Classes B and C relate to Westpower; Classes A and D relate to Transpower).

*2.8.6.1 **Data Collection***

At the time of an outage, there are two categories of notification that may occur: Alarm/Operator and Informant/Customer. These notifications trigger the recording part of the process.

Alarm/Operator

If a circuit breaker opens, an alarm will trigger on the SCADA system and the operator (if on duty) will notify the retailer. If the operator is not on duty then the alarm will trigger a pager and the on-call operator will be called in.

Informant/Customer

If a circuit breaker has not opened and the cause of the outage is localised to a distribution transformer (for example), this will not cause an alarm on the SCADA system. The fault will generally be forwarded to the retailer from the affected consumer.

The outage will then be passed on from the retailer to Call Care, who will then notify ElectroNet Services, who will initiate any work required to fix the fault. A Control Room operator will collect the following data whenever a network interruption is experienced:

- Date and time (time power went off and time last customer was restored),
- Location,
- Description of event,
- Type of outage (planned or unplanned),
- Feeder,
- Notification,
- Component affected,
- Cause,
- Voltage affected,
- Protection unit information,

- Network (Westpower or Transpower).

This outage information is currently stored in a geodatabase via Westpower's GIS. The GIS is used to select transformers affected by an outage and, along with all related information, is recorded as a entry in the geodatabase.

Customer information such as Installation Connection Point (ICP) numbers, retailer numbers and site numbers are automatically updated every night and stored as a Comma Separated Variable (CSV) file. This file is uploaded to the geodatabase and used in calculations to find the number of customers affected by outages. The customers are linked to their respective transformer numbers, so when transformers are selected from the GIS, an accurate number of customers can be found.

2.8.6.2 Data Processing

SAIDI, SAIFI and CAIDI are the most widely accepted KPIs for electricity networks.

Westpower collects the data required from several different internal systems including the GIS and Maximo to perform the following calculations:

SAIDI (Total System Minutes Lost x Number of Customers Affected) / Total Number of Customers

SAIFI Number of Customer Interruptions / Total Number of Customers

CAIDI Can be derived by dividing SAIDI by SAIFI

In some power outage events, not every customer has their power restored at the same time. Because of this, it is unrealistic to use the start and end time of an outage to calculate SAIDI and SAIFI.

1. Each switching operation is recorded, including the number of customers affected and the time power went off and the time power was restored.
2. A SAIDI/SAIFI figure is calculated for this operation.
3. To calculate the total for the outage, the SAIDI/SAIFI for each operation is summed.

Figure 2.25 shows the data process.

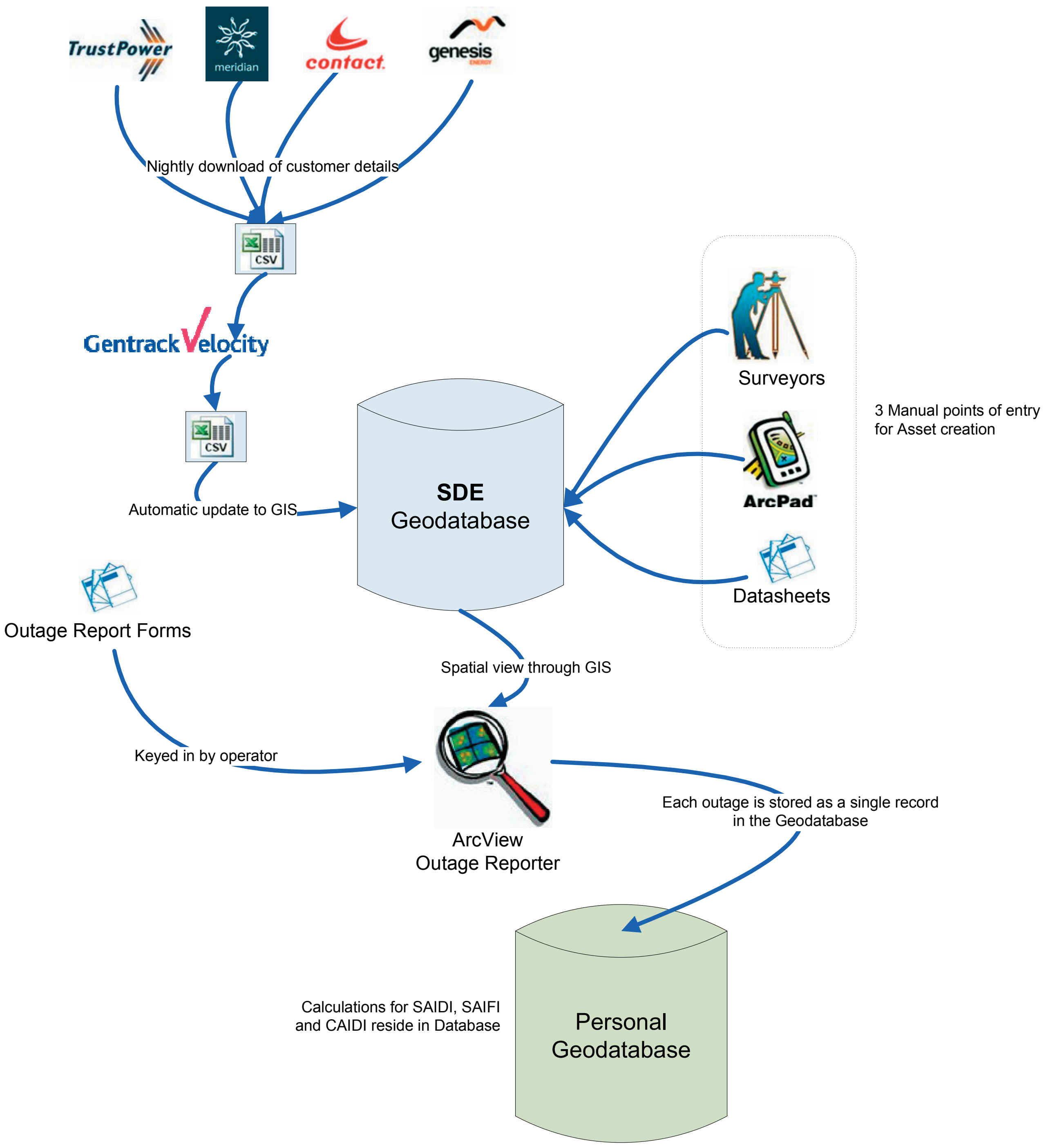


Fig 2.25 Data Model for Reliability Data

3.0 ASSETS COVERED

Westpower owns electricity reticulation assets that are used to provide distribution and connection services to electricity retailers and generators. These assets generally comprise equipment that is common to all New Zealand ELBs and, wherever possible, industry standard assets have been employed. In particular, the AMP covers the electricity and associated systems owned by Westpower, comprising:

- Sub transmission assets - Electric lines and cables, including associated easements and access ways, operating at voltages of 33 kV and higher;
- Distribution assets - Electric lines and cables, including associated easements and access ways, operating at a voltage of 11 kV;
- Reticulation assets - 400 V electric lines and cables, including associated easements and access ways;
- Services - Connection assets at any voltage owned by Westpower for the purpose of supplying a single customer (not including the line on the customer's premises);
- Zone substations - HV substations connected to the subtransmission network. This includes all plant and equipment within the substations such as transformers, switchgear, structures and buswork, SCADA, protection and metering equipment, and station land and buildings;
- Distribution substations - Substations connected to the distribution network. This includes plant and equipment within the substations such as fuses, platforms, lightning arrestors and maximum demand indicators, together with land and fibreglass covers, but excluding transformers;
- Medium Voltage switchgear - Circuit breakers, reclosers, sectionalisers, regulators and disconnectors used in the distribution and sub transmission systems;
- SCADA and communications equipment – SCADA and communications equipment and associated facilities not installed at zone substations. This includes control room equipment, radio repeaters and fibre-optic systems installed, owned and maintained by Westpower;
- Distribution transformers - Standard transformers used in distribution substations ranging from 5 kVA to 1000 kVA and generally having a primary voltage of 11 kV;
- Ripple control - Ripple injection equipment;
- Embedded generation - Generation units connected to Westpower's network but not necessarily owned by Westpower;
- Capacitor units - For voltage support;
- Mobile substation - Allows improved maintenance access to existing substations and for emergency use in case of substation failure;
- Buildings - Substation buildings within the Westpower network.

Westpower own assets throughout the length of the West Coast of the South Island, and this area extends about as far as the distance from Christchurch to Dunedin (refer to Figure 3.1).

An overview of Westpower's network diagram can be seen in Figure 3.3.

3.1 Asset Condition

The present condition of the above asset types is also described in this section, based on information from routine inspections.

The reader unfamiliar with the geographical layout of the system is referred to the maps throughout Section 3.

This assessment of the present condition of the assets, and the implications of this on future network asset performance after taking asset criticality into account, is the basis for the proposed maintenance programmes and network development described in Section 5. The primary asset management drivers are:

- Safety,
- Network performance,
- Economic efficiency,
- Environmental responsibility,
- Corporate profile,
- Regulatory compliance.

The majority of these network assets are shown in value terms as a percentage of Optimised Depreciated Replacement Cost (ODRC) in the pie chart of Figure 3.2.

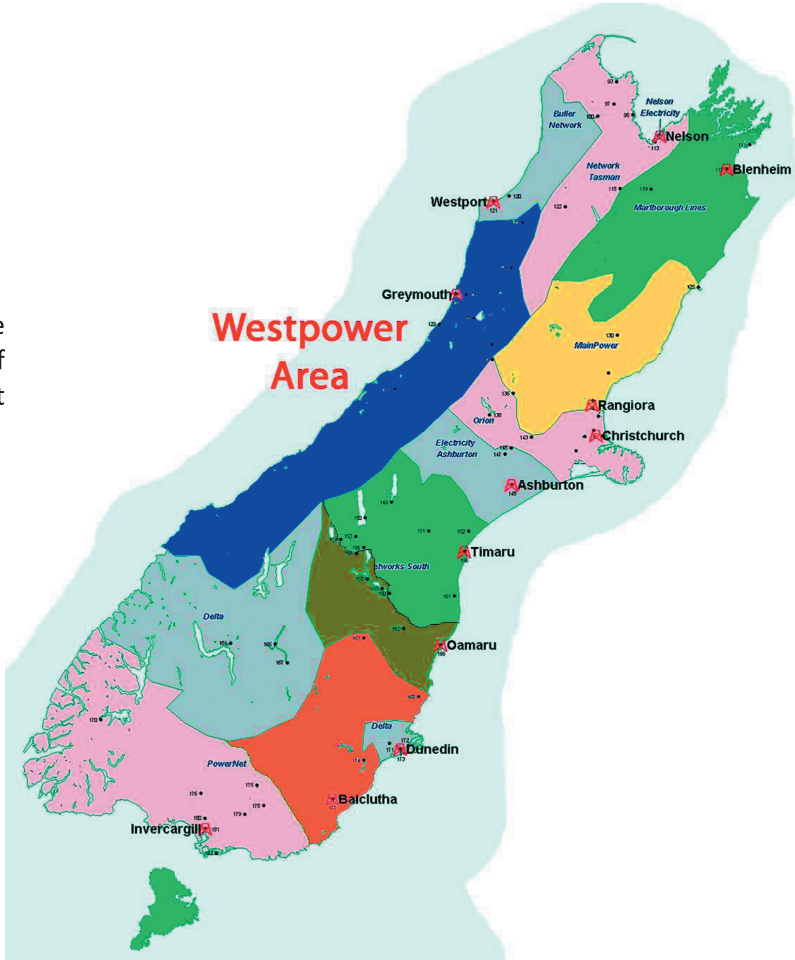


Fig 3.1 Westpower's Operational Area in relation to other South Island Electricity Lines Businesses

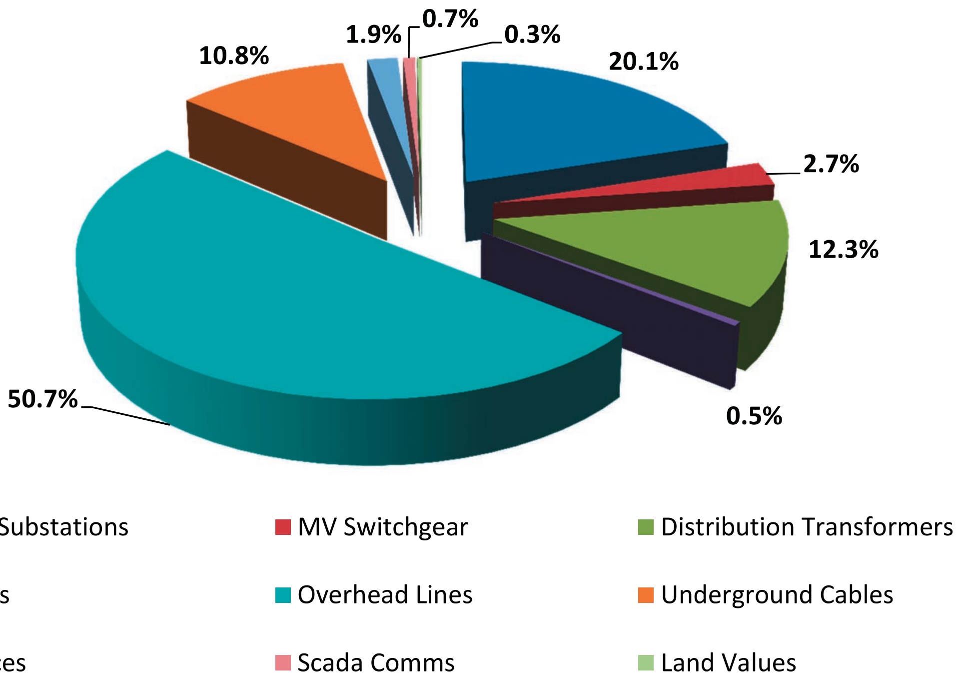


Fig 3.2 ODRC - Optimised Depreciated Replacement Cost (as a percentage of Total Network Asset ODRC)

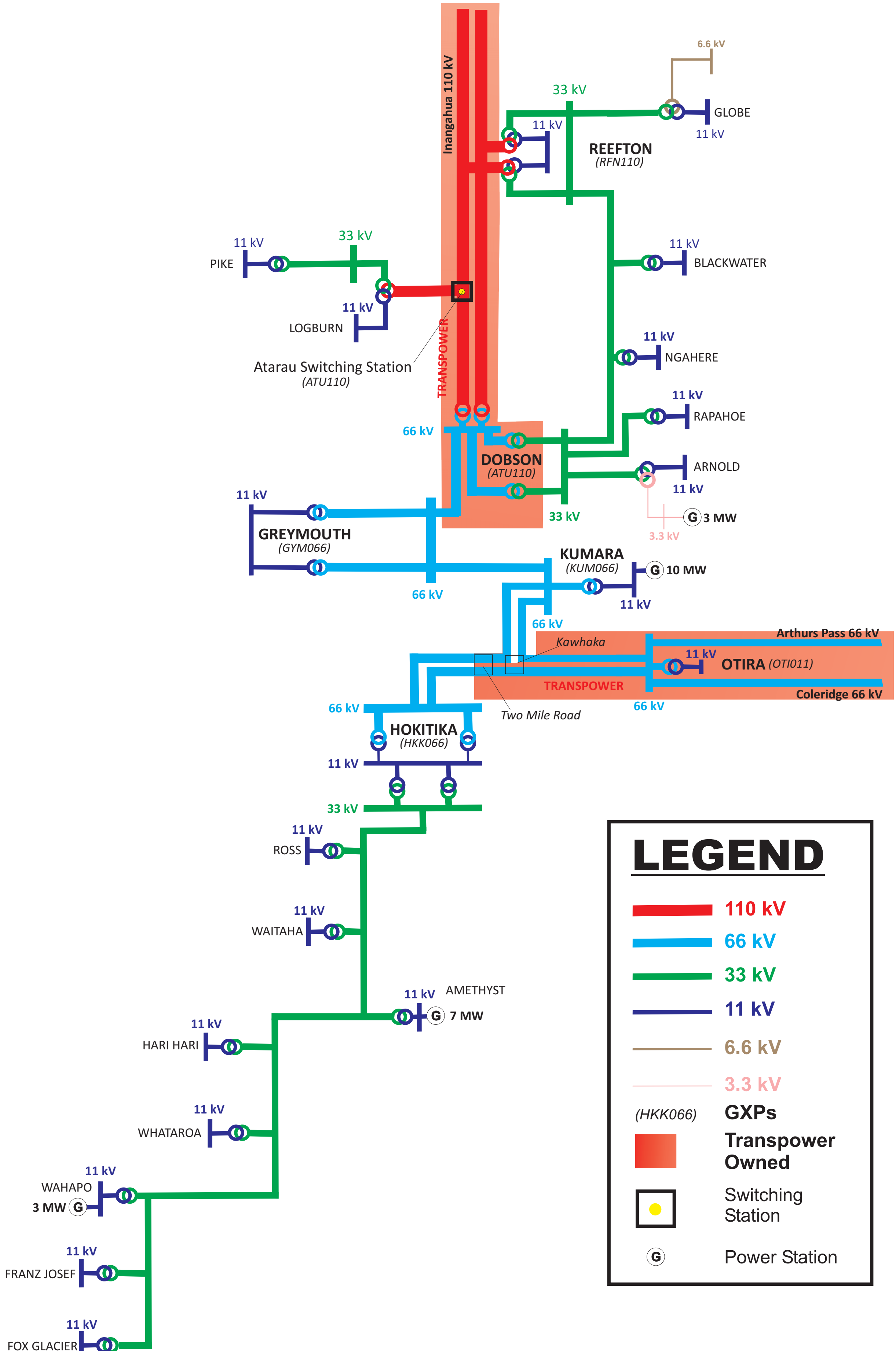


Fig 3.3 Diagram of Westpower's Network

3.2 Transpower GXPs

Atarau switching station, situated on Transpower's Dobson to Reefton to Inangahua circuit, was commissioned by Transpower in 2007 to feed the Pike River Coal Mine. Westpower takes supply at 110 kV from this GXP.

The Electricity Commission's approval of the WCGUP in 2008 paved the way for an additional 110 kV circuit constructed from Dobson to Reefton, and this circuit provides two geographically diverse and relatively strong feeds from Inangahua to Dobson, securing supply into the West Coast from the north. Westpower was already well advanced with securing property rights for this route, which extends some 72 km through farmland and Department of Conservation (DOC) reserves, and had built up a good rapport with local landowners.

The new line, termed DOB-TEE A, was commissioned in late 2011 and provides n-1 security to the Atarau GXP. An agreement was reached between Transpower and Westpower for Westpower to construct the new line and then sell it to Transpower on commissioning.

Prior to the completion of this line, there was insufficient capacity in the Transpower network to supply this load from the south in the event of a fault on the 110 kV circuit from the north. The load was therefore interruptible.

This project, along with a related 14 Mvar switched capacitor bank installed at Hokitika, has restored security levels to a good electricity industry practice standard for loads of the size and type supplied by Westpower.

Westpower takes supply from seven Transpower GXPs at 110 kV, 66 kV, 33 kV and 11 kV as shown in Table 3.1.

Table 3.1 - GXP Capacity and Load Profile

GXP	Asset Owner	Voltage (kV)	Transformer Max Capacity (MVA)	Present Maximum Demand (MW)
Greymouth	Westpower	66	2 x 15	13.17
Hokitika	Westpower	66	2 x 20	19.277
Kumara	Westpower	66	1 x 10	9.246
Dobson	Transpower	110	2 x 17	8.701
Otira	Transpower	11	1 x 2.5	0.589
Reefton	Westpower	110	2 x 30	10.6
Atarau (Switching Station) / Logburn Rd*	Transpower	110	1 x 30	0.6
* The Atarau switching station supplies Logburn Rd substation and therefore the transformer capacity is applicable for Logburn Rd.				

Maintenance of the metering equipment at these GXPs is Transpower's responsibility.

The southern part of the Westpower network is fed from a double-circuit 66 kV line from Coleridge, which is supported by a limited capacity 66 kV connection between Dobson and Kumara (see Figure 3.3). This provides an acceptable level of supply security, although some load curtailment may be necessary should a common mode fault affect both circuits of the incoming double-circuit line at the same time. The probability of such a fault occurring is relatively low.

The construction of the twin-circuit Kumara-Kawhaka line in May 1997 by Westpower has greatly improved security of supply to the Kumara and Greymouth supply points. It is considered that the levels of security are appropriate for Westpower's network in line with industry best practice for loads of this size and type.

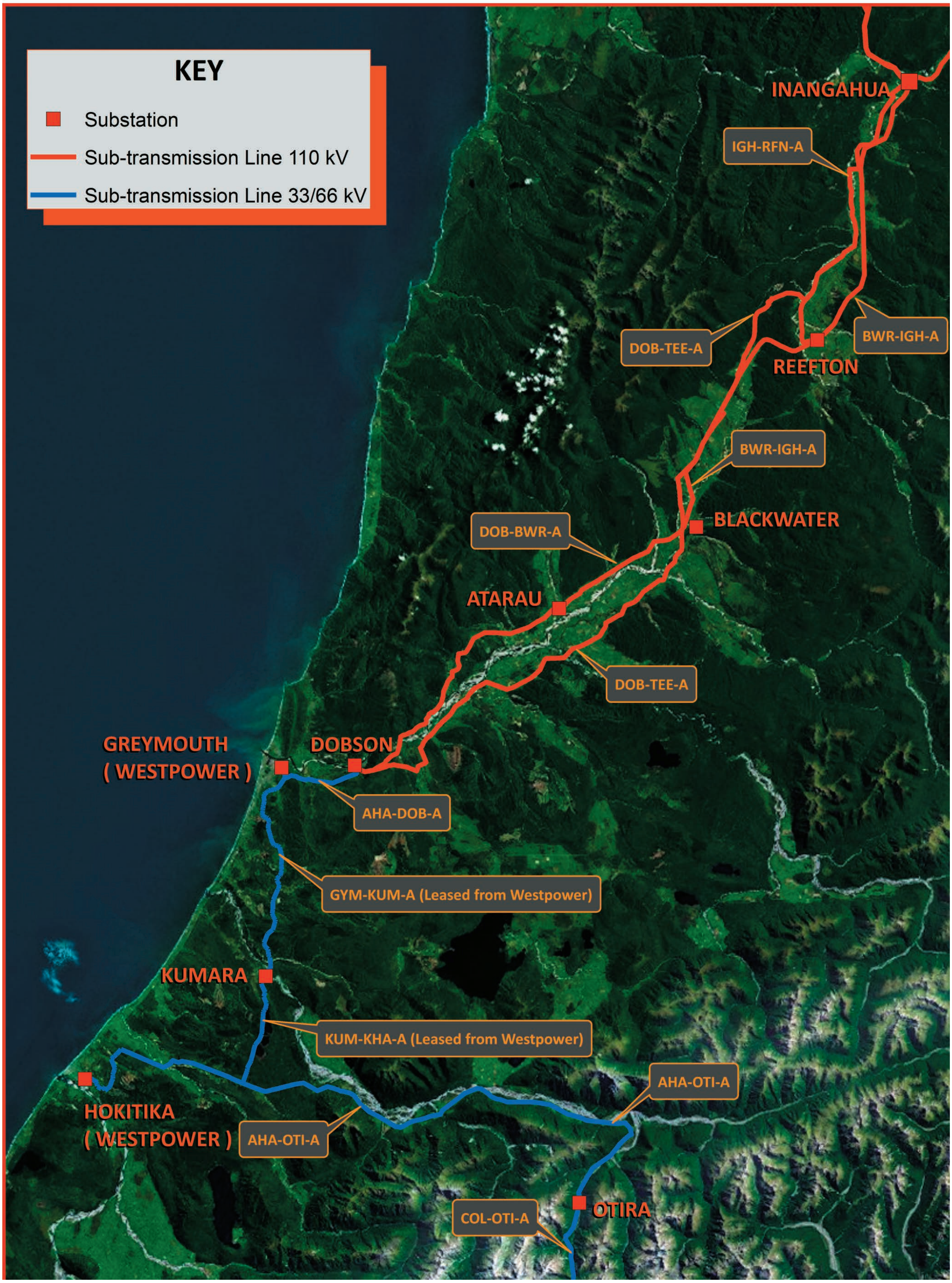


Fig 3.4 Map of Transpower Lines to Westpower's Network

3.3 Sub Transmission Assets

Westpower owns three distinct classes of subtransmission assets, running at 110 kV, 66 kV and 33 kV. The 66 kV assets are leased back to Transpower for operation as part of their West Coast transmission network and these assets are under Transpower's operational control.

The 110 kV assets owned by Westpower include the Reefton substation, where the interface points between Westpower's and Transpower's assets are the incoming disconnectors on the line side of the 110 kV circuit breaker.

Westpower also owns an 8 km stretch of 110 kV line from Transpower's Atarau switching station to an associated 20/30 MVA 110/33/11 kV substation at Logburn. This was commissioned by Westpower in 2007 as part of the reticulation to the Pike River Coal Mine.

3.3.1 Asset Justification

Sub transmission assets, either at 110 kV, 66 kV or 33 kV, are required to transmit high levels of electrical energy over significant distances, prior to stepping the voltage back down to 11 kV for local distribution. The long distances involved in reticulation of electricity on the West Coast mean that these assets are essential for the capacity and load diversity involved.

3.3.2 Sub Transmission Asset Condition

The condition of the sub transmission assets largely reflects their age and the quality of materials used in construction. In general, the 33 kV lines are constructed with concrete poles and the 66 kV lines with hardwood poles.

Figure 3.5 shows the age profile of sub transmission lines, by circuit kilometre.

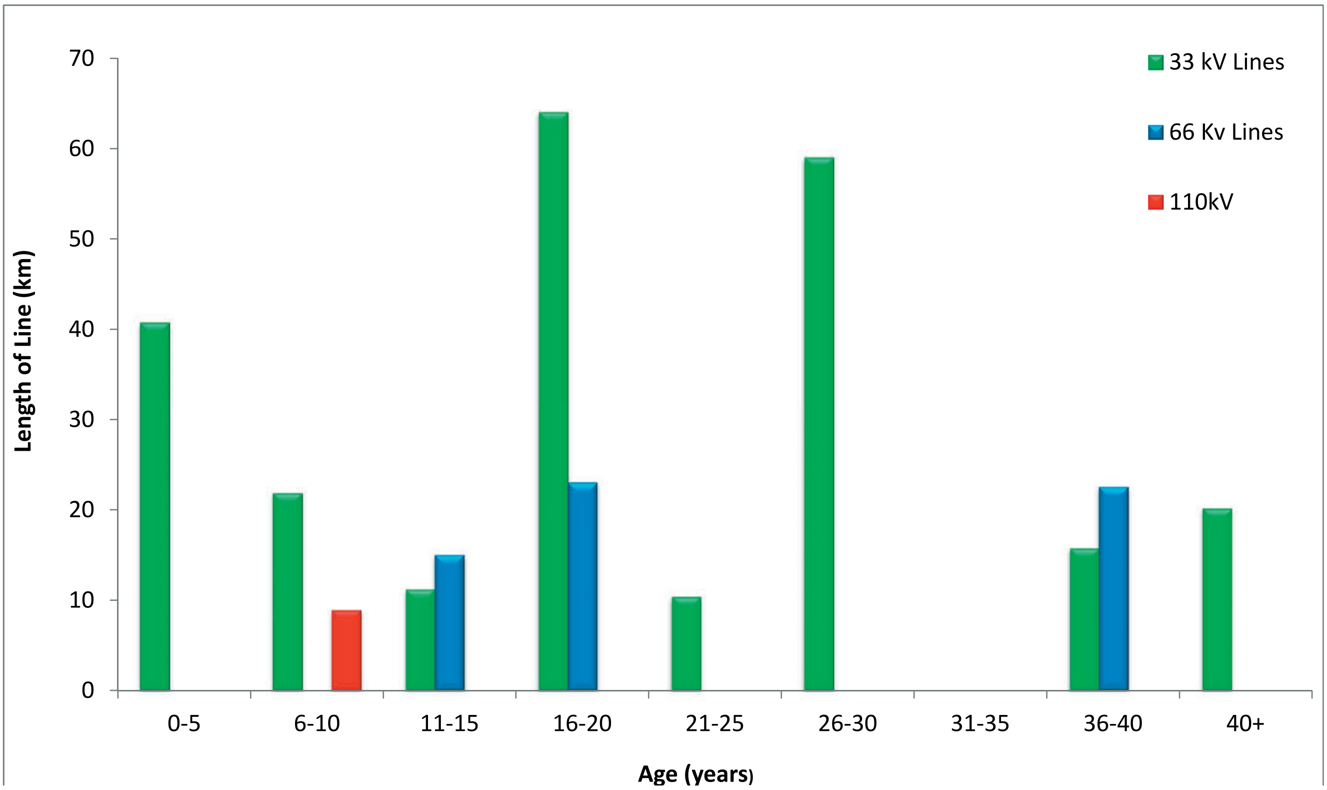


Fig 3.5 Sub-transmission Line Age Profile

The present condition of any sub transmission line is largely a factor of its age, the quality of materials used and the environmental corrosiveness of the location it traverses.

Westpower's sub transmission lines fall into four broad groups: 110 kV pole lines, 66 kV wood pole lines, 33 kV pole lines and 33 kV fully insulated lines using 33 kV Hendrix Spacer Cable.

3.3.3 110 kV Lines

Westpower owns one 110 kV line from Atarau to Logburn Road. This line is 8 km of concrete poles strung with Neon All Aluminium Alloy Conductor (AAAC).

Table 3.2 summarises the quantity of the 110 kV line by circuit length.

Table 3.2 - 110 kV Lines Summary

Type	Circuit Length (km)
Light Overhead	0
Medium Overhead	0
Heavy Overhead	9

3.3.4 66 kV Lines

DRC* - $ 2,074,730

ODRC - $ 2,074,730

Westpower owns three overhead 66 kV sub transmission lines. Two of these are connected to the Westpower Kumara Substation, while another is an extension of the Transpower-owned TMR-OTI circuit.

As discussed above, all three of these assets are currently leased to Transpower on a long-term lease arrangement.

The line between Greymouth and Kumara is a 25 km hardwood pole line strung with Dog Aluminium Conductor Steel Reinforced (ACSR) conductor. This was constructed in 1977 to connect the Kumara power station to the Westpower Greymouth substation and then to the Transpower grid.

The 66 kV double-circuit treated hardwood pole line between Kumara and Kawhaka was commissioned in 1997, and this was subsequently leased to Transpower, allowing them to reconfigure the grid on the West Coast. The line is 11 km long and uses Iodine AAAC conductor on both circuits.

The most recently constructed 66 kV line, between the Two Mile and Hokitika substations, was completed in July 2002. This, too, is a double-circuit line; however, pre-stressed concrete poles have been used to support the 7.8 km of Iodine AAAC conductor.

Westpower has no underground cables at transmission voltages of 66 kV and above.

Table 3.3 summarises the quantity of 66 kV overhead line by circuit kilometre.

Table 3.3 - 66 kV Lines Summary

Type	Circuit Length (km)
Light Overhead	0
Medium Overhead	60
Heavy Overhead	0

**All DRC and ODRC values are taken directly from the 2004 ODV revaluation excercise. While these values are now somewhat out of date, they provide a constant basis for comparison with the valuations of other ELBs by using the last industry-wide valuation date.*

3.3.4.1 66 kV Wood Pole Lines

The Greymouth-Kumara 66 kV line constructed in 1977 was constructed with de-sapped, untreated hardwood poles, which are now showing signs of early ground-line deterioration. A recent major ground-line inspection has shown that there is no reason for immediate concern, but a management plan needs to be put into place within the next five years to contain any risk of premature failure.

The Kumara-Kawhaka line was completed in 1997 and used treated hardwood poles, which are expected to last for at least 45 years. This line is in excellent condition, with annual patrols showing no signs of deterioration, as would be expected from a brand new line.

Both lines use stand-off porcelain insulators and this has greatly reduced the component count on each pole.

Of note, both the Greymouth Kumara and Kumara Kawhaka circuits are leased to Transpower, who operates them as part of the national grid. A performance-based contract exists between Transpower and Westpower, whereby Westpower provides a minimum level of reliability, and this, in turn, requires a higher than usual standard of maintenance.

During the early 1990s, a programme of pole bandaging was carried out on approximately 50% of the poles on this line. This involved cleaning off any rotten sapwood, placing a heat shrink bandage around the pole at the ground-line and injecting a fungicidal emulsion to halt any further deterioration. In 1994, however, this programme was discontinued because of concerns over the effectiveness of the process.

3.3.5 33 kV Lines

DRC - $6,566,784

ODRC - $6,566,784

There are two general areas served by Westpower’s 33 kV subtransmission network, one based around the Dobson and Grey Valley areas, and the other serving South Westland. These two areas are connected between Greymouth and Hokitika via Kumara through the 66 kV network.

Figure 3.6 shows the geographical spread of these two asset areas.

Transpower’s Dobson point of supply serves as the hub of the northern sub transmission system and is used to feed substations at Rapahoe, Ngahere, Reefton and Arnold. The line to Arnold was originally built in the 1930s and uses 7/.080” copper conductor.

Except for a short length of Mink ACSR line over Mt Hercules and some fully insulated 33 kV overhead line in South Westland, the rest of the sub transmission lines are strung with either Dog ACSR or Iodine AAAC conductor.

The 33 kV sub transmission line from Hokitika to Harihari, originally constructed in 1966, was purchased from Transpower. The large majority of the remaining 33 kV assets have been constructed since 1983 and are mainly of concrete pole construction.

Table 3.4 summarises the quantity of 33 kV overhead line by circuit length.

Table 3.4 - 33 kV Lines Summary

Type	Circuit Length (km)
Light Overhead	268
Medium Overhead	0
Heavy Overhead	0

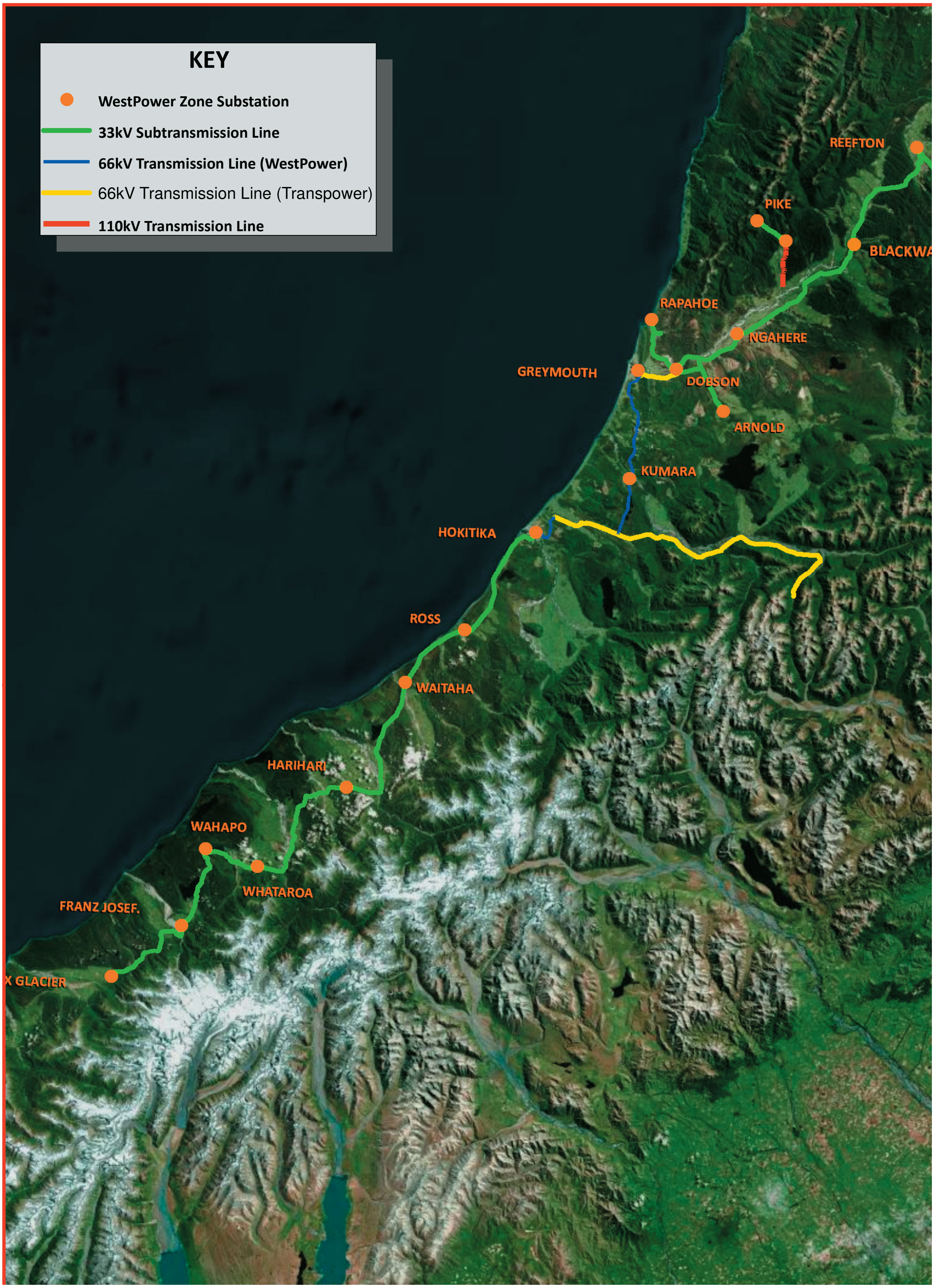


Fig 3.6 Westpower's 33 kV Networks - North and South

3.3.5.1 33 kV Pole Lines

These lines are mostly double-circuit under-built construction (33 kV above with 11 kV and/or 400 V circuits below) wired in ACSR and AAAC conductor, and are between 4 and 50 years old.

Three distinct construction types are present in the subtransmission network:

- Hardwood poles on the Harihari-Whataroa and Dobson-Arnold lines
- Stresscrete 12.2m pre-stressed concrete poles (used on the majority of lines constructed in the last 15 years)
- Two types of fully insulated construction on hardwood poles.

3.3.5.2 33 kV Overhead Line Reliability

Most of Westpower's reticulation consists of overhead lines.

Over the past 15 years, all of the major 33 kV and 11 kV feeders have been replaced or refurbished, and are in very good condition overall.

While overhead lines are subject to more faults than underground cables, due to such things as lightning and bird strikes, it is relatively easy and quick to get them back into service.

The maximum repair time (about four hours) is required when a complex pole structure is damaged due to, say, a vehicle running into it.

Distribution automation equipment installed over recent years has allowed Westpower to diagnose and locate rural faults quickly, and then restore supply remotely to adjacent areas without having to get staff on site.

Spares of all types of conductors and poles are kept in stock to cover most eventualities. Access to other network companies' stocks is likely in the event of a major disaster.

3.3.6 33 kV Cables

In Westpower's case, the highest voltage underground cables it operates are at a voltage of 33 kV. These are of standard Paper-Insulated Lead-Covered Steel Wire Armoured (PILCSWA) construction over a very short distance of less than 100 m with backup. These are used as feeder cables at the Dobson substation.

In general, underground cables are very reliable as they are not exposed to the external environment and, if carefully laid, should give at least 50 years of good service. The most likely mode of failure is damage by contractors using hydraulic excavators.

The failure rate of cables is relatively low; however, repair times are critical. Underground cables are the major constraint in this area.

3.3.6.1 Hendrix 33 kV Spacer Cable

In South Westland, there are two sections of fully insulated 33 kV overhead conductors, both constructed using the Hendrix Spacer Cable System.

By using this specialist conductor, Westpower was able to mitigate the environmental effects on a sensitive environment with high scenic values. In fact, this line runs through a National Park. A 2 km stretch of this cable also runs close to Lake Wahapo (this uses three separate, fully insulated conductors, held apart by insulated spacers).

The Hendrix system has a 40-year track record in the United States and has proven to be very reliable.

Spacer cable was installed for a 6 km stretch of line around Lake Mapourika in 2000, and this replaced the existing Aerial Bundled Cable (ABC) system that had proven to be unreliable.

This new system also involves fully insulated overhead conductors, but instead of the individual phases being bundled together, they are spaced apart by insulating "spacers" every ten metres, and supported by a separate, high strength catenary wire (Figure 3.7).

Experience to date with this system has been excellent, even when large trees have fallen across the catenary wire, as the system continues to operate without the conductors being damaged. Repairs can also be made quickly because there is no need to apply stress control measures when jointing.

Fig 3.7 Hendrix 33 kV Spacer Cable

3.3.7 Condition of Specific Line Components

3.3.7.1 Wood Poles

The Greymouth-Kumara 66 kV line was constructed in 1977 using untreated hardwood poles and these are now beginning to show signs of deterioration. However, approximately 50% of the line had ground-line preservation work done on it in the early 1990s, which should extend the life of the poles involved. Over the next few years, condition assessment of the line will be stepped up and it is likely that a pole replacement programme will be initiated toward the end of the planning period.

The 33 kV line south of Hokitika to Harihari was constructed in the mid-1960s and a large proportion of the untreated hardwood poles have now reached replacement criteria. A pole replacement programme was initiated in 2008 and this is expected to be completed mid 2014.

3.3.7.2 Conductors and Conductor Accessories

Copper 7/.080" conductor is fitted to the Dobson-Arnold lines. Much of it is still in reasonable condition and can remain in service for a further ten years. However, vibration damage and corrosion has taken its toll.

No replacement is planned at this stage, as any further hydro generation development at Arnold will require the conductor to be upgraded anyway to remove an effective constraint.

Most of the conductor installed since the 1960s up to the mid-1990s, has been conventional Dog ACSR with a greased steel core. All conventional ACSR is prone to corrosion, especially where the line is subject to wind borne salt contamination. This will be carefully watched, although there is no evidence to date of such deterioration.

Since the mid-1990s, Iodine AAAC conductor has been used exclusively for subtransmission lines and the enhanced corrosion protection afforded by this alloy material should result in at least 60 years' effective life.

Most lines are fitted with spiral vibration dampers, where appropriate, and this has greatly reduced the incidence of vibration damage to conductors and fittings. The Arnold-Dobson and Greymouth-Kumara lines are exceptions to this, and a study will be carried out to determine whether a retro fitting programme is warranted to minimise any risk of damage.

3.3.7.3 Insulators and Insulator Fittings

There are a number of older porcelain discs now known to be unreliable due to inherent design faults plus in-service internal deterioration. This has not been a major problem on sub transmission lines because of the use of multiple discs, which affords some redundancy. Nevertheless, the effects of ongoing deterioration will have to be taken into account in the lifecycle management plan.

Replacement insulators are either glass or polymer disc insulators with round pins.

Problems have been noted with the 33 kV Ethylene Propylene Diene Methylene (EPDM) polymer dead-end insulators that have failed and showed signs of chalking and cracking. The cracking is through the sheds, and axial to the fibreglass strength member, with no apparent penetration toward the core.

An investigation was carried out to assess the seriousness of the problem and the risk, if any, that this apparent deterioration poses. An independent consultant suggested that the LAPP-manufactured 33 kV units have an effective in-service life of approximately ten years, which soon will be exceeded. A replacement programme will need to be initiated to mitigate the risk of future failure.

3.3.8 Condition of Access Roads

The Dobson-Arnold line is serviced by a good quality access road that may be used by trucks and four-wheel drive vehicles. While it is not Westpower policy to provide for this standard of access road, its existence owes much to the line's heritage as a Transpower asset. The road is in excellent condition for the purpose intended.

The Kumara-Kawhaka line had an access road constructed to allow the line to be built, and is suitable for four-wheel drive vehicle and excavator access. This road is in reasonable condition for the level of use required.

No specific access roads have been constructed to gain access to the Greymouth-Kumara or Mt Hercules lines.

3.4 Distribution Assets

DRC - $25,183,835

ODRC - $24,988,272

Electric lines and cables operating at a voltage of 11 kV, including associated easements and access ways, make up the bulk of Westpower's infrastructure assets, in terms of both value and number.

Figures 3.8 and 3.9 show the extent of Westpower distribution line assets spread throughout the length of the West Coast.

3.4.1 Asset Justification

These are core assets for ELBs, and comprise the distribution lines and cables that deliver electricity at 11 kV to the distribution substations that supply 415 V or 230 V to individual installations. These assets are therefore essential to the operation of the network.

3.4.2 11 kV Overhead Lines

Table 3.5 below lists the total overhead distribution line assets owned by Westpower.

Table 3.5 - 11 kV Lines Summary

Type	Circuit Length (km)
Light Overhead	1009
Medium Overhead	396
Heavy Overhead	8

Fig 3.8 Northern Section of Westpower's Distribution Line Assets

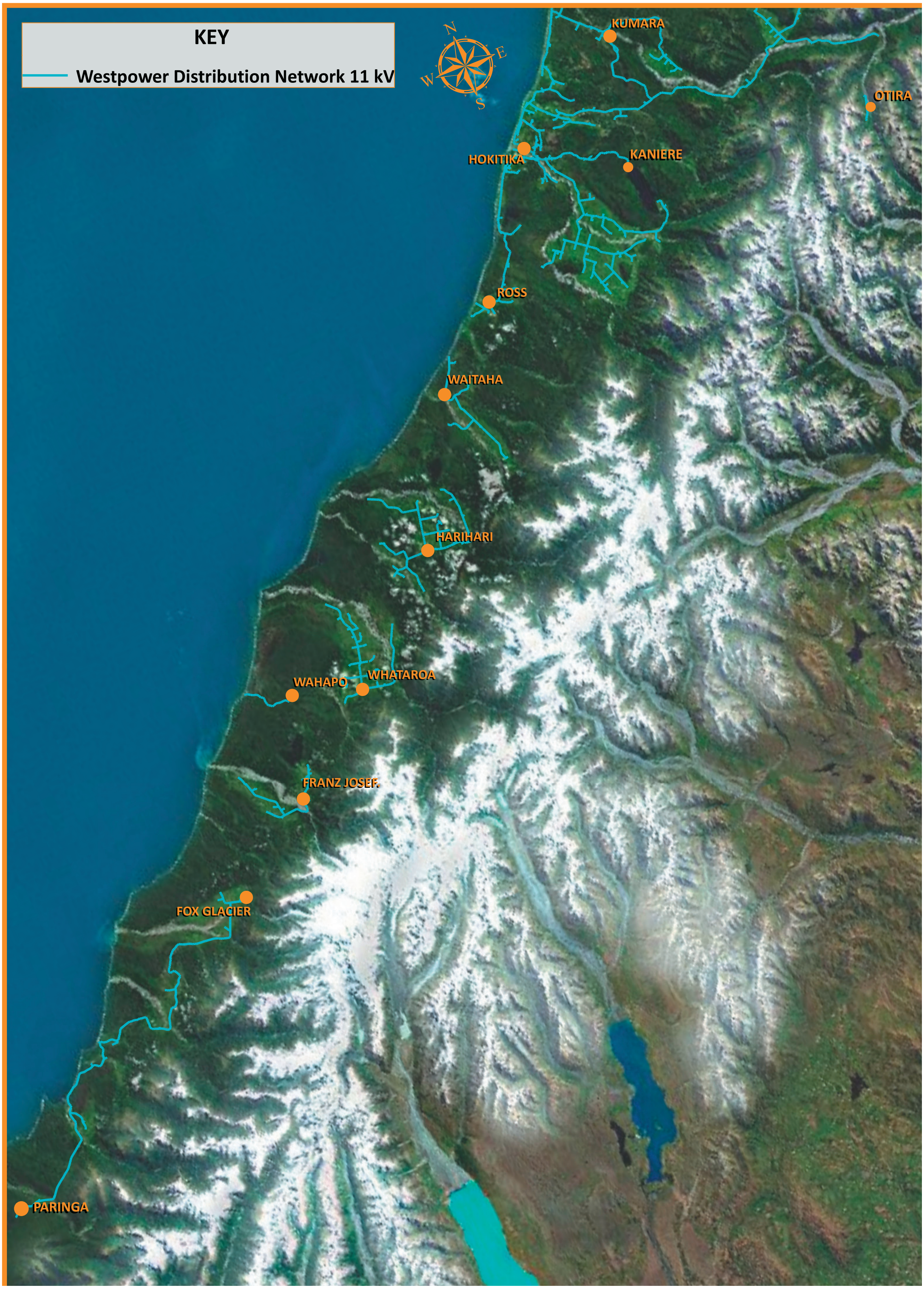


Fig 3.9 Southern Section of Westpower's Distribution Line Assets

Fig 3.10 Modern Line Components

Westpower owns a large variety of distribution lines and cables that cover a wide age profile. Overhead lines cover three broad groups including:

- Early hardwood pole lines,
- Concrete pole lines,
- Treated softwood pole lines.

Since 1972, most of the major lines have been reconstructed with concrete poles, and AAAC or ACSR conductors, with only a few remaining pockets of earlier hardwood lines in the Greymouth and Reefton areas. There are some notable exceptions, such as the Fox-Paringa and Coast Road lines, which used treated softwood poles for environmental and constructability reasons.

Softwood or concrete poles are used for all replacement or new construction work, and these types make up over 60% of the pole population. An example of a modern construction is shown in Figure 3.10.

The insulators consist of porcelain pin insulators, and a mixture of porcelain, glass and polymer strain insulators. Westpower has used stand-off post insulators in some environmentally sensitive areas. Apart from these sections, however, conventional overhead construction is widely employed.

3.4.2.1 Distribution Line Condition

The construction of lines in the past has often been driven by customer demands and political influences, which has resulted in the seemingly erratic nature of the line ages. A major undergrounding programme extending throughout the 1980s, coupled with an overhead feeder replacement extending from 1992 through to 1999, has resulted in an average line age of 20 years.

The present condition of any distribution line is largely a factor of its age, the quality of materials used and the environmental corrosiveness of the locations it traverses.

It is difficult to generalise about the condition of distribution lines. However, if we exclude those lines in severe environments and look at the rest, then Westpower's lines tend to fall into three broad groups.

Figure 3.11 shows the age profile of distribution lines, by circuit kilometre.

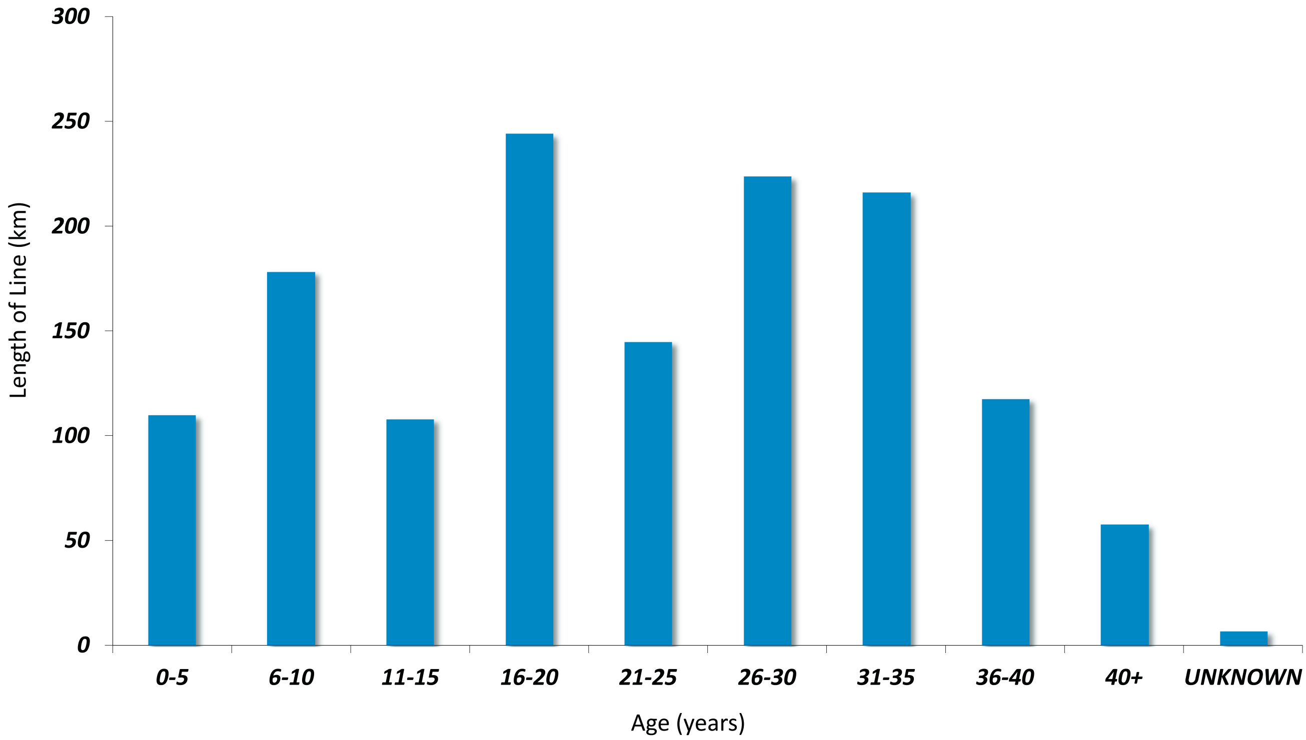


Fig 3.11 Distribution Line Age Profile

3.4.2.2 Early Wood Poles

These lines are 11 kV single-circuit and double-circuit construction, and many of them are around 40 years old. Few of the lines have had replacements of major components to keep them in service and, overall, they are generally in poor condition. Generally, the conductors (usually copper) have some limited remaining life.

Because of the major replacement programme recently completed, wood pole lines are generally limited to spur lines or the remote ends of rural feeders.

3.4.2.3 Concrete Pole Lines

These lines are mostly single-circuit, wired in ACSR and AAAC conductor, and are between 1 and 25 years old.

Two types of concrete poles were used:

- The earlier heavy-reinforced type manufactured by Westpower from the 1970s until the early 1980s. These are often referred to as "Hokitika" concrete poles because of where they were manufactured;
- Pre-stressed concrete poles manufactured since the early 1980s by a local bridge-beam builder under license to Stresscrete.

The poles are structurally sound and have an expected life of 60 years.

There has been some concern regarding the long-term effect of the leaching out of cement below ground level in the "Hokitika" concrete poles in certain soil conditions; however, the extent to which this affects the structural integrity of the pole is still under investigation.

3.4.2.4 *Treated Softwood Pole Lines*

Construction of treated softwood pole lines began in 1992 for economic reasons and continued through until 1994 for main lines, when the cost differential between concrete and treated softwood poles underwent a reversal. These lines are wired in ACSR or AAAC conductor.

3.4.3 *11 kV Distribution Line Components*

Table 3.6 summarises the present numbers of specific distribution line components.

Table 3.6 - Summary of Distribution Line Components

Components		No.	%
Structures (11 kV)			
Poles-Wood	Hardwood	1847	14%
	Silver Pine	5	0%
	Softwood	1160	9%
	Larch	3	0%
Poles-Concrete	Concrete	3016	23%
	Stresscrete	6907	52%
	Spuncrete	15	0%
	Buller	127	1%
	Other	92	1%
Total Structures		**13,172**	**100%**
Crossarms			
	11 kV	22589	70%
	400 V	8017	25%
	Service	1523	5%
Total Crossarms		32,129	100%
Conductors and Accessories			
	11 kV Conductor (km)	1401	
	400 V Conductor (km)	178	
Insulators	11 kV	99613	61%
	400 V	47950	30%
	Service	14592	9%
Total Insulators		**162,155**	**100%**

3.4.3.1 *Wood Poles*

There are approximately 2200 distribution wood poles in service. An estimated 252 poles are assessed to be currently at replacement criteria, or will reach them within five years. Approximately another 344 are estimated as needing to be replaced between 2012 and 2015.

3.4.3.2 *Conductors and Conductor Accessories*

Copper conductor is fitted to the majority of older lines. Much of it is still in reasonable condition and can remain in service for a further 10-20 years. However, vibration damage and corrosion have taken their toll.

Westpower

Most of the conductor installed since the 1960s has been conventional ACSR with greased steel cores. All conventional ACSR is prone to corrosion, especially where the line is subject to windborne salt contamination. Much of the early ACSR in exposed areas has been identified for careful inspection over the next ten years to determine what, if any, replacement programme should be undertaken.

3.4.3.3 Insulators and Insulator Fittings

There are a number of older porcelain discs now known to be unreliable due to inherent design faults plus in-service internal deterioration. In particular, the relatively recent international discovery that older conventional porcelain can develop porosity during its service life (leading to punctures and mechanical separation) plus the known poor quality of much of the older porcelain insulation have provided added weight to the replacement programme.

Replacement insulators are either glass or a polymer disc insulator with round pins.

Problems have also been noticed with EPDM polymer insulators showing signs of chalking and even cracking. An investigation is currently underway to assess the seriousness of the problem at 11 kV and the risk, if any, that this apparent deterioration poses.

A condition assessment programme was begun to confirm the service life of a number of older 33 kV porcelain pin insulators used on the 33 kV sub transmission line from Ngahere to Reefton.

Approximately 800 of these insulators were installed second-hand in the mid-1990s as a cost-saving measure. Initially, they were installed in the 1960s on the line to Ruatapu south of Hokitika, but then removed about ten years later and placed in storage until being used on the line to Reefton.

During commissioning of the line in 1999, two of these insulators failed, resulting in spectacular earth faults. A further insulator failed in January 2000 following a severe lightning storm. These combined events, raised some doubt as to the on-going serviceability of this particular type of insulator. Subsequent analysis of a random sample of insulators confirmed that the general population of insulators is in good condition, however, and no further remedial action is required.

Corrosion problems have recently been identified with the Dulmison pre-formed insulator ties used to attach aluminium conductors to insulators. When these are installed in coastal environments, severe corrosion occurs under the neoprene cover used to cushion contact between the Helitie and the insulator, leading to complete failure of the unit.

3.4.4 11 kV Cables

The majority of Westpower's underground HV cable network consists of 11 kV cable of both PILCSWA and Cross-linked Polyethylene (XLPE) construction. Both of these are dry-type constructions that allow for joints to be readily made within four hours after the fault has been located and the trench dug.

In the Greymouth area, the reticulation in the Central Business District (CBD) consists of a double-redundant ring of 11 kV cables. At least two separate HV cables would have to fail to cause an outage of a distribution transformer. Even if this was to happen, the LV networks are highly interconnected and would continue to supply most of the load.

All of Westpower's cables are operating well within their thermal ratings, even taking account of the possibility of poor thermal resistivity backfill.

Cable makes up a very small portion of Westpower's total HV assets, and is generally limited to CBDs or zone substations. There are, however, some exceptions to this, such as the recreational areas of Moana and Punakaiki.

Throughout the 1980s, Westpower had a policy of undergrounding cables in urban areas and this resulted in a significant amount of the overhead reticulation in those areas being replaced. As a case in point, the majority of Hokitika is reticulated underground, and underground HV cables are used throughout the CBD and near the airport.

While some of the older 11 kV cables around Greymouth were installed in the 1950's, many of these have since been overlaid or replaced with modern equivalents. PILCSWA was the standard for normal distribution purposes until the mid-1980s, when XLPE insulation gradually came into vogue.

Table 3.7 shows the distribution of 11kV underground cables in the Westpower network.

Table 3.7 - 11 kV Undergound Cable Summary

Type	Circuit Length (km)
Heavy Underground	0
Medium Underground	53
Light Underground	11

3.5 Reticulation Assets

DRC - $5,306,762

ODRC - $5,306,762

These assets include 400 V overhead lines and cables used to reticulate electricity to the boundary of consumer's premises.

3.5.1 Asset Justification

Once the electricity is "stepped down" from 11,000 V to 415 V at distribution substations, the 415 V reticulation assets, comprising overhead lines and cables, are necessary to deliver electricity to the boundaries of individual installations. As such, these assets are a core part of Westpower's network.

3.5.2 Overhead 400 V Lines

Westpower uses a conventional overhead LV configuration with insulated conductors and cross arms; ABC construction techniques are not employed.

In terms of conductor selection, copper was used extensively until the mid-1970s, but was gradually replaced with Polyvinyl Chloride (PVC) covered aluminium because of economic and constructability considerations.

Virtually all of the LV networks from Hokitika southwards, and some within the urban area of Greymouth, have been replaced in the last 20 years by underground cable.

However, in some older areas such as Reefton, there are still sections of older wood pole LV reticulation.

Westpower currently owns 182 circuit km of 400 V LV line assets, and this is not expected to change dramatically over the planning period. The largest single contribution to more LV lines is likely to come from new subdivisions. In this case, the reticulation will almost certainly be of underground construction because of the requirements of local District Plans.

Many of the factors described in Section 3.4 "Distribution Assets" apply equally to their LV counterparts.

Table 3.8 lists a summary of 400 V overhead lines in Westpower's network.

Table 3.8 - 400 V Lines Summary

Type	Circuit Length (km)
Light	132
Medium	50
Heavy	0

In general, the age distribution of these assets shows an average age of around 20 years. Figure 3.12 shows the age distribution profile for these assets.

3.5.2.1 South Westland

The areas of Hokitika and South Westland have largely been rebuilt over the last 15 years. During this time, most

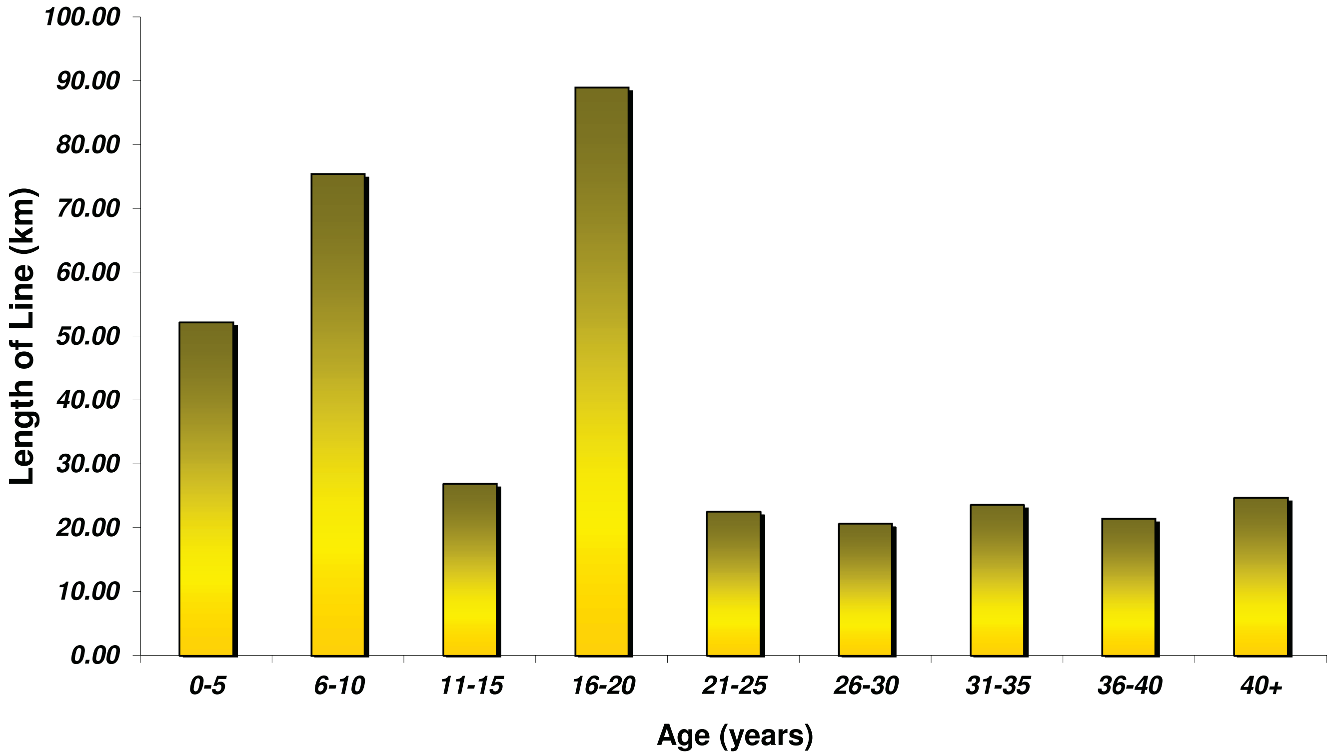


Fig 3.12 400 V Riticulation Line Age Profile

of the urban reconstruction has been carried out using underground reticulation, which has a life of up to 50 years. Little further LV work is therefore planned in these areas.

3.5.2.2 Greymouth

In the central Greymouth area, some of the oldest lines were placed underground during the 1980's. The change in focus during the late 1980's to a more commercial footing led to the demise of undergrounding because of the substantially higher capital cost involved. From the early 1990s on, the remaining refurbishment work has been carried out with overhead reticulation.

The LV networks in the satellite towns of Blaketown, Cobden and Runanga have been reconstructed overhead in the last ten years and are currently in good condition.

3.5.2.3 Reefton

The Reefton area consists of some very old overhead LV lines which are in need of replacement. During the 1980's there was an undergrounding programme in place, which resulted in several streets, including the main business area, being undergrounded. In conjunction with Telecom, some areas will continue to be undergrounded where cost sharing can be achieved.

Several small pockets of LV lines will also need attention during the planning period, and the required level of replacement for these areas will be identified during condition assessment of the asset. This will enable maintenance to be effectively targeted and provide a solid foundation for the move to a Condition-Based Maintenance (CBM) programme.

3.5.2.4 Underground 400 V Cables

A variety of underground cable types have been used for LV reticulation spanning a period of some 30 years.

In the early days, single-core aluminium cables, with either a stranded or solid core, were widely used. Over time, however, multi-core cables became popular because of the cost advantages.

A standard cable now used in residential areas is 95 mm^2 stranded aluminium with a copper neutral screen. For denser CBD areas such as the town of Greymouth, four-core 185 mm^2 cables were used.

Currently, all new urban subdivisions are reticulated underground as a requirement of the appropriate District Plans.

With the exception of a small number of old 400 V feeder cables in the Greymouth CBD, most of the underground LV reticulation throughout Westpower's area is less than 20 years old and in good condition.

The underground fittings used are also in good condition, mainly because of their age; however, constant minor maintenance is still required to overcome problems due to corrosion or water ingress.

Table 3.9 shows the distribution of 400 V underground cable.

Table 3.9 - 400 V Underground Cable Summary

Type	Circuit Length (km)
Light	173
Medium	0
Heavy	0

3.5.3 Condition of Specific LV Line Components

3.5.3.1 Wood Poles

Most of the LV wood poles are very old, predominantly hardwoods, and range in condition from very poor to good. Their condition is best assessed through an objective testing programme.

3.5.3.2 Conductors and Conductor Accessories

All of the overhead lines constructed over the last 20 years consist mainly of PVC-covered AAAC and are in generally good condition.

For about 20 years prior to this, PVC-covered copper conductors were used, and these also are in good condition. Where a LV line is replaced or refurbished, this type of conductor is reused if it is in good condition and of an adequate cross-sectional area.

All lines over 40 years of age that have not been refurbished during their life still use the original braid-covered conductors. The condition of these conductors is very poor and could become a significant safety hazard if not attended to in the short term.

Other accessories demonstrate a condition commensurate with the age of the line and are replaced as part of the overall replacement programme.

3.6 Services

DRC - $637,381

ODRC - $637,381

This asset consists of the equipment used to connect approximately 12,000 consumers to Westpower's network.

The major components of this asset are the service protective devices, which may be one of the following:

- 400 V rewireable pole fuse,
- 400 V High Rupturing Capacity (HRC) pole fuse,
- 11 kV dropout fuse,
- 11 kV circuit breaker.

In the last case, the consumer would own the 11 kV circuit breaker and the connection asset would be an 11 kV disconnector.

The service line on the premises of the consumer is owned and maintained by the consumer.

3.6.1 Asset Justification

Services include assets required to make the final connection between a customer's installation and Westpower's network. These are necessary for an individual customer to take supply from Westpower.

3.6.2 Service Line Condition

Service lines on customers' premises are owned and maintained by the individual customers.

Notwithstanding this, there are some service lines which are not of an acceptable standard due to insufficient clearance or other reasons. Westpower is responsible for bringing these up to standard before transferring them to the customer.

Most service lines are either PVC-covered copper or neutral screened copper, and should give good service for many years. A few of the very old services are still of the braid variety, and these are replaced as a matter of course and at Westpower's cost when a section of LV line is refurbished or replaced.

3.7 Zone Substations

DRC - $11,810,454

ODRC - $11,786,895

Zone substations are used to transform power from transmission and sub transmission voltages of 33 kV and higher down to Westpower's standard distribution voltage of 11 kV.

These substations comprise buildings, switchyard structures and associated hardware, HV circuit breakers, power transformers, instrument transformers and a multitude of other associated power supply cabling and support equipment. Furthermore, the substations range in size from 1 MVA to 40 MVA and are used to feed large areas of Westpower's network, thus playing a critical role in the overall reliability of Westpower's network (please refer to Appendix C "Network Reliability by Zone Substation and Feeder" for further information).

Table 3.10 shows the zone substation capacity, asset owner and current maximum demand seen in 2013.

Table 3.10 - Zone Substation Capacity and Maximum Demand

Substation	Asset Owner	Voltage (kV)	Present Maximum Demand (MW)	Transformer Capacity (MVA)
Greymouth	Westpower	66	13.170	2 x 10/15
Hokitika	Westpower	66	19.277	2 x 15/20
Kumara	Westpower	66	1.632	1 x 10
Dobson	Westpower	33	2.927	1 x 5
Otira	Transpower	11	0.589	1 x 2.5
Reefton	Westpower	110	10.600	2 x 20/30
Blackwater	Westpower	33	1.660	1 x 5
Ngahere	Westpower	33	2.067	1 x 5/6.25
Arnold	Westpower	33	3.231	1 x 5/6.25
Rapahoe	Westpower	33	1.758	1 x 5
Ross	Westpower	33	0.488	1 x 1
Waitaha	Westpower	33	0.331	1 x 1
Harihari	Westpower	33	1.021	1 x 1
Whataroa	Westpower	33	0.794	1 x 1
Wahapo	Westpower	33	3.104	1 x 5
Franz Josef	Westpower	33	1.639	1 x 5
Fox Glacier	Westpower	33	0.845	1 x 5
Spring Creek	Solid Energy	33	1.139	1 x 6 & 1 x 3
Globe	Westpower	33	5.515	1 x 8/10
Logburn	Westpower	110	0.600	1 x 20/30
Pike	Westpower	33	0.277	1 x 15/20

Figure 3.13 shows the location and size of Westpower's 19 zone substations.

Fig 3.14 Greymouth Zone Substation

Figure 3.14 shows Westpower's zone substation at Greymouth, which houses two 10 MVA 66/11 kV transformer banks and was constructed in 1977.

The latticework steel structure is unique within Westpower's area and reflects the common standards used by Transpower at the time.

The HV bus and equipment in this substation is leased to Transpower for operation as part of the national grid.

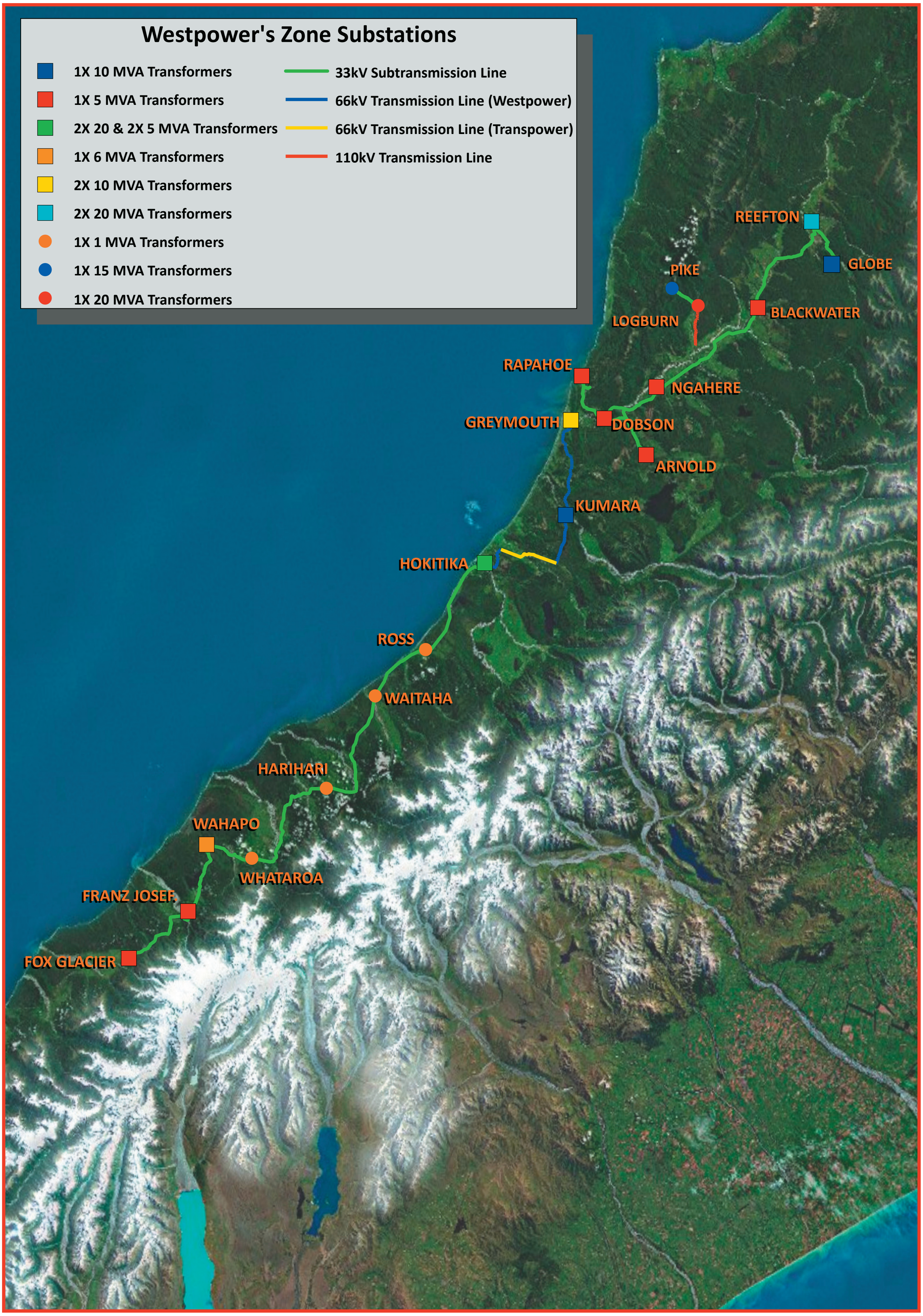


Fig 3.13 Westpower's Zone Substations

At the other end of the scale are the 1 MVA 33/11 kV substations used at sites such as the Whataroa substation, shown in Figure 3.15.

Installations at Harihari, Ross and Waitaha use similar standard designs to the Whataroa site.

These substations use a small transformer with an external regulator for economic reasons.

Furthermore, they were constructed in the early 1990s and use modern construction techniques.

Westpower also owns a number of nominal 5 MVA substations, which are similar to the Arnold construction shown in Figure 3.16.

These substations use On-Load Tap Changers (OLTCs), and were constructed between 1984 and 2003. Sites included in this classification are Ngahere, Arnold, Rapahoe, Wahapo and Franz Josef.

Fig 3.15 Whataroa Zone Substation

Fig 3.16 Arnold Zone Substation

All zone substations are connected to Westpower's SCADA system for alarm monitoring and remote control operation.

3.7.1 Asset Justification

Zone substations are required to transform sub transmission voltages (110 kV, 66 kV and 33 kV) to the local distribution voltage of 11 kV. These assets form an integral part of the supply chain and are strategically spread throughout Westpower's area.

3.7.2 Power Transformers

Westpower has 42 power, voltage regulating and earthing transformers installed at its zone substations (as opposed to distribution transformers, which are used in distribution substations). Of these, 15 are fitted with OLTCs.

Table 3.11 gives the general details of the power transformer population.

Table 3.11 - Summary of Power Transformers

Type	110 kV	66 kV	33 kV	11 kV	Total Units
Power Transformers					
Supply 3 phase	3	5	17	0	25
Subtotal	3	5	17	0	25
Other Transformers					
Earthing	0	0	2	1	3
Voltage Regulating	0	0	0	14	14
Subtotal	0	0	2	15	17
Total Transformers	**3**	**5**	**19**	**15**	**42**

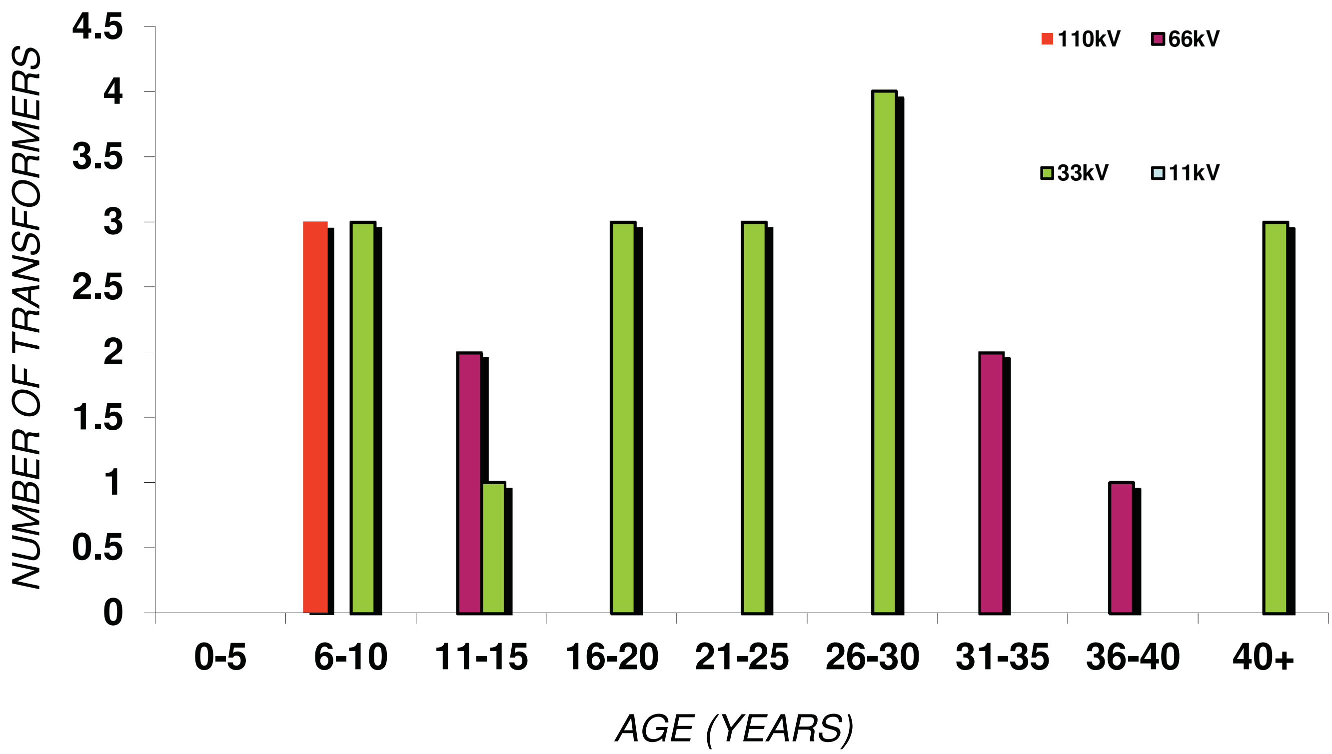


Fig 3.17 Power Transformers Age Profile

Most of the larger power transformers (above 1 MVA) are three-phase units fitted with OLTCs.

Earthing transformers are used at zone substations connected to generating stations to provide appropriate source earthing requirements. These are high-impedance units designed to limit earth fault currents by providing reactance earthing. They also comprise a 400 V secondary unit to provide local service to the site.

3.7.3 Oil Containment

Oil containment facilities have been installed at major substations constructed since 1993, including the Dobson, Blackwater, Globe, Logburn, Pike, Fox Glacier, Reefton, Arnold and Hokitika substations. These facilities have also been retrofitted at the Greymouth, Kumara, Wahapo, Rapahoe, Ngahere and Franz Josef substations.

3.7.4 Switchgear

Table 3.12 summarises the present asset mix for this equipment used in zone substations.

Table 3.12 - Circuit Breakers

Type	110 kV	66 kV	33 kV	11 kV	Total Units
Outdoor					
SF6	3	12	6	0	21
Vacuum Recloser	0	0	22	16	38
Total Outdoor	3	12	28	16	59
Indoor					
SF6	0	0	0	2	2
Vacuum	0	0	1	55	56
Metalclad Panels (Bulk Oil)	0	0	0	3	3
Total Indoor	0	0	1	60	61
Total Circuit Breakers	**3**	**12**	**29**	**76**	**120**

3.7.5 General Condition

Most of Westpower's zone substations are less than 30 years old and demonstrate a condition commensurate with their age. Three of the older substations at Harihari and Franz Josef were substantially upgraded in 2010, along with upgrades at Fox, Dobson and Ngahere in 2011 and Wahapo in 2013. The control room at Kumara was upgraded in conjunction with TrustPower and Transpower in 2013.

Although the Greymouth zone substation is now 35 years old, upgrade and replacement work has been carried out over the last 10 years, including the replacement of the 66 kV circuit breakers over the last six years; all 66 kV buswork insulators and all 11 kV indoor circuit breakers in 2002; and mid-life refurbishments and protection upgrades on both transformers during the 2009/10 financial year.

The following is a list of recently built zone substations:

- A new 110/33/11 kV zone substation was built at Reefton in 2005.
- A new 110/33/11 kV zone substation was built at Logburn Road in 2007.
- A new 33/11/6.6 kV zone substation was built at Globe in 2006.
- A new 33/11 kV zone substation was built at Pike in 2007.
- A new 33/11 kV zone substation was built at Blackwater in 2009.

The enactment of new legislation in the areas of occupational health and safety and the Resource Management Act (1991) may require upgrading work at stations in the areas of fire protection, station earthing and security fencing.

3.7.5.1 Transformers

Because of the transformers' proximity to a coastal environment, corrosion of tanks and fittings is a constant problem, which needs to be addressed by an on-going painting programme.

The remaining population of transformers is now in a generally good condition, and no major maintenance will be required throughout the planning period.

Dissolved Gas Analysis (DGA) performed annually for the last few years, has allowed Westpower to monitor the internal condition of its power transformer population and demonstrate that, in general, there is little evidence of insulation aging or deterioration.

3.7.5.2 Switchgear

In general, all switchgear is in very good condition, partly due to Westpower's very low fault duty. However, the Cooper type KFE Vacuum reclosers are proving to be unreliable and have been responsible for unplanned outages from faults with their auxiliary switches, CT's and microswitches. A replacement programme is in place to replace these units with Viper-S Vacuum Reclosers. Circuit breakers at the Harihari and Franz Josef substations have been completed in 2010, Fox, Ngahere, Dobson in 2011 and Wahapo in 2013. The Whataroa zone substation is to be completed in March 2014 along with the Arnold, Ross and Waitaha zone substations in the near future. Vacuum reclosers, in particular, have very low maintenance requirements and are expected to remain in service for at least the next 20 years.

At the Kumara substation, new Siemens SF6 66 kV circuit breakers were installed in 1997 as part of an upgrade project along with an Areva SF6 66 kV circuit breaker installed in 2004; all are in excellent condition. Four similar Areva SF6 circuit breakers were installed at the Greymouth substation in 2010.

Disconnectors are constantly subject to corrosion of bolts and operating linkages, and need continual minor maintenance to keep them in good order. A four-yearly preventative maintenance programme is in place for all zone substations to counteract this.

3.7.5.3 Minimum Oil Switchgear

The last two remaining minimum oil circuit breakers were replaced at the Greymouth zone substation in 2010.

3.7.5.4 Outdoor Circuit Breakers

This population has an age profile as shown in Figure 3.18.

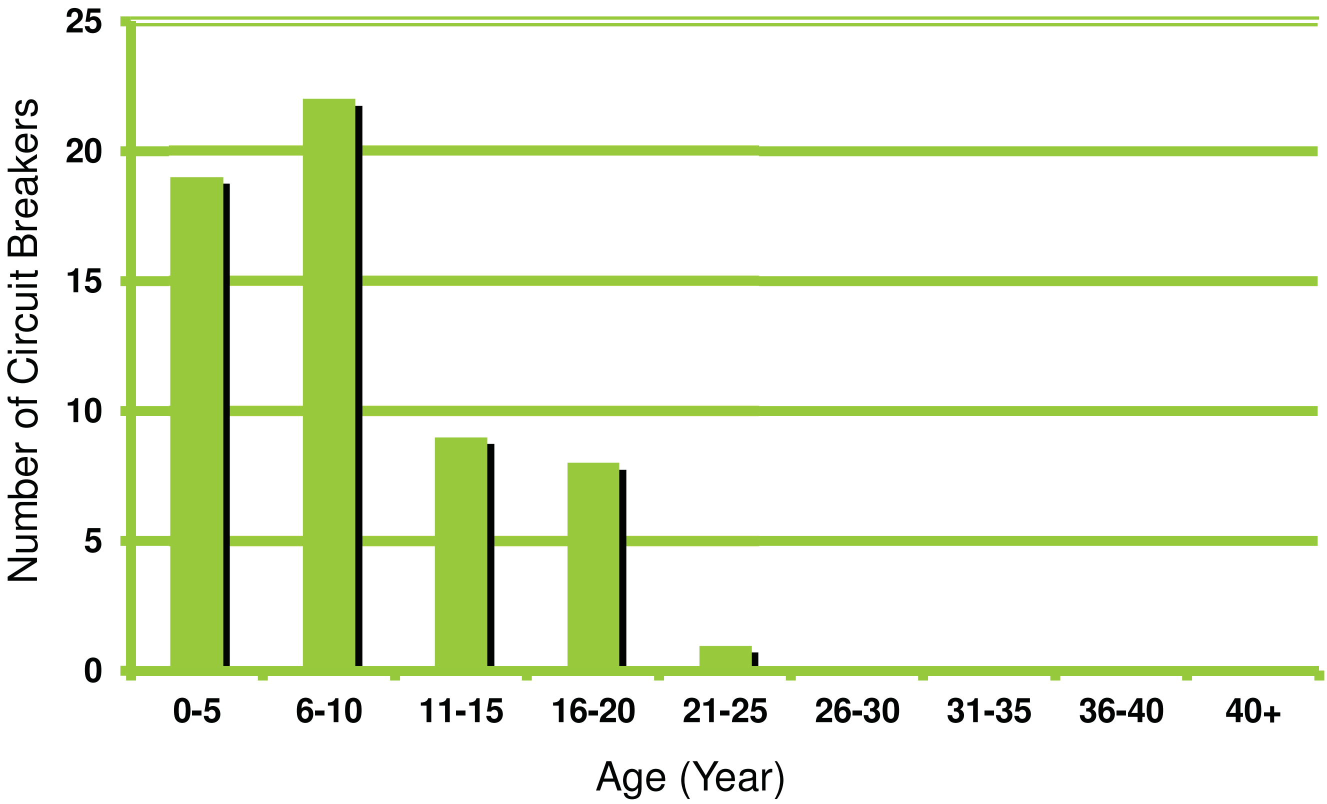


Fig 3.18 Outdoor Switchgear Age Distribution (Zone Substations)

International Council for Large Electric Systems (CIGRE) studies indicate typical replacement ages of 40 to 45 years for circuit breakers rated at 80 kV and below.

3.7.5.5 Indoor Circuit Breakers

Westpower's indoor switchgear installations comprise 61 switch units in ten locations of the following types:

- 2 SF6 circuit breakers,
- 56 vacuum circuit breakers,
- 3 bulk oil circuit breakers.

The majority of the indoor circuit breakers are the Reyrolle vacuum type metalclad switchgear which has proven to be reliable.

The only bulk oil switchgear in use is GEC type BVP equipment installed at Rapahoe, which were installed in 1984. This equipment is due for replacement with Reyrolle vacuum type metalclad switchgear with Arc Flash protection and external venting in 2014/15.

Figure 3.19 shows the age profile of Westpower's indoor switchgear.

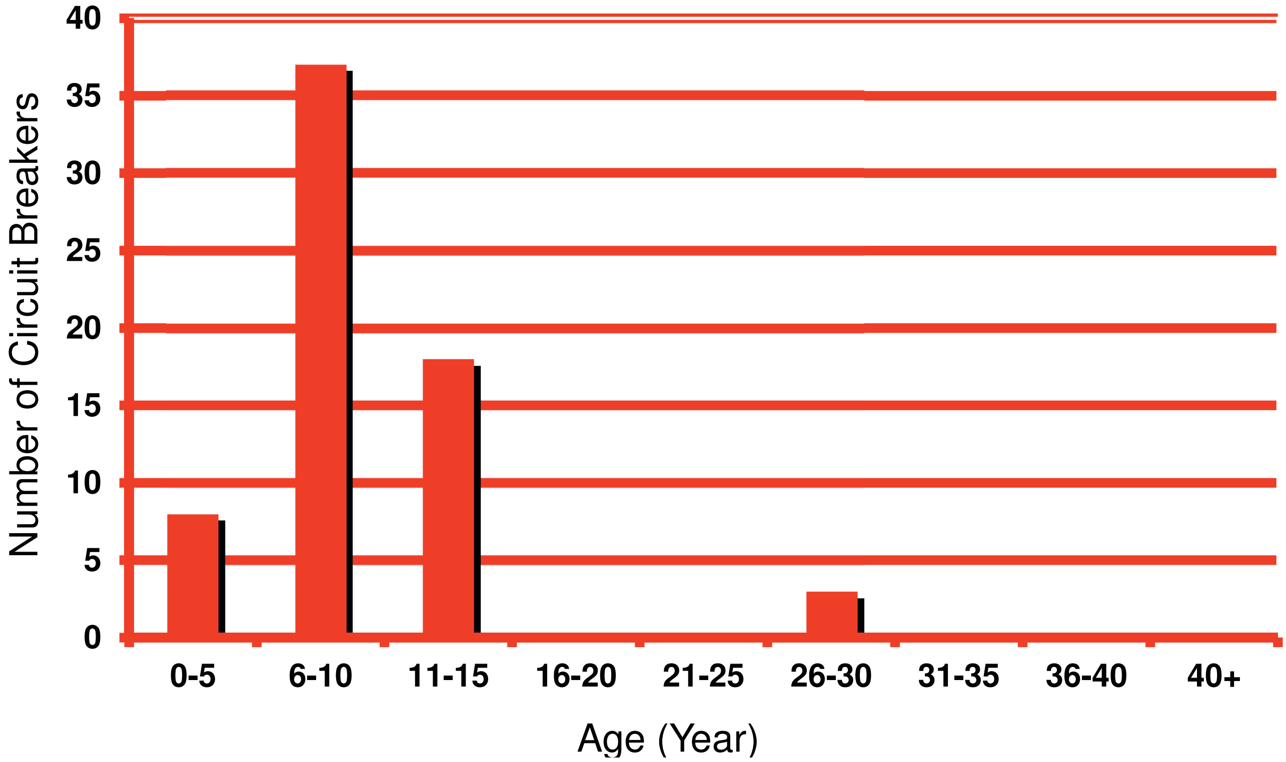


Fig 3.19 Age Distribution of Indoor Switchgear

3.7.5.6 Disconnectors

Disconnectors are HV switches, which are used to disconnect sections of overhead line or other primary plant.

New disconnectors generally give satisfactory service, but older designs are unreliable and very old models are now becoming electrically inadequate. The only effective remedy is replacement of these units.

Some of the older Canterbury Engineering type DA2 disconnectors have also had problems with failing insulators, but the occurrence of this type of failure has been infrequent enough not to require a special replacement programme.

The five-yearly preventative maintenance programme checks the condition of all disconnectors in all zone substations and carries out general maintenance to ensure the disconnectors are kept in a good condition for operation and having a normal operational life.

3.7.5.7 Buswork

Most buswork systems consist of concrete poles and tubular aluminium buses. These items require virtually no maintenance throughout their lives.

At the Greymouth substation, a galvanised steel lattice structure is in place and is in good condition. A concern with this type of construction occurs when they reach an age where rusting develops, which requires continuous maintenance to contain. A common problem is advanced deterioration of bolts, which gradually reduces the overall strength of the structure. Severe structural corrosion is generally found at substations located near marine environments and where industrial works nearby give rise to a corrosive atmosphere. The proximity of the Greymouth substation to the coast means that a regular inspection programme will have to be maintained to counter this. Remedial maintenance may include periodic painting of the structure. The older 66 kV porcelain disc insulators have been replaced.

Corrosion is also a problem in the metal parts of cap and pin insulators, which support buswork. On post insulators and string insulators, severe rusting of the pins leads to cracking of the porcelain, causing the insulator to fail. Also, the older type of porcelain itself has been found to deteriorate. These are the same problems that affect line insulators. In the case of strung buswork, a failure could result in collapse of the conductor. Replacement with modern insulators and general upgrading of other hardware components is necessary to reduce the risk of failures.

Cracking or spalling of concrete support structures and rusting of the reinforcing steel can be problems that require remedial action.

3.7.5.8 Instrument Transformers

Westpower has several outdoor oil-filled instrument transformers, comprising current (excluding bushing types) and voltage units in the 11 kV to 110 kV range. It is estimated that their average age is over 15 years and only a small percentage is in excess of 30 years of age.

Generally, they are in a good condition and require minimal maintenance. The cost of refurbishment and regular monitoring is such that, in most instances, it is more economical to replace the units if they fail.

The most common form of failure is due to stone damage by vandals, and this is handled as required.

At the Greymouth substation, consideration is being given to replacing these transformers with modern equivalents using vandal-resistant composite insulators.

3.7.5.9 Earthing Systems

Earthing systems in substations constructed within the last 15 years were designed to a high standard and meet current industry guideline.

All of the older zone substations that did not comply, including Greymouth, Kumara and Whataroa, underwent major upgrades of their earthing systems contemporaneous with other substation enhancement work completed within the last six years.

3.7.5.10 Protection Relays

Most protection relays are in reasonable condition, and will only require minor inspection and servicing throughout the planning period.

A minor problem has been identified with sealed batteries in Cooper Form 4C and Form 3A recloser control units, whereby the units succumb to a high rate of battery failure after three years of service. The interim solution has been to carry out a cyclic battery replacement programme of all recloser batteries after three years.

Accordingly, all critical protection relays at zone substations will be brought up to the current Westpower standard, which includes modern numerical Schweitzer protection relays, over the next three years. At the same time, distance elements are now being used as the primary protection for 33 kV feeders.

Some replacement of protection relays due to obsolescence is scheduled within the planning period.

3.7.5.11 Other Station Equipment

Battery banks at all Zone Substations are replaced after 7 years in service as per Westpower and industry standards. All banks are Gel Cell type generally using the Marathon brand which has proven to be reliable. A replacement program is in place to replace whole banks when they reach replacement age.

Safety permit ropes and stands are also part of the station inventories.

3.8 Distribution Substations

DRC - $2,988,413

ODRC - $2,988,413

Distribution substations generally consist of a distribution transformer and associated equipment including:

- 11 kV drop-out fuses,
- Lightning arrestors,
- LV fuses,
- Support crossarms,
- Earthing system.

Fig 3.20 Typical Distribution Substation

Figure 3.20 shows a typical three-phase distribution substation.

The fitting of lightning arrestors is now standard on all substations, and a retrofitting programme over recent years has ensured that virtually every existing substation meets this requirement.

Fig 3.21 Distribution Substation (>100 KVA < 200 KVA

In addition to these items, larger substations rated at 100 kVA and above, such as that shown in Figure 3.21, will often have the following additional components:

- Galvanised steel platform,
- Maximum demand indicator.

Because of the extremely corrosive coastal environment that Westpower is confronted with, galvanised steel or Coreten steel tanks are standard for all distribution transformers.

For large substations over 200 kVA, pad-mount construction is normally used, where the transformer is placed on the ground as shown in Figure 3.22.

Extra assets required for these substations are:

- Concrete pad,
- Fibreglass cover,
- HV and LV feeder cables,
- DIN LV fusegear.

Table 3.13 lists the overall range and transformer capacities of the distribution substation sites, sub-totalled by number and total capacity.

Fig 3.22 Pad Mount Substation

All substation data, including servicing records, are stored in the Maximo system. In addition, all substations are logically linked to individual ICPs for the purposes of outage notifications and network reliability analysis.

3.8.1 Asset Justification

Distribution substations are required to break down the distribution voltage of 11,000 volts, to either 400 volts or 230 volts suitable for supplying individual installations.

3.8.2 Distribution Substation Condition

Within Westpower's network, there are around 2400 distribution substations comprising single and three-phase units ranging from 5 kVA to 1.5 MVA, in the voltage range of 33 kV to 11 kV.

The condition of these assets covers the whole range from being in need of immediate replacement to brand new.

All main line substations have been rebuilt over the last 20 years as part of Westpower's refurbishment programme and are generally in very good condition. There are still some very old substations on some spur lines, however, which will need on-going refurbishment throughout the planning period.

3.8.3 Distribution Transformers

DRC - $5,996,168

ODRC - $5,996,168

A variety of styles exist on the network, from early painted steel tank units through to the current modern galvanised tank transformers.

A so-called stainless steel tank was also trialled for a short period, but the poor quality tank material exhibited low corrosion resistance and the unit was no longer accepted.

All units used in Westpower's network must now have galvanised or Coreten steel tanks, and use stainless steel bolts to maintain resistance from corrosion.

A number of small transformers purchased in the 1990s are exhibiting bushing gasket deterioration. A programme is in place to refurbish these units.

In addition, all units have an off-load tap switch fitted to provide a range of +2.5% to –7.5% (on the HV side) for voltage regulation.

Two three-phase 33 kV/400V units were purchased specifically to supply the remote South Westland broadcasting site at Mt Hercules; one unit was maintained in service and the other kept as a spare.

Single-phase 33 kV/400 V units supply customers in the South Westland area who are remote from Westpower's distribution network, but close to the Hokitika-Harihari 33 kV line. The customers accept that no spare will be provided for these units.

Table 3.13 summarises the distribution transformers by type and size.

Table 3.13 - Distribution Substation Transformers Number and Capacity

KVA	Inside Building		Concrete Pad-Mounted		Pole-Mounted	
	1 PH	3 PH	1 PH	3 PH	1 PH	3 PH
1	0	0	0	0	1	0
5	0	0	0	0	18	0
7.5	0	0	0	0	24	0
10	0	0	0	0	298	11
15	0	0	0	1	573	61
16.5	0	0	0	0	0	1
20	0	0	0	0	32	22
22.5	0	0	0	0	1	0
25	0	0	0	0	2	20
30	0	3	1	10	57	562
35	0	0	0	0	0	1
40	0	0	0	0	1	0
50	0	0	0	4	0	183
66.6	1	0	0	0	0	0
75	0	1	0	4	0	96
100	4	0	1	24	0	84
125	0	1	0	2	0	12
150	0	0	0	15	0	26
175	0	0	0	0	0	1
200	0	1	0	81	0	25
250	0	0	0	1	0	3
300	0	2	0	45	0	6
325	0	0	0	0	0	0
500	0	5	0	42	0	4
750	0	0	0	8	0	0
1000	0	3	0	6	0	0
1250	0	0	0	2	0	0
1500	0	0	0	0	0	0
2000	0	0	0	0	0	0
Subtotal	**5**	**16**	**2**	**245**	**1007**	**1118**
Total						**2393**

Figures 3.23 and 3.24 show the age profile and kVA profile of the distribution transformers, respectively.

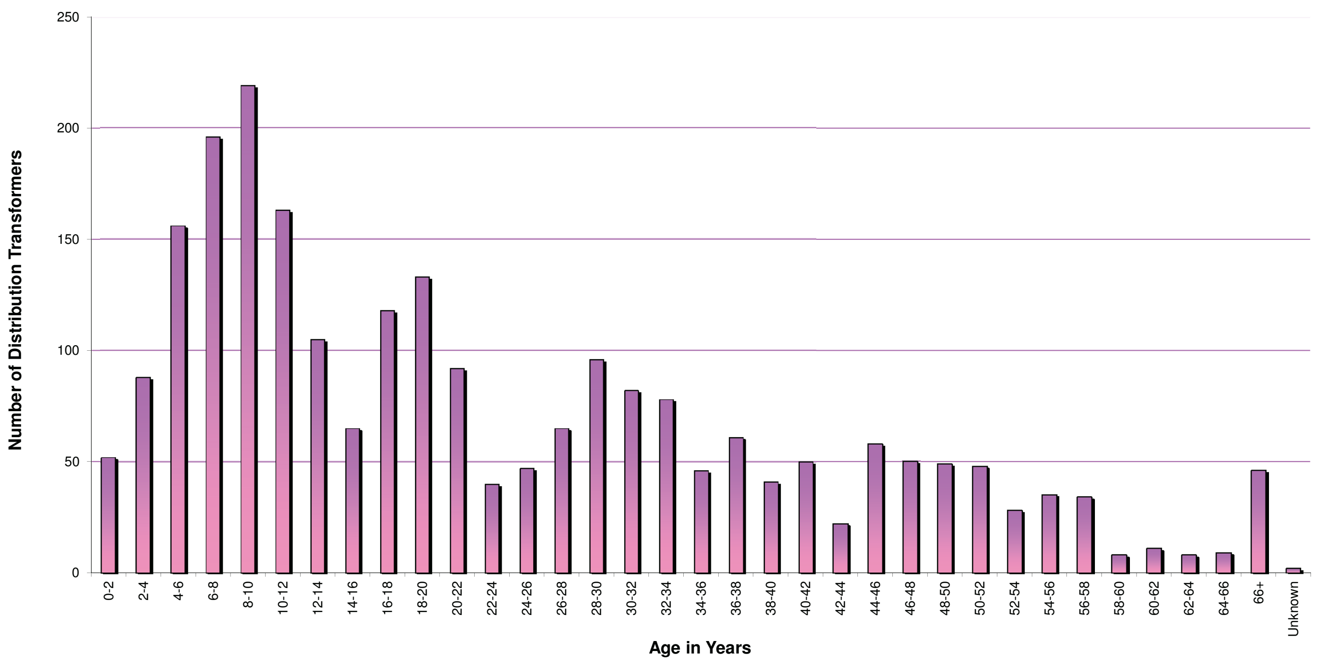


Fig 3.23 Age Profile of Transformers

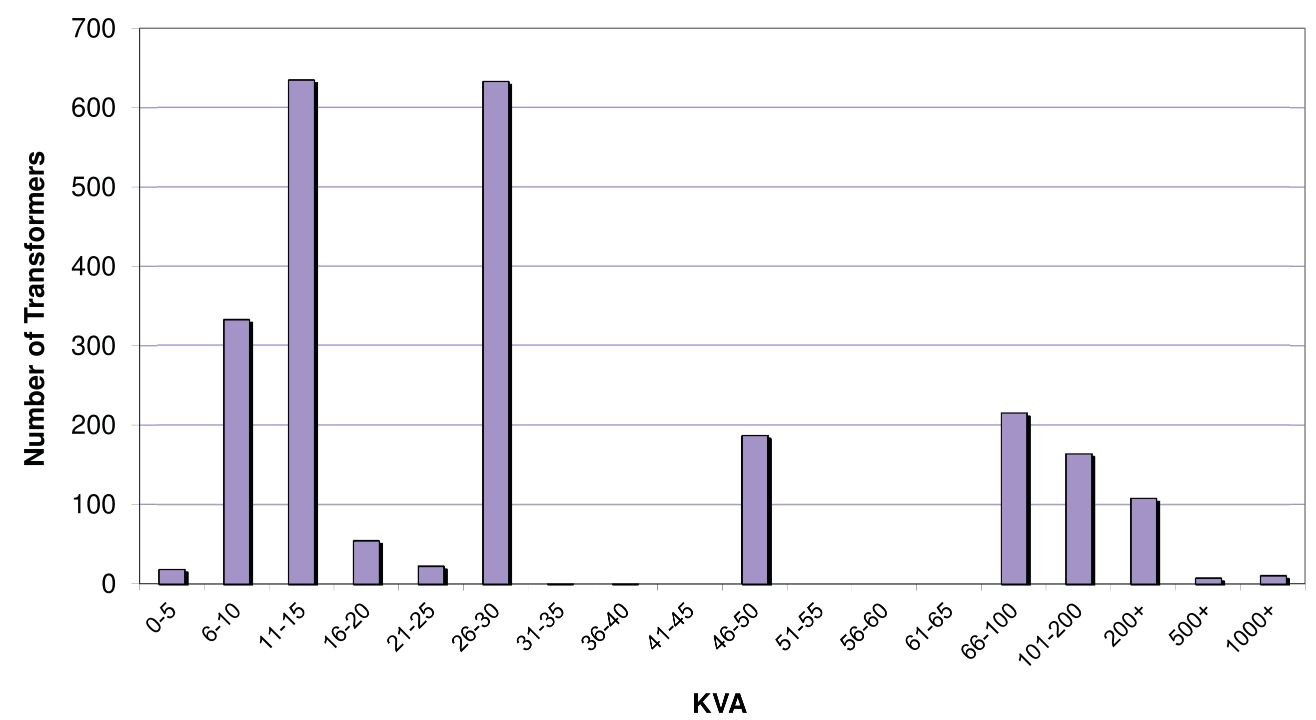


Fig 3.24 KVA Profile of Distribution Transformers

Table 3.14 summarises the population of distribution transformers.

Table 3.14 - Summary of Distribution Transformers

Primary Voltage				
Type	66 kV	33 kV	11kV	Total Units
Power Transformers				
Distribution 1 phase	0	3	1010	1013
Distribution 3 phase	0	4	1375	1379
Total Transformers	**0**	**7**	**2385**	**2392**

3.8.3.1 Asset Justification

Distribution transformers are the key component of a distribution substation, and the justification for these assets is the same as for distribution substations covered in Section 3.8.1.

3.8.3.2 Distribution Transformer Condition

The majority of transformers are less than 30 years old, with a median age of just over 20 years and a negligible number beyond 50 years old (3%). This coincides with the period of system development in the 1960s and early 1970s.

Transformers are generally in good condition, although for some of the older painted transformers, refurbishment and/or replacement is required rather than general maintenance.

A problem has been identified with deterioration of bushing gaskets on smaller units in the six-ten year age bracket where these are installed near the coast. It appears that the surface leakage current attacks the gasket material, eventually leading to failure of the gasket and water ingress, resulting in electrical failure of the transformer. To address this issue, a refurbishment programme has begun to replace at-risk gaskets, and to install replacement bushings with a partial semi conductive coating around the flange area.

3.8.4 Dominion Drop-Out Fuses

As a standard design policy, a Dominion Drop-Out (DDO) fuse unit fuses all the distribution transformers, which are fed directly from an overhead HV line.

Up until 1996, all fuse units were of the E C Gough type manufactured locally for many years. A major reliability problem with these units caused Westpower to move to the AB Chance style of DDO. However, these units were found not to pivot open properly when exposed to a corrosive environment for a period of time. AEM type drop-outs imported from Australia were then implemented, with the Gough and Chance units being replaced as scheduled maintenance takes place on distribution substations. Further problems with the AEM units meant that a complete technical review was undertaken, and S and C units are now being purchased.

3.8.5 Earthing Systems

The Electricity Regulations suggest that all substation earthing systems should be brought up to a standard of 10 Ω. In Westpower's situation, because of the very high soil resistivity that is often encountered, a desired earth resistance of 10 Ω is not practically achievable in all cases.

Nevertheless, the regulations require that earthing systems be tested every five years, and Westpower is now addressing this issue in earnest. To meet the requirements, a programme of regular five-yearly tests has been instituted.

Based on experience, it is expected that during the testing phase, several substandard earthing installations will be identified that are capable of being practically upgraded. A programme of upgrading these earthing systems using driven rods and extra copper conductors will follow directly from the earth testing exercise.

3.9 MV Switchgear

DRC - $1,468,901

ODRC - $1,468,901

This class of equipment includes:

- Regulators,
- Disconnectors,
- Reclosers,
- Sectionalisers,
- Load Break Switches,
- Ring main units,
- 11 kV dry fuse units.

These are not installed at zone substations. (MV switchgear within zone substations is included in that classification.)

Fig 3.25 Typical Recloser

Line regulators are installed on long 11 kV lines with significant loads near the end. Westpower has such installations at Longford Corner (near Kokatahi), Cronadun (north of Reefton) and the Haupiri area. There is also a 33 kV regulator at Harihari.

In general, disconnectors are standard three post DA2 type units made by Schneider Electrical (ex-Canterbury Engineering). Some units are fitted with CE Break load-break heads.

Westpower has used a range of reclosing equipment over the last 50 years, but has now standardised on the use of G & W Viper St vacuum reclosers and ENTEC load break switches for all future installations.

A typical recloser can be seen in Figure 3.25.

Small numbers of old 11 kV circuit breakers are still in use as distribution substation breakers.

The ring main units are mainly Reyrolle or ABB "Safelink" type, SF6 SD insulators or ABB oil insulators, and are all less than 25 years old. There are two remaining Andelect ring main unit. Some Hazemeyer dry-type equipment has also been installed in the network, but its use is not widespread. A variant of this equipment made by Krone has been phased out and replaced because of reliability concerns.

Table 3.15 summarises the present population of MV switchgear.

Table 3.15 - MV Switchgear

Type	33 kV	11kV	Total Units
Disconnectors	14	384	398
Load Break Disconnectors	0	23	23
Motorised Disconnectors	13	6	19
Vacuum Recloser	2	43	45
Load Break Switch (ENTEC)	0	20	20
Ring Main Unit	0	54	54
Ganged Expulsion Drop-outs	0	32	32
Total Units	**29**	**562**	**591**

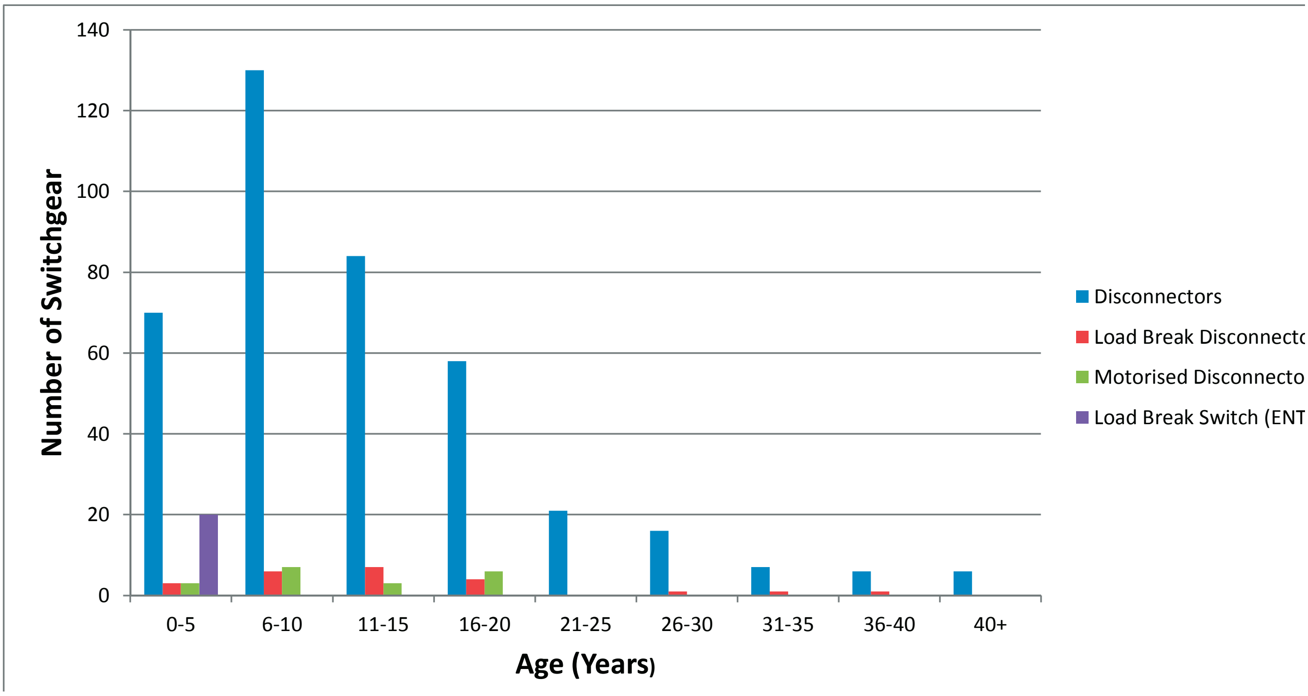


Fig 3.26 MV Switchgear Age Profile

3.9.1 Asset Justification

These assets cover a diverse range of devices, but generally include switches of various types that are used to protect and sectionalise the network. In the event of a fault on the network, fuses, reclosers and sectionalisers are needed to isolate the faulted section safely and quickly, and thereby maintain supply to other customers on un-faulted sections of the network. The devices are also necessary to isolate sections of line to allow maintenance to be carried out.

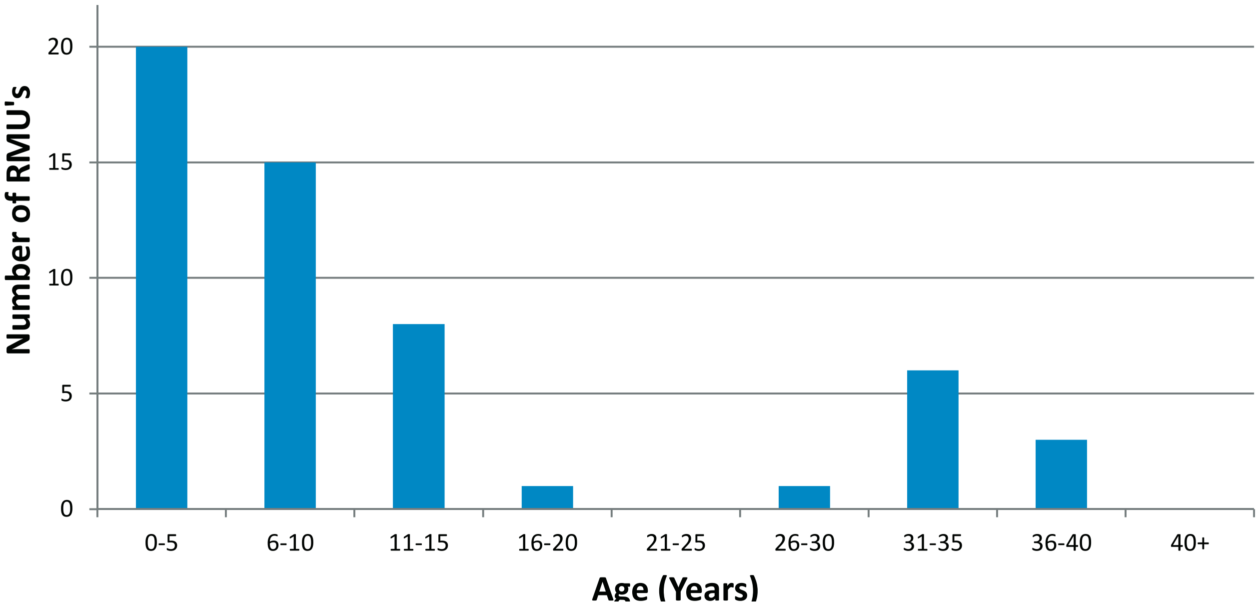


Fig 3.27 Ring Main Unit Age Profile

3.9.2 MV Switchgear Condition

Most of Westpower's MV switchgear is relatively modern and in good condition. However, a recent series of faults on the Andelect 0utdoor type ring main units has given reason for replacement of these units over the last five years with new SF6 units. Westpower no longer uses Series I Anderlect oil-insulated ABB ring main units to close onto expected faults.

Other exceptions to this are the large and diverse population of disconnectors, which will need to be managed on an asset-wide basis (see Section 3.9.6).

3.9.3 Regulators

A moving coil three-phase regulator was installed at Longford Corner. The 2 MVA unit was proving to be unreliable and difficult to find replacement parts for. The unit was due to be replaced in the 2012/13 financial year but failed in August 2011. This was replaced with two single-phase units and returned to service in September 2011. The remaining work required at this site was completed in 2012.

In the early 1980s, six Cooper SR32 single-phase 32 step regulators were purchased for Fox and Kokiri. The three installed in Fox were moved to the new substation site from Cook Flat Road in 2003. The three at Kokiri were moved to Harihari when the 33/11 kV substation was developed there and Kokiri's function was replaced by the Arnold 33/11 kV substation. In 2007, one of the Fox units failed (lightning was suspected) so a new Cooper unit was purchased to replace it. With the increasing load at Fox (present peak at about 50 A), the 100 A regulators' capacity was limited. These regulators were replaced with 200 A units in 2009.

The line regulator at Cronadun was an old tap-changing unit purchased second-hand from Transpower. This unit reached the end of its economic life and required constant maintenance. Spare parts were hard to source and the unit was costly to maintain. This regulator was replaced with refurbished (ex-Fox) 100 A units in 2009. The SR32s are in relatively good condition, though the paint work will need attention soon.

At the end of the 2003 dairy season, it was identified that the Haupiri area needed a voltage regulator to compensate for the on-going developments. A set of two GE 100 A regulators were bought and installed near the old Miers Mill site.

The South Westland Potential Support project was completed in 2005, involving installation of a 10 MVA 33 kV voltage regulator at Harihari. This was purchased second hand from Aurora (ex-Queensberry). Its function is to provide support to the South Westland area for periods when Wahapo is not generating. This will be removed from service when 66 kV is returned to South Westland from Hokitika.

Each of the Ross, Waitaha and Whataroa substations has a 1 MVA induction regulator installed. They are all similar and were purchased second-hand from Transpower. Their manufacture dates are unknown but they are thought to be in excess of 60 years old. These all work well at present but would not be worth fixing if a major fault occurred within them. Their condition and operation is being monitored.

The Whataroa Regulator is to be replaced this financial period.

3.9.4 Circuit Breakers

Aged indoor bulk oil circuit breakers supplying indoor distribution transformers have reached the end of their economic lives. These will be replaced with fused switch units or modern equivalents over the next five years.

3.9.5 Pole-Mounted Reclosers

There are a total of 45 pole-mounted reclosers (43 x 11 kV, 2 x 33 kV) at various locations throughout the network. All of these reclosers are controlled remotely by SCADA. These reclosers are a combination of Cooper type KFME and Viper ST reclosers.

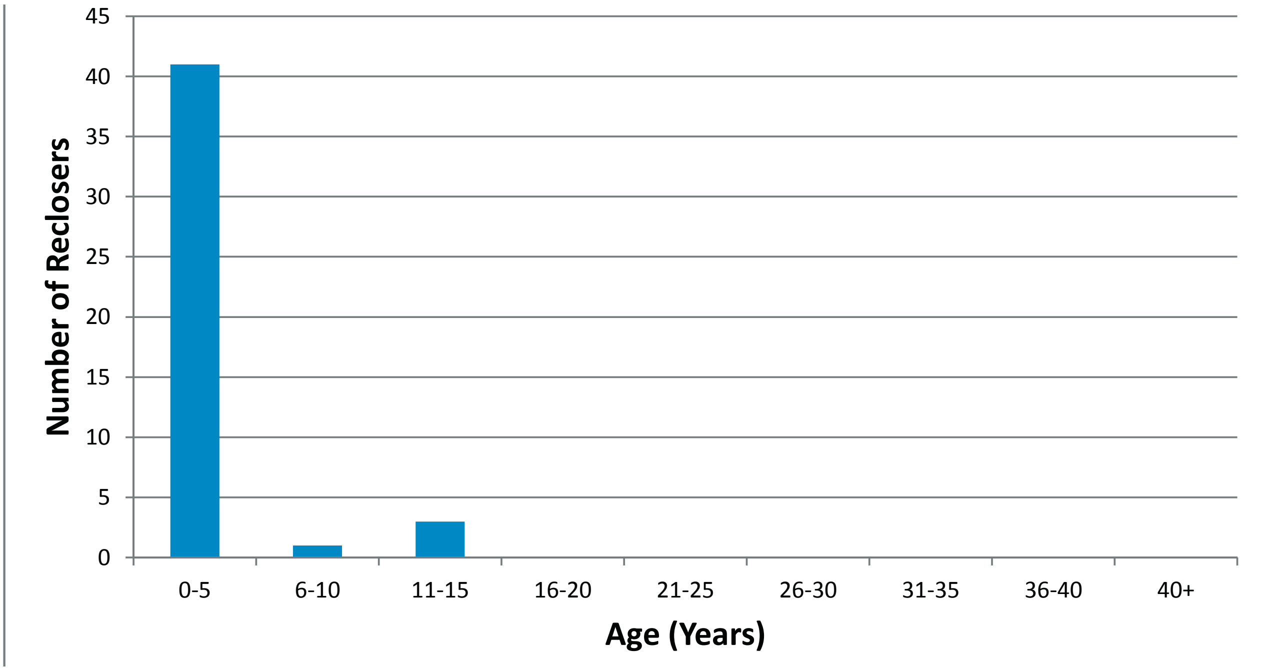


Fig 3.28 Vacuum Recloser Age Profile

Cooper KFE type reclosers have been progressively replaced with G & W Viper ST reclosers, protected by modern digital SEL651R protection relays. This project was completed in the 2011/12 financial year.

3.9.6 Remote Controlled Motorised Disconnectors

For some time, Westpower has been having trouble sourcing a reliable motor drive unit for the motorised disconnectors. Westpower has now developed a hydraulic actuator. These are gradually being fitted to various locations on the network.

Also The Dulmison motor drive units had also become unreliable. These have been gradually replaced with ENTEC load break switches, with the last remaining Dulmison units replaced in the 2012/13 financial year.

3.9.7 Disconnectors

A five-yearly preventative maintenance programme is in place to ensure all disconnectors are maintained to a good and safe operating condition.

All network disconnectors will have been maintained by the end of March 2014. The majority of the disconnectors have been assessed as being in good condition. Crews have carried out necessary repair work to the disconnectors as identified while completing the maintenance.

A small number were identified as needing to be replaced immediately or in the near future. Immediate replacement was carried out where identified and a replacement plan is in place to be completed in the next preventative maintenance cycle. Rust was one of the major issues identified when maintenance was carried out. These disconnectors were predominantly in coastal areas.

In conjunction with the maintenance programme, a disconnector refurbishment programme is in place. As most disconnector maintenance is carried out using Live Line techniques, all disconnectors are assessed before maintenance is carried out to determine if it is safer and more cost effective to replace the disconnector instead of carrying out repairs/maintenance. These are replaced with refurbished disconnectors.

A stock of refurbished disconnectors is kept at the Greymouth depot ready to install at any location. These are disconnectors that have been removed from services and refurbished at the Greymouth depot.

As maintenance is carried out, earthing is checked to ensure all locations meet Westpower's current standard and are upgraded as required.

3.9.8 Protection

Protection systems are mainly restricted to zone substations, with the notable exception of line reclosers.

Westpower used to have Cooper Power System type reclosers as the standard; the protection involved was often that supplied with the reclosers. These often comprise a mixture of the KFE or KFME reclosers and FXA /FXB protection controllers.

Due to the high maintenance costs, unreliability and unavailability of spare parts for these reclosers, Westpower has just completed a replacement programme to replace all KFE type Reclosers. The new reclosers approved by Westpower are G & W Viper ST controlled by a SEL651R protection relay.

Refurbished KFME Reclosers with SEL Protection have been installed to protect Spur Lines.

All protection units are less than 25 years old and are of solid state construction.

All other protection systems are included in Section 3.7.

Most of the protection assets owned by Westpower are related to overhead line protection, and the majority of lines are protected by overcurrent and earth fault relays.

The 33 kV and 11 kV feeder protection equipment is generally of the same age as the switchgear.

Schweitzer Engineering Labs protection relays are now used across the network.

3.10 SCADA and Communications

DRC - $233,333

ODRC - $233,333

This includes all communications equipment and radio repeater sites, as well as vehicle-mounted equipment and the SCADA plant including the master station in the control room. Any equipment installed at zone substations has already been covered under that area.

3.10.1 Asset Justification

The SCADA and communications networks are essential to allow Westpower to monitor and operate its network. In the event of a fault, these systems allow safe isolation of the defective plant and also fast restoration of supply to as many customers as possible. The system is also required for Westpower to monitor the real time performance of the assets.

3.10.2 SCADA System

Westpower's master SCADA station is based upon the RealFlex 6 product supplied by DATAC operating on Servers running QNX Neutrino operating system.

The Human-Machine Interface (HMI) is a Windows-based client running on standard desktop networked PCs. Storage of historical data is via a MySQL DBMS. The operator HMI for data and control is done via Flexview software, which is run in the control room on a standard Windows PC fitted with three 22-inch LCD screens. This gives the operator the ability to not only view SCADA data but also simultaneously use any other PC software. The ability of Flexview to run on PCs allows the SCADA information to be viewed from almost anywhere within Westpower's computer network.

Figure 3.29 shows a control room HMI.

Fig 3.29 Control Room HMI

The information viewed within Flexview is captured by RealFlex which runs on a pair of dedicated Servers located in Westpower's secure server room, one being the online server, while the other acts as a hot standby in case of hardware failure. These servers run the latest version of RealFlex, on an operating system called QNX Neutrino RTOS, which is a network operating system designed for real-time applications.

All vital SCADA equipment is powered via an Uninterruptible Power Supply (UPS), which provides an eight-hour backup in case of a major power outage. Furthermore, a three-phase generator has been installed to provide power to all equipment including the UPS, further extending this back-up period if required. Figure 3.30 shows the three-phase generator used.

3.10.3 Remote Terminal Units

RealFlex has the ability to communicate with many different types of Remote Terminal Units (RTU) and field equipment such as protection relays and PLC's via most of today's standard communication protocols.

For smaller zone substations and remote sites such as reclosers and automated disconnectors in the distribution network, Abbey Systems Topcat II, TopCat, and MicroLink RTUs are installed.

The TopCat II is a small unit with fixed I/O and also has two local communication ports to connect to a PLC or protection relay, which provides additional control and equipment status data.

A feature of these units is the pre-emptive communications protocol, which allows the RTU to be polled very infrequently, while simultaneously providing the ability for the RTU to update the master station whenever a change of state occurs.

Abbey RTU's use Westpower's VHF speech and data radio channels to communicate with the master station.

Fig 3.30 Three-Phase Generator

3.10.4 Communication System

Westpower communications network provides vital SCADA, telephony and tele-protection services for the Westpower distribution network, Transpower transmission network, TrustPower and Solid Energy. The communication network is a mix of fibre, analogue radio and digital radio.

3.10.5 Communication Cables

A fibre-optic cable runs from the server room in the Tainui St building to the Greymouth substation. This fibre link is used for speech, SCADA and surveillance monitoring of the Greymouth substation.

A second fibre cable runs from the server room to Chapel St. This fibre link is used for SCADA and offsite computer backups.

3.10.6 VHF Network

The VHF speech network is an extensive system used by Westpower, ElectroNet Services and TrustPower (West Coast Generation).

As vehicles are replaced, regular removal and reinstallation of existing mobile sets takes place.

3.10.7 Digital Network

The digital radio network consists of a mixture of radio technologies, mostly consisting of licensed point-to-point radio frequencies. Digital radio links provide Transmission Control Protocol and Internet Protocol (TCP/IP) and where required, serial and voice channels to all major Westpower substations. Current sites covered by the digital network are the Greymouth, Dobson, Hokitika, Reefton, Ngahere, Arnold, Rapahoe, Kumara, Globe, Logburn, Blackwater and Pike, Harihari, Whataroa, Wahapo, Amethyst substations and 33 smaller sites.

3.10.8 Communication System Condition

All VHF communication equipment is in excellent condition after a complete replacement programme that took place in the early 1990s. Tait 2000 series equipment is now used throughout the network and rarely gives trouble.

3.11 Ripple Injection Plants

DRC - $180,000

ODRC - $180,000

Westpower owns five ripple injection plants, with one each at Reefton, Greymouth, Hokitika, Dobson and Wahapo.

These plants are used for load control purposes as well as providing tariff-switching signals for use by retailers.

Retailers also use this system, by contractual arrangement with Westpower, to shift load from high-cost to low-cost periods, provided that load control operational requirements are not compromised.

Hokitika and Greymouth have Enermet SFU-K303 series 120 kVA injection plants installed, while Dobson and Reefton have Enermet SFU-K 203 series 80 kVA plants. All plants have associated injection transformers, coupling cells and HV circuit breakers. In all cases, the injection plant and major coupling cell components are housed inside a building.

There was only one injection point at Greymouth from 1982 until 1996, when the supplementary plants were installed. During this period, the system relied on the Transpower 66 kV transmission system for a signal path to outlying areas.

All plants are controlled remotely by the SCADA load management system and locally via Abbey Powerlink Injection controllers.

Four of the five on-line plants run synchronously, i.e. they are able to inject the identical ripple waveform at each of the four sites at the same time. GPS technology has made this possible by providing an accurate time base at each site which is perfectly synchronised in frequency and phase with the other bases.

A stand-alone ripple plant was installed at Wahapo zone substation in 2011/12 financial year. This was installed in the existing shed and is used on occasion to provide ripple control to South Westland area when Wahapo generation is running islanded from the remainder of Westpower’s network.

This plant consist of the best available parts from the decommissioned Plessey TR series 75 kVA plants at Reefton, Greymouth and Hokitika.

3.11.1 Asset Justification

Ripple injection plants are a key part of Westpower's demand side management strategy and are used to send ripple signals to receivers in customers' premises that allow interruptible loads such as water heating to be switched on or off. This is critical to maximise use of existing assets and avoid unnecessary asset expenditure to cover unnecessarily high peak demands.

3.11.2 Ripple Control Condition

Westpower sold all of its ripple relays to the new incumbent retailer on 31 March 1999 along with exclusive use of channels existing at that time. The ripple injection plants were retained for the purpose of load control as well as to provide a load switching service to retailers under contract.

All ripple injection plants are either new or in good order, as would be expected from their age profile.

3.12 Optimised Assets

Other than the following asset optimisation, there has been no other overdesign or over-investment in the Westpower network. Table 3.16 summarises the optimised assets.

Table - 3.16 Optimised Assets

Asset	Asset Type	Physical Rating	Optimised Rating
Wahapo Zone Sub transformer	Zone Substation	6 MVA	4 MVA
Punakaiki Feeder	Distribution Line	33 kV	11 kV
Hokitika-Harihari Line	Subtransmisison Line	66 kV	33 kV

The Hokitika to Harihari 66 kV line was purchased from Transpower in 2001 but has only been running at 33 kV since 1993, when a physical optimisation took place. A new generation scheme at Waitaha in South Westland, tentatively planned for 2018/2019, will involve recommissioning the line at a 66 kV voltage level, and upgrading the existing conductor and the connected substations from 33 kV to 66 kV.

The Punakaiki feeder was built at 33 kV in the mid-1990s when an ilmenite mine was planned for the area, but this project was shelved. The line is now only required to operate at 11 kV. Notwithstanding this, the coastal environment in which this line operates is characterised by extreme salt mist pollution, and the additional creepage distance afforded by the 33 kV insulators employed is regarded as beneficial and reduces the numbers of transient faults in the area.

The Wahapo 6 MVA transformer were purchased second-hand for a very low price following the closure of the Tarakohe cement works in the late 1980s and the overcapacity now apparent is more to do with optimal capital investment (i.e. a good bargain) than evidence of perceived "gold-plating".

On 19 November 2010 a disaster occurred at the Pike River Coal Mine, and this has resulted in a significant reduction at the site. At the time of preparing this AMP, the future requirement for electricity supply at the mine is largely unknown and this may well result in stranded assets that may require future optimisation.

3.13 Generation

Westpower currently owns no generation plant, but has re-entered this market segment through a joint venture with other partners to construct a 7 MW hydro scheme near Harihari called the Amethyst scheme, which was commissioned in May 2013.

A 20 MW scheme near Waitaha is also being investigated.

Customer-embedded generation onto the Westpower network (greater than 0.5 MW) is as shown in Table 3.17.

Table 3.17 - Embedded Generation

Site	Owner	Year in Service	KW Generated	Connection Point	Connection Voltage
Amethyst Power Station	Westpower	2013	7,400	Amethyst	11 kV
Arnold Power Station	TrustPower	1932	3,000	Arnold	11 kV
Dillmans Power Station	TrustPower	1978	3,500	Dillmans	11 kV
Duffers Power Station	TrustPower	1979	550	Duffers	11 kV
Kumara Power Station	TrustPower	1978	6,500	Kumara	11 kV

3.14 Load and Customer Characteristics by GXP

As discussed in Section 3.2, Westpower is supplied by six GXPs spread throughout its area. The following discusses the load characteristics and large consumers in each of the areas supplied by these GXPs.

3.14.1 Reefton (RFN110)

The Reefton GXP supplies load from Lyell in the north, Berlins in the east and Blackwater to the south.

The load is characterised mainly by dairy farming and domestic load, although there is some small commercial load in the town of Reefton, along with some mining.

Table 3.18 shows the bulk customers supplied from this GXP.

Table 3.18 - Bulk Customers from Reefton GXP

Bulk Load	Load Type	Load Size
Terrace Mine	Underground Coal Mine	75 kW
Oceana Gold Limited - Reefton Gold Project	Open Cast Gold Mine	5300 kW

3.14.2 Atarau (ATU110)

As noted above, this GXP was commissioned in 2007 to supply the Pike River coal mine.

Apart from a few small farms and domestic dwellings in the area, this GXP is dedicated to the supply of the mine. The future prospects for this GXP are unknown at this stage.

3.14.3 Dobson (DOB033)

Dobson supplies the Grey Valley from Blackwater in the north to Punakaiki in the west, to north of Greymouth in the south and Rotomanu in the east.

This GXP covers a wide area with a mix of farming, industrial, residential and holiday home load, but relatively little commercial load. It was originally constructed to supply the town of Greymouth and the coal mining load in the lower Grey Valley and Runanga areas, but was situated too far from Greymouth township to supply the growing load there. A separate GXP was constructed in Greymouth in the late 1970s.

Table 3.19 shows the bulk customers supplied from this GXP.

Table 3.19 - Bulk Customers from Dobson GXP

Bulk Load	Load Type	Load Size
Solid Energy - Spring Creek Mine - Dunollie	Underground Coal Mine	1000 kW
Roa Coal Mine - Roa (near Blackball)	Underground Coal Mine	1200 kW
Stillwater Lumber - Stillwater Sawmill	Timber Mill	1200 kW
CMP - Phoenix Meat Works, Kokiri	Abattoir	1360 kW

3.14.4 Greymouth (GYM066)

The Greymouth GXP supplies the town of Greymouth and the satellite townships of Cobden and Blaketown, as well as South Beach, Rutherglen and Paroa to the south.

As would be expected, the load is mainly domestic, commercial and light industrial, with a small but growing load resulting from increased tourism to the area.

Table 3.20 shows the bulk customers supplied from this GXP.

3.14.5 Kumara (KUM066)

Table 3.20 - Bulk Customers from Greymouth GXP

Bulk Load	Load Type	Load Size
Kingsgate - Kingsgate Hotel - Greymouth	Hotel	300 kW
Westfleet - Westfleet Fish Processing - Greymouth	Fish Processing Plant	1000 kW
Fresh Choice - Greymouth	Supermarket	220 kW
Monteiths Brewery - Greymouth	Brewery	200 kW
New World - Greymouth	Supermarket	310 kW
The Warehouse - Greymouth	Retail Store	200 kW
Coast Health - Greymouth Hospital - Greymouth	Hospital	410 kW
IPL - Plywood - Gladstone	Timber Processor	650 kW

The Kumara GXP is mainly required to provide a GIP for Trustpower's 10 MW Kumara hydro scheme, but also supplies local load in the area from Gladstone in the north to Jacksons in the east to Duffers in the south. When the generation is not running, a peak export demand of less than 2 MW is provided from this substation.

Apart from the significant generation, the load type is mainly farming and rural residential, although there is one significant industrial load connected to this GXP, as shown below in Table 3.21.

3.14.6 Otira (OTI011)

Table 3.21 - Bulk Customers from Kumara GXP

Bulk Load	Load Type	Load Size
IPL - Plywood Mill - Gladstone	Timber Processor	550 kW

The load at Otira is totally isolated from other GXPs. Apart from a small hotel and a few houses and baches, the majority of the load consists of the fan motors for the Otira Tunnel. This is detailed in Table 3.22 below.

3.14.7 Hokitika (HKK066)

Table 3.22 - Bulk Customers from Otira GXP

Bulk Load	Load Type	Load Size
Tranz Rail - Otira	Fan Load	600 kW

The Hokitika GXP supplies the town of Hokitika and all areas south of there as far as Lake Paringa, some 200 km away.

The load is a mix of dairy farming, residential, commercial, light industrial and large industrial. South of Whataroa, the load is predominantly driven by the tourist centres of Franz Josef and Fox Glaciers.

Table 3.23 shows the bulk customers supplied from this GXP.

Table 3.23 - Bulk Customers from Hokitika GXP

Bulk Load	Load Type	Load Size
Westland Dairy - Hokitika Dairy Factory - Hokitika	Milk Processing Factory	8200 kW
Westco Lagan - Ruatapu Sawmill - Ruatapu	Timber Mill	880 kW
Silver Fern Farms - Hokitika Venison Factory - Hokitika	Venison Abattoir	250 kW
New World - Hokitika	Supermarket	200 kW
Westland Motor Inn - Franz Josef	Hotel	180 kW

3.15 Voltage Support Systems

Westpower regularly uses voltage regulators throughout its distribution network and has also installed regulators in its 33 kV sub transmission network at Harihari to support the voltage in South Westland when Trustpower's Wahapo generator is not running. Although this regulator is generously rated, it was bought second-hand for a price well below modern replacement cost and could be replaced by a smaller unit if it had to be replaced in the future.

Table 3.24 shows the schedule of voltage regulators installed in Westpower's network.

In addition to voltage regulators, a number of HV capacitors have been strategically installed throughout the 11 kV distribution network. This improves the apparent power factor of the loads seen from Transpower's GXPs, resulting in improved voltage regulation throughout the West Coast. It also improves the voltage profiles in individual 11 kV feeders leading to improved capacity and reduced losses.

Table 3.24 - Voltage Regulators

Regulator Site	Voltage	Size
Cronadun (north of Reefton)	11 kV	2250 kVA
Longford Corner (east of Hokitika)	11 kV	2000 kVA
Haupiri (east of Dobson)	11 kV	2000 kVA
Harihari	33 kV	10000 kVA

Capacitors have been installed at various locations throughout the 11 kV network. There are a total of 16 capacitor sites, varying in size from 0.3 Mvar to 1.2 Mvar, with a total capacity of 13.5 Mvar. All of these capacitor locations are less than ten years old, and are a combination of pad-mounted and pole-mounted. All of the above are under Westpower's operational control.

Most of the capacitors installed in the network are fixed, where they are in service at all times. An automated site has now been installed at Kumara Junction, which was used for voltage support during the Kumara project. This site has proved to be successful in switching the capacitor banks in and out of service when required. All sites will be gradually assessed to determine if they are required to be automated. Switched capacitor banks also exist in Greymouth, Hokitika, Franz Josef and Shantytown. The Franz Josef and Shantytown capacitors banks are LV.

Because capacitors can absorb ripple signals, depending on the size of the capacitor and the system configuration, they are often installed with separate blocking chokes to avoid this problem.

Table 3.25 details the 11 kV distribution capacitors installed on Westpower's network and the zone substation that they are connected to.

Table 3.25 - Capacitors

Location	Zone Substation	Voltage	Capacity
South Highway 6 - Hokitika	Hokitika	11 kV	1000 kVAr
Kaniere Tram	Hokitika	11 kV	1000 kVAr
Strongman	Rapahoe	11 kV	1000 kVAr
Fox Glacier	Fox Glacier	11 kV	500 kVAr
Reefton Saddle	Reefton	11 kV	1000 kVAr
Kokiri	Arnold	11 kV	1200 kVAr
Wahapo	Wahapo	11 kV	500 kVAr
Solid Energy Bath House	Rapahoe	11 kV	1000 kVAr
Punakaiki	Rapahoe	11 kV	300 kVAr
Rotomanu	Arnold	11 kV	500 kVAr
Kokatahi	Hokitika	11 kV	1000 kVAr
Kotuku	Arnold	11 kV	500 kVAr
Haupiri	Arnold	11 kV	300 kVAr
Gladstone	Greymouth	11 kV	500 kVAr
Christian Community	Arnold	11 kV	1200 kVAr
Kumara Junction	Kumara	11 kV	1000 kVAr
Shantytown, Rutherglen	Greymouth	0.4 kV	500 kVAr
Franz Josef	Franz	0.4 kV	500 kVAr

In addition, a 7 Mvar capacitor bank at Greymouth substation and a 19.2 Mvar bank at Hokitika substation are under Transpower's operational control.

3.16 Westpower Mobile Substation

Westpower's mobile substation was developed to provide an effective means of maintaining electricity supplies to areas served by zone substations with single transformers. Essentially, it is a self-contained zone substation on wheels, and is rated at 33/11/3.3 kV and 8/10 MVA.

The 33 and 11 kV cables are stored on reels and rolled out on-site to connect to the local 33 and 11 kV networks. All of the switchgear, SCADA, control and protection systems are on board and ready to go at short notice.

This substation can be used to:

- Reduce restoration time in the event of a forced outage of a transformer at a single transformer substation;
- Provide for a temporary or augmented supply to an area near to the sub transmission system when a new build is not warranted for short duration peaks or loads;
- Allow for extended maintenance outages at substations without interrupting supply to consumers for significant periods.

This is one of only three such substations that Westpower is aware of, with two of these in the South Island. This innovation has improved security and reliability in Westpower's network. So far, it has been used on several occasions, saving loss of supply or extra cost from temporary hire of generators.

Figure 3.31 shows the completed mobile substation.

Fig 3.31 Westpower's Mobile Substation

A number of substations have been modified to accommodate the mobile substation and this modification programme will continue throughout this planning period. The zone substation sites prepared for mobile substation connection so far are Arnold, Dobson, Ngahere, Rapahoe, Franz Josef, Fox Glacier, Whataroa, Globe, Harihari, Blackwater and Waitaha. Wahapo is to be completed this financial period.

3.17 Substation Buildings

Westpower has a number of substation buildings of different types located around its network. Some house substations and some house control equipment. Table 3.26 lists the substation buildings within the Westpower network, their location, purpose and type of construction.

Building maintenance is an important part of maintaining the condition of assets within the Westpower network. The condition of the buildings was assessed in the 2004 Lifelines survey report for Westpower and a number of issues were highlighted. These included checking for the presence of reinforcing steel in the early permanent buildings and ensuring that the sandwich panel buildings were restrained sufficiently to mitigate the effects of earthquake loads.

A zone substation building climate control programme has seen air conditioning units installed at various zone substations. During a three year period, units were installed at Reefton, Globe, Blackwater, Pike, Logburn, Rapahoe, Greymouth, Franz Josef and Hokitika. These have been installed to provide a constant temperature in zone substations, allowing for a more stable environment for all equipment in zone substation control rooms.

Table 3.26- Summary of Substation Buildings

Building Location	Purpose	Materials of Construction
Arnold Substation	Storage and office	Light timber framed
Badger Lane Substation	Switchgear	Permanent
Dobson Substation	Control equipment	Transportable sandwich panels
Fox Substation	Control equipment	Transportable sandwich panels
Franz Josef Substation	Control equipment	Light timber framed
Greymouth Substation	Switchgear & control gear	Permanent
Harihari Substation	Control equipment	Transportable sandwich panels
Hokitika Substation	Switchgear & control gear	Permanent
Mawhera Quay Substation	Switchgear & control gear	Permanent
Rapahoe Substation	Switchgear & control gear	Light timber framed
Ross Substation	Control equipment	Transportable sandwich panels
Wahapo Substation	Control equipment	Light timber framed
Waitaha Substation	Control equipment	Transportable sandwich panels
Whataroa Substation	Control equipment	Light timber framed
Dobson Substation	Switchgear & control gear	Light timber framed
Reefton Substation	Switchgear & control gear	Permanent
Logburn Substation	Switchgear & control gear	Permanent
Ngahere Substation	Control equipment	Light timber framed
Harihari Regulator	Control equipment	Transportable sandwich panels
Globe Substation	Switchgear & control gear	Transportable sandwich panels
Pike Substation	Switchgear & control gear	Transportable sandwich panels
Blackwater Substation	Switchgear & control gear	Transportable sandwich panels

4.0 LEVELS OF SERVICE

4.1 Introduction

In order to properly manage the delivery of service to Westpower's consumers, it is critical that appropriate KPIs are developed to measure the performance of the network objectively, and to ensure that these KPIs can be applied consistently across the network and over time. Furthermore, these KPIs must be relevant to the service being delivered and readily understandable by interested stakeholders.

Once the KPIs are created and reporting mechanisms are put in place to monitor them routinely on an ongoing basis, performance targets can be developed to set clear benchmarks against which the service delivery performance of the business can be assessed. This has a twofold benefit of providing:

- A means of monitoring trends over time and measuring just how well the business is delivering service to its consumers;
- A way of creating realistic goals for the future that provide a clear basis for the provision of well targeted reliability maintenance or enhancement programmes.

The targets created through this process need to be consistent with Westpower's business strategies and asset management objectives, which, in turn, are derived from the asset management policy that forms the key linkage between the corporate direction of the business and the asset management function.

Over time, the KPIs and targets will continue to be refined, based on historical performance and stakeholder requirements. In addition, the targets must reflect what is realistically achievable, given the current condition of the network and the financial expenditure capability of the business.

Furthermore, by adopting this approach of setting targets and then measuring performance against the targets, it is possible to objectively assess the success of programmes designed to enhance the service delivery performance of the asset and then make adjustments to provide optimum long-term outcomes.

The target levels of service may generally be subdivided into the following two main areas:-

- Consumer-oriented performance targets;
- Other targets relating to asset performance, asset efficiency and effectiveness, and the efficiency of the ELB activity.

This section explains the target levels of service that have been chosen based on the KPIs developed. Historical performance against these target levels is provided, along with commentary on the reasons for any underlying trends or significant perturbations. Finally, a justification is provided for current and future target levels of service based on consumer, legislative, regulatory, stakeholder and other considerations. Included in this justification is a discussion of how stakeholder needs were ascertained and translated into service target levels.

4.2 Customer-Orientated Performance Targets

The key performance indices commonly used throughout the electricity industry to assess customer-oriented performance are SAIDI and SAIFI as defined in IEEE Standard 1366:2033.

These are the same indices as used by all ELBs. By adopting an approach consistent with this standard, benchmarking of Westpower's performance against other ELB's is supported.

This section describes historical performance of the network according to these indices and compares them with related targets currently mandated by the targeted control regime under the control of the Commerce Commission.

As Westpower is now exempt from such regulation, it has developed more meaningful targets that are specific to particular customer groups and types of outages, as discussed in the following sections. These have been derived from historical performance as well as expectations of the impact of particular improvement initiatives that Westpower has undertaken over recent years. Westpower does, however, still come under the Electricity (Information Disclosure) Requirements 2008 and must still disclose industry standard performance indices.

4.2.1 Extreme Events

As Westpower's area is subjected to extreme weather events from time to time, it is important to disaggregate the KPIs into baseline values that reflect the underlying performance of the business, and extreme event values that result from environmental externalities that are beyond the reasonable control of Westpower. The baseline values (i.e. those excluding major events) are the key indicators used consistently throughout this plan, and the reader needs to exercise caution in comparing these normalised statistics with information published under the information disclosure regime, which includes all events.

The method of achieving the normalisation of the measured values is based on IEEE Standard 1366:2003, where a Major Event Day (MED) is defined and then used as a threshold to exclude statistics that relate to a major event.

This process used to identify MEDs is termed the "Beta method". Its purpose is to allow major events to be studied separately from daily operation and, in the process, to better reveal trends in daily operation that would be hidden by the large statistical effect of major events.

A MED is a day in which the daily system SAIDI exceeds a threshold value, T_{MED}. The SAIDI index is used as the basis of this definition since it leads to consistent results regardless of utility size, and because SAIDI is a good indicator of operational and design stress. Even though SAIDI is used to determine the MEDs, all indices should be calculated based on removal of the identified days.

In calculating daily system SAIDI, any interruption that spans multiple days is accrued to the day on which the interruption begins.

The MED identification threshold value, T_{MED}, is calculated at the end of each reporting period (typically one year) for use during the next reporting period as follows:

1. Collect values of daily SAIDI for five sequential years ending on the last day of the last complete reporting period. If fewer than five years of historical data are available, use all available historical data until five years of historical data are available.
2. Only those days that have a SAIDI/day value will be used to calculate the T_{MED} (do not include days that did not have any interruptions).
3. Take the natural logarithm (ln) of each daily SAIDI value in the dataset.
4. Find α the average of the logarithms (also known as the log-average) of the dataset.
5. Find β the standard deviation of the logarithms (also known as the log-standard deviation) of the dataset.
6. Compute the MED threshold, T_{MED}, using the following equation:

$$T_{MED} = \mathbf{e}^{(\alpha + 2.5\,\beta)}$$

7. Any day with a daily SAIDI greater than the threshold value T_{MED} that occurs during the subsequent reporting period is classified as a MED.

Activities that occur on days classified as MEDs are excluded from the measured statistics.

Westpower has calculated a T_{MED} based on all outages recorded during a five-year outage period covering April 2004 through to March 2009 and this has yielded a SAIDI figure of 18.14 system minutes. Accordingly, the reported statistics have been normalised by excluding all events that had a SAIDI value in excess of this figure.*

*Note that this is slightly different from the commerce commission approach, where the statistic for the MED is capped to a maximum value rather than excluded. The purpose of this service level performance exercise is best served by excluding the values so that the statistical effects of major events on daily operations are completely removed.

Historical performance has been based on using the same number for the T_{MED} in all years, as opposed to using a rolling five-year dataset, as there is some question around the accuracy of data collected prior to 2003.

4.2.2 Breakdown by Location

To further disaggregate the performance data and create more meaningful targets against which performance can be assessed, the data are broken down by the following locations:

- Urban – including major towns and isolated areas with urban characteristics (e.g. underground distribution);
- Rural – generally farming areas outside of major towns;
- Remote Rural – areas of South Westland south of Hokitika but excluding local feeders of Ross, Waitaha, Harihari and Whataroa.

The definition used for Remote Rural is slightly different than that used by the Commerce Commission (i.e. more than 75 km from the nearest base), as all of South Westland, extending up to around 150 km south of Hokitika, is fed by a single 33 kV feeder. Analysis is greatly simplified by grouping this area together for 33 kV faults only, as a mixture of areas are affected. Local faults are treated as rural, as discussed above.

Figure 4.1 and 4.2 overleaf shows the defined areas.

4.2.3 Planned vs Unplanned Performance

In addition to the foregoing analysis of the data, namely exclusion of MEDs and disaggregating the reliability data by location, a further refinement has been applied by splitting the service levels into planned and unplanned (fault) categories. The rationale behind this approach is that there are different drivers for each type of service level.

Planned outages result from scheduled maintenance activities that are often part of a proactive maintenance approach to improve the overall performance of the network over the long term. In addition, consumers are notified well in advance of a planned outage and are often able to take steps to minimise their exposure to the effects of the outage. In view of this, planned outages are less disruptive than unplanned outages. In addition, they are more acceptable to consumers in view of the perceived longer-term benefits.

On the other hand, unplanned outages can cause significant economic damage to industrial and commercial consumers, while residential consumers are often significantly inconvenienced. Accordingly, consumers are less tolerant of this type of outage and separate targets need to be developed that recognise the disparity between the customer damage functions from each of these of outages.

The data included in this section of the AMP allow for this disaggregation wherever possible, including the comparison of historical performance against historical targets.

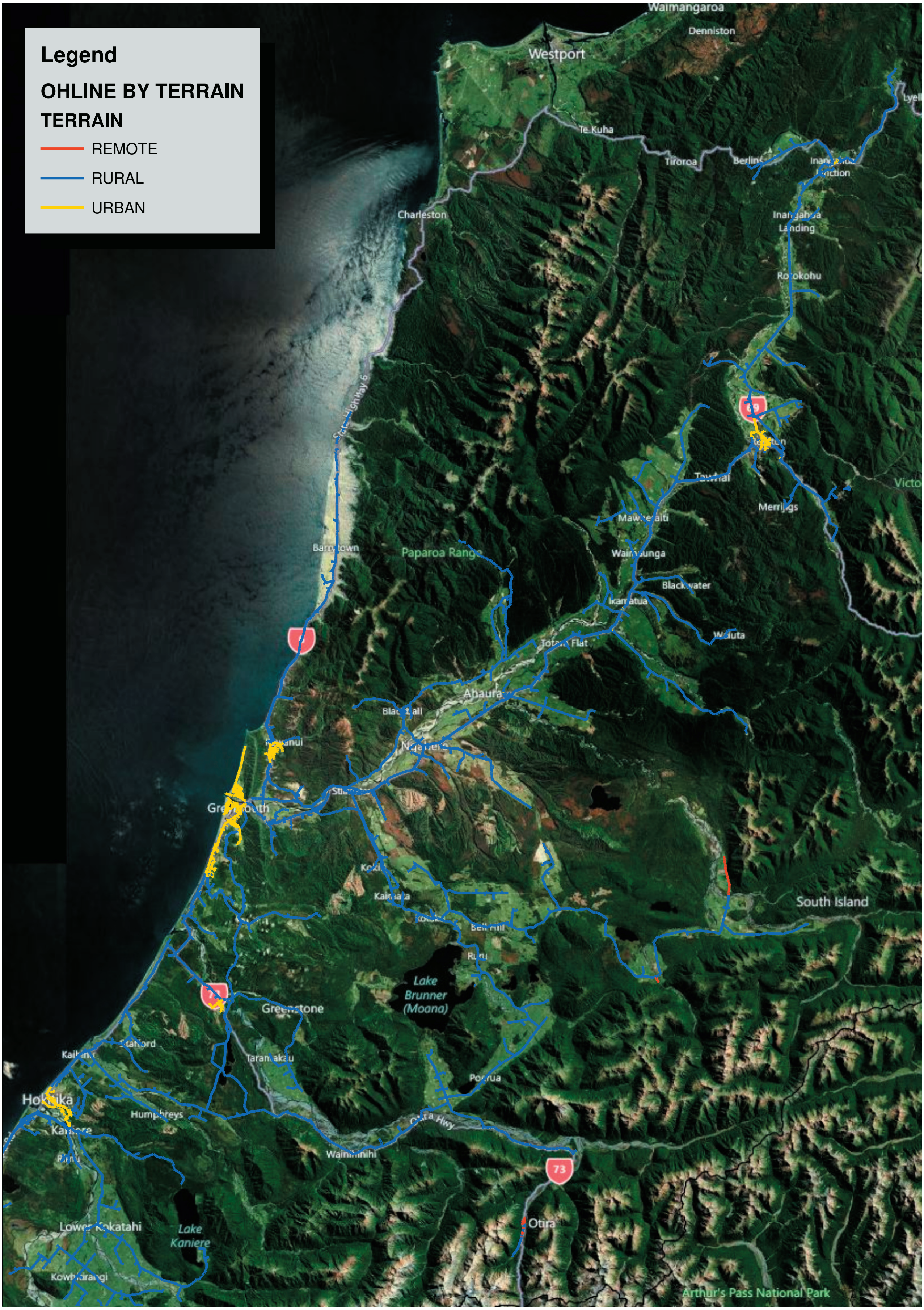


Fig 4.1 Areas defined within Westpower's Network - North

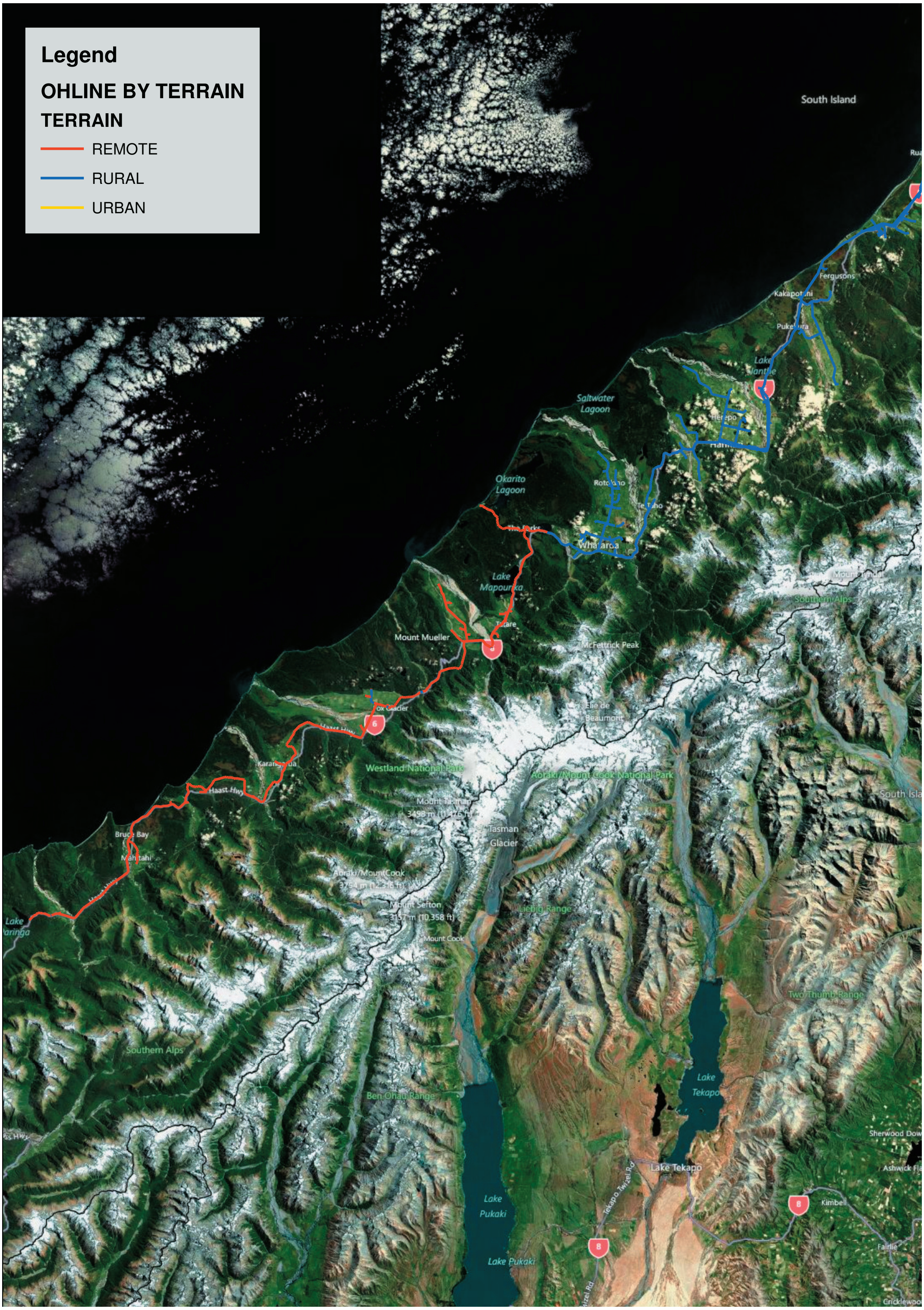


Fig 4.2 Areas defined within Westpower's Network - South

4.2.4 Historical Performance

The historical figures for SAIDI and SAIFI shown in Tables 4.1 and 4.2, and Figures 4.3 to 4.6, have been normalised by the removal of MEDs.

Table 4.1 - Planned and Unplanned SAIDI (Urban, Rural and Remote Rural)

		2008-09	2009-10	2010-11	2011-12	2012-13
URBAN	Planned	19.56	26.97	12.88	11.90	14.35
	Unplanned	36.21	31.95	35.41	18.39	50.43
	Total	55.77	58.92	48.29	30.29	64.78
RURAL	Planned	21.42	16.68	31.48	27.87	41.00
	Unplanned	54.91	67.78	62.13	48.53	52.45
	Total	76.33	84.46	93.61	76.40	93.45
REMOTE RURAL	Planned	2.74	10.19	2.55	4.56	10.33
	Unplanned	43.96	56.59	44.03	25.78	44.34
	Total	46.70	66.78	46.58	30.34	54.67
Grand Total		178.80	210.16	188.48	137.03	212.90
Planned Actuals		43.72	53.84	46.91	44.33	65.68
Planned Targets		40.00	55.00	60.00	60.00	60.00
Unplanned Actuals		135.08	156.32	141.57	92.70	147.22
Unplanned Targets		70.00	95.00	115.00	115.00	115.00

Table 4.2 - Planned and Unplanned SAIFI (Urban, Rural and Remote Rural)

		2008-09	2009-10	2010-11	2011-12	2012-13
URBAN	Planned	0.080	0.089	0.054	0.074	0.051
	Unplanned	1.140	0.289	0.877	0.705	0.662
	Total	1.220	0.378	0.932	0.779	0.713
RURAL	Planned	0.120	0.057	0.104	0.097	0.133
	Unplanned	1.110	0.561	0.791	0.727	0.903
	Total	1.230	0.618	0.895	0.824	1.036
REMOTE RURAL	Planned	0.020	0.034	0.014	0.018	0.043
	Unplanned	0.650	0.930	0.784	0.256	1.328
	Total	0.670	0.964	0.798	0.273	1.371
Grand Total		3.120	1.960	2.624	1.876	3.119
Planned Actuals		0.220	0.180	0.172	0.189	0.226
Planned Targets		0.250	0.340	0.680	0.680	0.680
Unplanned Actuals		2.900	1.780	2.452	1.687	2.893
Unplanned Targets		1.000	1.360	1.310	1.310	1.310

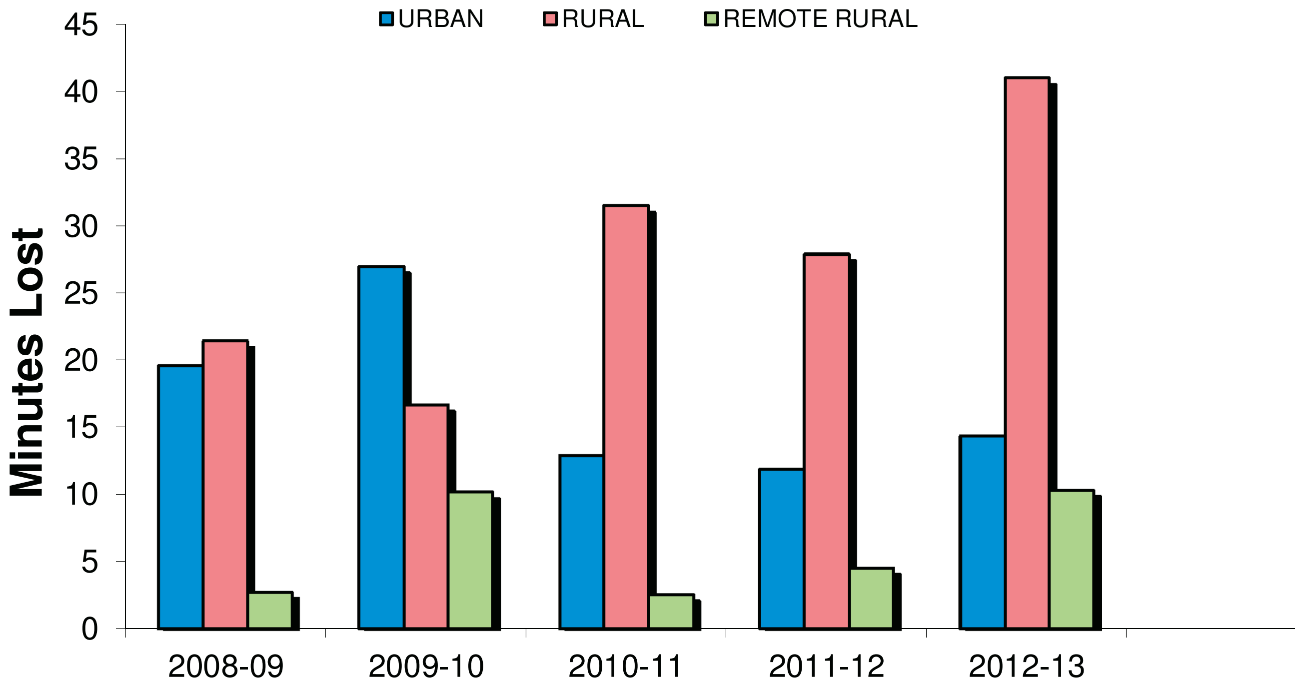


Fig 4.3 Planned SAIDI Profile for last Five Years

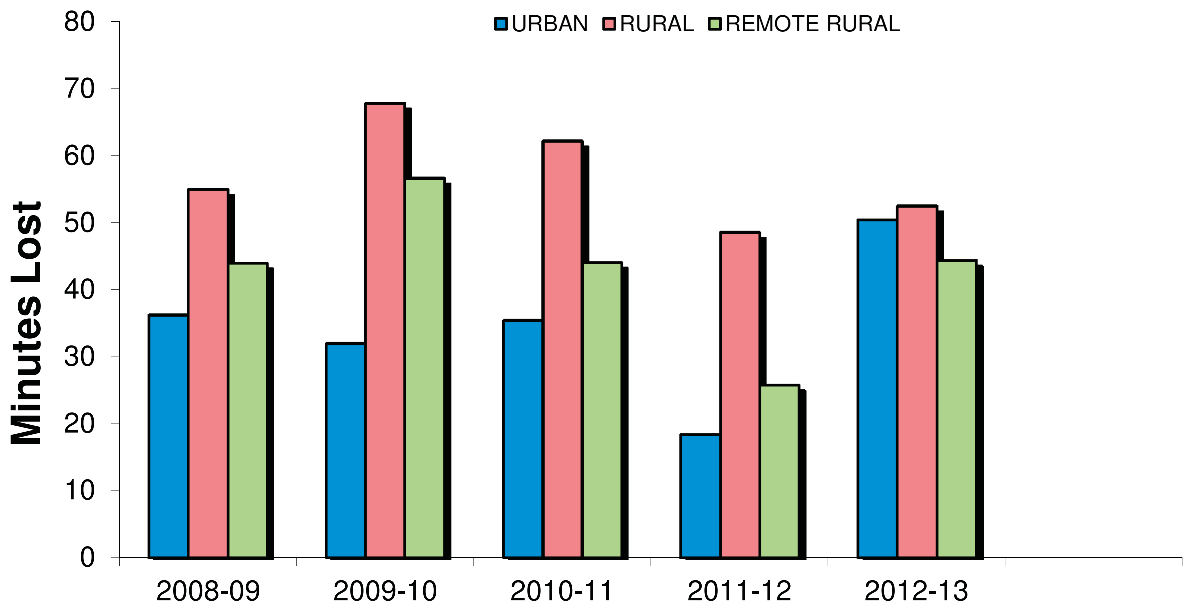


Fig 4.4 Unplanned SAIDI Profile for last Five Years

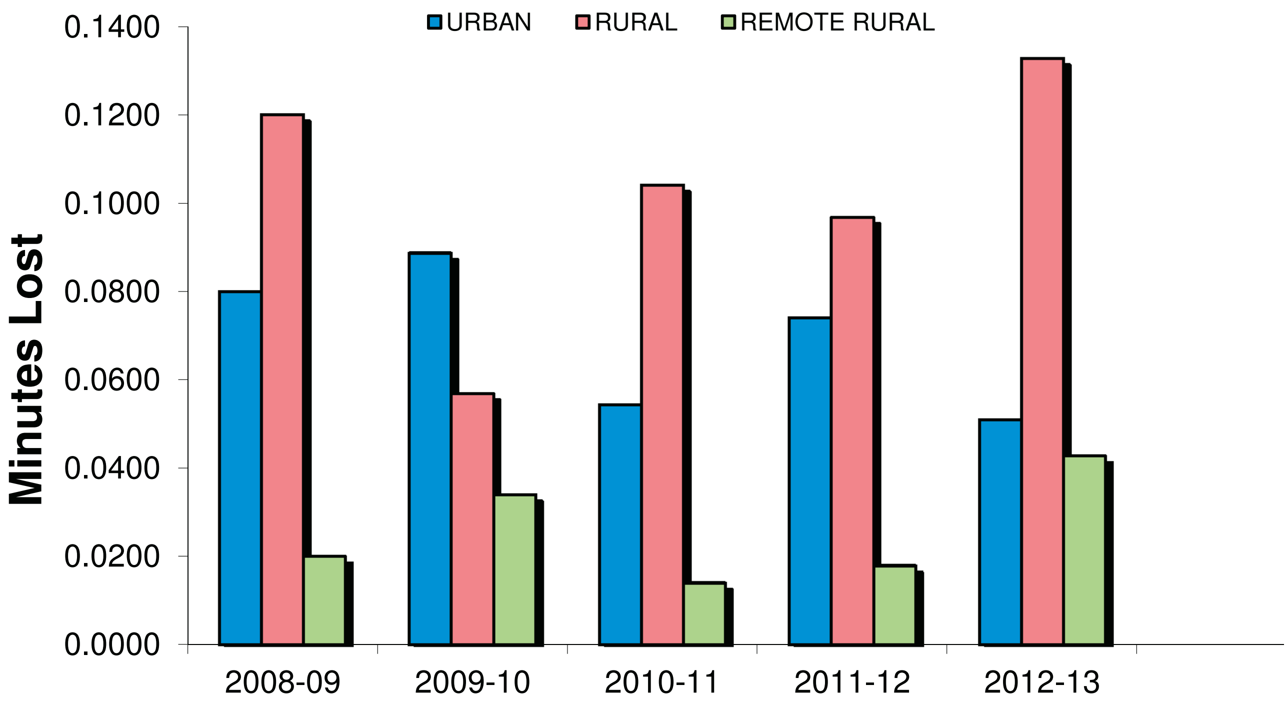


Fig 4.5 Planned SAIFI Profile for last Five Years

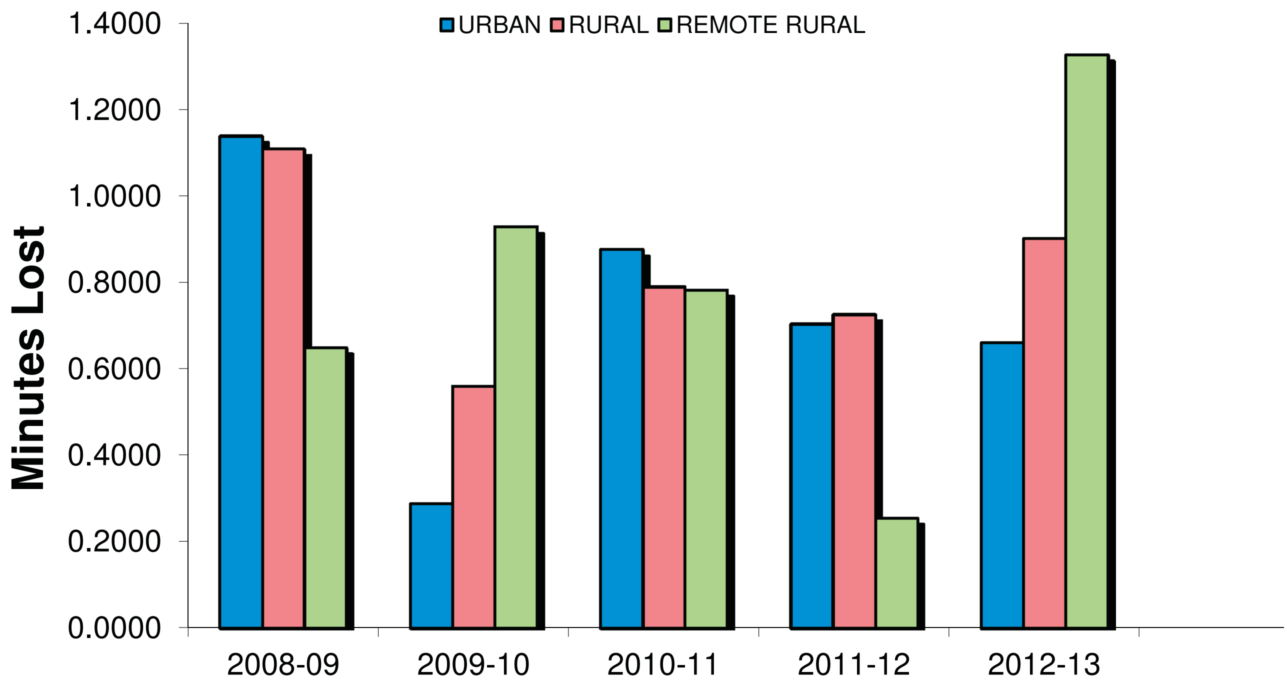


Fig 4.6 Unplanned SAIFI Profile for last Five Years

For the reasons discussed in Section 4.2.2, rural areas appear to have poorer performance than remote rural areas, but this is mainly due to difficulties in disaggregation of the fault data for South Westland.

4.2.5 Performance Targets

Tables 4.3 to 4.5 below show the specific performance targets set by Westpower for the planning period in question.

Table 4.3 - SAIDI Targets Projected Forward 10 Years

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Planned Targets	66	66	66	66	66	66	66	66	66	66
Unplanned Targets	147	147	147	147	147	147	147	147	147	147
Totals	**213**	**213**	**213**	**213**	**213**	**213**	**213**	**213**	**213**	**213**

Table 4.4 - SAIFI Targets Projected Foward 10 Years

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Planned Targets	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
Unplanned Targets	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67
Totals	**1.89**	**1.89**	**1.89**	**1.89**	**1.89**	**1.89**	**1.89**	**1.89**	**1.89**	**1.89**

Table 4.5 - Other Customer Service Targets

Service Area	Customers Affected	Performance Target
Restoration of Supply	Urban Areas	95% of faults restored within three hours of notification
	Rural Areas	95% of faults restored within eight hours of notification
	Remote Rural Areas (South of Hokitika excluding local 11 kV Feeders of Ross, Whataroa, Waitaha, and Harihari)	95% of faults restored within twelve hours of notification
Customer Outage Impact	Urban Customers	No more than two planned outages per annum. No more than two unplanned outages per annum (for 90 % of customers)
	Rural Customers	No more than two planned outages per annum. No more than four unplanned outages per annum (for 90 % of customers)
	Remote Rural Customers	No more than two planned outages per annum. No more than eight unplanned outages per annum (for 90 % of customers)

The rationale for setting the specific target levels is discussed in Section 4.4.

In addition to the generic targets discussed above, additional targets have been developed around:

- The maximum length of outage;
- The number of extended faults that consumers will be exposed to in each type of area.

These targets are constant throughout the planning period and the performance.

4.3 Other Targets

A small number of key asset performance and efficiency targets have been chosen that provide the reader with a clear understanding of the way the business is performing. It is felt that this is a better approach than to include a large number of less significant and often conflicting performance targets that would create unnecessary confusion.

Relevant standard performance and efficiency targets, as defined in the Electricity (Information Disclosure) Requirements 2008 have been chosen for inclusion in this AMP. These are:

- Operational Expenditure (OPEX) ratio (OPEX/system assets replacement cost),
- Capital Expenditure (CAPEX) ratio (CAPEX/system assets replacement cost);
- Renewal ratio (asset renewal-refurbishment OPEX and CAPEX/depreciation),
- Distribution transformer capacity utilisation;
- Faults per 100 circuit km (disaggregated by voltage and conductor type (overhead/underground).

These indicators will be measured in a manner that is consistent with the definitions in the Electricity Distribution (Information Disclosure) Requirements 2008.

Table 4.6 below shows the historical performance of these indices and future targeted performance.

Table 4.6 - Historical and Future Targeted Performance

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
					Projected										
Distribution Transformer Capacity Utili-sation	30%	31%	31%	31%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
Faults per 100 km Circuit Length	5.35	5.35	5.38	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09

Based on the historical performance disclosed in Table 4.6 and the targets for the financial ratios already defined in Westpower's SCI, the targets in table 4.7 are provided for the planning period.

A KPI in terms of asset performance is the faults per 100 km index. As can be seen in Table 4.6, this value was recently reset to reflect the values achieved over the last five years more realistically.

4.4 Justification for Targets

In general, the targets reflect historic performance while consumer engagement indicates a high level of satisfaction with existing service levels. In addition, consumers have indicated an unwillingness to pay the additional costs necessary if service levels were to be significantly improved.

In general, the targets reflect feedback from consumers regarding current and future performance, along with historic performance achieved to date.

The financial ratio targets are based on figures disclosed to and accepted by the trustee owners of Westpower on behalf of the consumers as disclosed in the SCI.

These have been carefully derived, based on:

- Historical performance,
- Stakeholder requirements,
- Industry best practice,
- Asset renewal requirements.

The WCEPT considers the SCI each year, and either approves the document or requests further changes. In considering a draft SCI, the WCEPT will often take independent advice, which this allows benchmarking of performance against similar companies. Such scrutiny forms the basis of a regular and ongoing formal review that ensures a robust outcome that is designed to meet our consumers' needs.

The targets shown in Table 4.7 below are based on Westpower's ten-year business plan, which is built up from the AMP forecasts. The CAPEX ratio and the renewal ratio drop over time as much of the older assets will soon be replaced, leading to a lower level of steady state replacement.

Table 4.7 Future Performance of Efficiency Targets Stated in Section 4.2

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
OPEX Ratio	8.40%	8.70%	8.90%	9.50%	9.50%	9.50%	9.50%	9.50%	9.50%	9.50%
CAPEX Ratio	2.20%	2.20%	2.10%	2.10%	2.10%	2.10%	2.10%	2.10%	2.10%	2.10%
Renewal Ratio	37%	33%	30%	33%	33%	33%	33%	33%	33%	33%

As such, the financial targets represent a clear mandate that Westpower is bound to reflect in its internal planning processes.

The SAIDI and SAIFI targets are based on a five-year rolling average of performance to date. This is felt to be a valid approach because the key drivers for these statistics are external, subject to long-term weather patterns. At the same time, Westpower wants to ensure that performance does not degrade; a rolling average achieves this.

4.4.1 Consumer Engagement

Westpower has carried out consumer satisfaction surveys with the most recent survey being completed in December 2009.

The following is an extract of the summary from the most recent survey:

This report summarises the views and preferences obtained from the following two sample spaces:

- Westpower's 25 largest consumers,
- A random sample of 497 mass market consumers pro-rated from six GXP areas.

The number of completed mass market surveys was only 30%, which is slightly lower than the previous Westpower survey (38%) and also lower than similar surveys performed for other ELBs. Some reasonably clear patterns have emerged, as follow:

- The most important aspect of electricity supply is continuity of supply.
- The second most important aspect of electricity supply is restoration of supply.
- The third most important aspect of electricity supply to mass market consumers is timely shutdown notices, with the top 25 consumers preferring no flicker or surges as their third preference.
- Mass market consumers rate Westpower's performance in the most important aspect of continuity as very good, with a slight skew towards excellent.
- Mass market consumers rate Westpower's performance in the second most important area of restoration as being very good, with a skew toward good.
- In the third most important aspect of shutdown notices, mass market consumers rate Westpower's performance as very good, with a skew toward good.
- Mass market consumers have expressed an obvious preference (76%) for continuing to pay about the same line charges to receive about the same reliability. However, a smaller but nonetheless distinct minority (15%) expressed a preference for paying slightly more to receive slightly more reliability.
- Large consumers expressed a distinct preference (76%) for paying about the same to receive about the same reliability, with only three consumers indicating a willingness to pay slightly more to receive slightly more reliability.
- Consumer engagement indicates a high level of satisfaction with existing service levels. In addition, consumers have indicated an unwillingness to pay the additional costs necessary if service levels were to be significantly improved.

As a result of this strong customer mandate, Westpower will strive to at least maintain its SAIDI and SAIFI levels at recent levels.

4.4.2 Historical Reliability Performance

Westpower has already taken a number of steps to improve network performance over recent years, using all readily available means and to such an extent that future improvements are expected to be incremental at best. Moreover, future performance will continue to be strongly influenced by external drivers such as storms, which will far outweigh and effectively mask any improvements gained through additional technological improvements.

After a number of years, during which the actual SAIDI and SAIFI statistics significantly exceeded the mandated targets under the price/quality regime, an opportunity was taken to reset the target levels to values that more accurately and realistically reflect the expected performance moving forward.

Accordingly, after some consideration, it was decided to adopt five-year rolling average values for SAIDI and SAIFI, thus ensuring that there is no overall degradation in service, while also providing an achievable target that contractors and system operation staff can confidently aim for. To further avoid unnecessary volatility, Westpower will continue to use figures that exclude MEDs, both in the targets and the actual performance indices disclosed.

The target figures for 2014 to 2024 are thus based on the average figures achieved over the five-year period from 2009 to 2013. In addition, as there is no likelihood of significant step improvements in the future, a flat profile has been projected throughout the planning period, although this will continue to be revised each year so that any incremental improvements gained are reflected in future targets.

This is important, as Westpower will continue to seek out cost-effective reliability enhancement solutions where these can be shown to offer an opportunity for real benefits, such as the forthcoming installation of a ground fault neutraliser at the Greymouth substation, which supplies over 30% of Westpower’s consumers. By using a five-year rolling average for SAIDI and SAIFI, any material improvement resulting from this innovation will be captured in future forecasts and may become a justification for progressively extending this technology to other substations.

Two feeders have been identified with high unplanned outage SAIDI minutes:

Hokitika-Harihari 33kV circuit (HKK1012)

A current project involves the staged replacement of this asset. The construction has been designed to allow for future upgrading by ensuring that line insulation and clearances are suitable for 66 kV operation. Reliability will be progressively improved with the staged completion of this project.

The 33 kV disconnectors at Ross, Waitaha and Harihari are being automated with SCADA control to reduce fault isolation switching times and restoration of supply.

FOX 1 Feeder

The Fox CB1 feeder supplies an area from Fox Glacier to Paringa. Because of the remoteness of the area, fault isolation switching times can be long. To reduce fault isolation times, a sectionaliser (ENTEC switch) is to be installed in the Bruce Bay area to segregate faults automatically.

Table 4.8 SAIDI CAUSE BREAKDOWN April 12 to March 13

Description	Year to Date		
	Events	Time (Minutes)	% of SAIDI
Planned Outages	94	65.68	40.69%
Vehicle	8	21.11	3.46%
Wind/Rain	12	12.95	5.19%
Lightning	26	16.5	11.26%
Animal	0	0	0.00%
Earthmoving Equipment	2	0.36	0.87%
Equipment Failure	11	20.98	4.76%
Deterioration	2	0.27	0.87%
Unknown	17	9.99	7.36%
Human Error	1	0.07	0.43%
Tree Falling	8	12.45	3.46%
Tree	15	13.03	6.49%
Overload	11	16.3	4.76%
Bird Strike	13	3.97	5.63%
Salt Deterioration	0	0	0.00%
Vandalism	0	0	0.00%
Snow	5	2.26	2.16%
Other	0	0	0.00%
Fire	3	2.17	1.30%
Flood	3	14.81	1.30%
Unplanned Outages Sub Total	**137**	**147.22**	**59.31%**

4.5 Stakeholder Needs

In order to set reasonable security standard targets for Westpower's customers that are compatible with end user expectations, appropriate research must be carried out.

The needs of electricity users have changed greatly over the last ten years with the rapid introduction of technology into the domestic market. Appliances from video recorders to bread makers and home computers are now commonplace in many homes, and have greatly increased the sensitivity of householders to power outages and minor interruptions. Consultation with the 25 largest customers has confirmed that adoption of Programmable Logic Controllers (PLC) and SCADA by industry has reduced tolerance to fleeting events – rotating and thermal plant that has sufficient inertia to continue through a fleeting outage will now probably be tripped when its controller loses power for a cycle or two.

Customer damage function reports recently carried out on behalf of the Electricity Commission in support of Transpower's application for the WCGUP showed that even short outages can result in several hours of production downtime for major process-based consumers. Accordingly, solutions that provide for continuous connection to the network rather than "change-over" schemes are preferred.

Part of Westpower's role is to maintain an efficient and reliable electricity distribution network on the West Coast. In this context, "efficiency" and "reliability" are relative terms that are subject to personal perceptions. In turn, these perceptions must be viewed from the customer's viewpoint, which must be actively sought. Westpower intends to liaise closely with the energy retailers to determine the expectations of their customers and to quantify these in terms of desirable reliability indices.

5.0 NETWORK DEVELOPMENT

5.1 Introduction

This section outlines the network development plan required to maintain, enhance and develop the operating capability of the system.

The main focus of this section is the use of Condition Based Maintenance (CBM) and risk management techniques (as described in Section 9) to schedule the projects required to meet the reliability targets and remain within the budgetary limitations imposed for this planning period, and to appropriately schedule network development programmes for future periods.

5.2 Planning Criteria and Assumptions

Future load projection is a difficult task and is based on a complex multivariate environment.

Some of the drivers that effect future load include:

- Climatic conditions,
- Economic activity,
- Commodity prices,
- Foreign exchange rates,
- Major step load increases/decreases.

Some of these drivers such as climatic conditions tend to be cyclical, and therefore a long-term view of the likely trend needs to be developed rather than making assumptions based on short-term data.

Overall economic activity, which is directly affected by commodity prices, has a filter down effect on electricity consumption. The effects on underlying load range from small trends over the medium term if the economic changes are minor, through to short term step load changes if a major consumer starts up or closes down resulting in employment impacts.

With the relatively small overall demand, major step load changes also have a direct impact on system demand. Unfortunately, these are also the most difficult to predict or quantify, as they depend on investment decisions from major industries based on externalities such as interest rates and commodity prices. Historically, final decisions on these projects may also be made at relatively short notice, leaving Westpower in a difficult situation from a planning perspective.

For instance, the Pike River mine disaster, which occurred on 19 November 2010, followed by the sudden and unexpected closure of Solid Energy's Spring Creek Mine near Greymouth in November 2012, has resulted in a major step load decrease of over 10 MW for Westpower, representing some 20% of system load. At this stage, it seems unlikely that either of these loads will come back on stream within the short term or perhaps even over the entire planning period. Consequently the load forecast projections for 2014/15 are necessarily subdued.

Notwithstanding the unpredictable nature of major load changes as noted above, a careful and rigorous approach has been taken to developing future load projections based on historical trends, available information and estimates on future changes. A Loadwatch spreadsheet has been developed as a key data receptacle used to store information for later input into the demand forecasting process, where load growth projections are based on the likely timing of future projects, suitably modified by an assessed probability factor.

Firstly, load trends at each GXP over the previous seven years are studied to try to identify historic baseline changes. The effects of known step load increases are extracted, leaving the underlying long-term historic load profile.

Based on GXP data and general knowledge of the local economy and other drivers discussed above, an estimate is made of the likely future trend in load growth on a GXP basis. This then provides a new baseline for further work.

5.2.1 Enhancement and Development Criteria

This activity outlines work which is planned to enhance and develop the system. This means increasing the capacity of the system and eliminating any limitations in order to:

- Provide more load,
- Enhance voltage regulation,
- Improve security and reliability.

It includes projects (at specific sites) and programmes of related work. Network limitations which relate to system peak loading are:

- Acceptable standards of reliability of supply cannot be maintained.
- The acceptable network rating of plant and equipment cannot be maintained.
- The thermal rating of plant and equipment is exceeded.

Additional network limitations are:

- The fault rating of equipment is exceeded.
- The age of equipment renders its continued use operationally unsafe or uneconomic.
- Continued operation of the existing network is not economic, e.g. small conductor sizes or high reactive power flows causing excessive losses.

The process for evaluating network limitations is systematic and covers all items of equipment and all circuits. Particular attention to all the most common limitations is required (refer to Table 5.1 below).

Table 5.1 - Common Network Limitations

Equipment	Common Limitations
Transformers	Rating, ageing conditions, tapping range, voltage regulation
Switchgear	Rating, age, insulation, fault rating, bus zone protection, spare feeder units, sensitive earth fault protection
Cables	Rating, age, leaks, faulty joints, long repair time, fault rating
OH Lines	Rating, physical condition, reliability, losses, clearances, voltage drops, fault rating

5.2.2 Reliability and Security of Supply

5.2.2.1 Security Guidelines

The security guidelines are the basis for analysis and for determining the future performance of the distribution system. Table 5.2 outlines some of the security guidelines for distribution planning. The levels of security that currently exists for each zone substation are summarised in Appendix C.

Table 5.2 - Security Guidelines for Distribution Planning

Load (MW)	Basic Security Level	Transmission Circuits	Busbars	Transformers
Less than 10	n	One Circuit	One Bus or Bus section.	1 x 3-phase unit, if backed up from alternative supply points
Above 10	n-1	Two circuits	Two busbars or bus sections.	2 x 3-phase units. Firm supply of peak demand using any short term overload capacity.

With regard to the design of system changes or network extensions, due consideration is made of the level of security required for the connected consumers. An industrial customer, for instance, may require a non-interruptible supply for a specific manufacturing process, whilst a domestic customer can tolerate occasional supply interruptions. Specific criteria for interruption and quality of supply may need to be developed for individual customers both for design consideration and commercial contractual obligations.

Table 5.3 shows the minimum security levels for Westpower's distribution systems.

Table 5.3 - Minimum Security Levels for Distribution Networks

Circuit Type	Maximum Demand Under Normal Conditions	Minimum Circuit Arrangement
Overhead	Up to 1 MVA	Single circuit
Underground	Up to 300 kVA Up to 1 MVA for a single customer	Single circuit
Overhead	Greater than 1 MVA and up to two thirds of feeder capacity	Feeder backstopping

Customers who are prepared to enter into commercial agreements can be provided with enhanced levels of security.

Westpower is currently investigating the use of probabilistic planning techniques to assist in the evaluation of security and reliability benefits for specified projects. These techniques are applicable to network planning processes, as power system behaviour is stochastic in nature. A justification for the use of this approach is that it instils more objective assessments into the decision-making process.

In particular, probabilistic techniques can be used to provide measurable performance indices such as:

- System availability,
- Estimated unsupplied energy,
- Number and size of load curtailments,
- Number of hours of interruption,
- Excursions beyond set voltage limits.

While the use of a probabilistic planning approach offers significant benefits in terms of targeted CAPEX, the proper application of this technique also involves significant investment, both in terms of cost and resources. In particular, the following prerequisites apply:

- Competent staff, including experienced reliability engineers who are familiar with the application of probabilistic techniques to power systems;
- Accurate and complete historical fault outage records over a large number of years;
- Expensive and complex reliability evaluation software packages, user-friendly versions of which have only become generally available in recent times.

Accordingly, probabilistic planning techniques are not widely used, except so far as these are applied for network development prioritisation as discussed in Section 5.3.

5.2.3 Regulatory Factors and Quality of Supply

Programmes and projects are typically justified on the basis of the following benefits from improved voltage level or controls:

- The ability to meet any regulatory requirements with respect to voltage standards;
- Specific customer requirements which the customer is willing to pay for;
- Savings in losses;
- Improvements in transmission circuit capacity and the consequential deferment of CAPEX.

Power quality is considered to be the standard of the power supplied in an energised system. It includes voltage regulation, the level of harmonic distortion, and the frequency and magnitude of power sags and surges. Sags and surges are momentary voltage dips or increases with duration of less than a second, generally from a few milliseconds to half a second. Power interruptions of more than a second are considered to be outages, a factor of power reliability.

5.2.3.1 Voltage Regulation

Where customers are fed from a LV distribution system that supplies more than one customer, the distribution system will normally be designed so that the phase to earth voltage at the customer's point of supply is maintained within the limits as set out in the Electricity Regulations (the Electricity Regulations 1997 mandate the LV variations of ±6%, except for momentary fluctuations of the nominal voltage). The customer's point of supply will usually be taken as the customer's service fuse or property boundary.

In special situations, or where the customer is supplied at a voltage other than the standard LV, the distribution system should be designed so that the delivered voltage is maintained within the limits agreed by the customer and Westpower. Where no such limits are specifically agreed on, the limits as stated in the Electricity Regulations shall be applied (the Electricity Regulations 1997 allow for voltage variations of ±5% of the agreed voltage for installations supplied at other than standard LV).

5.2.3.2 Voltage Drop Allowances

Regulated 11 kV busbars on Westpower's distribution network are regulated to a voltage of 102% of nominal voltage. The voltage drop across the network should accordingly be distributed as follows under maximum design load conditions:

- 11 kV system 2%
- LV system 4%
- Service main 2%

In rural areas, the allocation of voltage drops must be determined on a case-by-case basis. The actual 11 kV voltage drop will depend on the distance of the customer from the regulated busbar, and this voltage drop could exceed 2%. A voltage drop of less than 4% on the LV system is thus required. In general, the design should endeavour to place the 11 kV supply point to the LV network as close to the customer as possible, resulting thus in relatively short LV networks.

5.2.3.3 Harmonics

Harmonic voltages and currents are generally generated by customer's equipment. The limits of harmonic voltage or current permitted at the point of connection between the network and the customer's installation, or the point of common coupling with any other customers, are as specified in the New Zealand Electrical Code of Practice for Harmonic Levels, NZECP 36:1993. In general, this restricts harmonic voltages at less than 66 kV to 4% for any odd-numbered harmonic, 2% for any even harmonic and 5% for total harmonic distortion.

5.2.3.4 Rating of Network Equipment

All equipment to be installed on the network shall be adequately rated both in terms of load capacity and in terms of fault level withstanding capability. In assessing the current or load rating, due allowance should be made for future load growth. Where appropriate, allowance may be made for the cyclical nature of any load.

In terms of fault ratings, before selecting the fault level withstanding rating of a network component, the actual fault level at the location on the network at which the network component is to be installed should be determined. Any expected network reconfiguration should also be taken into account.

After Diversity Maximum Demand (ADMD) is the most critical variable factor in LV system design, as its accurate selection directly affects the optimum costs of an installation and quality of supply.

It is therefore important that emphasis is applied to the optimum selection of ADMD. Accordingly, ADMD has been revised and depends mainly on the development type as presented below.

5.2.3.5 Commercial Areas

In new commercial developments, where small factories, retail shops or similar require LV distribution, no ADMD can be predicted, as it is not known what operations will occupy the premises. Load estimates should be generous, because the cost of later LV cable reinforcement can be considerable. Transformer load estimates may be more conservative. The designer should discuss each case with developers and Westpower before proceeding.

5.2.3.6 Urban Residential Areas

The network shall generally be designed for a normal residential ADMD of 5 kW per dwelling.

In special areas, identified by Westpower, this may be insufficient and the design ADMD shall be as specified by Westpower. In areas where zoning allows multiple residential dwellings and the property area permits, an allowance must be made for multiple dwellings per lot.

Contrariwise, some of the older areas in Westpower's network still use coal and wood fires as a principal source of heating and water heating, and the ADMD in these areas has been measured to levels as low as 1.5 kW per dwelling. This is taken into account when design work is being undertaken in these areas.

5.2.3.7 Rural Areas

Care must be taken to determine the ADMD per consumer in rural areas. Appropriate allowance must be made if large irrigation pumps are to be connected or if significant electrical heating is to be installed in large residential buildings.

The design and selection of the equipment used for the construction of overhead lines must meet, at least, the following requirements:

- Safety - The line must be safe for line workers to construct and maintain, and must offer no hazard to the general public.
- Electrical performance - The line must adequately serve the purpose for which it has been designed. It must safely carry any load current which it may be called upon to do without creating problems of unacceptable voltage drop. It must also be able to withstand any fault current that it may carry from time to time.
- Mechanical performance - The line must be able to withstand reasonable natural forces such as wind, rain, snow and earthquakes.
- Financial performance - The line should be designed to be as economical as possible, taking into account the original cost of maintenance and cost of line losses.
- Appearance - Consideration must be given to the impact of the line on the environment in choosing the line route and the aesthetic appearance of the line.

5.3 Prioritising Network Development

Westpower strives to ensure that optimal capital efficiency is gained through the application of a formal project evaluation process for capital projects, as these must compete for limited capital resources. In this way, only projects that meet Westpower's strict criteria will go forward and projects will also be completed in the best merit order.

As the key drivers for network development comprise both financial and non-financial factors, the following categories have been determined so that tailored planning criteria can be applied while still providing objective outcomes:

- Category A – projects with no direct financial justification;

- Category B – projects with marginal financial benefits;
- Category C – projects with clear financial returns.

For Category A projects, there are a number of diverse drivers that need to be carefully evaluated and then compared on an objective and equivalent basis. These are enumerated below.

1. Reliability/security of supply to meet customer levels of service and contractual obligations;
2. Asset replacement and renewal requirements to maintain the service delivery potential of the asset, and avoid unnecessary and unscheduled reactive maintenance;
3. Occupational health and safety to establish a safe environment both for workers and the public, and comply with Occupational Health and Safety (OSH) legislative safety requirements;
4. Regulatory compliance to meet regulations imposed by external governmental agencies;
5. Environmental to comply with emission regulations to air, land and water;
6. Quality of supply to ensure that all consumers receive a quality of supply that meets Westpower's minimum performance standards;
7. Technological efficiency to ensure that appropriate current business technology is applied in the business to leverage overall performance gains;
8. Corporate image to ensure that any activity carried out by the asset management team and subcontractors will not materially damage Westpower's image.

An objective scoring system has been developed to provide an equitable comparison between projects within this category, even though they might have quite separate drivers. For instance, in the case of Driver 1, the assessed impact on both the SAIDI and SAIFI reliability statistics is determined either by empirical or probabilistic means, and the weighted score for each metric is combined to give an overall score. On the other hand, if Driver 7 were the key driver, a multivariate approach using factors such as productivity effects, equipment costs and likely usage would be applied to come up with a comparable score.

Category B projects are based on clear financial criteria that can be assessed using financial evaluation tools. The following sub-categories are included:

1. Efficiency improvements resulting in a reduction in losses or costs while maintaining asset performance criteria;
2. Demand side management, reducing Westpower's overall peak demand charges;
3. Renewal and replacement where a clear business case can be provided for replacement of an asset through reduced maintenance costs;
4. Capacity enhancement where additional capacity is required by a consumer and this can be funded through increased line charges;
5. Strategic, leading to long-term quantifiable strategic benefits for the company.

Westpower has developed a robust evaluation tool using industry best practice CAPEX Stratagio™ software to provide objectivity and robustness around this process. This underlying approach is based upon a Discounted Cash Flow (DCF) analysis but the product has been adapted for Westpower's needs by adding expert decision support tools.

Category C projects are similar to those included in Category B, but because of the different risk profiles involved, they have different hurdle rates and success criteria applied to them. These projects could include:

1. Network extensions, including new substations;
2. Subdivision reticulation;
3. Communication infrastructure, where there is an ability to share costs with third-party users of the network;
4. Distributed generation, such as the new Amethyst hydro scheme that Westpower is currently constructing.

As discussed above, the same evaluation tools are used for both Category B and Category C projects.

Each of these above categories is evaluated by using a weighted scoring system that is based on the available metrics.

Appropriate weighting factors can then be applied to ensure that projects can be compared across each of the categories to develop a stack of projects that can be progressed in a predetermined merit order. This method therefore provides a fair comparison between a financially driven and non-financially driven projects, and this obviates the need to apply separate expert tools for the non-financially driven projects.

Whether or not a project will proceed in any given year will depend upon whether the score for that project reaches the project inclusion threshold for that year. In turn, the threshold will be determined by the stack of proposed projects, financial performance requirements and budgetary constraints, and these may vary from year to year due to a number of external business drivers. If a project fails to meet the threshold in the current year, it will be moved into the following year for reassessment along with other competing projects.

This process makes sure that only projects that meet Westpower's strict criteria proceed, and that network investment is carried out efficiently and in the right order to ensure optimum use of scarce capital resources.

In addition to the specific rating system used for key projects noted above, a number of general principles are applied when deciding the order in which projects should proceed. These generally fall into the categories below:

1. Top priority is given to meeting the load requirements for new, large (mainly mining) industrial loads. As there are no new major loads that have committed at this stage, no associated projects are included in this AMP.
2. Second priority is given to subtransmission augmentation required to meet capacity limitations as a result of incremental load growth. The only project currently sitting in this category is the upgrade of the sub transmission line from Hokitika to Waitaha from 33 KV to 66 KV in the second half of the planning period. However, this project will only proceed if there is a major generation development in South Westland such as the potential Waitaha hydro scheme noted in Section 3.13.
3. Third priority is given to subtransmission asset replacement, and distribution network development and replacement. Following the completion of the Hokitika to Harihari 33 kV line upgrade, no major sub transmission replacements are planned this side of the planning horizon.

5.4 Load Forecasting

5.4.1 Introduction

A critical factor in considering network development plans is the projected load growth. The projected load growth is presented in Figure 5.1 and represents after diversity demand, including the load supplied through local generation.

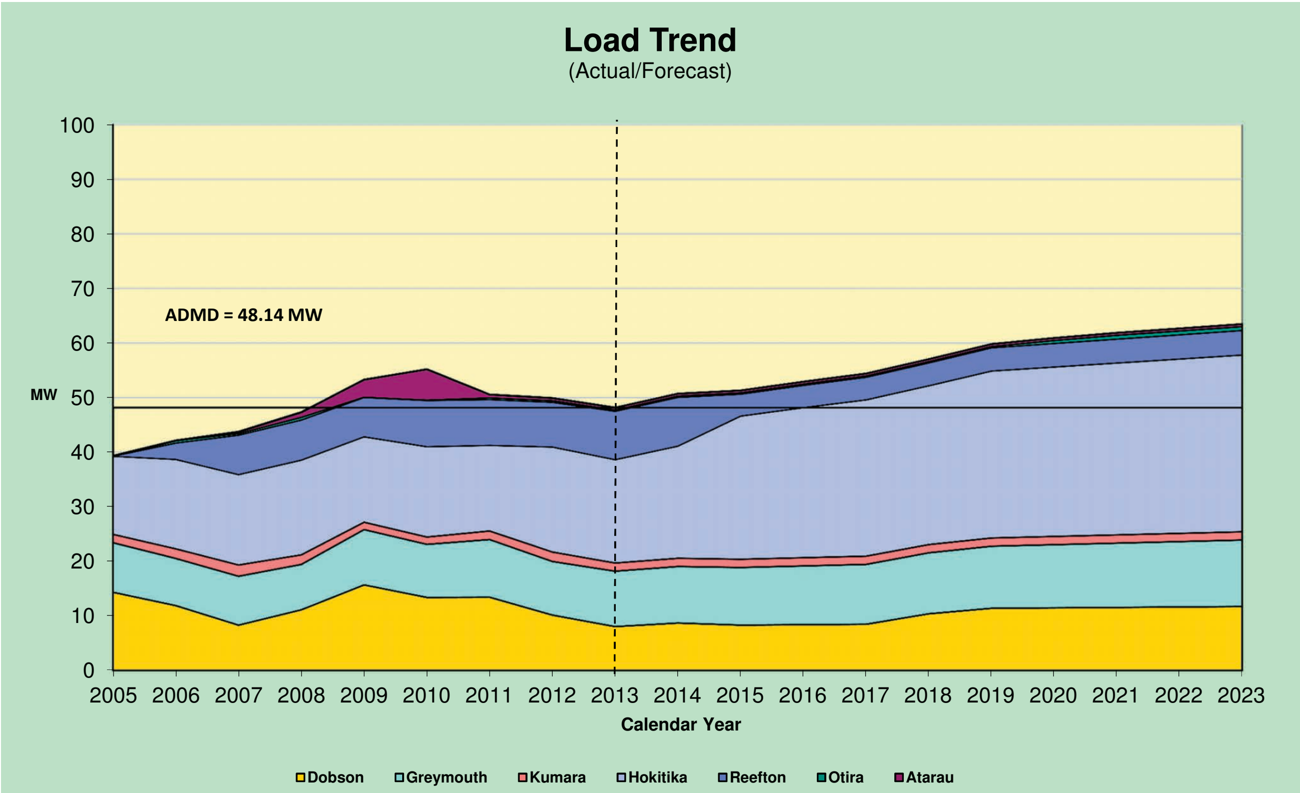


Fig 5.1 Load Trends(2005-2023)

The methodology used to determine the likely level of load growth is based on the use of After Diversity Maximum Demand (ADMD).

It is anticipated that the current ADMD of around 48 MW will increase slightly in the short to medium term, with future load growth driven principally by economic development and activity.

At the reticulation level, typical customer requests relate to issues of capacity, quality and/or security of supply, and can lead to plans for asset enhancement or development.

The most common upgrade in relation to capacity is the installation of new or transferred supply transformers at connected points, thus providing sufficient capacity to allow for future demand growth. Resolution of supply quality issues typically includes provision of local voltage support in the form of regulators or capacitors to maintain the steady-state voltage within specified ranges.

Alternatively, network analysis including load projections at points of supply, power flows, network and point of supply performance leads to options for consideration by customers and Westpower management. Figure 5.2 shows a typical example of a load trend table.

	PERCENT INCREASE OR DECREASE																		
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Reefton	----------	----------	141.66%	1.55%	-1.83%	17.49%	-0.90%	-2.36%	8.36%	0.69%	-55.19%	1.53%	1.51%	1.48%	1.46%	1.44%	1.42%	1.40%	1.38%
Atarau	----------	----------	----------	182.14%	239.45%	75.95%	-89.12%	-20.13%	-6.91%	0.50%	0.50%	0.50%	0.49%	0.49%	0.49%	0.49%	0.48%	0.48%	0.48%
Dobson	10.51%	-17.09%	-30.17%	33.92%	41.14%	-14.65%	0.31%	-24.45%	-20.87%	8.18%	-4.39%	0.97%	0.96%	22.75%	9.65%	0.70%	0.70%	0.69%	0.69%
Greymouth	-8.85%	-4.93%	3.71%	-7.17%	21.90%	-4.07%	8.64%	-7.03%	3.40%	2.00%	1.96%	1.92%	1.89%	1.85%	1.82%	1.79%	1.75%	1.72%	1.69%
Kumara	17.37%	15.39%	16.97%	-15.04%	-23.30%	-0.15%	16.78%	10.47%	-13.76%	0.97%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hokitika	12.68%	14.54%	1.09%	4.81%	-9.81%	5.70%	-5.22%	22.69%	-1.61%	33.09%	11.47%	1.60%	1.57%	1.55%	1.52%	1.50%	1.48%	1.46%	1.44%
Otira	-71.85%	531.58%	-37.92%	69.80%	-90.12%	44.00%	#######	-5.66%	-24.00%	1.00%	0.99%	0.98%	0.97%	0.96%	0.95%	129.08%	28.38%	0.32%	0.32%
Total Load	**5.70%**	**7.15%**	**3.81%**	**8.20%**	**12.59%**	**3.59%**	**-8.40%**	**-1.26%**	**-3.50%**	**10.94%**	**-3.99%**	**1.50%**	**1.48%**	**4.82%**	**2.99%**	**1.87%**	**1.58%**	**1.30%**	**1.29%**

	Actual kW 2005	Actual kW 2006	Actual kW 2007	Actual kW 2008	Actual kW 2009	Actual kW 2010	Actual kW 2011	Actual kW 2012	Actual kW 2013	Forecast kW 2014	Forecast kW 2015	Forecast kW 2016	Forecast kW 2017	Forecast kW 2018	Forecast kW 2019	Forecast kW 2020	Forecast kW 2021	Forecast kW 2022	Forecast kW 2023
Reefton	0	2986	7216	7328	7194	8452	8376	8178	8862	8923	3999	4060	4121	4182	4243	4304	4365	4426	4488
Atarau	0	0	336	948	3218	5662	616	492	458	460	463	465	467	469	472	474	476	479	481
Dobson	14305	11860	8282	11091	15654	13361	13402	10125	8012	8668	8287	8367	8448	10369	11370	11450	11531	11611	11691
Greymouth	9082	8634	8954	8312	10132	9720	10560	9818	10152	10355	10558	10761	10964	11167	11370	11573	11776	11979	12182
Kumara	1527	1762	2061	1751	1343	1341	1566	1730	1492	1507	1507	1507	1507	1507	1507	1507	1507	1507	1507
Hokitika	14302	16381	16560	17357	15655	16548	15685	19244	18935	25200	28091	28540	28988	29437	29885	30334	30782	31231	31679
Otira	76	480	298	506	50	72	318	300	228	230	233	235	237	239	242	554	711	713	715
Total Load	**39292**	**42103**	**43707**	**47293**	**53246**	**55156**	**50523**	**49887**	**48139**	**55343**	**53137**	**53934**	**54732**	**57371**	**59089**	**60196**	**61148**	**61946**	**62743**

Fig 5.2 Load Trends and Forecasts to 2023

5.4.1.1 Historical Factors

Future load projection is a difficult task and is must be carried out in a complex multivariate environment.

Long-term trends are assessed for the drivers discussed under Section 5.2, Planning Criteria and Assumptions, although these are often not reliable indicators of what will happen in the future.

For instance, climatic effects such as the impact of warm winters can be reviewed, but cannot be relied upon to predict the temperatures of future winters. Therefore, a conservative approach needs to be taken.

Similarly, overall economic activity on the West Coast has led to a cyclical “boom and bust“ tradition throughout the history of power supply to the West Coast and this serves to highlight the uncertainty that needs to be taken into account during the forecasting process. High commodity prices for resources such as gold and coal can lead to major step load increases, as seen over the last 10 years, but these loads can disappear equally quickly when the markets decline.

Nevertheless, historical trends in the underlying load are very useful tool for determining likely future load changes when used in conjunction with other intelligence. Of necessity, these projections are carried out without taking into account any embedded generation on Westpower’s network because of the need to determine an accurate consumption-only forecast.

In carrying out the assessment of historical effects, load trends at each GXP over the previous seven years are studied to identify historic baseline changes. The effects of known step load increases are extracted, leaving the underlying long-term historic load consumption profile.

Figure 5.3 shows the GXP demand for the 2013 calendar year.

Based on these data, and general knowledge of the local economy and other drivers discussed above, an estimate is made of the likely future trend in load growth on a GXP basis. This then provides a new basis for determining further work on the network.

5.4.2 Future GXP Load Projections

Customer input is sporadically sought through forums where major potential users are gathered and provided with updates on current load trends and capacity projections. More regularly, each customer or customer group (e.g. tourism) is asked to provide realistic forward load projections based on their specific industry knowledge. This information has proved to be extremely valuable, allowing for significantly improved projection of future loads, and has a direct impact on Westpower’s future plans for network reinforcement.

The data collected from the customers are analysed and adjusted with a weighting coefficient based on the likelihood of appearance, and the results are included into the Zone Substation load forecasts. This is termed a Loadwatch. The likelihood weight coefficients are:

- Load is confirmed = 100%;
- Load is likely to occur = 70%;
- Load is possible to occur = 30%;
- Load is speculative = 10%.

Fig 5.3 GXP Energy and Demand Statistics - 2013

Table 5.4 below shows the current maximum demand, firm capacity and utilisation factor.

Table 5.4 - GXP Maximum Demand and Current Capacity Utilisation

GXP Feeder	Maximum Demand 2013 (MW)	Maximum Demand 2013 (MVA)**	Firm Capacity (MVA)	Utilisation %
DOB0331	8.701	9.159	17	53.88%
GYM0661	13.170	13.863	15	92.42%
KUM0661	9.246	9.733	10	97.33%
HKK0661	19.277	20.292	20	101.46%
OTI0111	0.589	0.620	2.5	24.80%
RFN110	10.600	11.158	30	37.19%
ATU110 (LGN110)*	0.600	0.632	20	3.16%
BDMD	62.183	65.456		
*The ATU switching station feeds LGN substation and therefore the utilised factor is applicable for LGN				
**The Maximum Demand (MVA) is calculated based on the assumption that the power factor is 0.95				

This table shows non-coincident demands at each GXP and includes periods where load has been switched between GXPs. Nevertheless, it reflects the load that each GXP must be capable of supplying.

Although the local economy has been significantly impacted by the loss of major mining loads as noted earlier in the plan, the underlying economic activity on the West Coast from other sectors such as the dairy, gold and timber industries is underpinning a relatively stable outlook.

Currently, there is sufficient n-1 transmission capacity available in the transmission network feeding the West Coast, to ensure that major new loads can be supplied on an uninterruptible basis, and so electricity supply should not be a constraint to future economic development.

Such was not always the case, however, with major projects such as the West Coast Grid Upgrade Project (WCGUP), which was completed in late 2011 relieving a major constraint. The overall project had the following scope of work:

- Install a second 110 kV circuit between Reefton and Dobson;
- Install a second 110/66 kV transformer at the Dobson substation;
- Install a new 14 Mvar fast switching capacitor bank at the Hokitika substation.

The Hokitika capacitor section of the project was commissioned in June 2010, and the 110 kV line and associated transformer was completed in late 2011.

The reason for the installation of the new 14 Mvar switching capacitor bank at Hokitika was to provide pre-and post contingency reactive support to help prevent voltage collapse in the West Coast area following a system emergency.

The greatest challenge in planning for future network development is to accurately determine the likelihood and size of future step changes. To a large extent, this is based on discussions with existing or potential large consumers. Early load indications provided by these consumers are often very approximate and are subject to major variations if and when the project proceeds.

Furthermore, the West Coast has a history of premature major development announcements being made, only to fall through when macro-environmental changes occur such as the gold price dropping or a change in government policy. For this reason, the projected step load changes must be viewed circumspectly until there is a firm commitment.

Two of the larger industrial customers have indicated they will be increasing their load over the next five years as presented below:

1. Westland Milk Products is planning multiple upgrades throughout the planning period which could increase their load by 8-13 MW.
2. Solid Energy New Zealand Limited is investigating a new open-cast coal mine near Strongman (about 4 MW), which could happen by 2018.

Additional to the abovementioned loads, several new dairy farms may be developed in the Fox Glacier area on the Landcorp Farming Ltd property over the next five years now that Westland Milk Products has extended its collection area to include this region.

The impact of small embedded or distributed generation is considered on a case by case basis in the load forecast. Westpower prefers to adopt a prudent peak demand forecast approach. Factors such as location, capacity, reliability and utilisation are considered when determining the weighting given to a particular generator. For example, the combination of Amethyst and Wahapo Power Stations has been considered in the load forecast due to their high availability and significant output relative to the peak demand.

The projected additional demand over the next ten years is in the order of 12-17 MW. Prior to the WCGUP being commissioned, the Transpower supply capacity from the north was constrained to about 24 MW while the total after diversity system demand is around 50 MW. The DOB-TEE A line effectively doubles the transmission capacity, thus providing security to the West Coast.

5.4.3 Future Zone Substation Load Projections

Load forecasting is carried out at the zone substation level, and this is critical to ensure that sufficient capacity is available in Westpower's subtransmission and zone substation infrastructure. These forecasts are developed using a zero-based approach and load demand management from information and requests received directly from customers, including intelligence on future load trends such as proposed dairy farm conversions.

Future zone substation load projections demonstrate that most of Westpower's zone substations have sufficient capacity to deal with expected load growth throughout the planning period, although some substations may require capacity upgrades in five to ten years. As these load forecasts are subject to change and involve considerable uncertainty, no projects have been committed for the zone substations at this stage, but a close watch will be kept on customers' load expectations and maximum demand trends.

In Westpower's case, most of the subtransmission infrastructure has been built within the last 25 years and has been prudently designed to cater for future load growth, which means that there is usually ample capacity to cater for marginal load growth. In the event of proposals for major load steps crystallising, each case is considered in isolation and in combination with other proposals to make sure that any constraints due to substation capacity are taken into account.

A summary of the results by major zone substation is shown in Table 5.5.

Table 5.5 - Zone Substation Forecast Demand

Zone Substation		Firm Capacity (MVA)	Peak 2013 (MVA)	Predicted Load (MVA)										
				2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Arnold		**6.25**	**3.231**	**3.23**	**3.23**	**3.23**	**3.23**	**3.23**	**3.23**	**3.23**	**3.23**	**3.23**	**3.23**	**3.23**
Base Growth	0.0%			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loadwatch Growth				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utilisation				52%	52%	52%	52%	52%	52%	52%	52%	52%	52%	52%
Blackwater		**5**	**1.66**	**1.68**	**1.69**	**1.71**	**1.73**	**1.74**	**1.76**	**1.78**	**1.79**	**1.81**	**1.83**	**1.84**
Base Growth	1.0%			0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Loadwatch Growth				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utilisation				34%	34%	34%	35%	35%	35%	36%	36%	36%	37%	37%

Table 5.5 - Zone Substation Forecast Demand

Zone Substation		Firm Capacity (MVA)	Peak 2013 (MVA)	Predicted Load (MVA)										
				2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Dobson GXP		**17**	**8.701**	**9.41**	**9.00**	**9.09**	**9.17**	**11.26**	**12.35**	**12.44**	**12.52**	**12.61**	**12.70**	**12.78**
Base Growth	1.0%			0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Loadwatch Growth				0.63	-0.50	0.00	0.00	2.00	1.00	0.00	0.00	0.00	0.00	0.00
Utilisation				55%	53%	53%	54%	66%	73%	73%	74%	74%	75%	75%
Dobson		**5**	**2.927**	**2.99**	**3.04**	**3.10**	**3.16**	**3.22**	**3.28**	**3.34**	**3.40**	**3.45**	**3.51**	**3.57**
Base Growth	2.0%			0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Loadwatch Growth				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utilisation				60%	61%	62%	63%	64%	66%	67%	68%	69%	70%	71%
Fox Glacier		**5**	**0.845**	**0.86**	**0.88**	**0.90**	**0.91**	**0.93**	**0.95**	**0.96**	**0.98**	**1.00**	**1.01**	**1.03**
Base Growth	2.0%			0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Loadwatch Growth				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utilisation				17%	18%	18%	18%	19%	19%	19%	20%	20%	20%	21%
Franz Josef		**5**	**1.639**	**1.67**	**1.70**	**1.74**	**1.77**	**1.80**	**1.84**	**1.87**	**1.90**	**1.93**	**1.97**	**2.00**
Base Growth	2.0%			0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Loadwatch Growth				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utilisation				33%	34%	35%	35%	36%	37%	37%	38%	39%	39%	40%
Globe		**10**	**5.515**	**5.52**	**0.51**	**0.51**	**0.51**	**0.51**	**0.51**	**0.51**	**0.51**	**0.51**	**0.51**	**0.51**
Base Growth	0.0%			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loadwatch Growth				0.00	-5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utilisation				55%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Greymouth		**15**	**13.170**	**13.43**	**13.70**	**13.96**	**14.22**	**14.49**	**14.75**	**15.01**	**15.28**	**15.54**	**15.80**	**16.07**
Base Growth	2.0%			0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26
Loadwatch Growth				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utilisation				90%	91%	93%	95%	97%	98%	100%	102%	104%	105%	107%
Harihari		**1**	**1.021**	**1.03**	**1.04**	**1.05**	**1.06**	**1.07**	**1.08**	**1.09**	**1.10**	**1.11**	**1.12**	**1.13**
Base Growth	1.0%			0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Loadwatch Growth				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utilisation				103%	104%	105%	106%	107%	108%	109%	110%	111%	112%	113%
Hokitika		**20**	**19.277**	**17.66**	**22.55**	**23.63**	**25.42**	**25.80**	**28.29**	**28.68**	**29.06**	**29.45**	**29.83**	**31.62**
Base Growth	2.0%			0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
Loadwatch Growth				1.00	4.50	0.70	1.40	0.00	2.10	0.00	0.00	0.00	0.00	1.40
Utilisation				88%	113%	118%	127%	129%	141%	143%	145%	147%	149%	158%
Min. Generation			3.000											
Kumara		**10**	**9.246**	**9.34**	**9.34**	**9.34**	**9.34**	**9.34**	**9.34**	**9.34**	**9.34**	**9.34**	**9.34**	**9.34**
Base Growth	0.0%			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loadwatch Growth				0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utilisation				93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%
Logburn		**30**	**0.600**	**0.60**	**0.61**	**0.61**	**0.61**	**0.62**	**0.62**	**0.62**	**0.62**	**0.63**	**0.63**	**0.63**
Base Growth	0.5%			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loadwatch Growth				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utilisation				2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Ngahere		**5**	**2.067**	**2.73**	**2.27**	**2.32**	**2.36**	**2.40**	**2.44**	**2.48**	**2.52**	**2.56**	**2.61**	**2.65**
Base Growth	2.0%			0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04

Table 5.5 - Zone Substation Forecast Demand

Zone Substation		Firm Capacity (MVA)	Peak 2013 (MVA)	Predicted Load (MVA)										
				2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Loadwatch Growth				0.63	-0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utilisation				55%	45%	46%	47%	48%	49%	50%	50%	51%	52%	53%
Otira		**2.5**	**0.589**	**0.59**	**0.60**	**0.61**	**0.61**	**0.62**	**0.62**	**1.43**	**1.84**	**1.84**	**1.85**	**1.85**
Base Growth	1.0%			0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Loadwatch Growth				0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.40	0.00	0.00	0.00
Utilisation				24%	24%	24%	25%	25%	25%	57%	73%	74%	74%	74%
Pike		**20**	**0.277**	**0.28**	**0.28**	**0.28**	**0.28**	**0.28**	**0.28**	**0.28**	**0.28**	**0.28**	**0.28**	**0.28**
Base Growth	0.0%			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loadwatch Growth				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utilisation				1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Rapahoe		**5**	**1.758**	**1.79**	**1.83**	**1.86**	**1.90**	**3.13**	**3.17**	**3.20**	**3.24**	**3.27**	**3.31**	**3.34**
Base Growth	2.0%			0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Loadwatch Growth				0.00	0.00	0.00	0.00	1.20	0.00	0.00	0.00	0.00	0.00	0.00
Utilisation				36%	37%	37%	38%	63%	63%	64%	65%	65%	66%	67%
Reefton		**30**	**10.600**	**10.71**	**5.81**	**5.92**	**6.02**	**6.13**	**6.24**	**6.34**	**6.45**	**6.55**	**6.66**	**6.77**
Base Growth	1.0%			0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Loadwatch Growth				0.00	-5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utilisation				36%	19%	20%	20%	20%	21%	21%	21%	22%	22%	23%
Ross		**1**	**0.488**	**0.50**	**0.51**	**0.52**	**0.53**	**0.54**	**0.55**	**0.56**	**0.57**	**0.58**	**0.59**	**0.60**
Base Growth	2.0%			0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Loadwatch Growth				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utilisation				50%	51%	52%	53%	54%	55%	56%	57%	58%	59%	60%
Spring Creek		**8**	**1.139**	**1.14**	**1.14**	**1.14**	**1.14**	**1.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**
Base Growth	0.0%			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loadwatch Growth				0.00	0.00	0.00	0.00	0.80	1.00	0.00	0.00	0.00	0.00	0.00
Utilisation				14%	14%	14%	14%	24%	37%	37%	37%	37%	37%	37%
Wahapo		**5**	**3.104**	**3.10**	**3.10**	**3.10**	**3.10**	**3.10**	**3.10**	**3.10**	**3.10**	**3.10**	**3.10**	**3.10**
Base Growth	0.0%			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loadwatch Growth				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utilisation				62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%
Waitaha		**1**	**0.331**	**0.34**	**0.34**	**0.35**	**0.36**	**0.36**	**0.37**	**0.38**	**0.38**	**0.39**	**0.40**	**0.40**
Base Growth	2.0%			0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Loadwatch Growth				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utilisation				34%	34%	35%	36%	36%	37%	38%	38%	39%	40%	40%
Whataroa		**1**	**0.794**	**0.81**	**0.83**	**0.84**	**0.86**	**0.87**	**0.89**	**0.91**	**0.92**	**0.94**	**0.95**	**0.97**
Base Growth	2.0%			0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Loadwatch Growth				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utilisation				81%	83%	84%	86%	87%	89%	91%	92%	94%	95%	97%
Legend:	#.##	**- represents firm capacity overloaded by up to 25%**												
	#.##	**- represents firm capacity overloaded by over 25%**												

5.4.4 Possible Constraints

5.4.4.1 Harihari Substation

The maximum peak demand recorded in 2013 was about 1 MW and reached the firm capacity of the substation. To eliminate this constraint, the substation capacity needs to be increased or a load management programme needs to be implemented.

The International Electrotechnical Commission (IEC) standards state that oil-filled transformers have to withstand a 25% load increase over its nominal capacity continuously. Therefore, even though the peak load has reached the firm capacity of the substation, the transformer is still able to cope with the load, albeit with slightly higher losses.

Based on the load trend, the peak load has been reasonably steady over the last few years. The base load growth has been decreased to 1.0% to reflect this and as result the transformer should not require replacement within the next 10 years.

5.4.4.2 Hokitika Substation

A maximum peak demand of 16.4 MW was recorded for the Hokitika GXP in October 2013 which includes the local embedded generation. The net peak load on the 11 kV bus was 19.3 MW which is independent of distributed generation. Based on the step load increases forecast at Westland Milk Products, by 2015 the total load will reach the firm capacity of the substation. The load increase by 2017 will be 25% above the firm capacity of the substation and therefore installation of a new transformer could be required.

As the Hokitika substation has two transformers in parallel, the constraint mainly applies during maintenance periods when one transformer would be out of service. This could be resolved at the maintenance planning stage and/or by implementing a load management programme.

The commissioning of Westpower's Amethyst Hydro station in 2013 reduces the demand on the Hokitika bus as it will be injecting into the 11 KV side of the supply transformers and thus offset some of the load on this bus. This is a run-of-the-river station that will be operating continuously at levels above 3 MW, except of course for maintenance and fault shutdowns. Together with the Wahapo Power station, it is considered to be a relatively reliable source of embedded generation that can rightly be taken into account in the load forecast.

5.4.4.3 Greymouth Substation

Recording a maximum peak demand of around 13 MW consistently for the last five years and considering no significant loads are forecast for the next 10 years the transformer is unlikely to reach firm capacity before 2019. Load growth for this substation is considered to be 2%.

5.4.4.4 Spring Creek Substation

With the unexpected closure of Spring Creek mine in 2012, there is no constraint identified for the 33 kV line feeding this substation. The substation is not owned by Westpower and is included in Table 5.5 only for load forecast purposes.

5.4.5 Impact of Demand Management on Load Forecast

Ripple control of water heating forms a core part of Westpower's load management strategy and provides the ability to defer network expenditure in areas where asset loadings have exceeded available capacity at peak times. Moreover, once the HV Direct Current (HVDC) upgrade is completed and New Zealand effectively becomes a single reserves market, additional value may become available through the ability to bid interruptible load into the market.

On the other hand, recent regulatory changes may mean that interruptible load such as water heating is no longer directly available to distribution companies to use for load control purposes, without negotiating access to this load with individual consumers. The impact of this change is still being assessed, but it is unlikely to promote efficient demand side management.

There are estimated to be around 9000 water heaters supplied by Westpower. Approximately half of these are on a fixed night-only ripple control programme that ensures they are not energised during coincident peak periods. The after diversity demand of the remaining water heaters in the Westpower network that are available for control by Westpower's load management system is estimated to total 4.5 MW at the time of the regional coincident peak on a cold winter evening.

Westpower supports injection telegrams for both the older Plessey Rhythmatic receivers as well as newer Decabit units. However, Westpower does not own ripple control receivers and therefore has limited ability to control their installation and maintenance.

The ripple injection system is modern and well maintained, with significant redundancy built in through the use of time-synchronised simultaneous injection across all four ripple plants spread throughout Westpower's area. As a result of significant signal "spill", the failure of a single plant has a minimal impact on overall signal levels.

After diversity loads used for forecasting load growth inherently take into account the ability to shed load at peak times, as these demands are based on historical loading figures derived from actual network performance. This is particularly true for newer houses using electric water heating, as generous cylinder capacities are supplemented by additional virtual storage through the use of tempering valves, leading to the ability to supply the load fully off-peak with a night rate only tariff.

However, for existing installations with limited storage, the increasing effects of diversity result in a dilution of the amount of after diversity demand on the network and load available to shed at the time of local peak demands, as the loads are aggregated across zone substations, GXPs and entire regions.

Magnifying this phenomenon, recent changes to the transmission pricing methodology have led to Westpower becoming a part of a joint load control scheme driven by Orion that focuses on minimising the Regional Coincident Peak Demand (RCPD) on Transpower's upper South Island network, rather than just controlling Westpower's own peak demands at local GXPs. This change in philosophy has resulted in markedly different peak demand shedding behaviour, and the resulting impact on diversity and individual GXP peak demands is still being analysed.

Once these effects are more clearly understood, it may well result in Westpower moving back toward supplementary control of local GXP demand in addition to the upper South Island control scheme if there are tangible benefits to be had. The forecasts would then be updated accordingly. In the meantime, the load forecasts are based upon the current demand management regime of regional load control.

Moreover, as noted above, the impact of recent regulatory changes may make it more difficult for Westpower to utilise this form of demand-side management in the future because of the cost involved in accessing it.

In any case, because Westpower's network is generally unconstrained at the distribution and subtransmission level, it is unlikely that even a significant change in demand management practices would have a discernible impact on short-to-medium term network investment decisions.

5.5 Distributed Generation

Westpower's policy regarding distributed generation is to assist any individuals or organisations through the application process and allow the connection of distributed generation to its network.

Westpower will also ensure that any new distributed generation connected to its network will comply with all relevant statutory and regulatory requirements, and applicable safety standards.

The main framework for implementing this policy is established by Electricity Governance (Connection of Distributed Generation) Regulations 2007.

Depending on the maximum capacity of the distributed generation to be installed, the application process differs significantly. Therefore, for 10 kW or less of capacity, the application will be a one-stage process; for over 10 kW of capacity, it will be a two-stage process.

Figure 5.4 shows the distributed generation process.

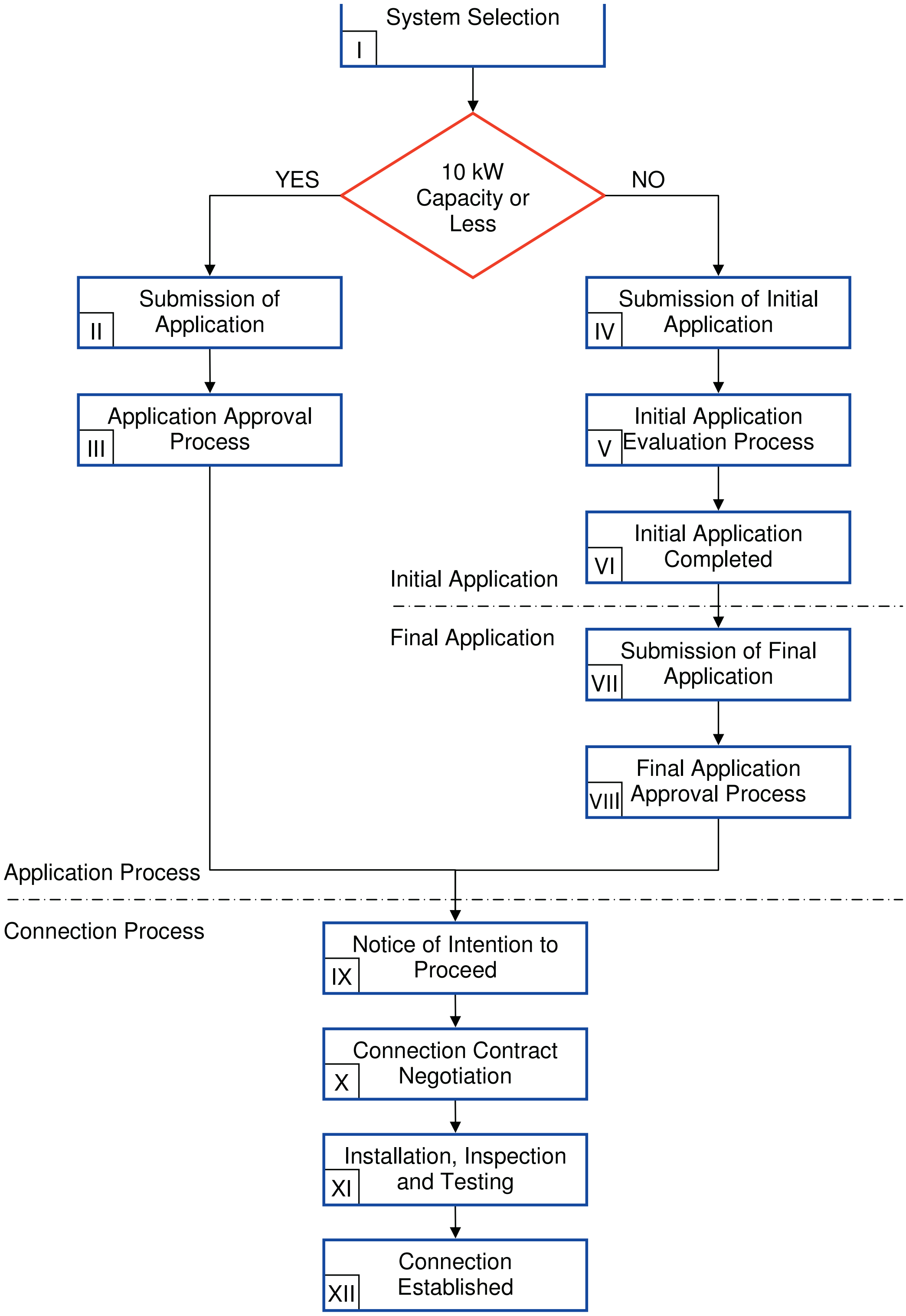


Fig 5.4 Distributed Generation Process

I. System Selection

Usually, distributed generation above 10 kW consists of diesel, wind or hydro generators; that below 10 kW consists of large arrays of solar panels or rotating plants such as wind turbines.

The selection of the equipment used as part of the distributed generation system should be planned ahead to ensure that the entire system complies with the requirements of the Health and Safety in Employment Act 1992, the Electricity Act 1992, and the rules and regulations made under the Electricity Act 1992. It also shall be installed in accordance with Westpower's Connection and Operation Standards and AS4777, NZECP4:1993 and/or NZS/AS 3000:2007 - Electrical Installations (known as the Australian/New Zealand Wiring Rules) or any subsequent revision.

II. Submission of Application

Any person or organisation who wishes to connect distributed generation capable of generating electricity at 10 kW or less to the network must submit an application to Westpower and provide all the information required in respect of the distributed generation proposed to be connected.

The application form has to be accompanied by the following attachments:

1. Information about the name plate rating or other suitable evidence that the generating unit is (or will be) only capable of generating electricity at a rate of 10 kW or less;
2. Detailed information about the inverter and/or battery (if applicable);
3. Technical specifications of the equipment that allow the distributed generation to be disconnected from the network on loss of mains voltage;
4. Information and justification showing how the distributed generation complies with AS4777 (where appropriate);
5. Information and justification showing how the distributed generation complies with Westpower's connection and operation standards;
6. The application fee.

III. Application Approval process

Based on the information provided in the application, Westpower will assess if:

1. The applicant complies with the requirements of the Health and Safety in Employment Act 1992; and
2. The distributed generation complies with the Electricity Act 1992, and the regulations and rules made under this Act; and
3. The connection of the distributed generation complies with Westpower's Connection and Operation standards (Westpower's Distribution Code).

IV. Submission of Initial Application

Similar to the "Submission of Application" stage for distributed generation with a capacity less than 10 kW, the applicants have to submit an initial application form accompanied by detailed information as requested in the form and the application fee.

V. Initial Application Evaluation Process

After receiving a complete application for a distributed generation with a capacity greater than 10 kW, Westpower will provide the applicant with the following information:

1. The capacity of our network, including both the design capacity (including fault levels) and actual operating levels;

2. The extent to which connection and operation of the distributed generation may result in a breach of the relevant standards for safety, voltage, power quality and reliability of supply to other connected parties;
3. Any measures or conditions, including modifications to the design and operation of Westpower's network or to the operation of the distributed generation;
4. The approximate costs of any network-related measures or conditions identified above, and an estimate of time constraints or restrictions that may delay the connection of the distributed generation;
5. Any further detailed investigative studies that Westpower reasonably considers necessary to identify any potential adverse effects on the system resulting from the proposed connection;
6. Any obligations to other parties that could affect the distributed generation;
7. Any additional information or documents that Westpower considers likely to assist the application;
8. Information about the extent to which planned and unplanned outages may affect the operation of the distributed generation.

VI. Initial Application Completed

Westpower will provide, if requested by the applicant, further information that is reasonably necessary to enable the applicant to consider and act on the information provided during the initial application process.

VII. Submission of Final Application

The final application has to be submitted to Westpower within 12 months after the initial application was completed and has to be accompanied by any investigative studies that were identified during that stage.

VIII. Final Application Approval Process

Similar to the "Application Approval Process" stage for distributed generation with a capacity less than 10 kW, based on the information provided in the application, Westpower will assess if:

- The applicant complies with the requirements of the Health and Safety in Employment Act 1992;
- The distributed generation complies with the Electricity Act 1992, and the regulations and rules made under this Act;
- The connection of the distributed generation complies with Westpower's Connection and Operation standards (Westpower's Distribution Code).

IX. Notice of Intention to Proceed

Once the final application for connection of the distributed generation is approved, the applicant must send a written notice to Westpower confirming his/her intention to proceed with the connection. The applicant also has to accept all the conditions (or other measures) which Westpower has specified as conditions of the connection and provide details of the generation to be connected.

Failure to provide Westpower with a notice of intention within the timeframe specified will lead to cancellation of the application and cessation of Westpower's responsibilities under the Electricity Governance (Connection of Distributed Generation) Regulations 2007. This does not prevent the applicant from submitting a new application for connection of distributed generation.

X. Connection Contract Negotiation

After receiving the notice of intention to proceed, both the applicant and Westpower should, in good faith, try to negotiate a connection contract.

If no connection contract is negotiated within the predefined timeframe, the regulated terms established by the Electricity Governance (Connection of Distributed Generation) Regulations 2007 will apply to the new connection.

The period for negotiating a connection contract may be extended by mutual agreement between both parties.

XI. Installation, Inspection and Testing

All wiring associated with the distributed generation system must comply with AS/NZS 3000 - Electrical Installations (Australian/New Zealand Wiring Rules) or any successive standard or legislation, and be undertaken by a registered electrician where required by legislation.

While AS 4777.1 deals primarily with the connection of inverter based systems, the principles covered by this Standard shall also be followed for distributed generation systems that do not employ inverters. Also, the Electrical Engineers Association's (EEA) – "Guide for the Connection of Generating Plant" may assist the applicant with determining the most appropriate electrical arrangements for the connection and protection of the distributed generator.

Before connecting the distributed generation to Westpower's network, it has to be inspected and tested. As a minimum, the applicant must ensure that:

1. The inspection and tests have been arranged;
2. Westpower has received adequate notice regarding the inspection and tests so they can send qualified personnel to the site for observation;
3. A written test report, including suitable evidence that the metering installation complies with the metering standards and rules, is provided to Westpower;
4. The fee specified by Westpower for observing the testing and inspection has been paid.

XII. Connection Established

Once the connection has been established, the applicant and Westpower must perform all obligations under the negotiated connection contract or regulated terms in accordance with connection and operation standards.

5.6 Non-Network Options

A number of strategies are available for dealing with load increases, as shown in Table 5.6.

Each of these options is carefully evaluated based on economic efficiency and technical performance. Wherever possible, capital intensive development is delayed until absolutely necessary, and non-asset intensive solutions are used where these are not incompatible with future development plans.

For instance, reactive support and/or voltage regulation is routinely employed to support dairy farming load growth in rural areas as this is far more cost-effective than overlaying with a higher voltage.

Where very short timeframes are involved and permanent solutions are not possible before the load comes on stream, demand side management is often employed by making at least part of the additional load interruptible until a long-term solution can be put in place.

Ignoring such increases, the first three solutions identified in the table, are essentially non-asset intensive.

Demand-based tariffs give the end user strong incentives to reduce peak demand and maximise plant load factors. This results in less peak demand and better regulation on the Westpower network.

Use of demand side management is linked to the tariff structure, and allows the plant or Westpower to control its internal demand by shedding nonessential load at peak periods.

Line Drop Compensation (LDC) can be used in specific circumstances to boost the sending end voltage on a feeder to improve down-line regulation. This effectively increases the available capacity on a feeder.

Westpower has also installed capacitors at strategic points in the network where voltage constraints are present or imminent. In some cases, load growth for a particular installation is dependent upon increased reactive support, and the consumer is required to contribute to the capital expenditure involved.

Distributed generation is seen as an excellent means of reducing demand on the Transpower network and enhancing the performance of Westpower's distribution network. As such, Westpower actively supports this approach. A transparent pricing methodology is in place to ensure that there are low entry barriers for new generators, and, if large enough, that these new generators receive the full Avoided Cost of Transmission (ACOT) benefits that they are entitled to.

Technical requirements for connection of distributed generation are based on the industry standard EEA Guidelines.

Notwithstanding the above comments, the quantum of load increases that Westpower is currently facing, as depicted in Table 5.5, means that energy conservation, distributed generation or small renewable generation projects are very beneficial in terms of demand side management and will also improve the quality of supply and reduce the marginal costs and losses associated with transmitting energy into the area.

The process that Westpower uses to identify and pursue economic and practical alternatives to conventional network augmentation in addressing network constraints is to consider each of the feasible alternatives discussed below in ascending order of cost and complexity until a solution is found that will meet the requirements of Westpower and its consumers, without conflicting with Westpower's medium and long-term planning requirements.

For instance, the Roa Mine recently signalled a significant increase in demand driven by increased production. The mine is fed by a relatively long length of 11 kV line, which involves few other consumers. In this case, additional automatic shunt reactive support allowed the demand to be supplied without violating acceptable voltage limits and also avoided the need to invest in a costly reconductoring exercise. This reduced costs for Westpower and ultimately the consumer, who was required to provide a capital contribution to fund the work.

Moreover, Westpower is open to the development of commercial arrangements that could defer the need for network investment (such as the voluntary curtailment of load by major customers at times of network peak demand) and would welcome discussion with stakeholders on this matter.

Table 5.6 - Options for Handling Load Increases

Strategy	Application
Economic tariff structure models	These options include demand based tariffs, off peak discounts and penalties for poor power factor. By signaling the true marginal economic costs of network extensions, the consumer is able to respond to these pricing signals by modifying their consumption behaviour and reducing their costs. This is best applied in the case of marginal load growth where optimization of the network is able to unlock its full potential.
Demand Side Management	Demand side management is typically applied by means of ripple control switching of interruptible loads such as water heating and night store heaters. Westpower routinely applies this method to reduce regional peak demand, which assists Transpower in managing existing transmission constraints.
Line Drop Compensation	On long rural feeders where most of the load is situated toward the middle or far end of the feeder, line drop compensation is a valid means of improving receiving end voltage regulation and maximising the line capacity. This is generally not applicable for 11 kV feeders with distributed load as near end customers would be adversely affected by voltage rise. Cost effective, but only applicable in limited cases.
Distributed Generation	Distributed generation is actively encouraged throughout Westpower's network, but Westpower is reliant on others investing in this technology. Furthermore, unless the generation is very reliable, or sufficiently diverse, the network must still be sized to provide full load without the benefit of generation to cater for times when the generation is unavailable or being maintained. Distributed Generation is not seen as applicable where it is the only means to supply continuous loads, but may be used by a customer who is happy to put up with occasional interruptions or constraints.

Table 5.6 - Options for Handling Load Increases

Strategy	Application
Voltage Regulation	On long 11 kV or 33 kV feeders, voltage constraints can be dealt with by installing either continuously variable or stepped voltage regulators. Westpower applies this technology in areas where either marginal or step loads increases would otherwise result in unacceptable voltage profiles. These are routinely applied in Westpower's 33 kV or 11 kV networks to cater for an increase in dairy farm loading in the rural area.
System Reconfiguration	Where significant loads are situated at the end of a meshed feeder, it is sometimes possible to provide enhanced capacity by switching the load to a nearby feeder. In the case of one bulk customer, a planned load increase (situated near the tie point between two feeders) will be catered for by spreading the factory load across two feeders. This is very cost effective, but depends very much on factors such as location of the load and therefore has limited application.
Reactive Compensation	This technique involves installing capacitors on the 11 kV distribution network to boost voltage and improve capacity. Westpower uses this technique extensively to support rural feeders and support the transmission grid voltage throughout the West Coast. Since only a certain number of fixed capacitors can be installed throughout the network before voltage rise problems occur, much more expensive switched banks are then required and the cost benefit balance is shifted. Switched capacitor banks are also used to support large motor starting applications.

5.7 Network Development Options

5.7.1 Reefton Network

No significant load growth is contained in the loadwatch analysis for the Reefton area. The existing network should be adequate to handle on-going growth.

In 1999, Westpower extended its 33 kV subtransmission network in the Grey Valley as far as Reefton and built a new zone substation on Transpower's Reefton substation site. This served the base demand for several years until a major new load developed in the form of the Reefton Gold Project, which is currently operated by Oceana Gold Limited.

Development of this project, involving a load of 5.2 MW, required significant strengthening of the supply into the Reefton area. After considerable investigation, the solution chosen by Westpower was to construct a new 2 x 20 MVA 110/33/11 kV zone substation at Reefton fed by two 110 kV lines from Inangahua. One of these lines was the existing Transpower DOB-IGH 66 kV circuit, which was upgraded to 110 kV. At the same time, a new 110 kV spur from Inangahua to Reefton was constructed by Westpower and then sold to Transpower.

In addition, a new 33 kV line and substation was constructed to feed the mine site and this has sufficient spare capacity to handle projected load growth throughout the life of the existing mine.

All of these projects were completed in 2005.

This work was designed to be compatible with Transpower's own transmission development in the area to ensure that the greatest shared benefit accrues to consumers in the area in terms of both capacity and security. This means that the Reefton area is now supplied by a strong transmission network with n-1 security, so further development will be limited to the distribution system.

Due to voltage constraints on the 11 kV circuits at Ikamatua, a new 33/11 kV zone substation was required at Blackwater to provide an additional 500 kW of demand to the Pike River coal load-out facility at Ikamatua and a possible gold mine at Waiuta. The substation was commissioned in December 2009.

The Oceana Gold mine supplied from the Reefton GXP is likely to cease operation in mid-2015 due to the current economic climate. This has been reflected in the load forecast by reducing the Globe substation peak load from 5.5 MW to 0.5 MW in 2015 to represent care and maintenance.

The net impact of these recent developments is that, barring any significant and unexpected load growth, no further strengthening of the subtransmission or distribution networks will be required for the remainder of the planning period.

5.7.2 Greymouth Network

Several significant coal mining projects may possibly be developed in the future near Rapahoe, but none of this load has yet been committed. Under the current economic circumstances, these projects are given a relatively low probability weighting.

On the other hand, the tragic event that occurred at the Pike River coal mine in 2010 means that the load at Atarau GXP has decreased by 6 MW. Similarly, the closure of the Spring Creek Mine near Rapahoe has reduced the demand on the Dobson GXP by some 5 MW. It is hard to predict whether these mines will ever reopen for production, but a prudent outlook would suggest that these loads may not reappear within the planning horizon.

A new 110 kV GXP switching station at Atarau was commissioned by Transpower in 2007 as a bus on the DOB-RFN-IGH circuit. This switching station, along with associated 110 kV and 33 kV lines and substations constructed by Westpower, is still in service and is available to provide full capacity for the Pike River mine should it ever be restarted, unless the mine owners at some point in the future decide to disconnect supply, in which case the GXP would be decommissioned.

Finally, muted base load growth and continuing expansion in the tourism industries will require minor capacity increases in the long term, but probably outside the planning horizon.

The existing Westpower 33 kV subtransmission network can support expected load growth. The recent upgrading of the DOB-RFN-IGH line to 110 kV has also strengthened the supply from Inangahua in the north, significantly improving firm capacity into the area.

If and when the TrustPower proceeds with its proposed 40 MW Arnold power station, a new 66 or 110 kV substation may be required at Kokiri to connect the power station into the local transmission grid. The new substation may be required by 2018/19, depending on a final decision to proceed from TrustPower.

Older distribution lines will be repaired and refurbished or replaced as dictated by on-going condition assessment.

Voltage support measures, including the installation of capacitors and voltage regulators, will continue to be applied at strategic points in the network to maximise performance of the existing assets, improve power quality and reduce marginal losses.

Apart from the above, no other developments are proposed throughout the planning period.

5.7.3 Hokitika Network

The completion of the Westland dairy factory supply in 2002, comprising a new Westpower 2 x 15/20 MVA 66/33/11 kV substation in Hokitika, vastly improved both the capacity and security of supply to the town of Hokitika and surrounding districts, including all of South Westland. This will also provide for continuing expansion at the Westland dairy products factory, along with downstream growth in the dairy industry in general. As noted earlier, however, the loading of the transformer banks will be closely scrutinised, to ensure that n-1 security is maintained throughout the planning period.

The Westland Dairy Factory is likely to continue with plans for step load increases throughout the planning period, and this will require some reconfiguration and possible augmentation of the 11 kV feeder cables into the plant, along with changes to the network within the plant itself.

As part of the WCGUP Project, Westpower has installed a 14 MVar switched capacitor bank on the 11 KV bus Hokitika substation. This provides reactive support in order to maintain and stabilise the voltage of Transpower's 66 kV transmission system on the West Coast. The project was fully funded by Transpower, which took over the ownership of these capacitors in June 2010.

No other major network development is planned in this area for the remainder of the planning period.

5.7.4 South Westland Network

After the amalgamation of the Grey, Westland and Amethyst Boards in 1972, it was found that the infrastructure assets in South Westland were in a very poor condition. Considerable expenditure has occurred over the last 30 years to bring the reticulation system up to an acceptable standard.

In addition, a new 33 kV regulator has been commissioned at Harihari, and this has provided significant additional capacity into areas south of that point, including the glacier region. Also, three new single-phase regulators have replaced the existing units at Fox to increase quality of supply for that area, along with providing additional capacity.

Major step load increases are conceivable in the Franz Josef area if a resurgent tourism industry should decide to invest heavily in new accommodation units. This has been made possible by the recent development of several large, new subdivisions in the area. Mitigating this driver, however, is an increase in concern around the proximity of Franz Josef and Fox glaciers to the major Alpine Fault and the creation of a Fault Avoidance Zone by the Westland District Council that prevents development in some areas of these townships.

It is possible that the Hokitika-Harihari 33 kV line may be upgraded to 66 KV in 2018 or later, depending on whether or not a large generation project in the area goes ahead, and this may require further work or reconfiguration at Ross and Waitaha substations.

Westpower replaced and re-conductored the Hokitika-Waitaha section of the existing 33 KV line in 2012/13 and this is now in new condition with sufficient capacity for the foreseeable future, excluding any major generation developments. This line was, in fact, originally constructed as a 66 KV line and so has been re-insulated at the same voltage level in order to facilitate future conversion to the higher voltage if and when this is required.

Security of supply is always going to be a major concern in this area, as it is fed by a very long single-circuit line and the benefit of alternative supply from local generation, including Wahapo and Amethyst power stations, is evident. The recently commissioned 7 MW Amethyst power scheme by Westpower as a joint venture with our partners will play a significant role in improving security of supply to South Westland.

5.7.5 Westpower Substations

In 2010, Westpower commissioned its first Ground Fault Neutraliser (GFN) at Greymouth substation as a public safety initiative which is expected to reduce the likelihood of fatal electric shock or damage to property in the event of network faults on the high voltage network.

During a ground fault, the GFN also maintains power supply to homes and businesses while field staff are dispatched to find and repair problem, greatly improving the reliability of supply to consumers in this area. Transient or momentary faults can be neutralised as well, eliminating many cases of flickering lights and short-term interruptions to power supply.

Once a good track record of performance during fault situations over the next few years has been collected and analysed, the value and applicability of this technology to other substations in Westpower's network will be reassessed and further planning decisions will be made at that time.

Due to network insulation coordination issues, this is currently limited to a maximum correction period of one minute, after which the faulted feeder is tripped, but this is expected to be relaxed once further upgrading work on Westpower's distribution transformers in the area is completed.

Most of Westpower's older vacuum KFE 11 KV circuit breakers have been replaced with new G&W Viper-ST vacuum interrupter circuit breakers, leading to improved network reliability. This has been driven by a number of recent failures of this equipment, which cannot be predicted or adequately covered by an enhanced maintenance programme. It is expected that all will be replaced by 2017/18. At the same time, the old protection systems will be upgraded with new digital relays to improve sensitivity and selectivity.

5.8 Zone Substations - Capital Projects

Table 5.7 summarises the planned expenditure by category for zone substations projects during the AMP period.

Table 5.7 - Zone Substation Projects and Programmes

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Enhancement	66	15	15	97	15	1782	15	15	15	15
Replacement	406	375	297	298	364	35	1129	969	367	327
Total	**472**	**390**	**312**	**395**	**379**	**1817**	**1144**	**984**	**382**	**342**

5.8.1 Enhancement

The age profile of Westpower's zone substations is such that only minimal enhancement expenditure is required throughout the planning horizon. The capacity of most of the assets is sufficient to handle normal expected load growth over the next ten years. Projected load growth in the Hokitika area may require the installation of an additional zone transformer by 2020.

Oil Interception Facilities

Oil interception facilities are installed to meet environmental requirements under the Resource Management Act. Previous policy did not set a cut-off criterion for the amount of oil at a site before oil containment facilities were installed. This has now been set at 1500 litres in line with Transpower standards, which will possibly be the measure for what could be considered "reasonably necessary" in terms of the Act.

5.8.1.1 Twelve month period (over $30,000)

54022: Wahapo Zone Substation – Prepare Site for Westpower Mobile Substation (WMS) Access

Costs: $35,000

The Wahapo zone substation primarily supplies the Okarito area and allows a connection point for TrustPower's Wahapo Power Station. It is proposed to prepare the Wahapo zone substation for WMS access this year. This will involve allowing for a 33 kV and 11 kV connection point to the zone substation, site preparation (earth mat, etc.) and as-built drawings.

Justification

Allowing the WMS to connect to the Wahapo zone substation will ensure critical zone substation maintenance can be conducted in a safe and efficient manner while maintaining supply to the Okarito area and enabling TrustPower generation to remain in service. This has proved greatly beneficial at other zone substations where a connection for the WMS has been established. Power can be retained to the area the zone substation supplies, reducing outages. This is vital, as no other alternative supply is available from the Westpower Network if there is an outage or fault at the Wahapo zone substation.

Alternative Options Considered

The option of using a generator was considered. Using the WMS was considered the best option as this can be connected quicker in a fault situation and it would achieve better utilisation of a Westpower resource as opposed to the extra costs incurred with finding an alternative during planned maintenance. Wahapo is the last substation on the Westpower network requiring mobile substation connection.

5.8.1.2 Twelve month period (under $30,000)

54023: Westpower Control Phone/Radio recording

Costs: $16,000

A budget has been allowed to install equipment to record phone and radio calls in Westpower's control room. This will ensure an accurate log is kept of all communications in an emergency or fault situations.

Table 5.8 - Zone Substation Projects

ID	Act	Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
54022	E	Install WMS access at Wahapo Zone Substation	35	0	0	0	0	0	0	0	0	0
	E	Hokitika - Install new T3, 66 & 11 kV CB's - Load Growth	0	0	0	82	0	1767	0	0	0	0
54023	E	Westpower Control Phone/Radio recording	16	0	0	0	0	0	0	0	0	0
54024	E	New Security Cameras for Zone Sub-stations (3 per year)	15	15	15	15	15	15	15	15	15	15
	RPL	Hokitika Protection Upgrade Design and Installation and As Built Drawings	0	0	0	41	324	0	0	0	0	0
	RPL	Reefton Zone Substation Protection Upgrade	0	0	0	0	0	0	0	0	309	0
	RPL	Dobson Zone Substation Protection upgrade	0	0	0	0	0	0	0	0	0	300
44010	RPL	Battery Replacement Programme	44	39	26	29	40	35	63	61	58	27
44023	RPL	Rapahoe Zone Substation - Replace 11kV metalclad switchgear	215	0	0	0	0	0	0	0	0	0
44024	RPL	Arnold Zone Substation - Replace CB 3 & 4 with Vipers & upgrade protec-tion	0	309	0	0	0	0	0	0	0	0
	RPL	Ross Zone Substation - Replace CB 1 & 3 with Vipers & upgrade protection	0	0	0	130	0	0	0	0	0	0
	RPL	Ross Zone Substation - T1 protection upgrade	0	0	0	98	0	0	0	0	0	0
44029	RPL	Waitaha Zone Substation - Replace regulator with single phase units	0	27	173	0	0	0	0	0	0	0
44030	RPL	Waitaha Zone Substation - Replace CB 1 & Protection Relay	0	0	98	0	0	0	0	0	0	0
	RPL	Fox Zone Substation - Replace T1 (TX:2438)	0	0	0	0	0	0	757	0	0	0
	RPL	Dobson Zone Sub - Replace T6 (TX:2240)	0	0	0	0	0	0	0	757	0	0
44034	RPL	Whataroa Zone Substation - Replace regulator with single phase units	147	0	0	0	0	0	0	0	0	0
	RPL	Ross Zone Substation - Replace regu-lator with single phase units	0	0	0	0	0	0	0	151	0	0
	RPL	Replace HHI R1 & T1 (Load Growth)	0	0	0	0	0	0	309	0	0	0
		Total	**472**	**390**	**312**	**395**	**379**	**1817**	**1144**	**984**	**382**	**342**

54024: New Security Cameras for Zone Substations (3 per year)

Costs: $15,000

A budget has been allowed to install 3 security cameras per year at all Zone Substations to help increase security especially at remote locations. These will be feed back into Westpower's control room.

5.8.1.3 Two to Five-Year period Projects

Hokitika Zone Substation – Install new T3, 66 and 11 kV CB's – Load Growth (2019/20) - $1,849,000

Due to Projected Load Growth in the Hokitika area, a third Zone Transformer is required to accommodate this additional load. A budget has been allocated to install a new T3 Transformer, protection, 66 and 11 kV Circuit Breakers at Hokitika Zone Substation. $82,000 has been allowed in 2017/18 for design drawings with $1,767,000 allocated for the project completion in 2019/20. Detailed analysis and costing will be conducted closer to the time.

5.8.1.4 Long-Term Projects (exceeding 5 years)

5.8.1.5 There are no long term enhancement projects planned at this stage.

5.8.2 Development

All development projects are dependent either on new investment agreements being reached with large customers or a clear economic justification.

There are no development projects planned for this AMP period.

Table 5.8 lists the expenditure for the zone substation projects planned for this AMP period.

5.8.2.1 Twelve month period (over $30,000)

There are no development capital projects planned for the next 12-month period.

5.8.2.2 Two to Five-Year period Projects

There are no development capital projects planned in the 2-5 year period.

5.8.2.3 Long-Term Projects (exceeding 5 years)

There are no development capital projects planned in the excess 5 year period.

5.8.3 Replacement

5.8.3.1 Twelve month period (over $30,000)

A detailed description of all capital projects over $30,000 scheduled for the next 12 months is given below:

44010: Battery Replacement Programme

Costs: $44,000

Battery Banks provide supply to Protection Relays and SCADA Communications during any outages at Zone Substations. These are designed to ensure they can maintain a continuous DC supply for a minimum period of 24 hours. The size of the Battery Banks varies depending on the size of the Zone Substation. A programme is in place to replace Battery Banks at all Zone Substation after they have reached 7 years as per Westpower guidelines. This programme runs for the duration of the AMP 10 year period. The costs each year vary depending on which Zone Substation Battery Banks are due to be replaced.

Replacement of the 24V and 110V Battery Banks at Hokitika and 24V Battery Banks at Harihari Regulator, Westpower Mobile Substation and Dobson are planned for this financial year.

Justification

These assets are critical to ensure Protection Relays and Communications are still operational during outages at Zone Substations and providing vital information back to the Control Room via SCADA Communications. Westpower guidelines are to replace these assets after 7 years from installation, which is seen as best practise with the like of Transpower adopting a similar guideline.

Alternative Options Considered

Alternatives considered was to test the Battery Banks when they reached replacement age and replacing individual cells that were identified as needing replacing. However, experience has found that it is more cost effective to replace the entire Battery Bank rather than testing and replacing individual cells.

Replacement of the entire Zone Substation Battery Banks when reaching replacement age was deemed to be the most cost efficient option.

44023: Rapahoe Zone Substation – Replace 11 kV Metalclad Switchgear

Project Justification Score: 71

Costs: $215,000

The bulk oil 11 kV indoor circuit breakers at Rapahoe zone substation supply an area covering the Coast Road area north to Punakaiki including Runanga, Rapahoe and Barrytown. They are the last of this type of circuit breakers on the Westpower network. It is proposed to replace these with new 11 kV Reyrolle vacuum reclosers with Arc Flash protection with external venting.

Justification

Arc Flash studies have identified potential hazards where equipment presents a higher than normal risk to personnel during operating or maintaining the equipment e.g. generic types of aged bulk oil circuit breakers. To minimise the risk to personnel and critical equipment, bulk oil circuit breakers are being removed from service and replace with modern vacuum reclosers which have been designed with arc flash protection and venting features.

The bulk oil indoor circuit breakers at Rapahoe are reaching the end of their serviceable life. These have higher maintenance costs as opposed to the Reyrolle vacuum reclosers, which require minimal maintenance. The Reyrolle vacuum reclosers are installed throughout the Westpower network, maintaining a standardised operational procedure for all 11 kV indoor switchgear and also standardising the spare parts required.

This project is planned to coincide with planned preventative maintenance at the substation. Completing both projects together while using the WMS to maintain supply ensures reduced costs associated with the WMS connection and better utilisation of resources.

Alternative Options Considered

Alternative options were considered including on-going basic maintenance and refurbishment of the existing switchgear. Maintenance costs of the bulk oil circuit breakers have increased considerably in recent years and parts are hard to source as the circuit breakers age.

A reliable circuit breaker is needed as there is no other alternative supply available from the Westpower Network if there is a fault with these 11 kV circuit breakers. The Reyrolle circuit breakers are reliable, have minimal maintenance costs and were considered the best option.

44034: Whataroa Zone Substation – Replace Regulator With Single Phase Units

Project Justification Score: 67

Costs: $147,000

The existing 1 MVA induction regulator at Whataroa was purchased second-hand from Transpower in the early 1990s. The manufacture date is unknown but is thought to be in excess of 60 years. It is proposed to replace the existing three-phase unit with three single-phase units.

Justification

With the three single-phase units installed, the regulator would be as per Westpower's standard design, (spares are already in stock) and would provide a more reliable voltage support, with room for future growth in the area. Remote operation can be achieved through SCADA communications, which is unable to be accomplished with the current regulator. SCADA communications are already established at the zone substation. As stated previously the age of the unit is thought to be in excess of 60 years and is at the end of its economic life.

Alternative Options Considered

Refurbishment of the existing unit was considered but due to the age of the unit, difficulty sourcing parts and costs of refurbishment and future maintenance, the most viable option was to replace the unit with new single phase units as per other Westpower locations.

5.8.3.2 Twelve-month period (under $30,000)

There are no replacement projects under $30,000 in the next 12 months.

5.8.3.3 Two to Five-Year period Projects

44024: Arnold Zone Substation – Replace CB3 and 4 With Vipers and Upgrade Protection (2015/16) - $309,000

Cooper type reclosers have proven to be unreliable of late. Their setting selection is limited and there have been several auxiliary switch failures. Arnold CB3 and 4 Cooper oil-filled reclosers are to be replaced with Viper reclosers. Protection will be upgraded with SEL351S type relays, enabling better fault analysis, protection settings, load trending and SCADA communications.

Waitaha Zone Substation – Replace Regulator With Single-Phase Units (2015/16 – 2016/17) - $200,000

The existing 1 MVA induction regulator was purchased second-hand from Transpower in the early 1990s. The manufacture date is unknown but is thought to be in excess of 60 years. It is proposed to replace the existing three-phase unit with three single-phase units.

Due to its close proximity to the sea and the high rainfall in the area, the regulator has started rusting around the bottom and needs attention. Dissolved Gas Analysis (DGA) tests also indicate that the unit requires replacing. It has been decided not to carry out any expensive repairs on this regulator.

With three single-phase units installed, the regulator would be as per Westpower's standard design, (spares are already in stock) and would provide a more reliable voltage support, with room for future growth in the area. Remote operation can be achieved through SCADA communications, which is unable to be accomplished with the current regulator. SCADA communications are already established at the zone substation. $27,000 has been allowed for design/drawings for 2015/16 with the remaining $173,000 to complete the project in 2016/17.

Waitaha Zone Substation – Replace CB1 With Viper and Protection Relay (2016/17) - $98,000

KFE type reclosers have proved to be unreliable of late. Their setting selection is limited and there have been several auxiliary switch failures. CB1 Cooper oil-filled recloser is to be replaced with a Viper recloser. Protection will be upgraded with a SEL351S type relay enabling better fault analysis, protection settings, load trending and SCADA communications.

Ross Zone Substation - Replace CB1 and 3 with Vipers and Upgrade Protection (2017/18) - $130,000

KFE type reclosers have proved to be unreliable of late. Their setting selection is limited and there have been several auxiliary switch failures. Ross CB1 and 3 Cooper oil-filled reclosers are to be replaced with Viper reclosers. Protection will be upgraded with a SEL351S type relays enabling better fault analysis, protection settings, load trending and SCADA communications.

Ross Zone Substation – T1 Protection Upgrade (2017/18) - $98,000

Ross T1 protection is the older type Combiflex protection. It is proposed to replace this protection with a modern SEL relay. This will ensure that the protection is standardised as per Westpower's other Zone Substations. Also the project is timed to coincide with CB1 and 3 replacement and protection upgrade, thus ensuring better utilisation of Westpower resources and reducing shutdown period.

Hokitika Protection Upgrade - Design and Installation and As Built Drawings (2018/19) - $365,000

The Hokitika zone substation was commissioned in 2002. Due to the on-going development in communications and technology, the expected life of digital protection relays is 15 years. $41,000 has been allowed for in 2017/18 for drawings, etc. The sum of $324,000 has been allowed to complete this upgrade in 2018/19.

5.8.3.4 Long-Term Projects (exceeding 5 years)

Harihari Zone Substation - Replace R1 and T1 – Load Growth (2020/21) - $309,000

Due to projected load growth in the Harihari area, a contingency budget has been allowed to replace the existing regulator and transformer at Harihari Zone Substation. Detailed analysis and costing will be conducted closer to the time.

Fox Zone Substation – Replace T1 (2020/21) - $757,000

Replace existing FOXT1 transformer.

Dobson Zone Substation – Replace T6 (2021/22) - $757,000

Replace existing DOBT6 transformer.

Ross Zone Substation - Replace Regulator With Single Phase Units (2021/22) - $151,000

Replace existing three-phase regulator with three single-phase regulators

Reefton Protection Upgrade - Design and Installation and As Built Drawings (2022/23) - $309,000

The Reefton zone substation was commissioned in 2005. Due to the on-going development in communications and technology, the expected life of digital protection relays is 15 years. The sum of $300,000 has been allowed to complete this upgrade.

Dobson Protection Upgrade - Design and Installation and As Built Drawings (2023/24) - $309,000

The sum of $300,000 has been allocated to complete the upgrade of the Dobson zone substation to allow for the on-going development in communications and technology of digital protection relays.

5.9 MV Switchgear - Capital Projects

Table 5.9 summarises the planned expenditure by category for MV switchgear-related projects during this AMP period.

Table 5.9 - MV Switchgear Projects and Programmes

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Development	81	162	80	57	60	154	67	71	74	77
Enhancement	120	69	61	64	67	70	73	77	81	83
Replacement	42	108	49	51	54	136	63	66	71	153
Total	**243**	**339**	**190**	**172**	**181**	**360**	**203**	**214**	**226**	**313**

5.9.1 Replacement

Westpower has determined its replacement programme for HV switchgear based on the following criteria:

Safety - Where equipment presents a higher than normal risk to personnel during operating or maintaining the equipment e.g. generic types of aged bulk oil circuit breakers with history of failures; circuit breakers that require hand closing.

Technical suitability - This applies to equipment that is no longer suitable for its service application e.g. disconnectors and circuit breakers that are unreliable or inconsistent in performing their functions due to excessively worn mechanisms, equipment which fails to meet Westpower's seismic requirements or under-rated equipment.

Economics - This is where replacement is justified purely for economic reasons, e.g. equipment is excessively expensive to maintain or repair, the high cost of spares or where spares can no longer be purchased or maintenance-intensive equipment installed at a sensitive supply location.

Circuit Breakers - Outdoor

In line with the practice of overseas utilities as reported by CIGRE, Westpower has a policy, subject to project-specific economic analysis, of replacement rather than life extension of aged and/or deficient bulk oil and minimum oil circuit breakers by major refurbishment. Circuit breakers are also replaced for the following reasons:

Where they have high maintenance costs;

Where they are unreliable due to an increased defect rate;

Where a system node requires a maintenance-free circuit breaker e.g. maintenance outages cannot be tolerated.

It is internationally recognised that 40 years is generally the "time expired" life of circuit breakers. Some types have an economic life greater or less than this figure. Bulk oil breakers generally have a longer life, while minimum oil breakers typically last only 30-35 years.

While age is not itself criteria for replacement, analysis based on likely total economic lives for each type, make and model of circuit breaker provides a means of assessing likely future replacement requirements. The replacements themselves would be determined by safety, economics and reliability assessments at the time.

Many of the existing older bulk oil reclosers have been replaced with modern low-maintenance vacuum circuit breakers.

The continuing replacement programme for outdoor circuit breakers has resulted in there being no breakers over 25 years of age.

Andelect Units

Westpower has experienced two serious failures of Series I versions of these oil switch units during routine operation, and they are considered to constitute a serious health and safety risk. A replacement programme was instituted five years ago to gradually replace all these units with new SF6 RMU type. At present, there are no series 1 type oil switch units in the network. Westpower still has series 2 type oil filled Andelect switch units, which have been assessed as safe to operate. There are two of these units remaining.

5.9.1.1 Twelve-month period (over $30,000)

Detailed description of capital works over $30,000 in the next 12 months. Some of these projects are on-going throughout the entire AMP timeframe:

46003: Disconnector Replacements

Costs: $35,000

Disconnectors normally fail due to deterioration of the operating arms with corrosion, or from an arc developing across two or more phases. By identifying under-rated or defective disconnectors and replacing these, the incidence of arcing faults should be reduced.

This is an on-going project; funds are allocated each year. With the disconnector maintenance programme in place disconnectors are identified that are more cost efficient and safer to replace than to maintain, therefore the number of disconnectors to be replaced varies from year to year. This budget allows for disconnector replacement when they have been identified as reaching the end of their economic and serviceable life.

5.9.1.2 Twelve-month period (under $30,000)

A summary of capital projects under $30,000 in the next 12 months, some of these projects will be on-going throughout the entire AMP time frame.

46004: Remote Locations Battery Replacement - $7,000

A five-year replacement programme is in place for batteries at remote locations in the network. This is an on-going project and funds have been allocated to achieve this.

5.9.1.3 Two to Five-Year period Projects

46006: Ring Main Unit Replacement (2015/16) - $62,000

A number of oil-filled Ring Main units have been identified as reaching replacement age. A budget has been allowed for a progressive replacement programme which will see one unit replaced every four years. Further investigation will be carried out closer to the 2015/16 financial year to determine which unit is to be replaced next.

5.9.2 Enhancements

5.9.2.1 Twelve-month period (over $30,000)

Detailed description of capital works over $30,000 in the next 12 months. Some of these projects are on-going throughout the entire AMP timeframe:

56005: Install Automation to Various Disconnectors

Costs: $36,000

Remote automated disconnectors have provided significant benefits to the network, and allow controllers to open and close switches without having to call on standby staff. Each year, Westpower is upgrading selected strategic switches with automated units. All new automation is to be achieved with the use of ENTEC load break switches or the actuator units designed by Westpower.

Justification

Network fault analysis has identified key areas on the Westpower 11 kV network which require automatic isolation of faults and remote operation of tie switches to retain supply to built-up areas and large customers.

The addition of extra automation to the network improves system reliability and fault selectivity. The ENTEC load break switches are also capable of automatic fault isolation on smaller spur lines.

The ENTEC load break switches have no external moving parts and are therefore more reliable. They are also virtually maintenance free.

The Entec load break switches can be interrogated for fault analysis and quality of supply, providing improved operating data to the control room SCADA and engineers via remote access.

The actuator units have been trialled and used on selected 33 kV disconnectors and have been performing well. These can be installed on existing disconnectors and any new locations.

Alternative Options Considered

The next best option was to fit motor drive units to disconnectors. This was rejected as motor drive units have proven to be unreliable when required for operation. They can sit for long periods of time and external parts seize up. ENTEC switches have no external moving parts, have internal CTs and VTs, are competitively priced, and provide fault selectivity and fault interrogation.

Installing ENTEC load break switches at identified locations was considered the best option.

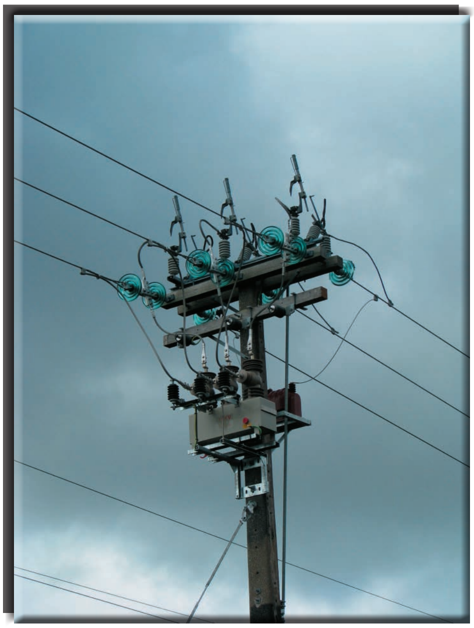


Fig 5.9 ENTEC Load Break Switch

56008: Fusing of Spur Lines by Feeder Classification

Costs: $44,000

A detailed study has been conducted to classify all feeders and lines on the Westpower network. The reasoning to give these feeders and lines classification was to help in determining what level of security was required to maintain supply to these feeders/lines. Factors taken into account with this study included feeders with hospitals, CBDs, commercial and large industrial customers; feeder sections with high SAIDI histories, critical sub transmission lines with no alternative means of supply; sections already protected by reclosers/sectionalisers or fused; and vegetation. These feeders/lines were classified ranging from F1 (Critical), F2 (Very High) through to F5 (Low).

Over the next few years, it is planned to fuse all possible spur lines off feeders/lines classified as F1 and F2.

Justification

Further investigation will be done to determine which spur lines can be fused by DDO Fuses. This is to help maintain security on main feeder Lines, reduce SAIDI, and to help reduce the outage area affected and to be patrolled when a fault occurs on these spur lines.

Alternatives Options Considered

Where it is possible to install DDO fuses, previous experience has shown that DDO fuses are a good option both in performance on spur lines and in price. Quite often, it makes sense to fuse a spur line, rather than incurring the costs of clearing trees or line upgrade. Larger spur lines with greater load will be identified and considered for installation of a recloser (new spur line reclosers budget).

56009: Relocate Haupiri Regulator Site

Costs: $40,000

The 11 kV regulator at Haupiri provides voltage support to the Haupiri/Kopara area and Gloriavale Christian Community. Complaints have been received at the end of this line in regards to voltage issues. A study needs to be initiated to identify possible options to mitigate this issue, with the possibility of the regulators needing to be relocated downstream of the Christian Community.

Justification

The regulator was originally installed after an investigation at the end of the 2003 dairy season identified voltage support was required on the end of the ALD4 feeder. Further expansion in the area, especially with an increase of load from the Christian Community, requires a suitable solution to be found.

An additional capacitor bank has been installed for voltage support to the Christian Community. However the increased load is still affecting other consumers downstream of the Christian Community.

Alternatives Options Considered

All options will be considered while the study is undertaken.

5.9.2.2 Twelve-month period (under $30,000)

There are no enhancement projects under $30,000 in the next 12 months.

5.9.3 Development

Reclosers are pole-mounted circuit breakers, which automatically isolate a faulted section of the line from the rest of the network. Where a large radial network exists, reclosers are often fitted on spur lines to prevent the main line from tripping out due to a spur line fault. The addition of extra reclosers to the network improves system reliability and fault selectivity. Justification of each project is carried out on a case-by-case basis.

Supply to the West Coast in general is voltage-constrained and this is partly due to the long inductive transmission lines. When a line outage occurs due to faults or planned maintenance events, voltage collapse can occur unless significant support is available from local generation; this, in turn, may depend on water availability.

Amethyst Hydro was completed in 2013, which will improve reliability of supply and the ability to carry out maintenance in the South Westland area.

Voltage support utilising capacitors on the Westpower network has had varied success. At night, when the load is low, capacitors may not be required, but are required at peak load times. A study has identified a cost-effective solution to automate the switching in and out of existing capacitor banks as required to provide this voltage support.

5.9.3.1 Twelve-month period (over $30,000)

Detailed description of capital works over $30,000 in the next 12 months. Some of these projects are on-going throughout the entire AMP timeframe:

66005: Automate Capacitors at Various Locations

Project Justification Score: 80

Costs: $50,000

Westpower have installed capacitors throughout the 11 kV network to help maintain voltage levels in areas where there is a large industrial load or where there is load on a long feeder. After a detailed study, a solution to automate existing capacitor locations on the network was found. The first site was selected and trialled in 2013 providing voltage support during the outage for the Kumara project and worked successfully.

One site per year will be automated. An investigation will be conducted to select the optimum existing or new location to automate.

Fig 5.10 Capacitor mounted inside Pad-mounted Cabinet

Justification

Currently in areas where capacitors are installed with large industrial loads, voltages can rise when this significant load is reduced e.g. at night when production ceases, or when planned maintenance is carried out and the load is reduced. At present, the capacitors are in service at all times. With the automation of these sites, the capacitors would be taken out of services when the voltage increases or by remote control from the control room via SCADA. This will help Westpower maintain the voltage within regulated limits at all times.

Alternative Options Considered

Alternatives considered were keeping the status quo with the capacitor banks in service at all times or changing the size of the capacitor banks. Complaints from consumers would still be experienced with the status quo.

One location has been downsized and the voltages have stayed within regulated limits at all times. However this is not viable for all locations so the option to automate capacitor banks was deemed the best option. During the investigation stage for determining locations, both options of automation and downsizing will be considered.

5.9.3.2 Twelve-month period (under $30,000)

A summary of capital projects under $30,000 in the next 12 months, some of these projects will be on-going throughout the entire AMP time frame.

66007: New Disconnectors - $31,000

Several new disconnectors are to be installed to further sectionalise the network and to reduce the number of customers affected by 11 kV switching operations. These disconnector installations will also assist with the isolation of faults.

5.9.3.3 Two to Five-Year period Projects

66001: New Main Line Recloser Sites (2015/16) - $84,000

Main line reclosers are being strategically positioned throughout the Westpower network to reduce the number of consumer outages incurred during faults, thus reducing SAIDI.

A budget has been allowed every 4 years to install new main line reclosers in areas when identified.

66002: New Spur Line Reclosers on Various Spur Lines - $16,000

Reclosers are being strategically positioned throughout the Westpower network to isolate problematic spur lines, reduce main line tripping's and reduce inconvenience to consumers and SAIDI.

Reclosers are being fitted to spur lines, where the number and size of consumers are too great to fit DDOs. As new locations are identified each year it is proposed to install refurbished KFME type reclosers to these locations.

The addition of extra reclosers to the network improves system reliability, fault selectivity, unplanned outages, SAIDI and customer satisfaction.

Table 5.10 - MV Switchgear Projects

ID	Act	Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
46003	RPL	Disconnector Replacements	35	39	41	43	46	49	53	56	59	60
46004	RPL	Remote locations Battery Replacement	7	7	8	8	8	9	10	10	12	13
46006	RPL	Ring Main Unit Replacement	0	62	0	0	0	78	0	0	0	80
56008	E	Fusing of spur lines by feeder classification	44	30	20	21	22	23	24	25	26	27
56005	E	Install Automation to Various Disconnections	36	39	41	43	45	47	49	52	55	56
56009	E	Relocate Haupiri Regulator site	40	0	0	0	0	0	0	0	0	0
66001	D	New main line recloser sites	0	87	0	0	0	91	0	0	0	0
66002	D	New Spur Line Reclosers on various Spur Lines	0	16	18	19	20	21	22	23	24	25
66005	D	Automate Capacitors at various locations	50	25	26	0	0	0	0	0	0	0
66007	D	New Disconnectors	31	34	36	38	40	42	45	48	50	52
		Total	**243**	**339**	**190**	**172**	**181**	**360**	**203**	**214**	**226**	**313**

5.10 SCADA and Communications - Capital Projects

5.10.1 Replacement

Table 5.11 summarises the planned expenditure by category for SCADA and comms related projects during this AMP period.

Table 5.11 - SCADA and Comms Projects and Programmes

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Development	112	219	162	82	104	86	88	108	108	48
Enhancement	151	186	259	209	224	199	236	214	186	231
Replacement	30	30	30	31	33	35	37	40	42	42
Total	**293**	**435**	**451**	**322**	**361**	**320**	**361**	**362**	**336**	**321**

Communications

Communications equipment has, in general, a shorter life expectancy than heavy electrical equipment. Typically electronic equipment reaches technical obsolescence in 5-10 years although the equipment can, in general, be supported in service for 10-15 years.

SCADA

5.10.1.1 Twelve-month period (over $30,000)

No planned replacement project exceeds $30,000.

5.10.2 Enhancement

There are several small upgrade jobs planned for the SCADA and communication systems throughout the planning period.

5.10.2.1 Twelve-month period (over $30,000)

57027: Reefton Voice Repeater - $40,000

The current voice repeater is ageing and needs updating otherwise voice communication to the Reefton area may regularly fail.

5.10.2.2 Large Projects over Five-Years

57028: SCADA Master Station Replacement – (15-16) $60,000 , (16-17) $60,000

As with all computer-based systems, it is expected that several upgrades of the operating system, software-applications and hardware will be required throughout the planning period.

The SCADA master system has been kept up to date with software changes to enable the system to have maximum functionality and to extend the life of the current system.

But the time has come for the current SCADA manster station to be overhauled with a major upgrade to the latest technology. A design and scoping phase is planned for 2014-2015. And after board acceptance of project the system upgrade will commence in 2015-16 year.

Waitaha Zone Sub Comms Upgrade (16-17) $40,000

The communications to this site will need to be upgraded at the time of the planned stations substation protection upgrade.

Waitaha Repeater Development (16-17) $40,000

To achieve IP communications to the Waitaha area the recently purchased Kordia Waitaha repeater site will need to be developed.

5.10.3 Development

5.10.3.1 Twelve-month period (over $30,000)

Detailed description of all capital projects over $30,000 in the next 12 months:

No development projects planned for this year that exceed $30,000

5.10.3.2 Large Projects over Five-Years

67038: Mt Bonar, Upgrade Repeater Site (15-16) $80,000 , (16-17) $60,000

Westpower has identified this site as a critical repeater site. Extensive development will be required to utilise this site to optimise comms coverage in South Westland. A design and scoping phase is planned for 2014-2015. And after board acceptance of project the site upgrade will commence in 2015-16 year.

Arnold Comms Upgrade (15-16) $40,000

This is aligned with the proposed protection upgrade of this substation.

Table 5.12 - SCADA and Comms Projects

ID	Act	Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
	D	ALD Comms Upgrade	0	40	0	0	0	0	0	0	0	0
67038	D	Mt Bonar, Upgrade Repeater Site	20	80	60	0	0	0	0	0	0	0
	D	Mt Kakawau	0	0	20	0	0	0	0	0	0	0
67018	D	Metering Reading	10	10	11	11	11	11	11	11	11	11
67019	D	VMWare Server Configuration / Equipment	11	12	13	13	14	15	16	16	16	16
67011	D	SCADA Off Site Backup	5	5	5	5	5	5	5	5	5	5
67017	D	61850 Rollout	11	12	13	13	14	15	16	16	16	16
67014	D	Fast IP Comms to All Recloser sites for DIFIS Project	20	20	20	20	20	20	20	20	20	0
67031	D	Comms to MV Switchgear Discon-nector Automation & New Reclosers	20	40	20	20	40	20	20	40	40	0
67033	D	Comms to Automate Capacitors	15	0	0	0	0	0	0	0	0	0
57003	E	Mt Bonar Repearer	4	5	5	5	5	5	6	6	6	6
	E	Fibre Link to Greymouth Depot	0	0	0	0	0	0	50	0	0	0
	E	HKK Protection upgrade	0	0	0	0	50	0	0	0	0	0
57026	E	Rapahoe Comms Upgrade	20	0	0	0	0	0	0	0	0	0
	E	Comms to upgraded Ross Zone Sub	0	0	0	40	0	0	0	0	0	0
57001	E	Modification of Load Control Sytem	10	10	12	12	12	12	13	13	13	13
57022	E	SCADA Master Station Enhancement	10	10	12	12	12	12	13	13	13	13
57025	E	ICCP Feed	10	10	10	10	10	10	10	10	10	10
	E	Waitaha Repeater Development	0	0	40	0	0	0	0	0	0	0
	E	Comms to upgraded Waitaha Zone Sub	0	0	40	0	0	0	0	0	0	0
57011	E	SCADA Critical Spares	15	15	15	15	15	15	15	15	15	15
57012	E	IP Fire Wall / Security / Remote Secure access	6	6	7	7	7	7	8	8	8	8
	E	PAP-ALD Radio Link	0	20	0	0	0	0	0	0	0	0
	E	PAP-ATU Radio Link	0	0	0	0	0	0	0	80	0	0
	E	Blackwater Radio Links	0	0	0	0	0	0	0	0	0	40
	E	Rlackwater Router	0	0	0	0	0	0	0	0	0	15
	E	Rlackwater Comms Processor	0	0	0	0	0	0	0	0	0	20
	E	PAP-CHAPEL microtik horiz	0	0	10	0	0	0	0	0	0	0
	E	PAP-CHAPEL microtik vert	0	0	10	0	0	0	0	0	0	0
	E	Dobson communications processor	0	0	0	0	0	25	0	0	0	0
	E	PAP-DOBSON Radio	0	0	0	0	0	70	0	0	0	0
	E	PAP-DOBSON Fibre Cable	0	0	0	0	0	0	0	0	20	0
	E	Fox T1 replacement	0	0	0	0	0	0	20	0	0	0
	E	Fox communications processor	0	0	0	0	0	0	20	0	0	0
	E	Globe Substation communications processor	0	0	0	0	0	0	0	0	0	20
	E	RFN-GLB Radio Link	0	0	0	20	0	0	0	0	0	0
	E	Greymouth sub Commsprocessor	0	0	0	0	0	0	0	0	20	0
	E	Greymouth sub Router and Switches	0	0	0	0	0	0	0	0	20	0

Table 5.12 - SCADA and Comms Projects

ID	Act	Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
	E	Westpower Control to Greymouth Substation Fibre Link	0	0	0	0	0	0	0	0	0	50
	E	HKK-PAP Radio Link	0	0	0	0	70	0	0	0	0	0
	E	Landing Hill to IGH Radio Link	0	0	0	0	0	0	0	0	70	0
	E	PAP-Kumara Radio Link	0	0	0	0	0	0	70	0	0	0
	E	PAP-NGH radio link	0	0	0	20	0	0	0	0	0	0
	E	Rapahoe Radio Link	0	0	0	0	0	0	0	0	0	30
	E	Reefton Substation IP Switch	0	0	0	0	0	0	0	8	0	0
	E	RFN BCL to RFN Sub Radio Link	0	0	0	0	0	0	0	50	0	0
	E	Reefton communications processor	0	0	0	0	0	0	0	20	0	0
57027	E	Reefton Voice Repeater	40	0	0	0	0	0	0	0	0	0
	E	Ross communications processor	0	0	30	0	0	0	0	0	0	0
57028	E	SCADA Master Station Replacement	20	60	60	100	100	50	50	0	0	0
	E	Ripple Master Injector	0	0	0	0	0	0	20	0	0	0
57029	E	Comms to MV Switchgear Replacement Program	10	10	10	10	10	10	10	10	10	10
57030	E	Convert Abbey Sites to Digital IP Sites	15	15	15	15	0	0	0	0	0	0
57031	E	Mobile Sub Digital Comms Upgrade	10	0	0	0	0	0	0	0	0	0
57032	E	Control Room VHF Radios	15	40	0	0	0	0	0	0	0	0
		Total	**297**	**420**	**438**	**348**	**395**	**302**	**393**	**341**	**313**	**298**

5.11 Subtransmission - Capital Works

As discussed in Section 3, this asset class involves 33 kV and 66 kV power lines. The 66 kV assets are leased to Transpower and are a critical factor in the reliability of the national grid in the area. Accordingly, a higher standard of care and maintenance is required.

Table 5.13 - Subtransmission Projects and Programmes

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Development	0	0	0	0	0	0	0	0	0	0
Enhancement	0	0	0	0	0	0	0	0	0	0
Replacement	245	191	146	118	124	130	137	145	121	121
Total	**245**	**191**	**146**	**118**	**124**	**130**	**137**	**145**	**121**	**121**

5.11.1 Replacement

North Westland 33 kV Network

If the level of refurbishment on the Arnold-Dobson line becomes greater than 50% of the asset, complete line replacement may be more cost-effective. This will be reviewed toward the end of the planning period.

No replacement is foreseeable on the concrete pole lines.

5.11.1.1 Twelve-monthly period (over $30,000)

40005: HKK-WTH 33 kV Pole Replacement

Cost: $150,000 Project Timeline: April 2014 – August 2014

Project Justification Score: 50

The hardwood pole line built originally by the State Hydro Commission in 1965 between the Hokitika substation (which replaced the old Arahura substation) and the Harihari substation had reached the end of its serviceable life with many of the poles found to be in very poor condition. Three years ago a project was initiated to replace the poles between Waitaha and Hokitika and the majority of pole replacement project has been completed between the Waitaha substation and the Hokitika substation, however continuing discussions with a landowner has seen a delay replacing a section of line at Mananui. This section of line, comprising nine poles, is to be relocated closer to the road.

Justification

The South Westland area from Ross to Paringa is dependent on supply from this 33 kV spur line, with only limited redundancy in areas around the Wahapo power station. Although capable of withstanding design loads, the poor condition of many of the poles could fail if subjected to extreme weather events frequently experienced in South Westland. Failure of any of these poles in an unplanned event could pose serious access issues and significantly extended outage times. The introduction of the Amethyst Hydro Scheme will provide additional drivers for the project, particularly to provide suitable support for the stringing of the heavy oxygen conductor.

Alternative Options Considered

No alternate options are available, as this supply to South Westland is a spur line with only limited alternate feed via local generation.

40012: GYM-KUM 66 kV Pole Replacement

Costs: $45,000 Project Timeline: October 2014

Project Justification Score: 59

In previous years, poles on the GYM-KUM 66 kV cct have been replaced in sections. However, a change in replacement strategy will see poles replaced only when the poles have been proven to be at the end of their serviceable life. A contingency sum of $45,000 has been allocated to allow the replacement of four structures.

Justification

Built in 1977 (approaching 35 years old), the GYM-KUM 66 kV cct is critical to the security of supply to Greymouth and the surrounding areas. Should a pole fail, particularly in some of the more remote areas, security of supply to Greymouth could be compromised.

Alternative Options Considered

As mentioned, the alternative to a pole-for-pole replacement strategy is that of sections of line being replaced as a 'project'. As this strategy is no longer supported, there are no other options available.

40013: Sub-transmission Condemned Pole Replacement

Costs: $50,000 **Project Timeline: April 2014 - March 2015**

Project Justification Score: 59

Previously, most sub-transmission poles replaced were included in projects that replaced sections of line deemed to be reaching replacement criteria. With the shift in asset management strategy to be more maintenance focused, only sub-transmission poles that have been proven to have reached the end of their operational life will be replaced. To prove this, thorough inspection, including scanning and analysis with the PortaSCAN XBS pole density scanning system, will be required.

Fifty five sub-transmission poles have been identified to be in poor or worse condition using the traditional dig and probe method of assessment. Consideration must be given to PortaSCAN XBS results, which are very likely to significantly reduce the number of poles requiring replacement due to the more accurate assessment that the PortaSCAN XBS provides.

From time to time, it may be more prudent to replace several poles in a section of line if considerations such as reconfiguration, landowner issues or outage restrictions warrant this.

Justification

To ensure safety to workers and the public, and to reduce faults, poles must be replaced if failure is imminent. Replacement must be balanced with gaining the maximum life from poles, hence the emphasis on detailed assessment before poles are changed out.

Alternative Options Considered

Poles at the end of their operational lives must be replaced. Therefore, no alternative options are available.

5.11.1.2 Two to Five-Year period Projects

Mapourika, Replace Substandard Poles (2015-2022) $20,000 p/year

Condition assessment revealed that most of the poles on the Hendrix cable section of line traversing Lake Mapourika are in very poor condition. A subsequent inspection with the PortaSCAN XBS pole scanning system disputed the traditional methods and found the majority of poles to have many years of operational life remaining, however several will need to be monitored and possibly replaced.

Warrens Paddock - Replace Structures (2014-2015) $50,000

The wooden 33 kV and 11 kV structures at Warrens Paddock near Taylorville support an integral link to the North via the Rapahoe and Ngahere substations. In particular, the 33 kV line to Rapahoe does not provide n-1 security, and the mines and surrounding townships rely heavily on this supply. At present, the structures could be deemed the weakest link for this critical line and although PortaSCAN result indicate the poles are in reasonable condition and should withstand normal loads placed upon them, the criticality of the aging structures deem this project necessary. At minimal cost, risk to this circuit could be achieved by replacing the structures. It is intended that a design will be carried out 2013-14 to allow a more accurate cost assessment.

5.11.2 Enhancement

Greymouth-Kumara 66 kV Line

The age of this asset is now assessed as midlife, requiring increased levels of inspection to manage risk and identify early signs of deterioration.

As a condition of the lease of this asset to Transpower, a circuit rating of 35 MVA must be maintained. The current Dog ACSR conductor has a summertime rating slightly below this value and re-conductoring may be required in the future.

Notwithstanding this, Transpower have yet to request full rating and it is very unlikely that load growth within the planning period will require the extra capacity.

Kumara-Kawhaka 66 kV Line

With the exception of the possible installation of enhanced lightning protection, should this prove necessary, no enhancement programmes are planned for this asset.

North Westland 33 kV Network

Enhancement of any of the concrete pole sections is not envisaged unless driven by a major load increase. In this case, reconductoring is the most likely activity.

The capacity of the existing Arnold-Dobson line is sufficient for the 3 MW Arnold power station to connect into the grid, but has no spare capacity. Any significant increase in the injection demand at this site above approximately 5 MW will require the Arnold-Dobson line to be upgraded by re-conductoring and partial pole replacement.

South Westland 33 kV Network

Much of the network in South Westland was constructed at the same time as that in North Westland and the same comments apply to both areas.

South Westland does have some unique features, with the fully insulated overhead cable routes around Lakes Wahapo and Mapourika, requiring special management.

The Mount Hercules line, with an age of 34 years, has been refurbished due to the deterioration of poles and conductors. This line provides an essential link to South Westland, thus demanding priority within maintenance programmes.

With the addition of the Fox Glacier 33/11 kV substation on the network in 2003, the 11 kV line from Franz Josef to Fox Glacier was uprated to 33 kV. This line had major refurbishment work carried out at this time and should not need any further major maintenance work for some years.

As the load in South Westland rises, it will be necessary to provide more capacity between Harihari and Whataroa to meet the substantially increased load being supplied south of Whataroa substation. The maximum acceptable load on this circuit without incurring excessive voltage drop is approximately 2 MVA. This gives little margin when supplying the present tourist season peak load of 1.6 MVA, but with current load forecasts is sufficient to avoid any short-term network augmentation initiatives. Additional reactive support has been installed along with the installation of 33 kV regulators at Harihari in 2004 to overcome unacceptable voltage regulation, particularly when Wahapo power station is not running.

Table 5.14 - Subtransmission Projects

ID	Act	Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
40005	RPL	HKK-WTH Pole Upgrade	150	0	0	0	0	0	0	0	0	0
40010	RPL	GYM-KUM 66 kV cct Pole Replacement	45	48	50	54	57	60	64	68	72	72
40015	RPL	Mapourika, Replace substandard poles	0	21	22	24	25	27	28	30	0	0
40013	RPL	Subtransmission condemned pole replacement	50	50	50	15	15	15	15	15	15	15
40011	RPL	Warrens Paddock - Replace Structures	0	50	0	0	0	0	0	0	0	0
40014	RPL	ALD-DOB 33 kV Pole Replacement	0	22	24	25	27	28	30	32	34	34
		Total	**245**	**191**	**146**	**118**	**124**	**130**	**137**	**145**	**121**	**121**

5.11.3 Development

South Westland 33 kV Network

No major development work is planned on this network within the planning period. Any development that does come about will probably be driven by customer requirements.

Other 33 kV Network Projects

Table 5.14 summarises the subtransmission projects for this planning period.

5.12 Distribution - Capital Works

These assets comprise the majority of Westpower's network by distance and value. As a logical result of this, the asset type also accounts for the greatest share of maintenance and enhancement expenditure.

Table 5.15 summarises the distribution projects and programmes for this planning period by category.

Table 5.15 - Distribution Projects and Programmes

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Development	16	67	18	19	20	21	22	24	25	25
Enhancement	100	100	100	100	120	120	120	120	120	120
Replacement	310	271	202	215	227	110	110	110	110	110
Total	**426**	**438**	**320**	**333**	**367**	**251**	**252**	**254**	**255**	**255**

5.12.1 Replacement

Greymouth Area

This is the largest area within Westpower's district and also involves the greatest diversity of line types and conditions.

With a few of the older lines within the Greymouth area and surrounding districts reaching the end of their economic lives, projects have been initiated to replace these lines. Some projects involve the replacement of conductor, and poles, while others will only see the poles being replaced.

5.12.1.1 *Twelve-monthly period (over $30,000)*

41064: Distribution Condemned Pole Replacement

Costs: $180,000 **Project Timeline: April 2014 - March 2015**

As with the sub-transmission poles, most distribution poles replaced have been included in projects that replaced sections of line that were deemed to be reaching replacement criteria. With the shift in asset management strategy to be more maintenance focused, only distribution poles that have been proven to have reached the end of their operational life will be replaced. To prove this, thorough inspection, including the scanning and analysis with the PortaSCAN XBS pole density scanning system will be required.

From time to time it may be more prudent to replace several poles in a section of line if considerations such as re-configuration, landowner issues or outage restrictions warrant this.

Justification

To ensure safety to workers, the public and to reduce faults, poles must be replaced if failure is imminent. Replacement must be balanced with gaining the maximum life from poles, hence the emphasis on detailed assessment before poles are changed out.

Alternative Options Considered

Poles at the end of their operational lives must be replaced, therefore no alternative options are available.

41063 Hokitika Primary School - Hazard Mitigation (2014)

Costs: $50,000 **Project Timeline: July 2014 - August 2014**

Project Justification Score: 74

A public safety assessment has identified an 11 kV overhead line constructed with concrete poles traversing the Hokitika Primary school playing field and could pose a potential hazard. The line is in an area where children are likely to congregate and a very real step-touch potential difference hazard is present. It has been determined that the most effective mitigation measures would be to either convert the 11 kV line to an underground circuit or replace the concrete poles with wooden equivalents. The most effective method is yet to be established.

Justification

The Public Safety Management System process, required in accordance with the Electricity (safety) Regulations 2010, has determined that a hazard to the public is present and steps must be taken to control this hazard.

Alternative Options Considered

The two options available is to replace the concrete poles with wooden equivalents or replace the overhead line with an underground cable. Both options are currently being considered.

41066 TeKinga – Iveagh Bay – Relocate 11 kV Line

Costs: $50,000 **Project Timeline: April 2014 - May 2014**

The Crooked River has dramatically changed its course threatening the 11 kV line supplying the TeKinga and Iveagh Bay area. Measures have been taken to relocate the line away from the river, however this is a temporary relocation and constructing a new line parallel with the Cashmere Bay Road is required to ensure a secure supply is maintained to the area.

Justification

The section of 11 kV line in question supplies a farming and residential area where a secure supply is vital. Should the river take out the existing line a very lengthy supply outage could be expected and new pole positions could be very limited.

Alternative Options Considered

Rock protection on the river was considered however it was deemed impractical given the extent of erosion and the volume of rock that would be required. As the river continues to consume the supporting river bank, the only way to ensure the line does not get washed away is to reroute closer to the road and bridge abutment, which will help to afford a greater level of protection.

5.12.1.2 Two to Five Year Period Projects

Fox Glacier Township - Develop 11 kV Ring (2015-2016) $50,000

A new 11 kV cable and ring main unit was installed behind the Fox Glacier Hotel in 2011-12 with the intention of developing a ring through a newly developed subdivision. The subdivision has not been occupied as expected and the merit of developing the ring was questioned. The new section of cable was to have been installed in the upcoming financial year, but has been deferred until 2014-15 pending uptake of sections at the subdivision.

Nelson Creek State Farm, Re-route and Replace 11 kV Line (2014-2015) $80,000

An assessment in 2008 of hardwood poles at the Nelson Creek State Farm showed that at least four poles need replacing while a number of others are deemed to be in very poor condition. This financial year will see a design carried out to investigate the feasibility of re-routing the line along a recently formed road to avoid the inhospitable terrain currently encountered by workers.

5.12.2 Enhancement

Greymouth Area

As for Reefton, it is possible that unanticipated new industrial load could trigger the need to enhance the network. Notwithstanding this, the network is relatively strong in the Greymouth and lower Grey Valley areas, with supply from major substations at Dobson and Greymouth, and relatively new feeders emanating from both sites.

Hokitika Area

The overall condition of distribution lines in the Hokitika is very good, with almost all lines constructed using either concrete or treated wood poles.

Apart from the specific projects discussed, there is no general enhancement programme planned for Hokitika.

South Westland Area

The distribution network in South Westland is contained in pockets based around Waitaha, Harihari, Whataroa Wahapo, Franz Josef Glacier and Fox Glacier south to Paringa, and is generally in good condition.

As many of the distribution lines in the South Westland area have recently been rebuilt or upgraded, there is unlikely to be a requirement for capacity enhancement. There is a possibility that some small areas may require further work, however, as a result of in-fill development, this is not likely to be significant.

5.12.2.1 Twelve-monthly period (over $30,000)

Conductor Replacement

Costs: $100,000 (per year) Project Timeline: April 2014 - March 2024

Project Justification Score: N/A

Age has caught up with conductors in a number of areas and these will require replacement. Areas in the coastal strip have been identified as needing replacement immediately and the condition assessment programme is continually identifying areas which may need attention. A programme will be initiated to determine the condition of conductors in more detail and a plan will be formulated to stage any replacement required.

Alternative Options Considered

As the conductor replacement is condition driven there are no alternative options available.

Table 5.16 - Distribution Projects

ID	Act	Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
61007	D	Fox Glacier Township - Develop 11 kV Ring	0	50	0	0	0	0	0	0	0	0
51001	E	Conductor Replacement	100	100	100	100	120	120	120	120	120	120
41065	RPL	Berlins 11 kV Line Replacement	30	0	0	0	0	0	0	0	0	0
41061	RPL	Nelson Creek State Farm , Re-route and Replace 11 kV Line	0	80	0	0	0	0	0	0	0	0
41063	RPL	Hokitika Primary School Hazard Mitigation	50	0	0	0	0	0	0	0	0	0
41064	RPL	Replace Condemned Distribution Poles	180	191	202	215	227	110	110	110	110	110
41066	RPL	TeKinga Iveagh Bay - Relocate 11 kV Line	50	0	0	0	0	0	0	0	0	0
		Total	**410**	**421**	**302**	**315**	**347**	**230**	**230**	**230**	**230**	**230**

5.13 Reticulation - Capital Works

Westpower owns a diverse range of reticulation assets, ranging from brand new underground subdivisions, through to 50-year-old overhead wood pole lines.

Tables 5.17 and 5.18 summarise the planned expenditure over the AMP period by category for the reticulation assets.

Table 5.17 - Reticulation Projects and Programmes

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Development	0	0	0	0	0	0	0	0	0	0
Replacement	79	80	82	45	48	50	54	57	60	60
Total	**79**	**80**	**82**	**45**	**48**	**50**	**54**	**57**	**60**	**60**

Table 5.18 - Reticulation Projects

ID	Act	Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
12005	RPL	Replace Condemned Reticulation Poles	29	30	32	20	21	22	24	25	27	27
12009	RPL	Pillar Box Replacement	50	50	50	25	27	28	30	32	33	33
		Total	**79**	**80**	**82**	**45**	**48**	**50**	**54**	**57**	**60**	**60**

5.13.1 Replacement

No major capital works programs are planned. The on-going condition assessment programme may identify replacements for later years.

Reefton Area

The Reefton area comprises a mixture of relatively new underground construction and very old overhead wood pole lines, with very little in between. One advantage Reefton holds is that it is well away from the seacoast and suffers less from the effects of corrosion than most other areas Westpower supplies. For this reason, the overhead lines can remain serviceable at an older age than in other areas.

5.13.1.1 Twelve-Month period (over $30,000)

42012 Pillar Box Replacements

Costs: $50,000 per year **Project Timeline: April 2014 - March 2024**

Project Justification Score: N/A

As with poles, LV pillar boxes are subject to condition deterioration or may be damaged and require replacement. As these pillars are identified they are replaced.

Justification

With LV pillar boxes easily accessible to the public, efforts must be made to ensure these assets are kept safe and secure. It is necessary to replace damaged or condemned pillar boxes to ensure an acceptable condition standard is upheld.

Alternative Options Considered

As public safety is the primary driver for pillar box replacement there are no alternatives available.

42011: Reticulation Condemned Pole Replacement

Costs: $29,000 per year **Project Timeline: April 2014 - March 2024**

As with the sub-transmission poles, and distribution poles, reticulation poles have been included in projects that replaced sections of line that were deemed to be reaching replacement criteria. With the shift in asset management strategy to be more maintenance focused, only reticulation poles that have been proven to have reached the end of their operational life will be replaced. To prove this, thorough inspection, including the scanning and analysis with the PortaSCAN XBS pole density scanning system will be required.

From time to time it may be more prudent to replace several poles in a section of line if considerations such as re-configuration, landowner issues or outage restrictions warrant this.

Justification

To ensure safety to workers, the public and to reduce faults, poles must be replaced if failure is imminent. Replacement must be balanced with gaining the maximum life from poles, hence the emphasis on detailed assessment before poles are changed out.

Alternative Options Considered

Poles at the end of their operational lives must be replaced, therefore no alternative options are available.

Development

Reefton Area

There are no significant development works planned for the Reefton area. Any development that does occur will be on the basis of new customer requirements.

Greymouth Area

New subdivisions often involve the development of reticulation networks that are handed over to Westpower on completion. In most cases, the developer builds these to Westpower’s standards.

Hokitika Area

New subdivisions often involve the development of reticulation networks that are handed over to Westpower on completion. In most cases, the developer builds these to Westpower's standards.

South Westland

New subdivisions often involve the development of reticulation networks that are handed over to Westpower on completion. In most cases, the developer builds these to Westpower's standards.

5.13.1.2 Twelve-Month period (over $30,000)

5.14 Distribution Substations - Capital Works

Table 5.19 summarises the planned expenditure by category for distribution substation-related projects during this AMP period.

Table 5.19 - Distribution Substation Projects and Programmes

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Development	47	50	53	56	59	62	65	69	73	73
Enhancement	40	30	20	20	20	21	21	21	21	21
Replacement	30	0	0	0	0	0	0	0	0	0
Total	**117**	**80**	**73**	**76**	**79**	**83**	**86**	**90**	**94**	**94**

5.14.1 Development

5.14.1.1 Twelve Month Period (over $30,000)

65003: New 11 kV Connections

Costs: $42,000 **Project Timeline: April 2014 - March 2015**

As with new service connections, new 11 kV connections are largely driven by development in the area. Numbers may vary, for example 78 applications for 11 kV supply were processed in 2008 yet the number in 2012 reduced to 36. Given this variation, funding has been set at a median level over the last 4 years.

Justification

Westpower provides an 11 kV connection service which generally includes installation of appropriate fusing (network connection point) and physical connection to the network connection point.

Alternative Options Considered

As the drivers for the connecting of new services is by the customer, there are no alternative options available.

45006 - S648 Britten St - Replace and Relocate Corroded Pad Mounted Sub

Costs: $30,000 **Project Timeline: June 2014 – July 2014**

The transformer at S648 is rusting and needs replacement. The transformer and associated fittings are housed behind a fence on a residential section which is not a preferred location due to access issues. The replacement of the transformer provides the opportunity to relocate the unit to a more suitable location, possibly on the grass berm.

Justification

The transformer at S648 Brittan St is an integral link in the low voltage system in Hokitika and needs to remain.

Alternative Options Considered

Should the transformer remain in service without extensive maintenance, the risk of oil spill due to severe corrosion is real. It is not practical to repair the transformer in situ therefore a replacement unit is required. Although a replacement unit could be installed in the existing location, it has been deemed prudent to remove the transformer from inside the existing enclosed area in private property and moving it to the berm which is far more accessible for inspections and maintenance.

5.14.2 Enhancement

5.14.2.1 Twelve Month Period (over $30,000)

No development projects planned for this year that exceed $30,000

Table 5.20 - Distribution Substation Projects

ID	Act	Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
65003	D	New 11 kV Connections	42	45	48	50	54	57	60	64	68	68
65002	D	New Transformer Sites	5	5	5	5	5	5	5	5	5	5
55002	E	Increase Transformer Site Capacity (Uprate)	20	20	20	20	20	21	21	21	21	21
55008	E	Install Janitza MDI's	20	10	0	0	0	0	0	0	0	0
45006	RPL	S648 Britten St - Replace and relocate corroded pad mounted sub	30	0	0	0	0	0	0	0	0	0
		Total	**117**	**80**	**73**	**76**	**79**	**83**	**86**	**90**	**94**	**94**

5.15 Services - Capital Works

In general, Westpower maintains overhead customer-owned service lines.

Underground service mains are the responsibility of the customer to maintain and they can use any competent contractor to do so.

Westpower also provides the following services free of charge to its customers:-

- Replacement of blown service fuses due to faults;
- Repair of substandard service lines where these were never brought up to standard prior to transferring to the customer;
- Replacement of service poles on the street where these were previously shared with Telecom and are now substandard;
- Repairs to network connection equipment;
- Repairs to service spans across road reserves.

Financial control procedures mean that only approved work is carried out, and that the customer will be required to pay for most work on customer-owned underground service lines.

Table 5.21 summarises the planned expenditure by category for service-related projects during the AMP period.

Table 5.21 - Services Projects and Programmes

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Development	53	56	60	63	67	71	75	80	84	0
Replacement	70	70	70	70	70	50	50	50	50	50
Total	**123**	**126**	**130**	**133**	**137**	**121**	**125**	**130**	**134**	**50**

The on-going replacement of rewireable fuses with HRC types as part of LV replacement projects has significantly reduced the number of premature service fuse failures, which should be reflected in a reduced cost of fault work.

Underground service lines are generally owned by the end customer and, as such, are not maintained by Westpower. However, as discussed above, there are some notable exceptions to this and these create a maintenance liability for Westpower.

Table 5.22 lists the planned expenditure for service projects over the AMP period.

Table 5.22 - Services Projects

ID	Act	Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
63001	D	New Service Connections	53	56	60	63	67	71	75	80	84	0
43002	RPL	Service Pole Replacement	70	70	70	70	70	50	50	50	50	50
		Total	**123**	**126**	**130**	**133**	**137**	**121**	**125**	**130**	**134**	**50**

5.15.1 Development

5.15.1.1 Twelve-Month Period (over $30,000)

63001: New Service Connections

Costs: $53,000 **Project Timeline: April 2014 - March 2015**

New connections are largely driven by development in the area. Numbers may vary, for example 309 applications for supply were processed in 2008 yet the number in 2012 reduced to 193. Given this variation, funding has been set at a median level over the last 4 years.

Justification

Westpower provides a connection service which generally includes installation of appropriate fusing (network connection point) and physical connection to the network connection point.

Alternative Options Considered

As the drivers for the connecting of new services is customer, there are no alternative options available.

5.15.2 Replacement

5.15.2.1 Twelve-Month Period (over $30,000)

43010: Service Pole Replacement

Costs: $70,000 **Project Timeline: April 2014 - March 2015**

Previous years have seen a concerted effort to rid the network of sub-standard service poles. Although many have been replaced there are still service poles deemed condemned during the condition assessment.

Justification

Service poles found to be condemned must be replaced to help ensure a safe and reliable supply.

Alternative Options Considered

As safety and security of supply are the primary drivers for the replacement of service poles, there are no alternative options available.

5.16 Distribution Transformers - Capital Works

The population of distribution transformers covers a diverse range of sizes, types and ages. As such, it is important that a comprehensive management plan is put in place, as the condition of the asset is not always easily discernible on an overall basis.

Westpower's policy is to extend the life of distribution transformers where this is economically feasible. In support of this policy, many distribution transformers run well below their rated values for much of the time, resulting in long lives for the cores and windings. Provided that the tanks and oil are well maintained, the overall unit may be kept in service for up to 55 years. In this way, the maximum return can be leveraged from these high value assets.

Table 5.23 summarises the planned expenditure by category for distribution transformer-related projects during this AMP period.

Table 5.23 - Distribution Transformer Projects and Programmes

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Development	371	393	417	442	468	496	526	558	591	591

5.16.1 Replacement

All replacement units are purchased to Westpower's purchasing specifications, which prescribe galvanised tanks, stainless steel fixings and oil sampling valves to minimise the cost of future maintenance.

5.16.2 Enhancement

Little enhancement work is carried out on distribution transformers, as these are essentially a standard module with no capacity for upgrading. Occasionally, duplex arcing horns may be fitted to existing units where lightning arrestors cannot be used.

5.16.3 Development

New units are purchased to Westpower's purchasing specifications as required. Independent contractors installing new substations for customers may provide new units and hand them over to Westpower on commissioning, provided that test results are satisfactory and that they meet Westpower's purchasing specification.

5.16.3.1 Twelve-Month Period (over $30,000)

68001: Purchase of New Transformers

Costs: $371,000 **Project Timeline: April 2014– March 2015**

As with new service connections and 11 kV connections, the purchase of new transformers are largely dependent on development in the area. The purchase of new transformers fluctuates relative to 11 kV connections, for example 65 transformers were purchased in 2008 as opposed to 29 in 2012.

Justification

As with the 11 kV connection service Westpower will provide a transformer and continue to own and maintain the transformer for those 11 kV connections requiring one.

Alternative Options Considered

As the driver for the purchase of transformer is generally by the customer, there are no alternative options available.

Table 5.24 lists the expenditure for the distribution transformer projects planned for this AMP period as described above.

Table 5.24 - Distribution Transformers Projects

ID	Act	Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
68001	D	Purchase of new transformers	371	393	417	442	468	496	526	558	591	591

5.17 Other - Capital Works

Westpower's four ripple injection plants are all of the same make (Enermet SFU-K series), making lifecycle management easier to implement.

Westpower has also installed an aftermarket stand-alone ripple plant at the Wahapo Zone Substation. This was installed in the existing shed and is used on occasion to provide ripple control to the South Westland area when Wahapo generation is running islanded from the remainder of Westpower's network.

This plant consist of the best available parts from the decommissioned Plessey TR series 75 kVA plants at Reefton, Greymouth and Hokitika.

5.17.1 Replacement

No further replacement work is planned.

5.17.2 Enhancement

The capacity of the existing equipment is fixed and provides ample room for network expansion. No enhancement work is planned.

5.17.3 Development

No new ripple plants are expected to be required for the foreseeable future.

5.18 Overall Work Plan - Capital Works

5.18.1 Replacement

5.18.1.1 Major Refurbishments

Table 5.25 - Replacement Projects and Programmes

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Replacement	1212	1125	877	827	920	546	1580	1437	821	863

It is necessary to retain in service some older lines, which are in poor overall condition. These lines require on-going repairs and refurbishment.

Major refurbishment on all line types is estimated to absorb only a small proportion of the total money proposed to be spent on line work in any year.

5.18.1.2 Wood Poles and Crossarms

It is currently projected that approximately 200 poles will need changing over the next year in order to cope with defects arising on the existing wood pole lines.

Wood poles are being changed to concrete or treated softwood wherever possible, due to the increasingly poor quality and increasing price of imported hardwoods from Australia. Local softwoods of the height and strengths needed are beginning to become more expensive and may require ground-line preservation techniques to extend their in-service life.

The use of concrete poles, providing they can be sourced at the right price from the local supplier, can result in significant savings in on-going maintenance, increased line reliability and increased line worker safety.

5.18.1.3 Conductors and Accessories

As a policy, all replacement ACSR is being purchased with a greased core wire. Where corrosion resistance is critical in coastal areas, all AAAC is used for its superior corrosion resistance properties.

For larger conductors with an aluminium cross-sectional area of over 95 mm^2, Westpower policy is to use AAAC exclusively.

5.18.1.4 Insulators and Insulator Fittings

From the condition assessment programme it is estimated that there are approximately 300 33 kV EPDM strain insulators requiring replacement over the next five years to avoid an unnecessary risk of line drop or fault outages. These insulators have been proven to deteriorate rapidly after ten years; therefore a proactive approach is required to manage the risk of failure.

The replacement of such insulators is a high priority because of its immediate impact on system reliability, and because of the safety risk of line drops if the work is not attended to.

5.18.2 Enhancement

Table 5.26 summarises the planned enhancement works for the planning period.

Table 5.26 - Enhancement Projects and Programmes

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Enhancement	511	415	472	547	513	2209	534	466	442	489

This activity outlines work which is planned to enhance the system. That is, it increases the capacity of the system to:

- Provide more load,
- Enhance voltage regulation,
- Improve security and reliability.

It includes projects (at specific sites) and programmes of related work covering a number of sites.

5.18.3 Development

This section outlines the projects currently anticipated over the planning period. The nature of each project is briefly described along with the reason why it appears to be required. The justifications for including each of the projects in the plan are categorised as described in Section 5, namely:

- Specific customer requests (and commitment to incur project-related charges);
- Anticipated demand growth;
- To meet security planning guidelines;
- Economics (i.e. where the project produces overall cost savings).

Table 5.27 summarises the planned development works for the planning period.

Table 5.27 - Development Projects and Programmes

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Development	680	947	789	719	778	890	843	910	955	814

Table 5.28 outlines the activity and the asset type numbers used for developing the project numbers, which are presented in the following format: year/activity/asset type/project number.

Table 5.28 - Format of Project Numbers

	Activity		Asset Type
1:	I,S&T	0:	Sub-transmission
2:	Faults	1:	Distribution
3:	Repairs	2:	Reticulation
4:	Replacement	3:	Services
5:	Enhancement	4:	Zone Substation
6:	Development	5:	Distribution Sub
		6:	MV Switcgear
		7:	SCADA/Comms/Prot
		8:	Distribution Transformers
		9:	Other

6.0 ASSET LIFECYCLE MANAGEMENT

6.1 Introduction

This section describes the processes used by Westpower to manage the lifecycle of its assets from design and planning through to disposal. A typical lifecycle of any asset consists of the following stages:

- Design and planning,
- Acquisition and installation,
- Maintenance and operation,
- Disposal.

The main drivers for lifecycle management are:

- Reliability/security and quality of supply to meet customer levels of service and contractual obligations;
- Occupational health and safety to establish a safe working environment and comply with OSH legislative safety requirements;
- Regulatory to meet regulations imposed by external organisations;
- Environmental to comply with emission regulations to air, land and water;
- Asset performance/condition use of historical data to assess the performance and condition of the assets and predict potential remaining life;
- Cost efficiency to ensure that maximum cost efficiency is achieved in accordance with asset management policy;
- Corporate image to ensure that any activity carried out by the Asset Management team and subcontractors will not damage Westpower's image.

Details of projected operating expenditure are included in Section 5 under the appropriate asset type. In this way, the reader can readily see the total projected costs for each asset type, along with the OPEX and CAPEX breakdown.

6.2 Maintenance and Operation

6.2.1 Replacement vs. Maintenance Trigger

Westpower has a policy of retiring older assets that have reached the end of their economic life where there is no economic means of providing life extension. Some of the triggers that would suggest a replacement strategy be employed rather than on-going maintenance would include:

- More than 50% of a line section reaching replacement criteria within the following five-year period when other work has to be carried out on that line;
- Technical obsolescence;
- Health and safety concerns (e.g. old oil-filled ring main units);
- Difficulty in obtaining spare parts;
- Inability to meet current needs.

Westpower also experiences severe corrosion in areas near to the sea coast, and it is often more cost effective to install new corrosion resistant fittings rather than continuing to repair existing fittings.

The maintenance triggers are outlined in Table 6.1.

Table 6.1 - Maintenance Triggers by Asset Category

Asset Category	Components	Maintenance Trigger
Zone substations	Fences & enclosures	Monthly checks made of fences with Zone Sub checks, breakages to be repaired. Maintenance fitters to monitor corrosion at ground of galvanised support types.
	Buildings	Landscaping. Exterior of buildings to be kept tidy, especially gardens and lawn. Foam sandwich type buildings to be washed on an annual basis. Items noted that need repair to have service request raised.
	Transformers	Annual DGA Oil sampling. Monthly zone sub checks, including Buchholz inspection, insulator integrity, no oil leaks, etc.
	11 kV & 33kV switchgear	Monthly check of gas pressure, insulator integrity, etc. Maintenance in line with manufacturers manual.
	Instrumentation	Check calibration with CB release as above, particularly transducer inputs to SCADA.
Sub-transmission lines & cables	Poles, arms, stays & bolts	Evidence of pole movement. Evidence of decay/splitting of timber. Evidence of lightning damage.
	Pins, insulators & binders	Evidence of pin corrosion - rusting/necking of the pins. Visibly loose binder. Visibly chipped or broken insulators.
	Conductor	Evidence of "birds nesting" following strand/s breaking. Electrical load increasing beyond conductor capacity.
LV lines & cables	Poles, arms, stays & bolts	Evidence of rot. Loose bolts, moving stays. Displaced arms.
	Pins, insulators & binders	Obviously loose pins. Visibly chipped or broken insulators. Visibly loose binder.
	Conductor	Visibly corroded, splaying or broken conductor.
Distribution substations	Poles, arms & bolts	Evidence of dry-rot. Loose bolts, moving stays. Displaced arms.
	Enclosures	Visible rust. Cracked or broken masonry or fibreglass.
	Transformer	Excessive oil acidity (500kVA or greater). Visible signs of oil leaks. Excessive moisture in breather. Visibly chipped or broken bushings.
	Switches & fuses	Corona discharge monitoring annually.
Distribution lines & cables	Poles, arms, stays & bolts	Evidence of dry-rot. Loose bolts, moving stays. Displaced arms.
	Pins, insulators & binders	Evidence of pin corrosion - rusting/necking of the pins. Visibly chipped or broken insulators.
	Conductor	Evidence of "birds nesting" following strand/s breaking. Evidence of vibration - fit damper.
	Ground-mounted switches	Evidence of pin corrosion - rusting/necking ofthe pins. Long rod types chalking if EPDM type.
	11 kV Switchgear	Corona discharge monitoring annually.

6.2.2 Maintenance

Maintenance work is largely based on the condition of the assets, as outlined in Section 5.

The scope of work planned under each maintenance activity is quantified wherever possible to assist in reviewing Westpower's achievement in future years. The estimated maintenance expenditure is projected in this section and, where relevant, the consequences of the proposed maintenance programmes are noted. It should also be noted that analysis of maintenance strategies and programmes is an on-going process, and the most cost-effective means of maintaining the system is constantly under review. In some instances (e.g. pole replacement), further investigation and analysis are required to determine a suitable strategy.

The maintenance requirements are influenced by development projects, many of which, if they proceed, will lead to dismantling and decommissioning of assets which would otherwise require significant repairs.

The base-line planned maintenance expenditure projections assume, for consistency within this plan, that development projects take place as projected in this section. It will be necessary to monitor closely the likelihood of each project proceeding, and additional remedial work will need to be programmed if certain projects do not proceed or are significantly delayed.

Repairs and Refurbishment

All line repairs are carried out to the requirements laid down in Westpower's line maintenance standards. These are based on international practice combined with local knowledge and New Zealand legislative requirements.

6.2.2.1 Maintenance

Routine Patrols and Inspections

Aerial and ground patrols of sub transmission lines are performed annually. Fault patrols and fault repairs are carried out on an as required basis.

Thermographic surveys are carried out on an annual basis to check for hot joints that could lead to later failure.

These surveys are normally carried out at times of high load such as the winter period to increase the chances of detecting a marginal joint.

A tree-trimming regime has been established due to the high growth experienced on the West Coast.

Table 6.2 shows patrol and inspection frequencies.

Table 6.2 - Routine Patrol and Inspection Frequencies

Voltage	RoutinePatrol	ConditionAssessment	Thermographic-Survey	Corona Dis-chargeSurvey	*Vegetation Survey
33 kV +	9 monthly	5 yearly	2 yearly	2 yearly	2-5 yearly
11 kV	as required	5 yearly	as required	-	2-5 yearly
400 V	as required	5 yearly	-	-	2-5 yearly
33 kV Hendrix Cable	Monthly	5 yearly	-	12 monthly	Monthly
***Note: Vegetation survey dependant on environmental factors.**					

6.2.3 Replacements

Major Refurbishments

It is necessary to retain in service some older lines, which are in poor overall condition, and these lines require on-going repairs and refurbishment.

Major refurbishment on all line types is estimated to absorb only a small proportion of the total money proposed to be spent on line work in any year.

Wood Poles and Crossarms

It is currently projected that approximately 200 poles would need changing over the next year in order to cope with defects arising on the existing wood pole lines.

Wood poles are being changed to concrete poles wherever possible, due to the increasing price of imported hardwoods from Australia.

The use of concrete poles leads to significant savings in on-going maintenance, increased line reliability and increased line worker safety.

Westpower now specifies Purple Heart hardwood for all crossarms that are used on its network, and these are expected to have a long service life.

Conductors and Accessories

As a policy, all replacement ACSR is being purchased with a greased core wire. Where corrosion resistance is critical in coastal areas, AAAC is used for its superior corrosion resistance properties.

For larger conductors with an aluminium cross-sectional area of over 95 mm^2, Westpower policy is to use AAAC exclusively.

Insulators and Insulator Fittings

Earlier concerns about the condition of a number of EPDM 33 kV strain insulators have largely proved to be unfounded, and so a planned replacement for these units is no longer scheduled.

With the exception of a number of glass insulators on the South Westland 33 kV line, which are due to be replaced as part of the line upgrade, all other insulators and fittings are generally in good condition.

6.2.4 Rectifying Westpower Assets

Network defect data captured in the field are incorporated into the general work plan via relevant processes. Although the primary focus of the condition assessment programme is the monitoring of pole and span assets, all asset types are to be included in the near future, with each awarded equal consideration.

Depending on the priority of the identified defect, work could be carried out immediately to rectify the problem; alternatively, the job could be scheduled to be undertaken at a more suitable time.

The status of the work order generated indicates the job's completion, from which regular audits ensure all follow-up administration tasks are completed.

All asset data are returned with an updated "Condition Code". These are separated and analysed for action where needed. Below is a list of the condition codes and the corresponding action that takes place:

Excellent: No further action is required on these assets.

Good: These assets have more than ten years life expectancy and will be assessed again within this term.

Fair: These assets have less than ten years life expectancy and will be assessed again within this term.

Poor: This asset could last up to five years, however, it is in poor condition and future assessment will be required.

Needs replacing: Any assets with this code are grouped into areas along with any other urgent work required. A work order is raised for the asset(s) to be replaced as soon as possible.

Red-tagged: All red-tagged assets are urgently in need of a replacement and because of this, work orders are raised individually for these assets for prompt action.

As well as condition codes, a "work required" table is utilised to drive any maintenance or replacements to assets. The work required table is split into two categories, "urgent" and "non-urgent".

- **Urgent work:** is grouped into geographical areas. A work order is then generated for this area including any assets marked as Needs Replacing or Red Tagged in the "condition" attribute in the asset data. Any asset that requires instant action will have a separate work order raised in order to rectify this issue as soon as possible.
- **Non-urgent work:** is also grouped into areas and, depending on the situation, a work order will be raised straight away or the work is set aside for action during planned outages or when time allows.

6.2.5 Condition Assessment and Vegetation Management

As Westpower has moved to a condition based maintenance regime, two key initiatives have demanded a clearer focus; namely condition assessment and vegetation management. Table 6.3 below shows the expenditure planned on detailed condition assessment across three line asset types. This is critically important in order to ensure that accurate condition data is available to feed into the work planning process. Westpower has mature asset condition assessment processes and the funding detailed below is necessary to ensure that these programs are properly resourced.

Table 6.3 - Condition Assessment

AssetType	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Distribution	320	320	320	339	339	339	339	359	359	359
Reticulation	53	53	53	56	56	56	56	60	60	60
SubTrans	70	70	70	74	87	87	87	92	92	92
Total	443	443	443	470	482	482	482	511	511	511

Vegetation management is also a key ongoing maintenance programme and has a number of drivers including:-

- public health and safety
- legislative compliance
- network reliability

Westpower funds a full-time vegetation management crew whose responsibility is to identify and then carry out vegetation management activities. The prioritisation of the work and final approval is carried out within the Asset Management division.

The manner in which Westpower carries out its vegetation management obligations is determined by the Electricity (Hazards from Trees) Regulations, and this also determines the level of funding required to comply with the regulations.

Table 6.4 shows the proposed vegetation management expenditure across all asset types.

Table 6.4 - Tree Trimming

Category	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015
Vege	486	486	486	509	516	516	516	516	523	523

6.3 Maintenance Programmes

6.3.1 SCADA and Communications

Below is a list of all maintenance works to be completed for SCADA Comms in the next 12 months. These are all on-going budgets that are carried out yearly for the duration of the AMP period.

17001: Communications Configuration in Server Room - $6000

As equipment in the main server room is critical to SCADA a sum has been allowed for IST of this equipment.

17002: Abbey Support Contract - $5000

This is an annual maintenance fee for Abbey Systems support.

17003: Power System Consultants Support Contract - $23,000

This is an annual maintenance fee for Power System Consultants (PSC) support.

17004: Realflex Datac Support Contract - $20,000

This is an annual maintenance fee for Realflex Datac Support Contract.

17005: SCADA General Licences - $20,000

Rockwell and Telemecaniquen license agreements required for SCADA system to operate. Also a contingency has been allowed for other software licenses as needed.

17006: MED Radio Licences - $13,000

Annual licence fees to the Ministry of Economic Development for the radio frequencies used by Westpower.

17007: Repeater Site Co-locations Fees - $90,000

Annual license fees to the site owners for radio repeater sites used by Westpower.

17009: Continual Document and As-build All Comms - $6000

An allowance for continued improvement of Westpower's communications records.

17010: Abbey Sites SCADA, Comms, IS&T - $15,000

Sum for the maintenance visits to Westpower pole top sites these sites are usually Abbey sites but more IP pole tops.

17011: Repeater Sites SCADA, Comms, IS&T - $25,000

Sum for the maintenance visits to Westpower repeater sites.

17012: Zone Subs SCADA,Comms, IS&T - $35,000

Sum for the maintenance visits to Westpower zone substations.

17013: Mt Bonar RSM 25 kHz Frequency Change - $10,000

Configure site to be compliant for changes to 25 kHz frequency changer required by 1 November 2015.

17014: Mt Kak RSM 25 kHz Frequency Change - $10,000

Configure site to be compliant for changes to 25 kHz frequency changer required by 1 November 2015.

17015: ICCP IS&T - $32,000

With the new proposed direct ICCP link to Transpower, an annual connection fee is required. Transpower has provided an estimated of future costs.

17016: Bruce Bay Voce Repeater IS&T - $6,000

With the remoteness of this site and its importance for voice communications in this area a sum has been allocated for its maintenance.

17017: Blue Spur IS&T - $6,000

This hill top site has a high significance to Westpowers communications to the Hokitika area and a specific sum has been allocated for its maintenance.

6.3.2 Subtransmission

10011: River Protection Works

Costs: Subtransmission - $100,000

Project Timeline: April 2014 - March 2015

The frequent heavy rain events experienced on the West Coast can often cause rivers to flood and threaten sub-transmission lines. Areas of concern are the Taramakau River and several rivers in South Westland that have the potential to breach their banks and re-route into the path of Westpower's structures. A design has been completed to install rock along the western bank of the Taramakau River to protect a section of the Greymouth – Kumara 66 kV circuit. For this, and other unexpected river threats, funding has been allocated.

Justification

To ensure structures are protected from the threats that river erosion poses, funds must be allocated to ensure flood protection work is carried out before an extreme event. Areas of concern are generally identified during routine or special line inspections.

Alternative Options Considered

For the reasons listed above, structures must be protected from the threat of erosion and therefore, there are no viable alternative options.

Tree Trimming and Felling

Costs: $486,000 **Project Timeline: April 2014 - March 2015**

The introduction of the Hazards from Trees Regulations 2003 placed a substantial emphasis on trimming and removing trees near power lines. From 2003 to the present day, significant progress has been made in keeping vegetation clear of lines on the Westpower network. This activity has helped to reduce SAIDI's and has vastly improving public safety. As mentioned, many trees have been removed from near lines and will not require a revisit, and a large number of trees have become the responsibility of the landowner, having received the first cut. In accordance with the Hazard from Trees Regulations 2003, these landowners will be required to fund the next trim.

Justification

To adhere to the Hazards from Trees Regulations 2003 and the Electricity Safety Regulations 2010, Westpower must continue to administer and carry out tree trimming work to an acceptable level.

Alternative Options Considered

As the drivers for the continued trimming and felling of trees is safety and regulatory, there are no alternative options available.

Sub-transmission Condition Assessment

Costs: $70,000 **Project Timeline: April 2013 - March 2014**

Condition assessment of all lines has become increasingly important, particularly with the recently introduced maintenance focused asset management strategy. To ensure optimum life levels are gained for each asset, particularly poles, assessment needs to be timely and accurate.

There are in excess of 700 hardwood subtransmission poles on the network, although some are reasonably new (68 on the KUM-KAW 66 cct constructed in 1997). Most of the rest are aging and will require careful and analytic inspection, including scanning with the recently implemented PortaSCAN pole density measuring device.

Given a five-year inspection schedule, 140 wooden subtransmission poles will require detailed inspection and assessment annually. In addition to the wooden poles, there are 1861 concrete sub transmission poles that require regular inspection. As there is no requirement for underground inspection, inspection and assessment times for these are far less than wooden equivalents; however, analysis of assessment results remains similar.

Justification

Best practice asset management calls for regular inspection and assessment of assets, and therefore inspection of sub-transmission assets is required. The condition assessment programme allows identification of defective components and aids in forecasting asset lives, providing a platform for replacement planning.

Alternative Options Considered

As the drivers for the condition assessment of subtransmission assets are safety and regulatory, there are no alternative options available.

Sub-transmission Line Patrols

Costs: $55,000 **Project Timeline: April 2014 - March 2015**

Over the last four years the numbers of sub-transmission line patrols have progressively increased with the use of preventative maintenance scheduling. Many defects have been found and corrected before a fault has occurred and the resulting reports have proved invaluable to provide a snapshot of the state of each line at any time.

A patrol differs from a condition assessment inspection as far as a patrol is a brisk visit to each structure or accessway and a visual inspection is all that is generally required with any defects or anomalies recorded.

As well as routine patrols other patrols, such as after extreme weather events, are also carried out and aid in potential fault identification. The allocated funding allows for the Preventative Maintenance (PM) schedules to be carried out and a contingency for any special patrols that may be required.

Justification

To ensure sub-transmission assets remain safe and operational, regular patrols are critical. Resulting reports containing information such as defective components, potential landowner issues, access issues and safety concerns can generally be addressed before they become a problem.

Alternative Options Considered

The patrolling of lines on a regular basis has been in carried out in earnest only recently and has already provided information that could have prevented faults and/or safety issues. To cease carrying out these patrols could contravene public safety regulations and compromise security of supply.

General Maintenance of Subtransmission Lines

Costs: $160,000 **Project Timeline: April 2014 - March 2015**

A sum is included in the budget for any general line maintenance work that may need to be carried out on any of the subtransmission lines. A variety of defects normally identified during condition assessment or general patrol, need attention and funding is allocated accordingly. Previously work such as repairing guy clamps, straightening leaning earth brackets and poles have been carried out under this funding category.

Justification

As the condition assessment and line patrolling has been progressively ramped up, so has the identification of this type of maintenance work.

Alternative Options Considered

As most defects identified require remedial action, no alternative options are available to ensure a safe and reliable sub-transmission supply.

Weed Spray Access Tracks and Various Line Routes

Costs: $64,000 **Project Timeline: April 2014 - March 2015**

It is imperative that access to poles and structures is kept clear to aid in swift fault response and afford a higher level of safety to workers. Funding is allocated to keep access tracks at an acceptable level, generally by spraying gorse and broom.

Justification

Swift fault response and continual inspections can only be achieved if access to poles and structures are clear of vegetation, allowing vehicle access.

Alternative Options Considered

Although not attending to vegetation on access tracks can be implemented from time to time, generally gorse and broom can get out of control if left for too long. This programme has been re-initiated after being excluded from last year's AMP works schedule, leaving the vegetation to grow for another year would greatly increase the difficulty of getting it back to a manageable level.

Subtransmission Crossarm Replacement

Costs: $50,000 **Project Timeline: April 2014 - March 2015**

The Condition Assessment programme has identified a number of 33 kV crossarms that need to be replaced due to rot.

Justification

Constant monitoring of crossarms and replacement where deemed necessary is required to ensure a safe and reliable supply.

Alternative Options Considered

As the crossarm replacement is condition driven there are no alternative options available.

6.3.3 Distribution

Distribution Condition Assessment

Costs: $320,000 **Project Timeline: April 2014 - March 2015**

Condition assessment of all lines has become increasingly important, particularly with the recently introduced maintenance focused asset management strategy. To ensure optimum life levels are gained for each asset, particularly poles, assessment needs to be timely and accurate.

There are in excess of 3390 wooden distribution poles on the network, which will require a thorough inspection including scanning with the PortaSCAN XBS pole density measuring device.

Given a five year inspection schedule, 680 wooden distribution poles will require detailed inspection and assessment annually. In addition to the wooden poles, there are 9748 concrete distribution poles that require regular inspection. As there is no requirement for underground inspection, inspection and assessment times are far less than wooden equivalents, however analysis of assessment results remains similar.

Justification

Best practice asset management calls for regular inspection and assessment of assets, therefore inspection of distribution assets is required. The condition assessment programme allows identification of defective components and aids in forecasting asset lives, providing a platform for replacement planning.

Alternative Options Considered

As the drivers for the condition assessment of distribution assets are safety and regulatory, there are no alternative options available.

Distribution Line Patrols

Costs: $10,000 **Project Timeline: April 2014 - March 2015**

Generally distribution line patrols are carried out to establish the cause of a fault, however it is intended to include 11 kV critical lines in PM schedules similar to that awarded to sub-transmission lines.

A patrol differs from a Condition Assessment inspection as far as a patrol is a brisk visit to each structure or access way and a visual inspection is all that is generally required with any defects or anomalies recorded.

As well as routine patrols, other patrols such as after extreme weather events are also carried out and aid in potential fault identification. The allocated funding allows for the PM schedules to be carried out and a contingency for any special patrols that may be required.

Justification

To ensure distribution assets remain safe and operational, regular patrols are critical. Resulting reports containing information such as defective components, potential landowner issues, access issues and safety concerns can generally be addressed before they become a problem.

Alternative Options Considered

The patrolling of lines on a regular basis has been carried out in earnest only recently and has already provided information that could have prevented faults and/or safety issues. To cease carrying out these patrols could contravene public safety regulations and compromise security of supply.

11 kV Crossarm Replacements

Costs: $65,000 **Project Timeline: April 2014 - March 2015**

Condition assessment and patrols have identified a number of distribution crossarms that have deteriorated to the point where replacement is required.

Over 600 distribution crossarms have been identified to be in “Needs Replacing” or worse condition, however it is planned to carry out more detailed aerial inspections to more accurately determine the extent of the issue.

Justification

To prevent conductor drop, all crossarms need to be capable of withstanding the loads placed upon them, even in the most extreme weather events. Given this, crossarms must be checked and replaced where required.

Alternative Options Considered

As crossarms are critical to the overall support of conductors, as mentioned, they must be capable of supporting loads expected of them. Therefore there is no alternative option than to replace defective crossarms.

Inspect and Replace Helities with Armourods and Binder

Costs: $50,000 **Project Timeline: April 2014 - March 2015**

In the eighties and early nineties heli-ties were used to secure many 11 kV aluminium conductors to insulators. Over time some these heli-ties have been found to have deteriorated and corroded to point where failure has occurred. A PSMS investigation has prompted a heli-tie inspection programme which will determine the condition of these components and replaced with the more reliable armour rods and binder where required.

Justification

To prevent conductor drop, conductors must be securely fastened to insulators. Allowing heli-ties to corrode to failure point would compromise public and worker safety as well as network security.

Alternative Options Considered

As the correct securing of conductors to insulators is critical to the safe and efficient operating of any power line, no other alternatives have been considered.

6.3.4 Reticulation

Reticulation Condition Assessment

Costs: $48,000 **Project Timeline: April 2014 - March 2015**

Condition assessment of all lines has become increasingly important, particularly with the recently introduced maintenance focused asset management strategy. To ensure optimum life levels are gained for each asset, particularly poles, assessment needs to be timely and accurate**.**

There are nearly of 700 wooden reticulation poles on the network, which will require a thorough inspection including scanning with the PortaSCAN XBS pole density measuring device.

Given a five year inspection schedule, 138 wooden reticulation poles will require detailed inspection and assessment annually. In addition to the wooden poles, there are 1580 concrete reticulation poles that require regular inspection. As there is no requirement for underground inspection, inspection and assessment times are far less than wooden equivalents, however analysis of assessment results remains similar.

There are also 3042 pillar boxes that require assessment, which includes a thorough inspection of the interior and exterior components of each pillar.

Justification

Best practice asset management calls for regular inspection and assessment of assets, therefore inspection of reticulation assets is required. The condition assessment programme allows identification of defective components and aids in forecasting asset lives, providing a platform for replacement planning.

Alternative Options Considered

As the drivers for the condition assessment of reticulation assets are safety and regulatory, there are no alternative options available.

Reticulation Crossarm Replacements

Costs: $47,000 **Project Timeline: April 2014 - March 2015**

Condition assessment and patrols have identified a number of reticulation crossarms that have deteriorated to the point where replacement is required.

Justification

To prevent conductor drop, all crossarms need to be capable of withstanding the loads placed upon them, even in the most extreme weather events. Given this, crossarms must be checked and replaced where required.

Alternative Options Considered

As crossarms are critical to the overall support of conductors, as mentioned, they must be capable of supporting loads expected of them. Therefore there is no alternative option than to replace defective crossarms.

6.3.5 Distribution Substations

Distribution Sub Inspections – Testing of Earths etc

Costs: $138,000 **Project Timeline: April 2014 - March 2015**

In accordance with best industry practice, all distribution substations are to be visited and visually inspected on a bi-annual basis and thoroughly inspected at six year cycles which include earth testing, bonding tests and a general assessment of condition observed and recorded. Of the 2320 active distribution subs on the network, 464 are to be thoroughly inspected each year.

Justification

To ensure a safe and reliable supply, transformer sites on the network must be kept at a high standard of maintenance. Public safety is paramount, therefore any work required to minimise or eliminate potential hazards from must be promptly attended to.

Alternative Options Considered

As safety and reliability of supply are the foremost drivers for substation upgrades there are no alternate options available.

Relocate Sub Fuses for 11 kV Spurs

Costs: $15,000 **Project Timeline: April 2013 – March 2014**

To assist in minimising outages on main line feeders, a project is to be initiated to relocate any HV fuses on spur lines from the substation pole to the main line take-off. This will ensure that any faulted component on the spur will only blow the fuses on the spur and not trip the nearest main line protection device.

Justification

Relocating spur line fuses to the main line take-off will reduce outages on 11 kV feeders by isolating the faulted spur line, avoiding main line circuit breaker trips.

Alternative Options Considered

As reliability of supply is the foremost driver for relocating fuses to the main line take off poles, there are no alternate options available.

Distribution substation upgrades

Costs: $150,000 **Project Timeline: April 2014 - March 2015**

Due to the inherent dangers a substandard distribution substation may pose, funds have been allocated to ensure the condition of these sites are kept up to a suitable level. All distribution substations on the Westpower network are fitted with lightning arrestors, approved drop-out fuses and an earthing system installed to a standard approved by Westpower and which meet all regulatory requirements. To avoid potential EPR issues and to ensure a safe reliable supply is provided from a distribution substation, frequent earth tests are carried out and replacement of substation components are undertaken where required. Although the probabilistic approach to distribution earthing as discussed in the EEA earthing guide will be adopted by Westpower and the pending commissioning of the Ground Fault Neutraliser (GFN) will mitigate dangers posed by inadequate earthing of distribution substations in the Greymouth area, all 2300 distribution substations on the network will need to remain in good condition.

The last few years have seen a push to have 9 kV lightning arrestors replaced with 12 kV units, primarily on substations emanating from the Reefton and Greymouth zone substation feeders. This was due to the installation of a NER unit in Reefton and the GFN in Greymouth which necessitated 12 kV arrestors be installed. As these areas have been completed, distribution subs in other areas will be inspected first and upgraded if required.

Justification:

As mentioned, Westpower intends to adopt a probabilistic approach to distribution substation earthing, which will see a higher degree of preventive measures to mitigate potential EPR problems in areas frequented by the public such as schools, parks and meeting places. This does not, however, absolve Westpower of its responsibility to ensure all distribution substations are safe and reliable. With this in mind, the upgrade programme must continue to guarantee that these obligations are met.

Alternative options considered:

As suitable earthing, lightning arrestors, HV and LV fuses are all essential components on a distribution transformer site, which are all prone to environmentally induced degradation, no alternative options have been considered. While the GFN in Greymouth and, to a lesser extent, the NER in Reefton have eased the emphasis previously placed on the earthing system impedance of distribution substations in those areas, maintaining effective earthing systems will continue to be a focus for the company.

6.4 Subtransmission Assets

As discussed in Section 3, this asset class involves 33 kV and 66 kV power lines. The 66 kV assets are leased to Transpower and are a critical factor in the reliability of the national grid in the area. Accordingly, a higher standard of care and maintenance is required.

Table 6.3 - Subtransmission Projects and Programmes - Maintenance

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Faults	25	25	25	27	27	27	27	29	29	29
Inspect, Service and Test	672	593	594	580	600	602	602	628	635	635
Repairs	34	34	34	36	36	36	36	38	38	38
Total	**731**	**652**	**653**	**643**	**663**	**665**	**665**	**695**	**702**	**702**

6.4.1 Greymouth-Kumara 66 kV Line

The age of this asset is approaching midlife, requiring increased levels of inspection to manage risk and identify early signs of deterioration.

6.4.1.1 Maintenance

Routine Patrols and Inspections

An aerial and ground patrol of this line is performed annually. Fault patrols and fault repairs are carried out on an as-required basis.

In addition to patrols, a detailed inspection of the entire line is regularly carried out. During this inspection, every aspect of the line is checked and recorded. The results will determine the extent of maintenance to be carried out in the coming years.

A 100% ground-line inspection, including ultrasonic pole density analysis, was carried out in 1998 to give a baseline for future inspections.

Thermographic surveys are carried out on an annual basis to check for hot joints that could lead to later failure. These surveys are normally carried out at times of high load such as the winter period to increase the chances of detecting a marginal joint.

A tree trimming regime has been established due to the high growth experienced on the West Coast. This entails the subtransmission lines being cleared of vegetation every two years so as to reduce the incidence of accidental contact during stormy conditions.

6.4.1.2 Faults

The level of fault occurrence is closely linked to condition of the asset and to external factors such as climatic conditions.

As far as climatic conditions are concerned, lightning and windstorms are usually the greatest sources of problems. This line has also developed transient earth faults during wet weather after long dry spells, possibly symptomatic of insulator contamination, but this is very rare.

It is very difficult to predict the number of faults from year to year due to climatic conditions. An estimate for fault work is provided based on information in the Maximo Asset Works Management System (AWMS) now used by the asset management division.

6.4.1.3 Repairs and Refurbishment

All line repairs are carried out to the requirements laid down in Westpower's line maintenance standards. These are based on international practice, combined with local knowledge and legislative requirements.

A decision will be made on possible insulation replacement toward the middle of the planning period once quantitative data have been gathered on the actual condition of the current insulators.

6.4.2 Kumara-Kawhaka 66 kV Line

6.4.2.1 Maintenance

Routine Patrols and Inspections

Fault patrols and fault repairs are carried out on an as-required basis.

This line, although only 17 years old, will be included in the condition assessment programme, with 20% of the line thoroughly inspected annually. This will be in addition to a twice-yearly ground patrol and annual patrol.

All joints used are of the compression type and were carefully tested with a micro-ohmmeter during installation. As a result, thermograph surveys are unlikely to be of any benefit throughout the planning period and are not planned for.

6.4.2.2 Faults

The level of fault occurrence is closely linked to condition of the asset and to external factors such as climatic conditions.

As far as climatic conditions are concerned, lightning is the most likely cause of problems. In the time that the line has been in service, it has only sustained one transient fault, and this was during a severe lightning storm.

6.4.2.3 Repairs and Refurbishment

No repairs or refurbishment is planned for this line. Trees likely to cause a problem were cleared from the route prior to construction and will not impact on the reliability of the line during the first half of the planning period.

6.4.3 North Westland 33 kV Network

With the exception of the Dobson-Arnold line, all of the lines in this area were constructed since 1984, giving a maximum age of only 30 years. The median age of this asset group is less than ten years.

The age of the Dobson-Arnold line (around 60 years) warrants higher levels of inspection and refurbishment. In addressing this matter, a programme has been implemented to renew any pole identified as defective over a five-year period.

6.4.3.1 Maintenance

Routine Patrols and Inspections

Fault patrols and fault repairs are carried out on an as-required basis.

In addition to patrols, a detailed inspection of this line is to be carried out on a rolling five-year basis, covering 20% of the route length per year. During the inspection, every aspect of the line is checked. The aim is to identify and document all components that do not meet Westpower's standards.

The Dobson-Arnold line had a major inspection completed in 1997 which included an assessment of pole and hardware condition as well as an estimate of the pole safety factors in terms of bending moment. All poles were shown to be adequate at the time; however, the age of the line means that annual general inspections will continue to be carried out.

All pole hardware will be included in the inspections.

A regular annual thermographic survey will be carried out on these lines to monitor the condition of the joints.

6.4.3.2 Faults

The level of fault occurrence is closely linked to condition of the asset and to external factors such as climatic conditions.

As far as climatic conditions are concerned, lightning and windstorms are usually the greatest sources of problems.

It is very difficult to predict the number of faults from year to year, due to climatic conditions. An estimate for fault work is provided based on information gathered in the Maximo and GIS software now used by the asset management group.

6.4.3.3 Repairs and Refurbishment

All line repairs are carried out to the requirements laid down in Westpower's line maintenance standards. These are based on international practice combined with local knowledge and legislative requirements.

With the above exceptions, no repair or refurbishment work is required on the concrete pole lines because of the low average age.

The Arnold-Dobson line will require individual pole replacement as well as reconductoring and reinsulation within the next ten years unless a planned enhancement project proceeds.

6.4.4 South Westland 33 kV Network

Much of the network in South Westland was constructed at the same time as that in North Westland and the same comments apply to both areas.

South Westland does have some unique features, with the fully insulated overhead cable routes around Lakes Wahapo and Mapourika, requiring special management.

The Mount Hercules line, with an age of 34 years, has been refurbished over the last four years due to the deterioration of poles and conductors. This line provides an essential link to South Westland, thus demanding priority within maintenance programmes.

With the addition of the Fox Glacier 33/11 kV substation on the network in 2003, the 11 kV line from Franz Josef to Fox Glacier was uprated to 33 kV. This line had major refurbishment work carried out at this time and should not need any further major maintenance work for some years.

6.4.4.1 Maintenance

Routine Patrols and Inspections

Fault patrols and fault repairs are carried out on an as-required basis.

In addition to patrols, a detailed inspection of this line is to be carried out on a rolling five-year basis, covering 20% of the route length per year. During the inspection, every aspect of the line is checked. The aim is to identify and document all components that do not meet Westpower's standards.

All pole hardware will be included in the inspections.

A regular annual thermographic survey will be carried out on these lines to monitor the condition of joints.

6.4.4.2 Faults

The level of faults in this area is similar to that in North Westland. It may be reasonably argued, however, that the incidence of heavy rain, strong winds and lightning is slightly higher than in other areas.

6.4.4.3 Repairs and Refurbishment

All line repairs are carried out to the requirements laid down in Westpower's line maintenance standards. These are based on international practice combined with local knowledge and legislative requirements.

Table 6.6 summarises the subtransmission projects for this planning period.

Tables 6.6 - Subtransmission Projects - Maintenance

ID	Act	Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
10012	I	Weed Spray Access Tracks and Various Line Routes	64	64	64	68	68	68	68	72	72	72
10006	I	General Maintenance of sub-transmission lines (IS&T)	160	160	160	170	170	170	170	180	180	180
10011	I	River Protection Works for Subtransmission Lines	100	20	20	21	21	21	21	22	22	22
10001	I	Access Road Maintenance	55	55	55	58	58	58	58	61	61	61
10004	I	Corona Discharge Testing at Various Subtransmission Lines	5	5	6	7	7	8	8	8	8	8
10013	I	Subtransmission Crossarm Replacement	50	50	50	10	10	10	10	10	10	10
11012	I	Analysis PortaSCAN Results	3	4	4	4	4	5	5	5	5	5
		Total	**437**	**358**	**359**	**338**	**338**	**340**	**340**	**358**	**358**	**358**

6.5 Distribution Assets

These assets comprise the majority of Westpower's network by distance and value. As a logical result of this, the asset type also accounts for the greatest share of maintenance and enhancement expenditure.

Table 6.7 summarises the distribution projects and programmes for this planning period by category.

Table 6.7 - Distribution Projects and Programmes -Maintenance

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Faults	264	264	264	280	279	279	279	296	296	296
Inspect, Service and Test	1849	1709	1706	1723	1713	1680	1712	1776	1805	1833
Repairs	53	53	53	56	56	56	56	59	59	59
Total	**2166**	**2026**	**2023**	**2059**	**2048**	**2015**	**2047**	**2131**	**2160**	**2188**

6.5.1 Reefton Area

The main feeders in the Reefton Area have been completely replaced over the last ten years, with the exception of parts of the Reefton Township and Inangahua to the Iron Bridge.

6.5.1.1 Maintenance

Routine Patrols and Inspections

The 2014-15 financial year will see the continuation of the condition assessment programme. Each line (feeder) is to be inspected on a rolling five-year basis, covering 20% of the route length per year. During the inspection, every aspect of the line is checked.

Fault patrols and fault repairs are carried out on an as-required basis.

6.5.1.2 Faults

Faults in the Reefton area, like many others, are dependent on climatic conditions.

Trees have been a major problem in this area, particularly on the Garvey's Creek line, which runs through heavily forested areas, including a pine plantation. A major tree-trimming project in 1998, coupled with harvesting of mature pine trees in the pine plantation, has reduced this risk, but it is still considerable.

A fault base will be maintained in the Reefton area contracted to ElectroNet Services for the foreseeable future to minimise the repair times that are involved during outage.

6.5.1.3 Repairs and Refurbishment

The condition assessment project discussed previously is likely to highlight several components requiring replacement on those lines. This will be handled by a liveline refurbishment programme including individual pole, crossarm, insulator and conductor replacement where required.

6.5.2 Greymouth Area

This is the largest area within Westpower's district and also involves the greatest diversity of line types and conditions.

6.5.2.1 Maintenance

Routine Patrols and Inspections

The 2014-15 financial year will see the continuation of the condition assessment programme. Each line (feeder) is to be inspected on a rolling five-year basis, covering 20% of the route length per year. During the inspection, every aspect of the line is checked.

As for the Reefton area, it is expected that this will form the basis of a repair programme involving individual component replacements throughout the planning period.

Fault patrols and fault repairs are carried out on an as-required basis.

A regular annual thermograph survey will be carried out on selected high-density lines to monitor the condition of joints.

6.5.2.2 Faults

Faults in the Greymouth area are normally caused by wind and lightning.

Trees have been a major problem in this area, and a regular tree-trimming programme carried out at a feeder level will contain this.

The base for Westpower's contractor ElectroNet Services is located in Greymouth, and this will continue to serve as a fault base for the area.

6.5.2.3 Repairs and Refurbishment

Previous inspection projects have highlighted several components requiring replacement on the Nelson Creek, Blackball, Haupiri and Kopara lines.

An on-going programme to replace very old service poles will continue as required.

6.5.3 Hokitika Area

The overall condition of distribution lines in the Hokitika is very good, with almost all lines constructed using either concrete or treated wood poles.

6.5.3.1 Maintenance

Routine Patrols and Inspections

A condition assessment programme will be continued to identify substandard components or construction methods.

Similar to that in the Reefton area, it is expected that this will form the basis of a repair programme involving individual component replacements throughout the planning period. After the initial inspection, the line is to be inspected on a rolling five-year basis, covering 20% of the route length per year.

Fault patrols and fault repairs are carried out on an as-required basis.

6.5.3.2 Faults

Faults in the Hokitika area are normally caused by wind and lightning, with trees falling through the line also being a common occurrence.

A fault base will be maintained in the Hokitika area and contracted to ElectroNet Services.

6.5.3.3 Repairs and Refurbishment

An on-going programme to replace very old service poles will continue as required.

6.5.4 South Westland Area

The distribution network in South Westland is contained in pockets based around Waitaha, Harihari, Whataroa Wahapo, Franz Josef Glacier and Fox Glacier south to Paringa, and is generally in good condition.

6.5.4.1 Maintenance

The lines around Waitaha, Harihari and Whataroa have been substantially rebuilt over the last ten years and are generally in excellent condition, requiring little planned maintenance work.

Routine Patrols and Inspections

The Okarito line (from the Wahapo substation) is a wood pole line constructed in the 1970s. Although this line is in reasonable condition for its age, it will now require a higher level of inspection and servicing as it reaches mid-life.

As for other areas, it is expected that this will form the basis of a repair programme involving individual component replacements throughout the planning period.

The line is to be inspected on a rolling five-year basis, covering 20% of the route length per year.

Fault patrols and fault repairs are carried out on an as-required basis.

6.5.4.2 Faults

Faults in the South Westland area are normally caused by wind and lightning.

A notable feature of South Westland, particularly the Whataroa area, is the incidence of very strong easterly winds. This can, at times, result in outages as branches and other debris gets caught up in the distribution network.

A fault base will be maintained in the Harihari area and contracted to ElectroNet Services.

6.5.4.3 Repairs and Refurbishment

An on-going programme to replace very old service poles will continue as required.

Any poles identified as reaching replacement criteria as a result of the pole inspection programme will be replaced as required, but these are not expected to comprise a significant number because of the age involved.

Table 6.8 details the planned expenditure over the AMP period for each of the above described projects.

Table 6.8 - Distribution Projects - Maintenance

ID	Act	Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
11003	I	Purchase of Aerial Photography	5	5	25	25	25	25	25	5	5	5
11014	I	Inspect and Replace Helities with Armourods and Binder	50	50	50	0	0	0	0	0	0	0
11005	I	River Protection Works for Distribution Lines	100	20	20	21.2	21	21	21	22	22	22
11008	I	Develop Network Standards	50	0	0	0	0	0	0	0	0	0
11006	I	Analysis of Network Components	11	11	11	11.66	12	12	12	13	13	13
11015	I	Measure and Record Ground-Conductor Clearance for High Load Routes	15	5	0	0	0	0	0	0	0	0
11011	I	11 kV Crossarm replacements	65	65	40	40	40	40	60	60	64	64
11012	I	Analysis PortaSCAN Results	16	16	16	16.96	17	17	5	18	18	18
11013	I	PortaSCAN XBS Lease	21	21	25	25	25	28	28	28	32	32
11016	I	Repair Damaged Concrete Poles	20	20	20	20	20	15	15	15	10	10
11017	I	Operational Support	50	50	50	50	50	0	0	0	0	0
		Total	**403**	**263**	**257**	**210**	**210**	**158**	**166**	**161**	**164**	**164**

6.6 Reticulation Assets

Westpower owns a diverse range of reticulation assets, ranging from brand new underground subdivisions, through to 50-year-old overhead wood pole lines.

Tables 6.9 and 6.10 summarise the planned expenditure over the AMP period by category for the reticulation assets.

Table 6.9 - Reticulation Projects and Programmes - Maintenance

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Faults	23	23	23	24	24	24	24	24	24	24
Inspect, Service and Test	240	200	195	156	157	157	147	157	157	157
Repairs	21	21	21	22	22	22	22	23	23	23
Total	**284**	**244**	**239**	**203**	**203**	**203**	**193**	**204**	**204**	**204**

Table 6.10 - Reticulation Projects - Maintenance

ID	Act	Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
12008	I	Replace LV Links	5	5	5	5.3	6	6	6	7	7	7
12016	I	Replace Bare LV Neutrals	30	10	10	10	10	10	0	0	0	0
12001	I	Data Collection of LV Circuits	25	5	0	0	0	0	0	0	0	0
12014	I	Replace condemned reticulation crossarms	47	47	47	0	0	0	0	0	0	0
		Total	**107**	**67**	**62**	**15**	**16**	**16**	**6**	**7**	**7**	**7**

6.6.1 Reefton Area

The Reefton area comprises a mixture of relatively new underground construction and very old overhead wood pole lines, with very little in between. One advantage of this area is that it is well away from the seacoast and suffers less from the effects of corrosion than most other areas within Westpower. For this reason, the overhead lines can still be in serviceable condition at an older age than in other areas.

6.6.1.1 Maintenance

Routine Patrols and Inspections

As with the distribution lines, the 2014-15 financial year will see the continuation of the condition assessment programme. Each line (feeder) is to be inspected on a rolling five-year basis, covering 20% of the route length per year. During the inspection, every aspect of the line is checked.

As for other areas, it is expected that this will form the basis of a repair programme involving individual component replacements throughout the planning period.

Fault patrols and fault repairs are carried out on an as-required basis.

6.6.1.2 Faults

Faults are limited to the occasional substation fuse blowing or the failure of a pole, either during high winds or when hit by a vehicle. Fault staff in the area are able to handle these faults locally.

6.6.1.3 Repairs and Refurbishment

Any poles identified as reaching replacement criteria as a result of the pole inspection programme will be replaced as required, and if the level in particular sections of line exceeds 50% of the line value, this will be upgraded to a replacement programme for that section.

It is expected that most remedial work will be accomplished through simple component replacement.

6.6.2 Greymouth Area

The comments that applied to Reefton reticulation assets apply also to Greymouth, except that the relative amount of very old wood pole lines is greatly reduced. The reason for this is the major replacement programme completed in the 1990s.

6.6.2.1 Maintenance

Routine Patrols and Inspections

As with Reefton, a detailed condition assessment programme will be continued.

Fault patrols and fault repairs are carried out on an as-required basis.

6.6.2.2 Faults

Faults are limited to the occasional substation fuse blowing or the failure of a pole, either during high winds or when hit by a vehicle.

Fault staff in the area are able to handle these faults locally.

6.6.2.3 Repairs and Refurbishment

Any poles identified as reaching replacement criteria as a result of the pole inspection programme will be replaced as required. If the level in particular sections of line exceeds 50% of the line value, this will be upgraded to a replacement programme for that section.

It is expected that most remedial work will be accomplished through simple component replacement.

6.6.3 Hokitika Area

Most of the reticulation in Hokitika has been undergrounded as part of major replacement programmes in the 1980s. As result, these assets are in excellent condition. Only a small number of pockets of overhead reticulation remain, and those that do are concrete pole lines, also in good condition.

6.6.3.1 Maintenance

Routine Patrols and Inspections

No planned inspections are planned on the underground reticulation.

Fault patrols and fault repairs are carried out on an as-required basis.

6.6.3.2 Faults

Faults are limited to the occasional substation fuse blowing or the failure of a pole, either during high winds or hit by a vehicle. Fault staff in the area, are able to handle these faults locally.

6.6.3.3 Repairs and Refurbishment

It is expected that most remedial work will be accomplished through simple component replacement.

6.6.4 South Westland

Most of the reticulation in the townships of Harihari, Franz Josef and Fox Glacier was undergrounded as part of major replacement programmes in the 1980s. As a result, these assets are in excellent condition. Only a small number of pockets of overhead reticulation remain, and those that do are concrete pole lines, also in good condition.

6.6.4.1 Maintenance

Routine Patrols and Inspections

No inspections are planned on the underground reticulation.

Fault patrols and fault repairs are carried out on an as-required basis.

6.6.4.2 Faults

Faults are limited to the occasional substation fuse blowing or the failure of a pole, or when a pillar box is hit by a vehicle. Fault staff from the area, are able to handle these faults locally.

6.6.4.3 Repairs and Refurbishment

It is expected that most remedial work will be accomplished through simple component replacement.

6.7 Services

In general, Westpower does not carry out maintenance on customer-owned service lines. These are the responsibility of the customer to maintain and they can use any competent contractor to do so. There are several exceptions to this general rule, however, including:

- Replacement of blown service fuses due to faults;
- Repair of substandard service lines where these were never brought up to standard prior to transferring to the customer;
- Replacement of service poles on the street where these were previously shared with Telecom and are now substandard;
- Repairs to network connection equipment;
- Repairs to service spans across road reserves.

Financial control procedures mean that only approved work is carried out, and that the customer will be required to pay for most work on customer-owned service lines.

Table 6.11 summarises the planned expenditure by category for service-related projects during the AMP period.

Table 6.11 - Services Projects and Programmes - Maintenance

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Faults	89	89	89	94	94	94	94	100	100	100
Inspect, Service and Test	56	56	41	42	43	43	43	44	44	44
Repairs	6	6	6	6	6	6	6	7	7	7
Total	**151**	**151**	**136**	**143**	**143**	**143**	**143**	**151**	**151**	**151**

The on-going replacement of rewireable fuses with HRC types as part of LV replacement projects has significantly reduced the number of premature service fuse failures, which should be reflected in a reduced cost of fault work.

Service lines are generally owned by the end customer and, as such, are not maintained by Westpower. However, as discussed above, there are some notable exceptions to this and these create a maintenance liability for Westpower.

Table 6.12 lists the planned expenditure for service projects over the AMP period.

Table 6.12 - Services Projects - Maintenance

ID	Act	Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
13001	I	Greymouth, Upgrade Under-veranda Lighting	15	15	0	0	0	0	0	0	0	0

6.8 Zone substations

Table 6.13 summarises the planned expenditure by category for zone substations projects during the AMP period.

Table 6.13 - Zone Substation Projects and Programmes - Maintenance

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Faults	6	6	6	6	6	7	7	8	8	8
Inspect, Service and Test	713	776	685	687	730	767	813	857	903	933
Repairs	76	78	78	78	83	88	94	99	105	108
Total	**795**	**860**	**769**	**771**	**819**	**862**	**914**	**964**	**1016**	**1049**

6.8.1 Inspections, Servicing and Testing

Westpower's station equipment is to be routinely inspected, tested and serviced in accordance with the requirements of Westpower's maintenance standards relevant to the actual equipment. These standard requirements, which define the scope and frequency of work, are reflected in maintenance schedules for individual stations.

Preventative maintenance plans (PMs) have been prepared for each station asset type set to a frequency as determined by Westpower's maintenance standards for that specific asset type.

Job plans are attached to each PM detailing the work plan for the maintenance required.

The intervals vary according to the equipment and its location. Special inspections and tests are also included in maintenance schedules or may be arranged as required.

Work identified as a result of the routine inspections and tests is budgeted for as repairs and refurbishment.

Station Inspections and Testing

Westpower's station maintenance involves a general monthly station inspection in accordance with specified procedures, from which reports are derived. Other station inspections incorporate annual Thermovision, corona discharge, partial discharge inspections, fire protection and security.

Switchgear

Oil-insulated switchgear is regularly inspected and the oil is changed as necessary depending on the results of breakdown tests, or when there are obvious visual signs of high carbon content. Extra servicing is carried out where the switchgear has sustained a higher than normal level of "heavy" faults.

Male and female contacts are checked for wear, and dressed or replaced as necessary.

Vacuum or SF6 gas insulated switchgear undergoes regular visual inspection including checks of SF6 gas pressure.

A baseline ultrasonic discharge investigation was carried out early in 1999 for substations with 11kV indoor switchgear, and this has formed the basis for future studies, which are carried out at regular intervals.

Thermovision and partial discharge inspections are carried out on all switchgear on an annual basis.

6.8.1.1 Protection

It should be noted that "maintenance" on protection equipment is essentially "recalibration/testing" rather than the conventional view of maintenance, which would imply replacement of consumable parts. Protection maintenance is mainly required to reaffirm that the protection is calibrated within tolerance and will operate when called upon to do so.

There are international trends towards reduced maintenance. Typically, intervals are being increased to between four and eight years in other utilities comparable to Westpower, particularly where microprocessor (numerical) protection systems are used. These protections have in-built self-testing and monitoring routines which reduce the necessity for manually driven maintenance testing.

A new fully-automated protection relay test set has been introduced to facilitate maintenance testing. This will be used for commissioning of new protection (developments and enhancements) as well as maintenance.

The protection expenditure planned over the review period is mainly in the following areas:

- Replacement of outdoor junction boxes;
- Replacement of aged feeder protection and controls;
- Replacement of lead-acid batteries with sealed cells;
- Seismic strengthening of protection panels;
- Seismic restraints for batteries;
- Installation of Direct Current (DC) monitoring and distribution panels.

6.8.1.2 Power Transformer Servicing and Testing

As part of Westpower's maintenance programme, all major power transformers have an annual minor maintenance service which encompasses a visual inspection, routine diagnostic tests and minor repair work in accordance with Westpower's standards which incorporate manufacturers' recommendations and Westpower's experience.

In general, maintenance on the transformers consists of maintaining oil within acceptable dielectric and acidity standards, patching up corrosion, fixing oil leaks and annual diagnostic tests on the insulating oil. In addition, the units fitted with OLTCs require periodic inspection of the tapchangers, and the contacts are dressed or replaced as necessary. Additional remedial work required outside the scope of the maintenance contract is referred to Westpower for further action and budgeted as repairs and refurbishment.

6.8.1.3 Oil Testing- Oil Conductivity and Dissolved Gas Analysis

Over the last nine years, all zone substations have had Dissolved Gas Analysis (DGA) tests carried out, and these have identified potential problems that need monitoring. This will be followed up by further annual oil conductivity and DGA tests until trends are reliably established. Once this is done, the period will be reviewed, possibly on an individual unit basis.

Costing for minor maintenance is very dependent on location and has been based on the present maintenance expenditure.

Costing for major maintenance, e.g. OLTCs, is not only dependent on the location of the site but also the usage and types of unit. Some units have to be serviced every two years and others every six years.

6.8.1.4 Structures and Buswork

The routine maintenance of structures, buswork and disconnectors is usually performed simultaneously when a particular circuit or section of bus is released from service.

Disconnectors are scheduled for servicing every four years but this may be extended when there are operational difficulties in getting a maintenance outage. The servicing is non-invasive and is generally limited to checks, adjustments, lubrication, corrosion control and cleaning.

Buswork and associated hardware is inspected and maintained with disconnectors, and includes checking and cleaning of insulators. At sites which are subject to atmospheric pollution, insulator cleaning must be done more frequently than usual. Structures are maintained up to a maximum interval of four years, and work is limited to corrosion control, general checking of fixings and removal of any debris. Wood poles are subject to a check for signs of rotting. It has been decided that for most stations, earth testing can be carried out every five years, and this will become the practice in future.

6.8.1.5 Instrument Transformers

As part of Westpower's maintenance programme, all instrument transformers have an annual minor maintenance service which encompasses a visual inspection, routine diagnostic tests and minor repair work. Additional remedial work required is outside the scope of the maintenance contract and is referred to Westpower for action.

6.8.1.6 Other Station Equipment

The new battery banks are virtually maintenance-free, and only a basic inspection and charger check is necessary.

Fire protection and security alarm systems are to be inspected every three months and serviced annually. Other switchyard equipment such as local service transformers, surge diverters, cables, etc. are maintained as necessary when the associated circuit is taken out of service.

6.8.2 Maintenance Works

The following is a summary of all maintenance works (I,S&T) to be completed in zone substations in the next 12 months. These are all on-going budgets that are carried out for the duration of the overall AMP period.

14014: Carry Out Thermovision Inspections of Zone Substation Equipment - $10,000

To identify high resistant joints present in zone substations, a Thermovision inspection programme is to be carried out at all zone substations. Strategic lines shall also be inspected on a rotational basis, with each line being reviewed every three years.

14015: Corona Discharge Testing at Various Zone Substations - $10,000

To identify any failing insulation in zone substations, a Corona Discharge inspection programme is to be carried out every two years at all zone substations. Strategic lines shall also be inspected on a rotational basis, with each line reviewed every three years.

14017: Update Zone Substation Drawings and Filing System - $10,000

In recent years the majority of Zone Substation drawings have been as built during projects and are now at an excellent standard. Funds have been allocated to maintain these drawings and filing system/audit trail for all future drawing updates.

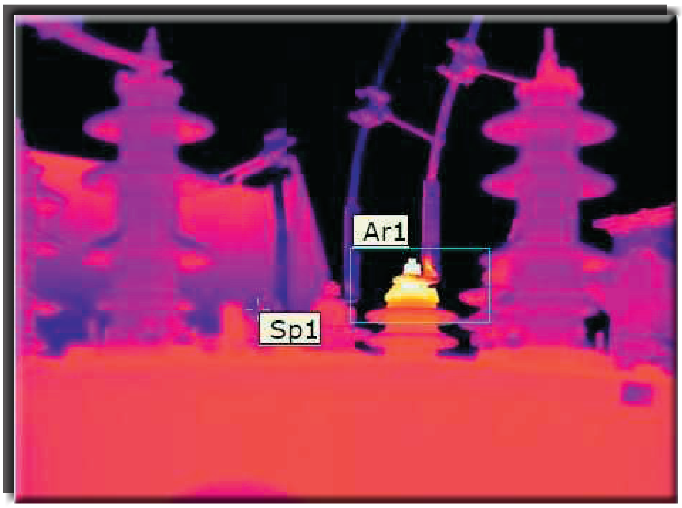


Fig 6.1 Thermovision Inspection Photo

14019: Oil Filter and Dry Out System for Transformers - $27,000

Annual zone transformer Dissolved Gas Analysis (DGA) reports identify a number of the zone substation transformers that have had moisture ingress which has the potential to severely shorten their life. The portable filter and dry out system is to be utilised to remove much of this moisture via online filtering.

14020: Perform Oil Tests at Zone Substations (DGA) - $27,000

An enhanced baseline analysis of transformer oil conductivity and dissolved gases will be continued this year to gain a better understanding of these critical zone transformer assets.

14024: Operator Training, Site Inductions and Site Familiarisation - $15,000

A fund has been made available for operator training, site familiarisation, inductions, etc. at zone substations and remote locations in the network.

14027: Purchase of Portable Earths and Authorisation - $9,000

Ensure an adequate supply of portable earths and permit equipment required for operating and permit issue is available on site.

14029: Westpower Store – Storage of key Assets in a Controlled Environment - $12,000

Continue with preparations this year to determine requirements for storing Westpower assets in a controlled environment. To include – list of assets and location, database, controlled procedure for booking in/out assets, location of store, indoor/outdoor temperature controlled environment.

14031: Zone Substation – Landscaping and Beautification - $10,000

This is an on-going project which incorporates, as the title suggests, landscaping and gardening work aimed at improving the amenity values at Westpower’s zone substation sites.

14032: Zone Substation – OLTC and Regulator Maintenance - $40,000

A planned maintenance/refurbishment cycle has been developed for all OLTC and regulator assets to prolong the life of these crucial assets. Funds have been made available for the on-going costs required each year.

14034: Zone Substation – Transformer Refurbishment and Maintenance - $30,000

A planned maintenance/refurbishment cycle has been developed for all zone substation transformer assets to prolong the life of these crucial assets. Funds have been made available for the on-going costs required each year.

14035: Zone Substation – Building Maintenance - $43,000

This is an on-going project which can include building maintenance such as cladding repairs, spouting repairs etc. on all of Westpower’s zone substation buildings.

14037: Zone Substation – WMS Relocation, Site Installation, Disconnection Costs - $28,000

This is an on-going project which incorporates as the title suggests Westpower Mobile Substation (WMS) relocation, transport costs, installation and disconnection for both planned and unplanned outages at zone substations.

14040: WMS (Mobile Substation) Storage - $10,000

Covered storage and SCADA monitoring is required to protect the WMS for the periods when it is not in use.

14041: Zone Substation Preventative Maintenance - $46,000

Five-yearly preventative maintenance plans have been developed for substation assets, including transformers, circuit breakers, disconnectors, BUS sections, etc. to prolong the life and reliability of these crucial assets. Funds have been made available for the on-going costs required each year.

14045: Earthing Inspection and Reports for Zone Substation Equipment - $45,000

As per industry best practice and guides, inspections are to be carried out on earthing for all Zone Substation equipment. An allowance has also been made for an earthing report to be conducted at selected Zone Substations each year.

6.8.3 Fault Repairs

Equipment failures occur randomly and without warning, and range from a simple circuit breaker mechanism failure due to a broken circlip, to a costly transformer winding failure. The cost budgeted is the cost to restore supply or the service following the failure, not the cost of any repair work after supply or service has been restored.

It is estimated that there are approximately two such faults per month. It is expected this frequency will be reduced as aged/defective equipment is refurbished or replaced.

The projected expenditure is based on actual expenditure incurred in recent years. It is not practicable to allocate projected expenditure against each substation asset category, given the range of faults which can occur.

6.8.4 Planned Repairs and Refurbishment

This area of expenditure includes corrective work identified following inspections and tests, and while undertaking routine maintenance or following equipment failures. The magnitude and costs of the work can vary greatly.

The planned expenditure also includes the cost of materials and spares.

Westpower has formulated its replacement programme based on the criteria below.

6.8.4.1 Power Transformers

The major causes of power transformer failures are winding and internal connection faults. These are caused, in general, by electrical causes, e.g. through faults or lightning strikes.

The other major internal maintenance on a power transformer is oil refurbishment and desludging, which is carried out as required based on oil acidity test results. It is not expected that this will be required on any of Westpower's units within the planning period.

At midlife, a full dry-out and core retighten is recommended.

6.8.4.2 Radiator Replacement

Radiator replacement is only carried out on coolers where the design of the radiators or extent of corrosion means repairs cannot be carried out satisfactorily.

The corrosion occurs after 20 or more years of age in transformers in corrosive environments (such as coastal). The radiators are replaced only once in the life of a transformer. Only two of Westpower's current power transformers meet this criteria.

6.8.4.3 Repainting

Painting is carried out on a regular basis at a period of generally between 10 and 15 years, depending on site conditions.

6.8.4.4 Other Equipment

On-going repairs are required to a variety of other station equipment including portable earthing equipment and battery banks.

6.8.4.5 Circuit Breakers - Outdoor

In line with the practice of overseas utilities as reported by CIGRE, Westpower has a policy, subject to project-specific economic analysis, of replacement rather than life extension of aged or deficient bulk oil and minimum oil circuit breakers by major refurbishment.

Circuit breakers are also replaced for the following reasons:

- Where they have high maintenance costs;
- Where they are unreliable due to an increased defect rate;
- Where a system node requires a maintenance free circuit breaker;
- Where maintenance outages cannot be tolerated.

It is internationally recognised that 40 years is generally the “time expired” life of circuit breakers. Some types have an economic life greater or less than this figure. Bulk oil breakers generally have a longer life, while minimum oil breakers typically last only 30 to 35 years.

While age is not itself criteria for replacement, analysis based on the likely total economic lives for each type, make and model of circuit breaker provides a means of assessing likely future replacement requirements. The replacements themselves would be determined by safety, economics and reliability assessments at the time.

6.8.4.6 Circuit Breakers - Indoor

Metalclad switchgear deteriorates with age, resulting in aging of insulation materials, e.g. formation of voids and penetration of moisture. Visible compound leaks and audible corona discharge often accompany this.

Replacement is justified primarily on reliability/risk of failure grounds and customer service operating limitations. There is potential for explosive failure, which occurs infrequently (approximately one such failure every ten years). Previous failures of SO-HI metalclad switchgear have led to the Greymouth 11 kV switchboard, the only SO-HI type in Westpower’s area, being replaced in 2003.

As contractors work close to the equipment and the equipment is oil-filled, there is an increased risk of personal injury. Overseas utilities have adopted designs such that new oil-filled equipment is not installed indoors, and blast walls have been installed between old equipment and places where contractors are required to work for extended periods.

Modern SF6/vacuum replacement installations with air-insulated bus chambers, rather than the old compound insulated types, and are virtually maintenance-free. There is a high cost associated with maintenance of old oil-filled and compound insulated equipment, which requires annual major service and frequent fault maintenance.

With the planned upgrade of the indoor metalclad switchgear at Rapahoe and Kumara in the not too distant future, all of Westpower’s indoor metalclad switchgear will be of a young age, and is expected to provide a reliable and safe operation for this planning period.

Fig 6.2 Circuit Breakers - Indoor

The typical economic life of Westpower's indoor metalclad switchgear installations (typically 11 kV) has been assessed to be 50 years based on past experience. At present, only a small percentage is over 20 years old.

6.8.4.7 Structures, Disconnectors and Buswork

Westpower's policy of using either galvanised steel or concrete support columns in switchyards means that there is only minimal maintenance required for buswork.

Disconnectors are scheduled for replacement when they develop a history of unreliability or failures, when their maintenance costs become unacceptably high, or when they are identified as being electrically under-rated.

A programme is currently underway to review the condition and suitability of each disconnector in Westpower's network. It has been found that the older type of disconnector without flicker arcing horns is not suitable for use in main lines when paralleling of feeders is involved, although they are still quite suitable for use on spur lines. A replacement programme is in place and, for the purposes of this plan, a contingency sum has been allowed.

6.8.4.8 Instrument Transformers

Aged instrument transformers are only replaced when they fail, or when they are about to fail as diagnosed by testing. They are then replaced with a similar unit, usually a spare. Other replacements occur during site development works and, depending on whether the condition and ratings etc. of the transformer are suitable for use at another site, they may be scrapped.

At the Greymouth substation, the 66 kV instrument transformers will be replaced over time with vandal-resistant units using composite insulators because of the risk of failure due to on-going vandal damage.

6.8.4.9 Power Transformers

Dobson T6, Fox T1 and HHI T1 Transformers are nearing the end of their serviceable lives. A sum for each of these Transformers has been allowed to replace these in 2021/22 and 2020/21 respectively.

There are no plans to replace any of the other existing power transformers during the planning period, based on the age and condition of the units.

There is a concern that an increased replacement requirement due to deteriorating condition will be required within the next 20 to 30 years, since the transformers purchased in the 1970s are likely to begin to fail at around 50 years of age.

Regardless of whether a pre-emptive replacement programme is undertaken, it seems likely that units will fail at an increasing rate in future, and this will force replacement. Provided sufficient diagnostic tests are undertaken to identify imminent failure and provided some suitable spare units are available, this should not lead to a noticeable decrease in customer supply reliability, and could be a cost-effective replacement strategy option.

6.8.5 Maintenance Summary

In summary, the zone substation maintenance expenditure is shown in Table 6.14.

There are consistent expenditure requirements for power transformer repair work, involving radiator repairs, repainting, repairs to internal connections and oil refurbishment.

Overall, other station expenditure projections are similar to present expenditure levels, with some changes and trends for specific assets and activities resulting from the AMP analysis.

Table 6.14 - Zone Substation Projects - Maintenance

ID	Act	Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
14008	I	Kumara Zone Substation 66 kV CB Maintenance (3)	0	93	0	0	0	0	0	0	0	0
14010	I	Rapahoe Substation - Paint Gantry Steelwork and Reinsulate	33	0	0	0	0	0	0	0	0	0
14014	I	Carry out Thermovision Inspections of Zone Substation Equipment	10	10	10	10	11	11	12	13	13	14
14015	I	Corona Discharge Testing at various Zone Substations	10	10	10	10	11	11	12	13	13	14
14017	I	Update Zone Substation Drawings & Filing System	10	10	10	10	11	11	12	13	13	14
14019	I	Oil Filter and Dry Out System for Transformers	27	28	28	28	30	31	33	35	37	38
14020	I	Perform Oil Tests at Zone Substations (DGA)	27	28	28	28	30	31	33	35	37	38
14024	I	Operator Training, Site Inductions and Site Familiarisation	15	15	15	15	16	18	19	20	21	21
14027	I	Purchase of Portable Earths and Authorisation Equipment	9	9	9	9	10	10	11	11	12	13
14029	I	Westpower Store - Storage of Key Assets in a Controlled Environment	12	12	12	12	13	13	14	15	16	17
14031	I	Zone Sub Landscaping and Beautification	10	10	10	10	11	11	12	13	13	14
14032	I	Zone Sub OLTC & Regulator Maintenance	40	41	42	43	44	45	46	47	48	49
14034	I	Zone Substation Transformer Refurbishment and Maintenance	30	31	32	33	34	35	36	37	38	39
14035	I	Zone Substation Building Maintenance	43	44	44	44	47	49	53	56	60	62
14037	I	WMS Relocation, Site Installation/Disconnection Costs, etc	28	29	29	29	31	32	34	36	38	39
14040	I	WMS (Mobile Substation) Storage	5	5	5	5	5	6	6	6	6	7
14041	I	Substation Preventitive Maintenance	46	47	47	47	50	54	57	60	64	66
14045	I	Earthing Inspection and Reports for Zone Substation Equipment	45	46	46	46	49	53	56	59	62	64
		Total	**400**	**468**	**377**	**379**	**403**	**421**	**446**	**469**	**491**	**509**

6.9 Distribution Substations

Table 6.15 summarises the planned expenditure by category for distribution substation-related projects during this AMP period.

Table 6.15 - Distribution Substation Projects and Programmes - Maintenance

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Faults	18	18	18	19	19	19	19	20	20	20
Inspect, Service and Test	492	492	492	507	491	477	478	507	508	508
Repairs	11	11	11	12	12	12	12	13	13	13
Total	**521**	**521**	**521**	**538**	**522**	**508**	**509**	**540**	**541**	**541**

6.9.1 Inspection, Servicing and Testing

All of Westpower's distribution substations require regular testing every five years for safety reasons in accordance with the Electricity Regulations. At the same time, the general condition of the transformer is checked and an oil sample taken to monitor the internal state of the unit.

Table 6.16 lists the expenditure for the distribution substation projects planned for this AMP period as described above.

Table 6..16 - Distribution Substation Projects - Maintenance

ID	Act	Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
15006	I	Sub (Site) Upgrades	150	150	150	159	159	159	159	169	169	169
15003	I	Replacement of Live Line Taps	10	10	10	3	3.18	3	4	4	4	4
15004	I	Installation of earth stirrups to dropout fuses	5	5	5	0	0	0	0	0	0	0
15012	I	Distribution Sub Inspections - Testing of sub earths etc	138	138	138		146	146	146	155	155	155
15009	I	Relocate Sub fuses for 11 kV spurs	15	15	15	15	0	0	0	0	0	0
15014	I	Fit Protection to Exposed Distribution Sub Terminals	14	14	14	14	14	0	0	0	0	0
		Total	**332**	**332**	**332**	**337**	**322**	**308**	**309**	**328**	**328**	**328**

6.9.2 Fault Repairs

Lightning damage and ingress of water causes most transformer faults.

Over the last eight years, Westpower has had a programme of retrofitting lightning arrestors on all substations that do not yet have these fitted, and this is now completed. Past experience has shown that lightning arrestors greatly reduce the risk of transformer damage.

Regular inspection of transformers will also reduce the number of failures due to water ingress caused by deterioration e.g. rusty tanks.

Minor repairs such as bushing replacements can be carried out on site if necessary, but most fault repairs involve the swapping of a transformer unit with a spare from the store.

6.9.3 Planned Repairs and Refurbishment

Corrosion and resulting water contamination of the insulating oil in distribution transformers is a major concern. A programme of identifying badly corroded transformer tanks has been instigated.

Once identified, these transformers will be removed for repair, retanking or replacement as dictated by the state and age of the unit.

Major rewinds of transformers are not undertaken unless the transformer's size is over 50 kVA and the transformer is less than ten years old. This is based on economics.

6.9.3.1 Oil Refurbishment/Desludging

Oil refurbishment is planned for ten distribution transformers per year.

6.10 MV Switchgear

Table 6.17 summarises the planned expenditure by category for MV switchgear-related projects during this AMP period.

Table 6.17 - MV Switchgear Projects and Programmes - Maintenance

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Faults	6	6	6	6	6	7	7	8	8	8
Inspect, Service and Test	236	242	243	243	258	274	290	307	325	335
Repairs	60	62	62	62	66	69	73	78	82	85
Total	**302**	**310**	**311**	**311**	**330**	**350**	**370**	**393**	**415**	**428**

6.10.1 Inspection, Servicing and Testing

Circuit breakers are subjected to minor and/or major maintenance routines in accordance with the requirements of Westpower's maintenance standards. Maintenance is also carried out when a circuit breaker has completed a specified number of fault trippings.

Modern vacuum circuit breakers are subjected to minor services and condition monitoring tests at four-yearly intervals only. Invasive major services are not scheduled and would be carried out only if required as indicated by condition monitoring tests.

As with power transformers, there are two levels of servicing:

- Minor servicing, involving external servicing (non-invasive);
- Major servicing, which involves invasive servicing.

Below is a list of all maintenance works (IS&T) to be completed for MV switchgear in the next 12 months. These are all on-going budgets that are carried out yearly for the duration of the AMP period.

16002: Disconnector Maintenance and Operation Check Programme - $78,000

Reliable and safe operation of disconnectors is imperative during switching. Some disconnectors become difficult to operate (e.g. linkages/contacts seize up). A five-yearly maintenance programme is in place to maintain and test-operate each of the 400 plus disconnectors.

16003: Recloser Maintenance – Protection, Batteries, etc. - $33,000

Network reclosers require regular protection tests and recloser maintenance as determined by Westpower's standards to ensure reliable and safe operation. On-going funds have been made available to complete this preventative maintenance program.

16004: Perform Partial Discharge Tests on Network Switchgear - $15,000

Carry out partial discharge tests on selected network switchgear. This is an on-going project to assist in the early detection of faults.

16007: Inspection of Earthing for MV Switchgear - $40,000

As per industry best practice and guides all MV Switchgear equipment earthing is to be inspected every two years and tested every six years.

16008: Removal of Temporary Links - $10,000

Temporary Links are used to isolate sections of lines where an outage is needed to complete work. These help reduce the area of the outage, therefore reduce SAIDI. This budget has been allowed to ensure these are removed after the work is completed.

Table 6.18 lists the expenditure for the MV switchgear projects planned for this AMP period as described above.

6.10.2 Fault Repairs

Table 6.18 - MV Switchgear Projects - Maintenance

ID	Act	Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
16007	I	Inspection of Earthing for MV Switchgear Equipment	40	41	41	41	43	46	49	52	56	58
16002	I	Disconnector maintenance, Operation Check Program	78	80	80	80	85	91	96	101	107	110
16003	I	Remote locations maintenance - Protection, Batteries, etc	33	34	34	34	36	38	40	43	45	47
16004	I	Perform partial discharge tests on Network Switchgear	15	15	15	15	16	18	19	20	21	21
16008	I	Removal of Temporary Links for Shutdowns	10	10	11	11	12	12	13	13	14	14
		Total	**176**	**180**	**181**	**181**	**192**	**205**	**217**	**229**	**243**	**250**

6.10.2.1 Circuit Breakers

Fault repairs to switchgear are carried out as required, but as the population of older oil insulated type reclosers diminishes in line with Westpower's recloser replacement programme, the occurrence of these faults has been greatly reduced.

6.10.2.2 Disconnectors

Disconnectors normally fail due to deterioration of the operating arms with corrosion or from an arc developing across two or more phases. By identifying under-rated disconnectors and replacing these, the incidence of arcing faults should be reduced. The preventative maintenance programme for disconnectors is working very well at identifying most potential problems before they occur.

6.10.3 Planned Repairs and Refurbishment

6.10.3.1 Circuit Breakers

Planned repair work in respect to circuit breakers would include additional corrective work and refurbishment identified during routine services, inspections and tests or following failures. Refurbishment work planned includes overhaul of decommissioned circuit breakers, identified as suitable for future use at remote spur line locations or for spares prior to placing them in storage.

6.11 SCADA and Communications

Table 6.19 summarises the planned expenditure by category for SCADA and Communications related projects during this AMP period.

Table 6.19 - SCADA and Comms Projects and Programmes - Maintenance

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Faults	46	46	46	48	51	54	58	61	65	65
Inspect, Service and Test	321	310	317	346	360	360	377	396	413	418
Repairs	46	46	46	48	51	54	58	61	65	65
Total	**413**	**402**	**409**	**442**	**462**	**468**	**493**	**518**	**543**	**548**

6.11.1 Periodic Inspections, Servicing and Testing

6.11.1.1 SCADA System

The integrity of the main hardware and software system at the control room is of the highest importance to the on-going management and safety of the grid network. Westpower's asset management staff manage the computer system and maintain the operational state of the software and hardware systems. This is a 24-hour task, with staff on call if required to ensure high availability of equipment. The main computer hardware and software are protected by a maintenance contract with the supplier.

An approved contractor will manage all communication and SCADA equipment external to the computer system. This provides for continuous maintenance and fast response for fault repairs.

6.11.1.2 Communications

Every asset is to be inspected six-monthly and serviced on an annual basis. The six-monthly inspection is, as far as possible, non-intrusive. No adjustments are made until items are out of tolerance or performance is affected.

Antenna support structures, e.g. wood poles, towers and monopoles, are inspected every two or three years.

Antennae are to be checked annually with a spectrum analyser.

6.11.2 Planned Repairs and Refurbishment

6.11.2.1 Communications

Westpower maintains communications assets at approximately 28 base sites, 83 pole-top or RMU sites and on 10 repeater sites. The planned repair and refurbishment estimates are based on past expenditure.

Contract maintenance technicians are expected to respond to approximately 12 major faults per annum.

6.12 Distribution Transformers

The population of distribution transformers covers a diverse range of sizes, types and ages. As such, it is important that a comprehensive management plan is put in place, as the condition of the asset is not always easily discernible on an overall basis.

Westpower's policy is to extend the life of distribution transformers where this is economically feasible. In support of this policy, many distribution transformers run well below their rated values for much of the time, resulting in long lives for the cores and windings. Provided that the tanks and oil are well maintained, the overall unit may be kept in service for up to 55 years. In this way, the maximum return can be leveraged from these high value assets.

Table 6.20 summarises the planned expenditure by category for distribution transformer-related projects during this AMP period.

Table 6.20 - Distribution Transformer Projects and Programmes - Maintenance

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Faults	3	3	3	3	3	3	3	4	4	4
Inspect, Service and Test	60	60	60	64	64	64	64	68	72	72
Total	**63**	**63**	**63**	**67**	**67**	**67**	**67**	**72**	**76**	**76**

6.12.1 Maintenance

6.12.1.1 Routine Patrols and Inspections

Smaller pole-mounted distribution transformers are regularly inspected on a rolling five-year basis in conjunction with Westpower's substation earth testing programme.

The inspection includes checks for:

- Tank corrosion,
- Paint chips,
- Breakdown,
- Oil leaks,
- Insulator damage,
- Breather condition,
- Termination faults.

Where possible, the oil level is checked and recorded, and if an oil sample valve is available (standard issue on all new transformers), a sample of the oil is taken and checked for dielectric breakdown.

Larger pole-mount and all pad-mount units have Maximum Demand Indicators (MDIs) which are read every quarter. These indicate loading trends to be monitored and allow for early intervention should a unit become overloaded.

Very large transformers in areas such as the CBDs of Greymouth and Hokitika have annual thermograph surveys carried out to check the tank and termination temperatures, as well as to identify any other potential hotspots. Any indications suggesting that the transformer requires attention results in prompt on-site repairs; if this is not possible, the transformer is swapped with a spare unit from the store and sent back to the contractor's workshop for refurbishment.

6.12.1.2 Faults

The majority of faults are caused by lightning damage; it is very rare for a unit to fail because of old age or deterioration because of the regular inspection and servicing carried out.

Most faults are handled by swapping the transformer with a spare and sending the damaged unit back to the transformer workshop for inspection and repair, or scrapping if the damage is too severe.

An exception to this is bushing faults on large units, where the bushing can be easily repaired or replaced on-site.

6.12.1.3 Repairs and Refurbishment

Repairs can range from a minor paint touch-up on earlier painted units through to insulator repairs and bolt replacements. Refurbishment may include oil changes, rewinds and even tank replacements.

Rewinds are only attempted on relatively modern units where modular replacement windings are readily available.

Tanks are often subject to corrosion, especially in the case of older painted units. At the same time, however, the internal core and windings may be in excellent condition. For this reason, tanks are often repaired or replaced if the unit is otherwise in good condition.

Each unit is assessed on its age, condition and service history in determining whether to repair or replace the unit.

6.13 Other

Four of Westpower's five ripple injection plants are all of the same make (Enermet SFU-K series), making lifecycle management easier to implement.

In 2012 a stand-alone ripple plant was installed at the Wahapo zone substation. This was installed in the existing shed and will be used on occasion to provide ripple control to the South Westland area when Wahapo generation is running islanded from the remainder of Westpower's network.

This plant consist of the best available parts from the decommissioned Plessey TR series 75 kVA plants at Reefton, Greymouth and Hokitika.

Table 6.21 summarises the planned expenditure by category for the "Other" related projects during this AMP period.

Table 6.21 - Other Projects and Programmes - Maintenance

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Faults	6	6	6	6	6	6	6	7	7	7
Inspect, Service and Test	105	5	5	5	5	5	5	6	6	6
Repairs	1	1	1	1	1	1	1	2	2	2
Total	**112**	**12**	**12**	**13**	**12**	**12**	**12**	**15**	**15**	**15**

6.13.1 Maintenance

6.13.1.1 Routine Patrols and Inspections

Monthly checks are carried out as part of regular zone substation visits, which includes the visual inspections of the:

- Converters,
- Coupling transformers,
- Coupling cells,
- GPS time base receivers.

Every three years, independent experts determine injection levels, current balance, optimum tuning and load sharing with other units during a full inspection.

6.13.1.2 Faults

The solid state construction of the injection plants and the fact that they operate well below their maximum power levels means that faults are very uncommon.

On rare occasions, the high-power output transistors may require replacement or the logic board may require repair. At other times, vermin may get into the HV coupling cells, causing flashover.

The redundancy built into the injection network means that the failure of any single plant will not severely impact on overall ripple signal propagation, and faults are able to be handled without undue time pressure on restoration.

6.13.1.3 Repairs and Refurbishment

Minor repairs are required on the coupling equipment and converters from time to time as a result of fault events.

There is no planned repair and refurbishment programme planned for this equipment, which is relatively young and in good condition. It is expected that the plants will give at least ten years of trouble-free service.

6.14 Overall Work Plan - Maintenance

This section provides an overview of the planned expenditure of maintenance projects and programmes by category.

Table 6.22 summarises the planned maintenance projects and programmes by category for the planning period.

Table 6.22 - Maintenance Projects and Programmes

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Inspect, Service and Test	4744	4442	4338	4353	4421	4429	4531	4746	4868	4941
Faults	486	486	486	514	515	520	524	557	561	561
Repairs	308	312	312	322	333	344	358	380	394	400
Total	**5538**	**5241**	**5136**	**5189**	**5270**	**5293**	**5413**	**5683**	**5823**	**5902**

6.14.1.1 Repairs and Refurbishment

All line repairs are carried out to the requirements laid down in Westpower's line maintenance standards. These are based on international practice combined with local knowledge and New Zealand legislative requirements.

6.15 Disposal

Decommissioned equipment or materials are only disposed of when they are not required as critical spares and there is a low likelihood of them being required in the future.

Where the equipment involves potentially hazardous materials, this is clearly stated and the recipient is required to provide documentary evidence that any further disposal is carried out in an approved manner.

All decisions to transfer or dispose of fixed assets must be authorised by the General Manager – Assets and Engineering Services. The General Manager – Assets and Engineering Services signs a Disposal/Transfer Authority Request (DTAR) form.

Following authorisation, the appropriate network manager is responsible for the reallocation/disposal of all equipment.

These managers are responsible for maintaining a register of Westpower assets that are available for disposal or transfer. This information is used to enable the effective reallocation of plant and equipment within the network. Importantly, this information also enables Westpower to assess opportunities to defer capital expenditure by reallocating assets between sites.

7.0 FINANCIAL SUMMARY

7.1 Financial Forecasts

The financial expenditures in this section are forecast for a ten-year period. These forecasts have been built up from the individual project and programme expenditures developed in Section 5, and demonstrate a generally stable expenditure over the duration of the planning period.

For more details regarding expenditure forecasts and reconciliation, please refer to Appendix D.

Table 7.1 below shows the projected ten-year AMP expenditure by activity and Tables 7.2, 7.3 and 7.4 show this expenditure by asset type.

Table 7.1 - Summary of Activity ($000)

Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Inspect, Service and Test	4744	4442	4338	4353	4421	4429	4531	4746	4868	4941
Faults	486	486	486	514	515	520	524	557	561	561
Repairs	308	312	312	322	333	344	358	380	394	400
Maintenance Total	**5538**	**5241**	**5136**	**5189**	**5270**	**5293**	**5413**	**5683**	**5823**	**5902**
Replacement	1212	1125	877	827	920	546	1580	1437	821	863
Enhancement	511	415	472	547	513	2209	534	466	442	489
Development	680	947	789	719	778	890	843	910	955	814
Capital Total	**2403**	**2487**	**2138**	**2093**	**2211**	**3645**	**2957**	**2813**	**2218**	**2166**
Total	**7941**	**7728**	**7274**	**7281**	**7481**	**8938**	**8370**	**8496**	**8041**	**8068**

Table 7.2 - Opex - Summary by Asset Type ('000)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Sub-Transmission	731	652	653	643	663	665	665	695	702	702
Distribution	2166	2026	2023	2059	2048	2015	2047	2131	2160	2188
Reticulation	284	244	239	203	203	203	193	204	204	204
Service	151	151	136	143	143	143	143	151	151	151
Zone Subsubstation	795	860	769	771	819	862	914	964	1016	1049
Distribution Substation	521	521	521	538	522	508	509	540	541	541
MV Switchgear	302	310	311	311	330	350	370	393	415	428
Scada & Comms	413	402	409	442	462	468	493	518	543	548
Distribution Transformer	63	63	63	67	67	67	67	72	76	76
Other	112	12	12	13	12	12	12	15	15	15
Total	**5538**	**5241**	**5136**	**5189**	**5270**	**5293**	**5413**	**5683**	**5823**	**5902**

Table 7.3 - Replacement Capex - Summary by Asset Type ('000)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Sub-transmission	245	191	146	118	124	130	137	145	121	121
Distribution	310	271	202	215	227	110	110	110	110	110
Reticulation	79	80	82	45	48	50	54	57	60	60
Zone Substation	406	375	297	298	364	35	1129	969	367	327
Distribution Substation	30	0	0	0	0	0	0	0	0	0
MV Switchgear	42	108	49	51	54	136	63	66	71	153
SCADA Comms	30	30	30	31	33	35	37	40	42	42
Services	70	70	70	70	70	50	50	50	50	50
Total	**1212**	**1125**	**877**	**827**	**920**	**546**	**1580**	**1437**	**821**	**863**

Table 7.4 - Development and Enhancement Capex - Summary by Asset Type ('000)

Asset Type	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Distribution	116	167	118	119	140	141	142	144	145	145
Service	53	56	60	63	67	71	75	80	84	0
Zone Subsubstation	66	15	15	97	15	1782	15	15	15	15
Distribution Substation	87	80	73	76	79	83	86	90	94	94
MV Switchgear	201	231	141	121	127	224	140	148	155	160
Scada & Comms	263	405	421	291	328	285	324	322	294	279
Distribution Transformer	371	393	417	442	468	496	526	558	591	591
Total	**1157**	**1347**	**1244**	**1209**	**1224**	**3082**	**1308**	**1357**	**1378**	**1284**

It should be noted that the estimates for the first half of the planning period are based on known drivers and hence are more accurate than those for the second half, which are more in the nature of forecasts due to a large number of unpredictable factors. Nevertheless, in developing these figures, Westpower has had several years of experience in budgeting and controlling this expenditure, and there is a high degree of confidence in these values.

Figure 7.1 shows the relative percentages of the total estimated expenditure as a pie chart for 2015 based on the figures shown in Table 7.1. Figure 7.3 shows the relative percentages of the total estimated expenditure as a pie chart for 2015 based on the figures shown in Table 7.2.

The management fee included in I, S and T, is part of a fixed annual fee paid to the maintenance contractor to

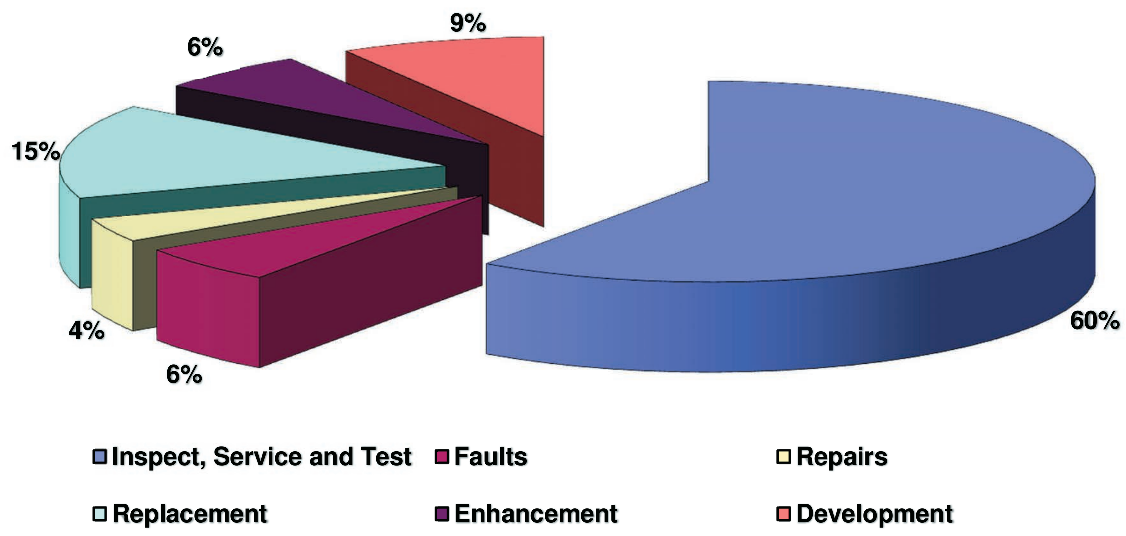


Fig 7.1 Relative Forecast Expenditure by Activity 2015

cover costs such as spare transformer management and the provision of otherwise uneconomic fault bases at Reefton and Harihari.

A contingency sum has also been provided to allow for unexpected events. This is especially necessary in the fault activity area where expenditure is highly dependent on weather conditions. In fact, just a few severe lightning storms can have a major impact on the annual result.

Previously, Westpower had a large proportion of older lines that were rapidly approaching failure, but a replacement programme over the last ten years has substantially overcome this issue.

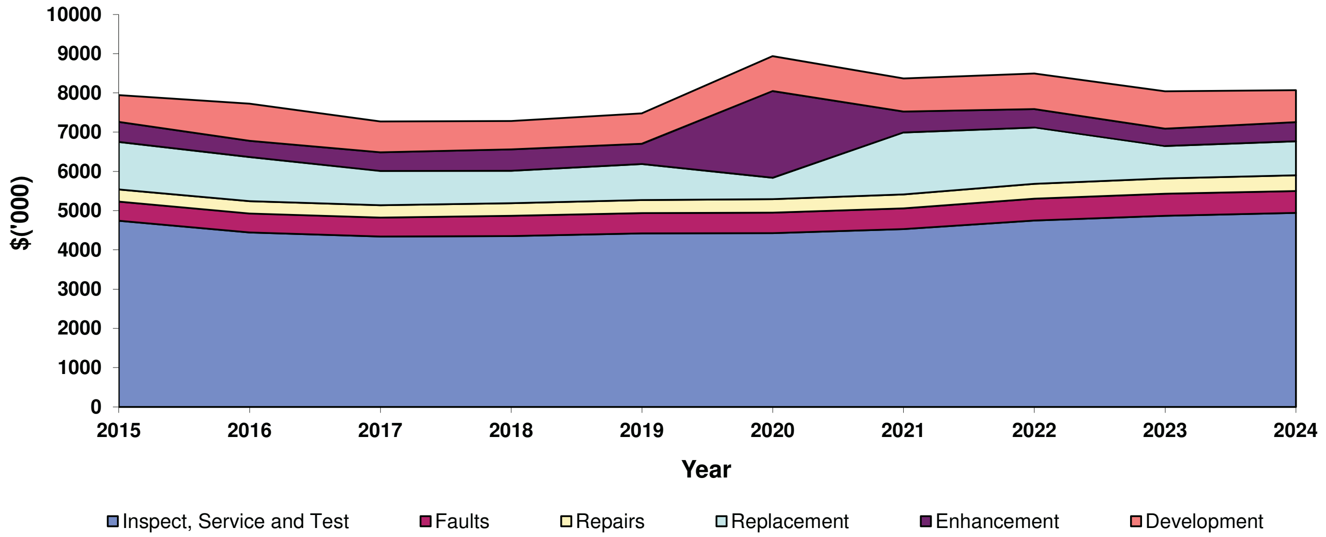


Fig 7.2 Forecast Expenditure by Activity for the planning period 2015-24

The I, S and T expenditure has increased due to a more rigorous condition assessment programme including density scanning of wooden poles for rot, along with an upward movement in contractor rates.

The enhancement expenditure reflects a continued emphasis on distribution automation as reclosers and disconnectors are progressively automated. By doing this, Westpower is able to greatly reduce outage durations and switching times, resulting in an improved SAIDI reliability statistic.

Asset types such as zone substations, and SCADA Comms, and protection exhibit a relatively young age profile, and little on-going maintenance is required. Not surprisingly, these assets also have the lowest susceptibility to fault failure. Notwithstanding these comments, a number of older circuit breakers installed at the smaller zone substations have been found to be unreliable and a replacement programme has been instituted.

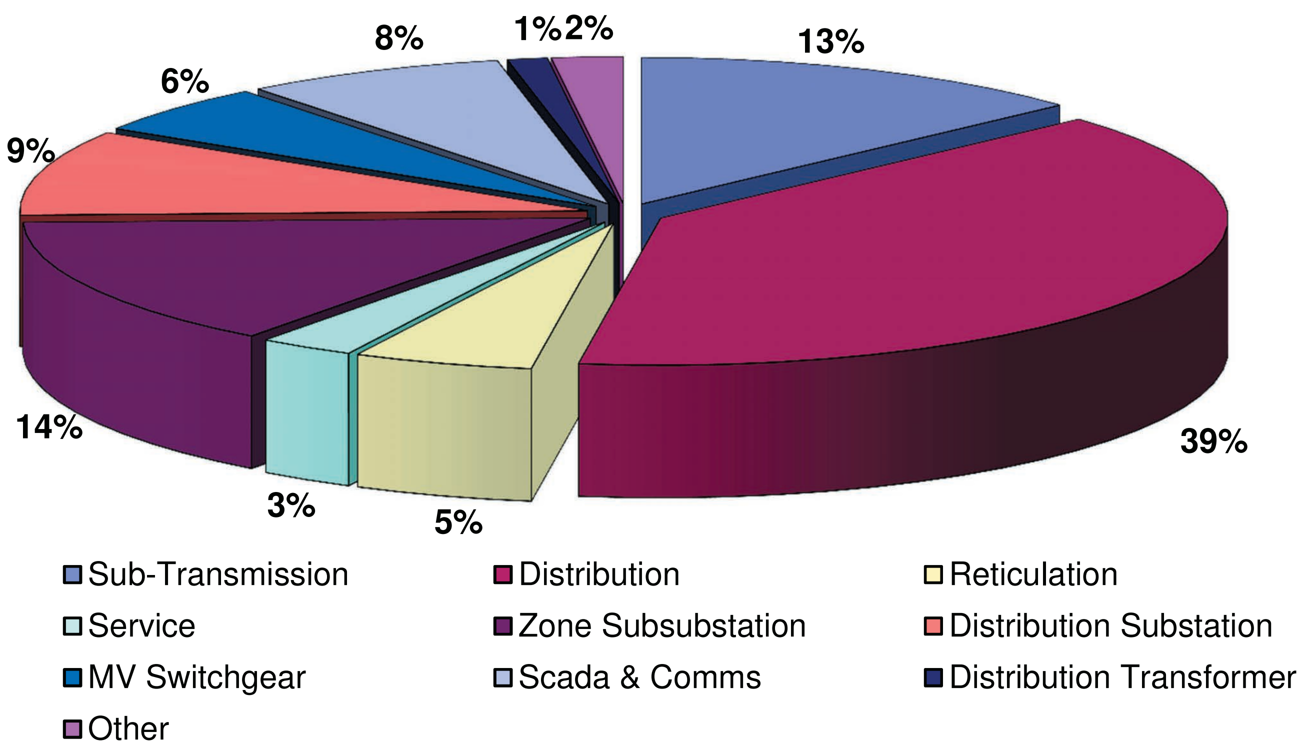


Fig 7.3 Relative Forecast Expenditure by Opex Asset Type 2015

7.2 Assumptions and Sensitivity Analysis

Some basic assumptions have been made. These include:

- As an ELB Westpower will continue to be a going concern under the new regulatory regime.
- Asset management, system control and corporate services functions will be provided by ElectroNet Services and be based in Greymouth.
- The ELB will continue to own ElectroNet Services and to operate it on an arms-length basis.
- The ELB must satisfy the twin constraints of providing a risk-adjusted normal profit for its beneficiaries sufficient to retain investment, while simultaneously performing within the regulatory limits set by government regulations.

Other factors that will impact on network expenditure are discussed below.

Table 7.5 – Sensitivity Analysis

Forecasting Assumption	Level of Uncertainty	Risk Assessment (Low/Med/High)	Reasoning for Assessment
Load Growth	It is likely that the projected load growth will in reality be different	High	The Asset Management Plan has assumed growth will occur in the high range of the NZ Statistics projections, which is the best information we have available, supplemented by knowledge of particular regional developments based on the Loadwatch spreadsheet. The impact of any change from the projection will be on capital expenditure as many step loads require augmentation of the network. The impact on maintenance expenditure is less significant. If growth slows then expenditure will be deferred and the asset will still have sufficient capacity. Many of the engineering solutions cater for growth up to 20 years out; however if growth is faster than forecast it may mean at some stage in the future upgrades may need to occur sooner than anticipated. This considered a high risk, but largely beyond Westpower's control.
Continuance of Supply	It is possible, but unlikely, that Westpower will not need to continue supplying existing customers	Low	A key assumption is that Westpower will need to continue to maintain and replace older lines that feed customers in rural areas. It is hard to see any government removing the protection that many farming communities rely on in terms of having a long term guarantee that electricity supply will continue to be available at current prices, after taking inflation into account. At the same time, Westpower's network is in very good condition with few areas requiring major refurbishment within the planning period and so any extended obligation will have little impact in the short to medium term.
Governance Structure	It is improbable that the governance structure will change	Low	Recent ownership reviews and the currently supportive regulatory framework for trust-owned lines businesses means that there do not appear to be any significant drivers for a change in the current governance structure.
Activities Undertaken	It is likely that new activities will be undertaken.	Low	Although Westpower is involved in a number of related activities through its subsidiary companies, and this is likely to increase over time, the impact on the AMP is not great as a clear focus will always be maintained on the asset.

7.2.1 Weather impacts

Weather affects the fault expenditure through the level of storm damage experienced. As it is very difficult to predict weather patterns over a 12-month period, the budget for fault expenditure can only be an estimate based on historical averages and general knowledge of the asset condition.

The sensitivity of the network to storm damage has greatly reduced over the last 20 years as major sub-transmission and distribution feeders have been progressively replaced with better quality materials. Lightning arrestors have been placed on all substations and reclosers to protect that equipment during lightning storms. In addition, a continuing distribution automation programme has reduced the amount of time and effort required for fault location and repair.

On the other hand, extreme weather events over the last five-years have had a notable impact on performance statistics such as SAIDI and so a continuation of the five year rolling average has been assumed to estimate forward fault and repair expenditure.

7.2.2 Growth Forecasting

Growth has been allowed for at a rate equivalent to the Statistics New Zealand high growth projections for the district. The AMP assumes that the region's population will increase by an average of approximately 0.4% per annum.

Gross Domestic Product (GDP) on the West Coast has a direct effect on Westpower's revenue stream through reduced distribution to large customers. It also has an indirect effect as secondary and tertiary level consumers in the commercial and domestic area contract.

The use of a Loadwatch spreadsheet to collect all available information on future load growth trends has been used as a starting point in the planning process. Where the loads are not yet committed, probabilities have been applied according to an assessment of the likelihood of a project proceeding. In addition, the diversity of any load needs to be considered and a diversity factor of 30% has been applied, as this is the average load factor experienced on the network. Where a load will clearly have a different profile, such as an industrial process industry that runs around the clock, an individual diversity factor is applied that is relevant to that particular load.

Within the AMP, growth has been based on known step changes. If there are no known step loads, then growth is assumed to be straight-line between years. These assumptions have been applied when projecting expenditure and growth over the ten-year period. The projections for different asset types will vary depending on the amount of system reinforcement required for each load.

7.2.3 Continuance of Supply

A key assumption is that Westpower will be required to continue to supply existing customers on its network for the foreseeable future in accordance with Section 105 of the Electricity Industry Act 2010

7.2.4 Governance Structure

It is assumed that the governance structure will remain in the state as anticipated by this plan over the duration of this plan.

7.2.5 Devolutions of Responsibility

For the purposes of this plan, it is assumed that there will be no devolutions of additional responsibility from a regulatory perspective, particularly not without the ability to recover any increased costs through a commensurate increase in revenue.

7.2.6 Assumptions as to Activities Undertaken and Levels of Service Provided

Westpower is assuming that the range of activities that it has signalled to undertake will not change.

Westpower is also assuming that the levels of service to which its activities are provided will not change, except as a consequence of planned expenditure programmes mentioned in this plan. The reality is that any change to service level and/or activities undertaken may place an additional cost on Westpower, and the recovery of this cost would need to be fairly and equitably allocated to the chief beneficiaries.

7.2.7 Fixed Asset Useful Life

A number of assumptions have been made about the useful lives of Westpower's infrastructure assets. The detail for each asset category is generally based on the guidelines provided in the latest ODV handbook. The useful lives are consistent with the assumptions applied to valuing each asset category and were determined by experienced and qualified asset engineering staff.

Individual asset lives are applied to assets that are either expected to last longer or less than the standard values because of the asset, condition or environmental factors, such as proximity to a corrosive coastal environment.

7.2.8 Resource Consents

Westpower is assuming that the major resource consents that it needs for delivery of the services outlined in this plan will be obtained and granted with conditions that can be met within anticipated expenditure estimates.

7.2.9 Vesting Assets

For the purposes of this plan it has been assumed there will be vesting of assets in Westpower. This has been based on historical information. However, it is noted that they are:

- Beyond Westpower's control and their number and value are very difficult to predict;
- Likely to be immaterial in the context of overall asset values;
- Being brand new, unlikely to impose any significant extra costs from those generated over the life of this plan.

7.2.10 Sustainability

Westpower has considered the sustainability of each of its services and activities in its preparation of the AMP alongside how the services it provides will meet the needs of present and future generations, and how its activities will protect and enhance the natural environment in the long term. While the company is primarily required to act in a commercial manner and remain a going concern, it is also cognisant of its responsibilities to take a sustainable development approach to providing for the social, economic, environmental and cultural wellbeing of communities. This involves taking account of the needs of people and communities now, the reasonably foreseeable needs of future generations, and the need to maintain and enhance the quality of the environment.

Taking a sustainable development approach is reflected in the way Westpower plans for a sustainable supply of electricity throughout its area,

Westpower has a significant role in the provision and operation of key infrastructure that is critical for the sustainable development of the communities that it serves.

7.2.10.1 Effects of Climate Change

It is assumed that the climate change reports provided by the Intergovernmental Panel on Climate Change (IPCC) are reliable and provide a reasonable indication of what Westpower needs to consider in its planning processes. Based on the IPCC reports, it is assumed that the sea level will rise by 0.5 m over the next 100 years.

7.2.10.2 Emissions Trading Scheme

This Ten-year AMP has been prepared based on the broad scientific community view that human-induced climate change through increased greenhouse gas emissions is occurring and may accelerate in the future. National and international efforts are underway to control emissions in response to agreements that the government is a signatory to.

Many of the climate change-induced changes are likely to eventuate over the longer term and will occur beyond the ten-year horizon upon which the activities and their service levels are described in this AMP. They are, however, factors to be taken into account such as increased electricity prices driving additional investment in distributed renewable generation and this needs to be catered for in Westpower's planning processes.

7.3 Actual Deviations from Previous AMPs

7.3.1 *Unallocated Works*

The following explains additional works (over $10,000) that were not included in the 2012-22 AMP, but which for various reasons, were undertaken.

7.3.1.1 Distribution

Light Conductor Replacement

For various reasons light conductor such as Mullet ACSR and 7/.064 Cu needed to be replaced. This was generally undertaken when bulk pole replacement was being carried out on particular sections of 11 kV line and the conductor was found to be in poor condition or considered to be of inadequate capacity for the required load. These conductor upgrades came at a cost of $17613.

Fox Hotel - Replace 11 kV Cable

Originally programmed for the 2011-12 financial year, much of the Fox Glacier hotel 11 kV cable replacement project was deferred due to delays in securing landowner agreements. This resulted in $21,125 being carried over to the 2013-14 financial year.

Ruatapu Township - Reconfigure LV and 11 kV

A condemned pole (11496) at Ruatapu township prompted an investigation into the line configuration in the area. The existing configuration was found to be in need of improvement and a design survey was carried out to provide alternate options that may be available. The resulting 11 kV and LV reconfiguration provided a more accessible, reliable and safer line than that of the original configuration at a cost of $24,085.

11 kV Network Reconfiguration Amethyst Power House

To avoid a potential hazard transporting high loads during penstock installation at the Amethyst Hydro power station, a section of 11 kV overhead line crossing the road was replaced with an underground cable at a cost of $19,601.

7.3.1.2 MV Switchgear

46001: Replace KFE Reclosers with Viper-ST & SEL Protection

Costs which were incurred in the previous financial year did not come through till the 2012/13 financial period resulting in an unbudgeted amount of $10,225.

7.3.2 *Uncommenced Works*

The following explains projects (over $10,000) that were not commenced in the 2012-22 AMP.

7.3.2.1 Sub-transmission

Arnold Dobson 33 kV Line Pole Replacement $20,000

The fate of the Arnold – Dobson 33 kV line hangs in the balance as proposed generation in the area will determine its future. With this in mind, the $20,000 allocated for pole replacement was put on hold.

7.3.2.2 Distribution

S670, Ahaura - Relocate 11 kV Line $35,000

The line to S670 at Ahaura was intended to be replaced in the latter part of the financial year however delays in final scope and design deferred the construction work to the early 2013-14 financial year.

7.3.3 Uncompleted Works

The following explains projects that were started and have more than $20,000 remaining in the 2012-13 AMP.

7.3.3.1 Distribution Substations

Upgrade S634 Tudor St - New Pad and Reconfigure LV

Resource constraints were the main contributing factor for the delay in completing the substation replacement on the corner of Tudor and Fitzherbert Streets. This job commenced late in the financial year with the majority of costs being passed through to the 2013-14 financial year.

Sub (Site) Upgrades

The figures originally forecast for the Distribution Sub Upgrade project was largely dependent on the commencement of the major substation inspection programme. It was anticipated that a significant number of distribution substations would have been identified during this process as needing an upgrade however due to delays in starting the inspection programme a lesser amount of subs than projected were identified as needing replacement.

7.3.3.2 Zone Substations

14032 - Zone Substation OLTC & Regulator Maintenance $75,000

Due to resource constraints the number of OLTC and regulators to maintain was reduced. All work able to be completed was done at a cost of $50,114 resulting in an under spend of $24,886.

44016 – Wahapo Zone Substation – Replace CB1 and Protection Relay $71,000

All work was completed on time and under budget, at a cost of $36,800 resulting in an under spend of $34,200.

7.3.3.3 MV Switchgear

46003 – Disconnector Replacements $32,000

Disconnectors that require replacing are identified during maintenance and operation of disconnectors. As a result of this, the cost varies from year to year. All disconnectors that were identified were replaced at a cost of $11,195, with $20,805 remaining on this contingency budget.

56008 – Fusing of Spur Lines by Feeder Classification $42,000

Resource constraints and a delay in identifying suitable spur lines to protect resulted in an under spend of $33,974 for this budget.

66005 – Automate Capacitors at Various Locations $42,000

Resource constraints and long lead time in ordering equipment required for developing a solution to automate existing Capacitor Banks locations resulted in an under spend of $25,928.

2012-13	Development		Enhancement		Replacement		IS&T		Faults		Repairs		Total	
	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget
0:Sub-Trans-mission	111,437	50,000	1,473,847	1,800,000	944,450	948,000	441,688	654,000	42,892	22,000	65,255	32,000	3,079,569	3,506,000
1:Distribution	27,994	14,000	17,613	0	418,404	435,000	1,710,905	1,186,000	223,825	324,000	88,537	50,000	2,487,277	2,009,000
2:Reticulation	17,150	0	1,307	0	40,136	90,000	259,728	234,000	42,566	22,000	24,895	20,000	385,783	366,000
3:Services	49,000	85,000	0	0	19,778	60,000	49,399	65,000	152,011	84,000	5,904	6,000	276,092	300,000
4:Zone Sub-stations	0	0	32,041	36,000	471,443	668,000	557,106	645,000	1,689	12,000	68,289	94,000	1,130,567	1,455,000
5:Distribution Substation	46,570	90,000	63,894	101,000	938	30,000	297,706	750,000	37,705	17,000	9,813	10,000	456,626	998,000
6:MV Switch-gear	259,568	344,000	69,058	119,000	78,855	123,000	185,278	186,000	6,015	6,000	69,210	44,000	667,985	822,000
7:SCADA/ Comms	347,774	405,000	17,037	55,000	37,852	60,000	285,945	360,000	40,196	45,000	39,484	45,000	768,288	970,000
8:Distribution Transformer	274,066	449,000	0	0	0	0	60,972	95,000	2,471	3,000	0	0	337,509	547,000
9:Other	0	0	0	0	0	0	11,730	5,000	1,995	6,000	0	1,000	13,726	12,000
Total	**1,133,560**	**1,437,000**	**1,674,797**	**2,111,000**	**2,011,855**	**2,414,000**	**3,860,458**	**4,180,000**	**551,366**	**541,000**	**371,387**	**302,000**	**9,603,423**	**10,985,000**

Table 7.6 Actual V Budget Performance by Asset Type

8.0 ASSET MANAGEMENT PRACTICES

8.1 Introduction

The electricity distribution system is comprised of assets with long lives. The management of these assets (including maintenance of existing assets and development of new assets) is Westpower's primary focus in providing an effective and efficient distribution service to its customers. Furthermore, because distribution is only one part of an integrated electricity system, consultation and coordination of plans is an essential ingredient for the effective functioning of that system.

This is an annually produced plan covering the next ten years and documents likely or intended asset management requirements. The plan provides a focus for ongoing analysis within Westpower aimed at continuously improving the management of the distribution system and it provides a vehicle for communicating AMPs with customers.

In many cases, particularly where asset development is involved, the work will be driven directly by customer requirements and associated financial commitments. This plan is based on Westpower's present understanding of its customers' requirements. It is part of the process of communication with customers, and Westpower will be responsive to customer input, with regard both to actual expenditure commitment and to long-term future planning.

The plan is also intended to demonstrate responsible stewardship of assets by Westpower to its customers and shareholders. The plan shows the maintenance and replacement requirements which are intended to maintain the operating capability of the system over the long term. Each year a process is carried out which reviews Westpower's achievement with respect to this plan and the results of this are summarised in the previous section.

This section broadly outlines Westpower's network services, current and desired asset management practices and specific improvement initiatives.

To identify and prioritise the asset management practices and needs of network services, asset management improvement tasks are discussed under broad headings of processes, information systems and data.

- Processes are the business processes, analysis and evaluation techniques needed for lifecycle asset management.
- Information systems are the information support systems used to store and manage the data.
- Data are those required for effective decision making (i.e. for managing using information systems).

Tables throughout this section broadly describe the current Westpower asset management practices and possible future (desired) business practices it is intended to ultimately develop. The asset management improvement plan discusses improvement priorities, timetables and resources for the next three years.

The following are specific issues and asset management procedures that are currently being addressed, using the process outlined in Figure 8.1 below.

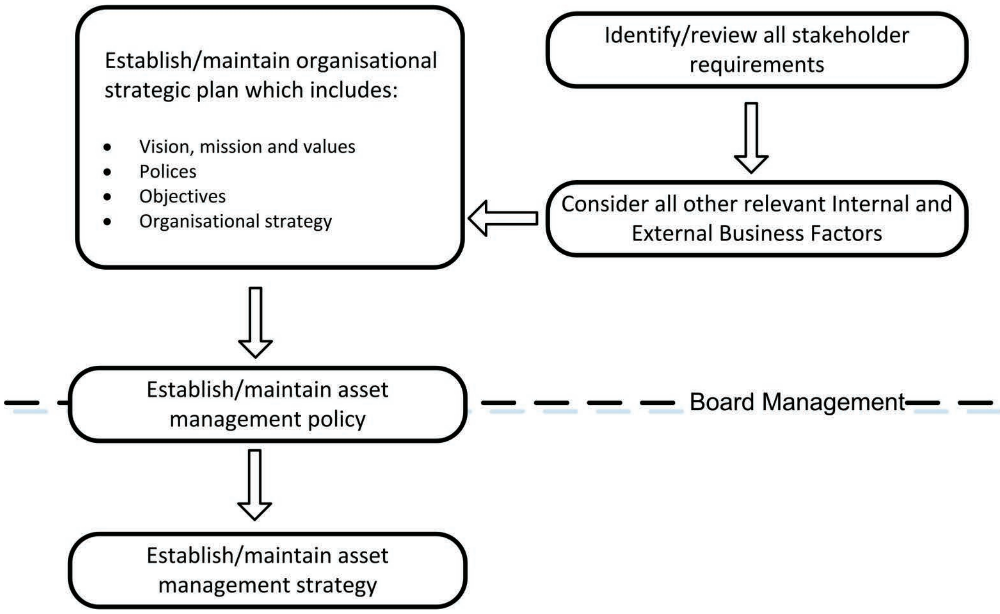


Fig 8.1 Asset Management System Elements

8.2 Asset Management Policy

The asset management policy is a direct communication from directors to management, employees and stakeholders of the organisation's position and intentions with regard to asset management. It provides a high level statement of the organisations principles, approach and expectations relating to asset management.

Westpower is committed to maximising shareholder's investments in a legally and environmentally compliant and sustainable manner, without compromising the health and safety of our employees, consumers or the public. This shall be achieved by adopting the following policy statement:

1. Safety

- Safety – Safety is of paramount importance in everything that we do and will not be compromised for cost, time or any other reason.

2. Reliability

- Reliability of Supply - Through continued investment in relevant technology and system configuration, reliability must meet approved targets at all times; and
- Quality of Supply – Quality of supply to commensurate with the load type and criticality, must meet Westpower's standards and remedial action will be taken where standards are not met.

3. Security

- Security of Supply - The desired level of security is defined by good industry practices and long term plans must be developed to achieve the required security; and
- Transpower - Every effort must be made to focus Transpower on security of supply for the West Coast.

4. Sustainability

- Maintain Service Potential - The future of Westpower's business is wholly dependent on the ability of the network to continue to provide service for the foreseeable future. Every effort must be made to maintain the ongoing service potential of the network where appropriate.

- Supporting Economic Growth - We recognise that electricity infrastructure is a key enabler of economic growth and will work with current and future developers to provide electricity with the capacity, security and quality required to support their business.
- Continual Improvement – The asset management system will be reviewed on an annual basis and where weakness is found, improvements will be made. Compliance with PAS-55:2008. Asset Management, shall be supported;
- Strategic and Long Term – Our infrastructure business involves long term investments and we will ensure our decisions align with and support the organisation's strategic plan.
- New Investment - Any new investment to expand the asset base must meet shareholder expectation and approval where necessary; and
- Communication - The requirements of the asset management system must be communicated to all stakeholders to enable them to be aware of their obligations and to ensure their expectations are considered in all aspects of planning.

5. Cost Efficiency

- Cost Efficiency - All projects must compete for financial resources and prudent asset stewardship requires careful budgeting and robust financial review processes are used to ensure maximum cost efficiency. Opportunities for improved productivity through training, technology, process improvement or other means will be constantly pursued.
- Energy Efficiency - Energy efficiency is encouraged in all areas of Westpower's activities and will continue to be a key outcome from the design process. Where opportunities exist to enhance energy efficiency for existing assets, these are actively pursued and implemented where technically and economically feasible.
- Technology - Technology is seen as a key enabler in providing improved service and value to our consumers. We will continue to keep abreast of developments in the field of new and emerging technology and apply these to Westpower's network where appropriate.
- Fair Pricing - The price of delivery of electricity to customers must be transparent and fair to all users of the asset; and
- Capital Contributions - Any expense for network extensions to supply new loads will be met by a consumer contribution towards the costs involved.

6. Environmental Impact

- Environmental Impact - Westpower is environmentally responsible and carefully considers the environmental impact of any of its actions. Furthermore, the company works hard to mitigate any negative affects and provide a net environmental benefit where this is practical. Westpower considers the climate change reports provided by the Intergovernmental Panel on Climate Change (IPCC) are reliable and provide a reasonable indication of what Westpower needs to consider in its planning processes.

7. Risk Management

- Risk Management - Westpower adopts the AS/NZS ISO 31000:2009 standard in its approach to risk management and has a Group Risk Management Plan that includes Business Impact Analysis and Business Continuity Planning. The asset management system has developed a risk management plan relating directly to Westpower's distribution assets.

8. Legislation

- Legislative Compliance - the asset management system must meet all relevant legislation but the key legislation is the Electricity Act and the Health and Safety in Employment Act. Where non-compliance issues are identified, these will be dealt with promptly and transparently.

9. Alignment with Other Policies

- The asset management system policies expressed above align with other functional policies within Westpower.

10. Audit and Review

The asset management system policy shall be subject to audit and review.

8.3 Rationalisation of Responsibilities and Procedures

The structure of ElectroNet's asset management group, reporting to the General Manager, Assets and Engineering Services, continues to develop to meet business needs and legislative change. Responsibilities, reporting lines, work flows and procedures have been implemented for the different activities carried out in the office. These activities include action, planning, monitoring and reporting.

8.4 Network Services Operational Support

Westpower uses ElectroNet Services as its preferred maintenance contractor for all network associated inspection service and testing, faults, fault repair, maintenance replacement and network enhancement. Development projects are handled in the same way, although outside contractors may be sub-contracted in to carry out carry out some of the work.

Service level agreements are currently in place with ElectroNet services for asset management and asset maintenance. Larger enhancement and development projects have contracts prepared on a specific basis.

8.5 Information Systems Development

The asset management group has implemented the IBM Maximo® Asset Works Management System (AWMS) used for asset and works management processes. Expenditure can be tracked by activity and by asset type, and is audited monthly.

Improvements have been made to the Maximo® asset database, which keeps information on the types of equipment installed at a site. This system also tracks the maintenance history of transformers and other associated equipment.

8.6 Specifications, Procedures and Manuals

Westpower is spending considerable effort in updating its manuals for easier use by contractors, which denote Westpower's specifications, levels of competency, network releases and access to sites. The completion of a full suite of manuals and standards suitable for use by contractors is a key strategic goal during the first year of the planning period. A set of network design standards are also available to contractors who wish to undertake network extensions and network reconstruction.

Procedures have been developed and deemed to be mandatory for contractors who wish to carry out work on Westpower's network.

8.7 Deregulation/Compliance with MED and Commerce Commission Requirements

The specific external environment in which Westpower operates is the power supply industry in general.

8.8 Asset Renewal Policy

The general renewal policy is to rehabilitate or replace assets when justified by asset performance.

Renewal of an asset is required when it fails to meet the required level of service. The monitoring of asset reliability, capacity and efficiency during planned maintenance inspections and operational activity identifies non-performing assets. Indicators of non-performing assets include:

- Structural life,
- Repeated failure,
- Ineffective and/or uneconomic operation,
- Economics.

Renewals are programmed with the objective of achieving:

- The lowest life cycle cost for the asset (uneconomic to continue repairing),
- An affordable medium term cash flow,
- Savings by co-ordinating renewal works with other planned works.
- Risk reduction.

The risk of failure and associated environmental, public safety, financial or social impact justifies proactive action (e.g. impact and extent of supply discontinuation, probable extent of property damage, health risk etc.).

Planned and reactive replacement works can be prioritised in accordance with the priority ranking shown in Table 8.1 below.

Table 8.1 - Asset Renewal Criteria

Priority	Renewal Criteria
1 (High)	Asset Failure has occured.
	Asset Failure of critical system component is imminent.
	Regular maintenance required.
	Valid and Ongoing Complaints from Stakeholders.
2	Failure of non-critical asset is imminent and renewal is the most efficient life cycle cost alternative.
	Maintenance requiring more than six visits per year.
3	Reticulation maintenance involving two to three visits annually.
	Difficult to repair, due to fragile nature or material obsolescence.
4	Existing assets have low level of flexibility and efficiency compared with replacement alternative.
	Technical Obsolescence

8.9 CAPEX Analysis

CAPEX needs to be carefully targeted to ensure that the greatest benefit is reaped from each capital dollar expended.

Westpower has developed a formal process for optimising its CAPEX and this involves the use of a discounted cash flow (DCF) analysis, where feasible, along with other methods to determine the optimal CAPEX profile. The process used has been explained in more detail in Section 5.3.

8.10 Distributed Generation

Distributed generation is electricity generation equipment connected to the customers' installations, and capable of generating electricity back to the electricity network, as well as supplying electricity for the customers' own use at the location it is installed.

Usually, it will be a fixed installation but it may be disconnectable and moveable if required. The installation will include all necessary protection equipment required for the safe operation of the distributed generation system.

In the context of Westpower's guides for connection, distributed generation comprises:

- Small systems of less than 5 kW capacity;
- Medium systems of between 5 kW and 30 kW capacity;
- Large systems between 30 kW and 1000 kW capacity;

Large systems would normally be associated with industrial sites or as dedicated generation facilities.

Westpower's policy is to actively encourage distributed generation as a means of reducing system losses and improving both the reliability and quality of supply to the area.

Customers interested in developing such facilities are invited to contact Westpower's agent ElectroNet Services to request a copy of the distributed generation information pack. This pack will provide valuable assistance in planning and engineering an acceptable solution.

Formal application forms will be available to ensure that the appropriate information is provided to allow Westpower to approve connection to its network and ensure compatibility with the existing reticulation network.

Any new distributed generation installation also requires contractual arrangements to be put in place with a retailer to purchase any excess electricity generated. Westpower may then credit the retailer for the energy that is exported at the same price that the retailer is charged for the delivery of energy, providing a net benefit to the distributed generator.

Refer to Section 5.5 for more detailed information.

8.11 Asset Management System Improvement Process

8.11.1 Introduction to PAS-55

Westpower has re-evaluated its asset management systems by conformance with the U.K. specification PAS-55-1:2008 Asset Management.

PAS-55 is the publicly available specification for the optimised management of physical assets and infrastructure. Development of PAS-55 was sponsored in the United Kingdom by the Institute of Asset Management in response to a need identified by regulators and asset owners. This was developed in order to define asset management in the context of physical infrastructure by setting out the key attributes of effective asset management system.

PAS-55 consists of 24 key requirements which together provide a framework defining current best practice for the whole-of-life management of physical assets. The 24 key elements shown diagrammatically in Figure 8.2 work together to provide a rigorous process based on the plan-do-check-act cycle. The requirements link strategic business objectives to detailed operational plans, ensuring that operating and capital investment is targeted at realising asset performance and risk profiles that meet stakeholder expectations and business objectives.

PAS-55, while not having the status of a British or an ISO standard is an auditable specification. As such, Westpower will seek to obtain independent external certification verifying conformance with the documented requirements. Such external certification is becoming recognized by asset owners and regulators internationally as a useful means to demonstrate good governance, due diligence in the management of asset related risk and optimized asset management decision making.

To date, Westpower has documented 95% of the processes required for conformity with PAS-55 and will spend the next twelve months implementing these processes, reviewing their effectiveness and commencing a program of continual improvement.

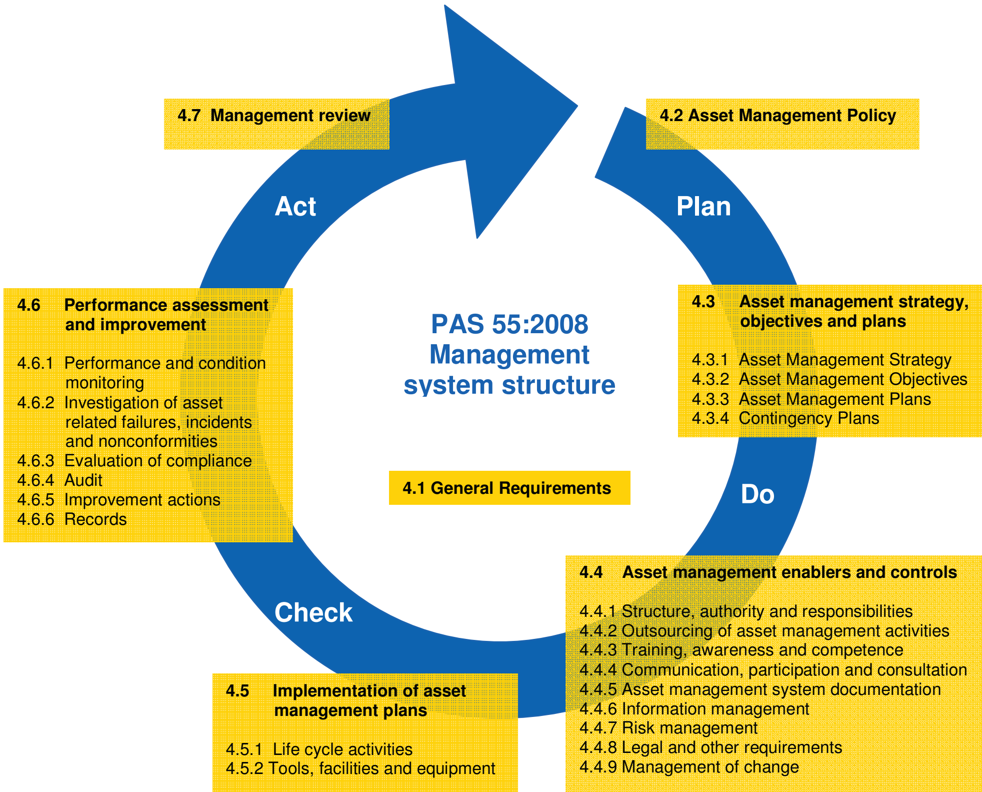


Fig 8.2 PASS-55 Asset Management System Elements

8.11.2 Purpose and Objectives of this Review

A detailed gap analysis of Westpower's asset management system has been conducted against the requirements of PAS-55 with the objective of conformance or certification against the document. The objectives of this review were to:

1. Provide an understanding of Westpower's current position with regard to alignment with PAS-55.
2. Identify areas where changes to asset management processes would yield improvements in financial performance, asset performance and risk management.

8.11.3 Improvement Plan

Westpower has adopted progression towards PAS-55 conformance as a key performance indicator in the overall business Strategic Plan.

As part of this process, the board signed off on the Asset Management Policy on (insert date), which provides the governance framework for all asset management activities. This ensures strategic alignment between Westpower's business goals and management of the asset.

Over the next year, Westpower plans to complete a number of initiatives aimed at reducing the conformance gaps that have been identified in the rest of this section.

Key targets for the coming year include:

- A formal and documented review of the performance of the last AMP as required by PAS-55;
- Implementation of the formally documented asset management system; and
- Reviewing conformance with PAS-55:2008 at the end of the period.
- Preparing a compliance strategy and timeframe.

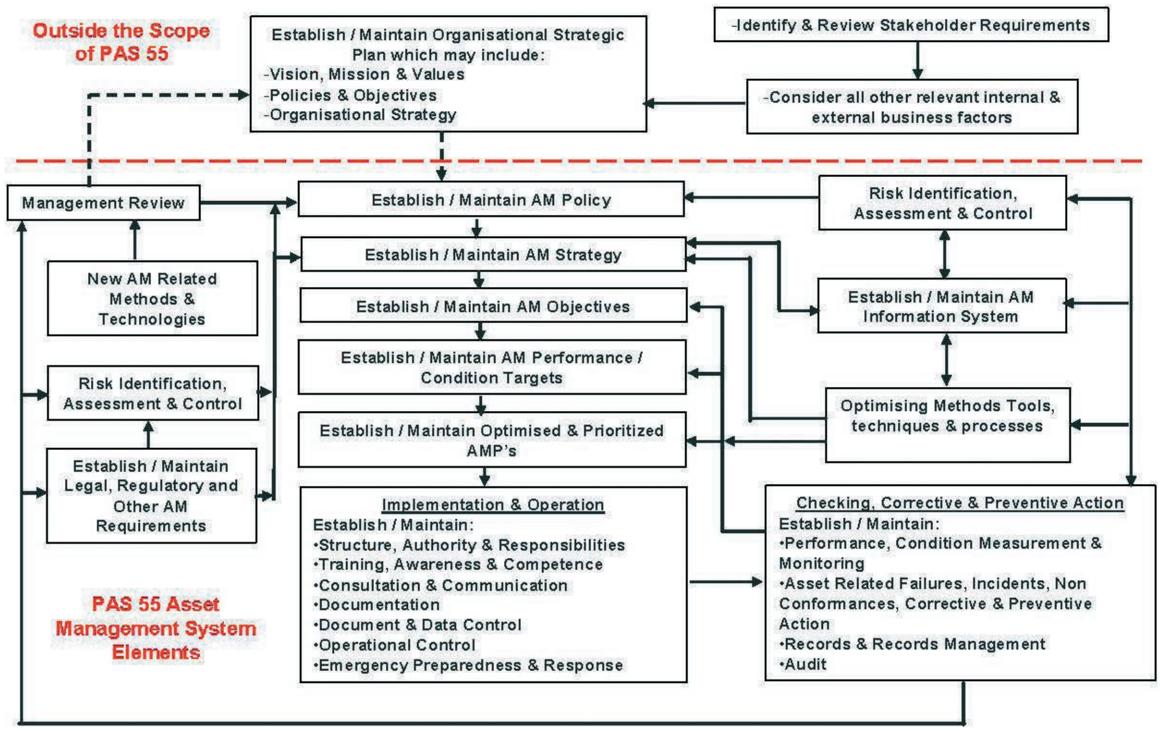


Fig 8.3 PAS-55 Asset Management Framework

8.11.4 Gap Analysis Assessment Criteria

PAS-55 contains 24 key mandatory requirements which can be further subdivided to a total of 164 discrete elements for evaluation. Questions chosen to reflect the intent of these elements were scored semi-quantitatively to provide a measure of the organisation alignment or maturity in that area. A summary of the scoring methodology is shown in Table 8.2.

Table 8.2 - Gap Analysis Assessment Criteria

Rating	%	PAS 55 Maturity Level	Evaluation Criteria
1	0	Innocent	This element of PAS 55 is not in place; the organisation is unaware of the need for this element.
2	20	Aware	The organisation has a basic understanding of the requirements of this element of PAS 55 and is in the process of deciding how this element will be applied.
3	40	Developing	The organisation has a sound understanding of this element of PAS-55. It has been deciding how this PAS-55 element will be applied and work is progressing on implementation.
4	60	Compliant	This element of PAS-55 is implemented as required; minor inconsistencies may exist.
5	80	Excellence	This element of PAS-55 is comprehensively implemented and integrated with other elements.
6	100	Beyond PAS 55	Using processes and approaches that go beyond the requirements of PAS-55, pushing the boundaries of asset management to develop new concepts and ideas.

8.12 Detailed Findings

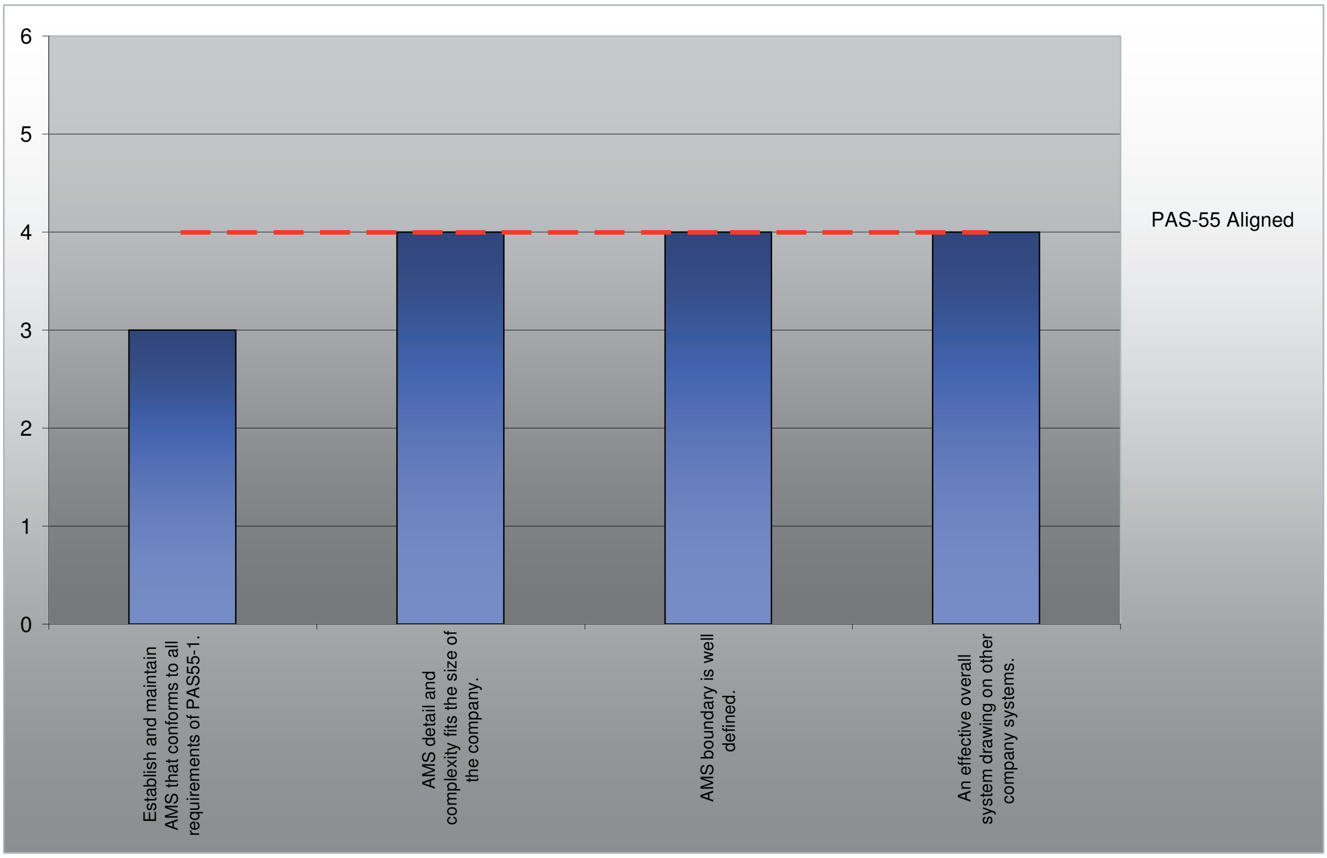
8.12.1 Asset Management System

"The organisation shall establish, document and maintain and continually improve an AMS in accordance with the requirements of PAS-55."

Table 8.3 - Asset Management System

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
1	a	Establish and maintain AMS that conforms to all requirements of PAS55-1.	3	Developing	The draft AMS is a good document for establishing PAS 55 into Westpower. All elements need to be satisfied to receive full compliance score for establishment. Unable to score for maintain as not fully implemented yet. PAS 55 was used in 2008 as a tool for practices review and reported in the 2011 AMP.	All
2	b	AMS detail and complexity fits the size of the company.	4	Compliant	The draft AMS is an appropriate size for Westpower.	All
3	c	AMS boundary is well defined.	4	Compliant	The AMS boundary is defined as electricity distribution for the West Coast. The relationship with Electronet is clearly defined and the link to Westpower for PAS 55 purposes.	2
4	d	An effective overall system drawing on other company systems.	4	Compliant	The AMS links well to other existing systems and there is good links to associated documents.	All

Review against PAS-55 Requirements



Observations and Improvement Opportunities

The intent of this group of requirements is that the organisation recognises asset management as a core business function, and demonstrates commitment to the development and continual improvement of the asset management function. This is clearly evident within Westpower through the AMP, the SCI and the organisation structure.

The concise and auditable document defining Westpower's asset management system clarifies asset management processes and enhances Westpower's ability to demonstrate conformance with PAS-55.

Recommended Actions

That Westpower concentrates on implementation of the processes defined in its overarching asset management system documentation. At the end of the period, Westpower must review the performance of the asset and the asset management system for conformance with PAS-55 to enhance its continual improvement program.

That Westpower completes a full internal audit against PAS-55 using a competent auditor prior to end of March 2015.

8.12.2 Review against PAS 55-1

"The organisation shall conduct a review to compare the current management of its assets against the requirement of PAS 55-1."

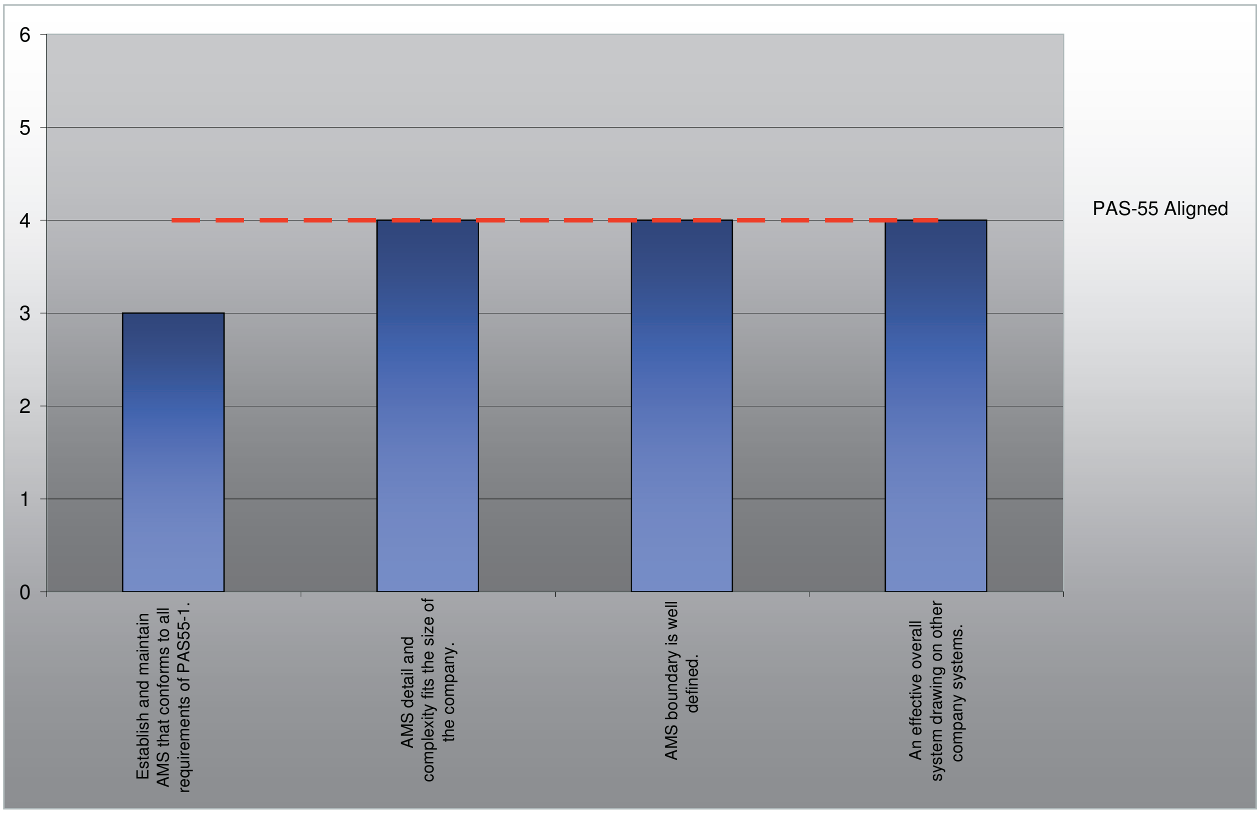
Table 8.4 - Review against PAS-55

Q#	PAS-55	Criteria		Maturity Level	Comments	AMS Section
5	a	Review against the Strategic Plan.	4	Compliant	The draft AMS is aligned with the SCI and Strategic Plan, Westpower's main strategic plans.	3
6	b	Review compliance with legislation and regulations.	4	Compliant	The draft AMS summarises legislative compliance in AM Policy, Strategy and Objectives, Sections 4.8, 5.8 and 6.6 respectively. It is reported to the board quarterly.	4.8, 5.8, 6.6
7	c	Identification and evaluation of asset management risks.	4	Compliant	A risk management assessment has been completed that covers likely risk events including critical assets, operations, future planning and environmental. Each identified risk is assessed for impact, effectiveness and likelihood ratings resulting in a consequences rating. This is summarised in draft AMS Section 5.7 and the associated document risk management analysis.	5.7
8	d	Existing AM practices and procedures.	4	Compliant	The existing practices are documented well in the 2011 AMP. This could be strengthened with a statement in Section 7 AMP about the review of Existing AM practices. Existing procedures are stated in the links to associated documents in the AM Strategy.	5, 7
9	e	Review the performance of assets and asset system (suitability, utilisation, condition and costs).	4	Compliant	Asset management performance is summarised in draft AMS Section 5.2, Reliability. There still needs to be a link to the 2011 AMP (Section 3 Assets Covered). It is stated that overall the assets are in good condition but there needs to be a statement that Westpower wishes to protect that position. We understand that assets are still not performing and not meeting the targets. This should be explicitly stated	5.2
10	f	Review feedback from previous incident investigations.	4	Compliant	The review of feedback from previous incidents, accidents and emergencies is provided in the draft AMS Section 6.1 Safety and 16.2 Investigation of Failure, Incidents and Non-conformities. An AM Review Process has been developed which includes performance of incident investigations, and started in 2011.	6.1, 16.2

Table 8.4 - Review against PAS-55

Q#	PAS-55	Criteria		Maturity Level	Comments	AMS Section
11	g	Relevant management systems, competency and resourcing.	4	Compliant	There is an internal business intelligence system The Vault that holds training records. We understand that Westpower has a Sharepoint operating that hosts dedicated health and safety information, training records and incidences. There is a formal Health and Safety Committee, staff training programs and Hazard Identification Program as detailed in AM Strategy. There is also a dedicated Asset Management Group with about 14 people based at Electronet, reporting to Westpower's Asset Manager. The training for this group is not covered by The Vault but there is a separate training record for the AMG and this is an associate document to Section 10.	5.1, 10

Review against PAS-55 Requirements



Observations and Improvement Opportunities

Westpower has developed a stand-alone asset management system as required by PAS-55. The document has been independently reviewed by AECOM and the gap analysis is presented in this AMP. The gap analysis relates mainly to the documented processes but it still remains for Westpower to fully implement and review these processes.

Recommended Actions

That the draft asset management system be fully implemented and reviewed with the intention of seeking to obtain independent external certification within two years, verifying compliance with the documented requirements. An internal audit at the completion of the first year would provide quality guidance.

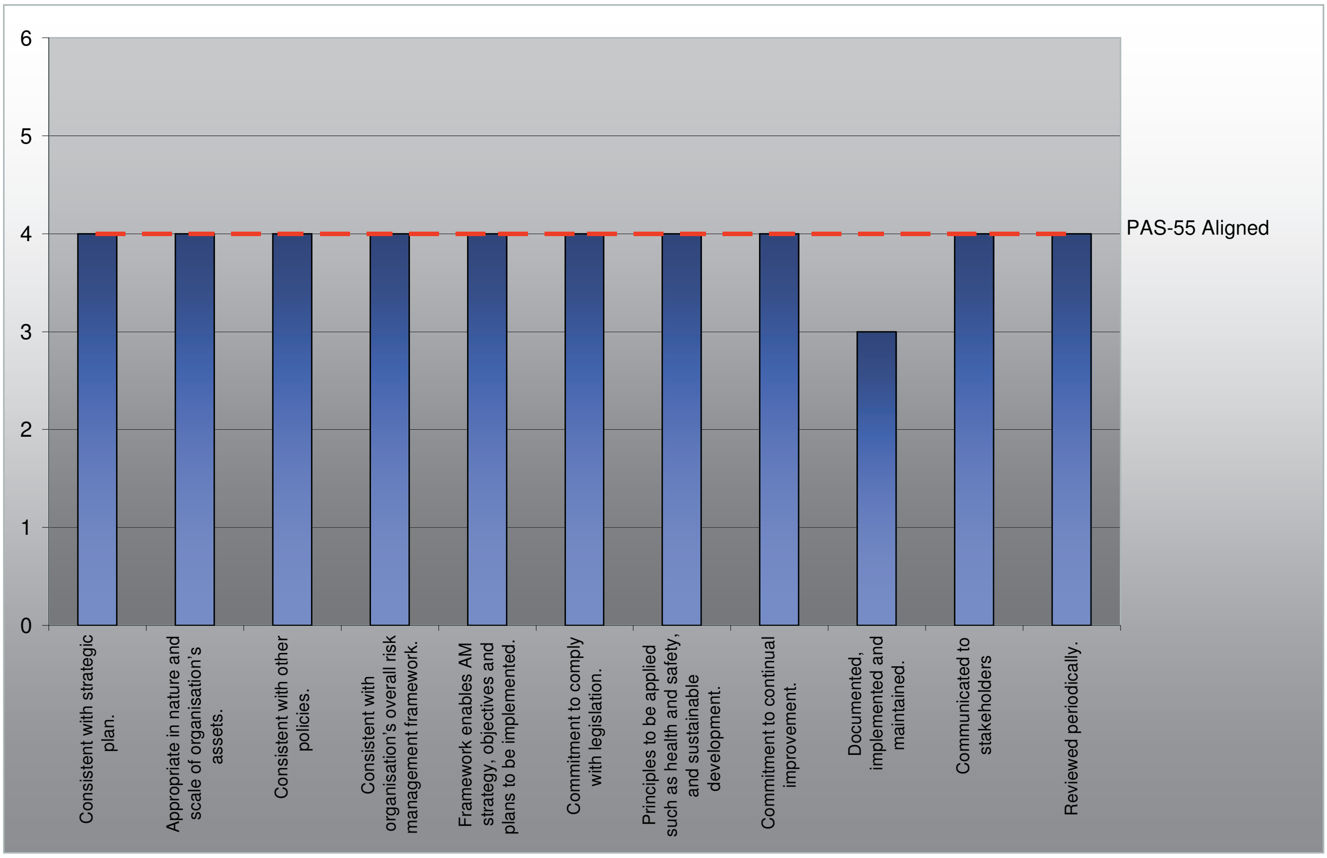
8.12.3 Asset Management Policy

"The organisation's top management shall authorise an overall asset management policy."

Table 8.5 - Asset Management Policy

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
12	a	Consistent with strategic plan.	4	Compliant	The policy is based on Westpower's SCI (dated 2011-2013) and the Strategic Plan (dated 30 September 2010). These are their main startegic plans.	4
13	b	Appropriate in nature and scale of organisation's assets.	4	Compliant	The draft AMP policy is three pages in length which is appropriate for most policies and considering Westpower is a relatively small EDB.	4
14	c	Consistent with other policies.	4	Compliant	The alignment with other policies is summarised in draft AMS Section 4.9 including the Maintenance and Operation Policy, and health and safety. There are links to other polices listed at the end of AMS Section 4.9. It would be desirable to have a separate environment policy.	4.9
15	d	Consistent with organisation's overall risk management framework.	4	Compliant	This is adequately addressed in AMS Section 4.7.	4.7
16	e	Framework enables AM strategy, objectives and plans to be implemented.	4	Compliant	The AM Policy in Section 4 sets the framework for the AM strategy, and objectives well. We understand that there are multiple sources of work needs that are not well linked to the financial policies and budgets. Frequently the planned capital works programmes are not delivered. There needs to be controls and consequences for not delivering the planned programme. This would be better covered in Section 15 Implementation of AMPs.	4
17	f	Commitment to comply with legislation.	4	Compliant	This is addressed adequately in AMS Section 4.8 although briefly and now states the key legislation such as Health and Safety in Employment Act and the Electricity Act.	4.8
18	g	Principles to be applied such as health and safety, and sustainable development.	4	Compliant	This is addressed adequately for health and safety, and sustainability in AMS Sections 4.1 and 4.4 respectively. More depth to health and safety principles would be helpful.	4.1, 4.4
19	h	Commitment to continual improvement.	4	Compliant	This is addressed adequately under continual improvement in AMS Section 4.4.	4.4
20	i	Documented, implemented and maintained.	3	Developing	The AM Policy is documented as provided in AMS Section 4. There is a formal review now as stated in draft AMS Section 4.10. Unable to score for maintain as not fully implemented yet.	4.4, 4.10
21	j	Communicated to stakeholders	4	Compliant	Communication with stakeholders is summarised in AMS Section 4.4 Sustainable under Communication. This is supported by an associated document showing the key stakeholders and their interest area. The policy is written in plain English and is easy to read so provides a good platform for communication with stakeholders. It is important that there is top management endorsement as suggested with CEO signature that is visible to staff and service providers. We understand that the AMS will be available on the intranet.	4.3, 4.4
22	k	Reviewed periodically.	4	Compliant	There is a statement on annual review in AMS Section 4.4 as discussed above. The review history will be shown in Section 4.10 after every annual review.	4.4, 4.10

Review against PAS-55 Requirements



Observations and Improvement Opportunities

The intent of requiring an asset management policy is to provide a reference document, endorsed by the most senior management of the business, defining the boundaries or framework within which asset management decisions must be made within the organisation. Westpower has developed a draft policy which is aligned with this requirement. Completion and endorsement of the policy would see the above ratings align with PAS 55.

Recommended Actions

That the asset management policy is formally endorsed by directors and the matter recorded in the company minutes:

- That the approval date and authority be recorded on the policy statement;
- That the policy be fully communicated throughout the organisation; and
- Set a review cycle; it is suggested that this coincide with finalisation of the SCI or other strategic planning documents.

8.12.4 Asset Management Strategy

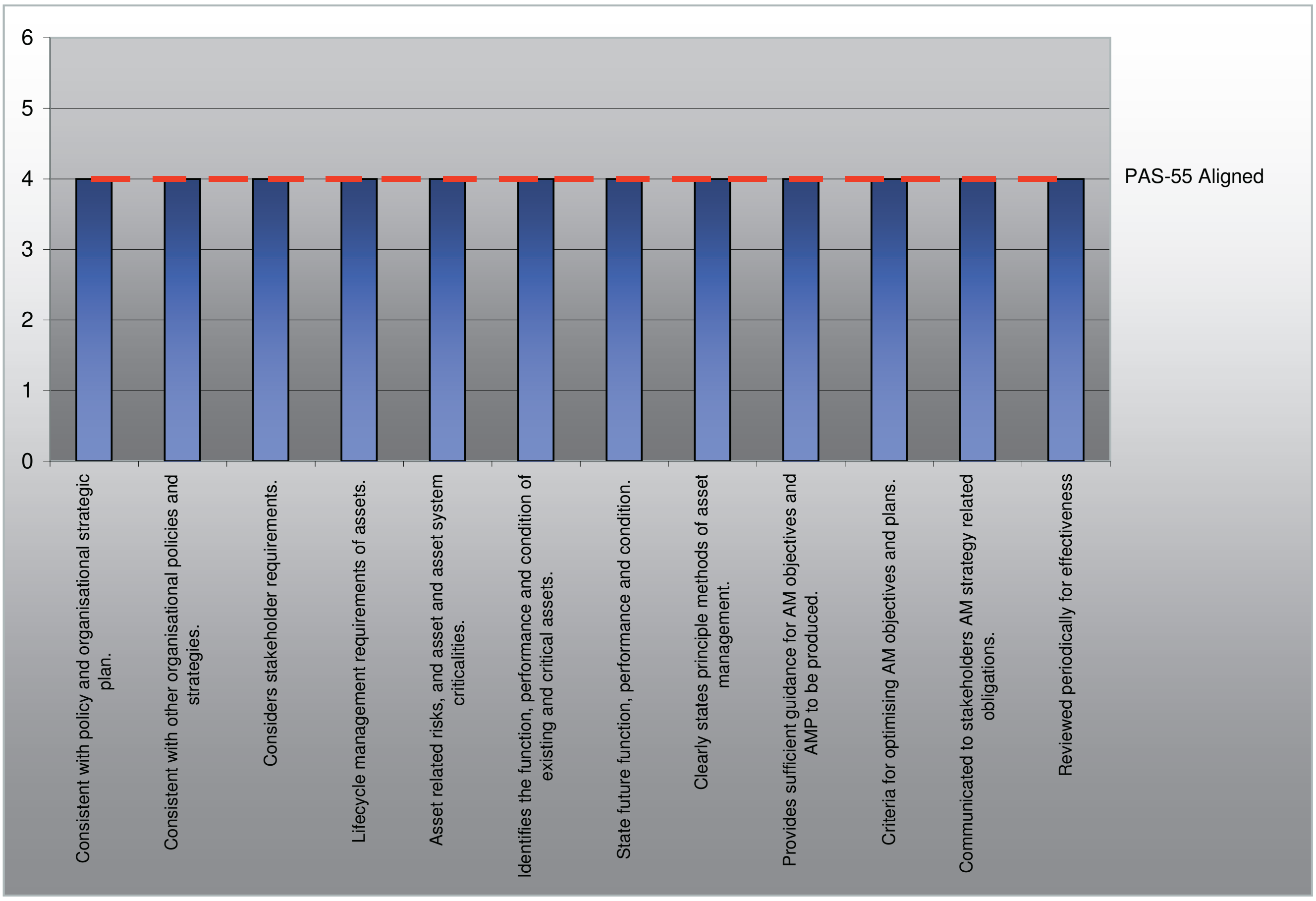
"The organisation shall establish, document, implement and maintain a long-term asset management strategy authorised by top management."

Table 8.6 - Asset Management Strategy

Q#	PAS-55	Criteria		Maturity Level	Comments	AMS Section
23	a	Consistent with policy and organisational strategic plan.	4	Compliant	This is addressed in the introduction paragraph at the start of AMS Section 5.	5
24	b	Consistent with other organisational policies and strategies.	4	Compliant	There are good links to associated documents at the end of each strategy section, although most of these documents are not strategies or policies. The strategy is consistent with the AMS policy with the same format. It would useful to shown how the Maintenance and Operations Policy relates to the AM Strategy, especially Section 5.2 Reliability.	5
25	c	Considers stakeholder requirements.	4	Compliant	There is consideration of stakeholder requirements as follows: 1. There is a general statement about communicating with contractors and public at the end of Section 5.1, Safety; 2. There is a general statement about surveying consumers on a regular basis and a customer complaint system in Section 5.2; 3. There is a general statement about discussions with Transpower in Section 5.3 Security; 4. There is a general statement about communicating with the Board about oil spills in Section 5.6 Environmental Impact; 5. There is a general statement about discussion with stakeholders on the AMS at the end of AMS Section 5.8, Compliance with Legislation. There is good information about two industry groups ENA and EEA that Westpower participates with; 6. The draft AMS Section 5.9 summarises communication with stakeholders. This includes a link to the Westpower stakeholder matrix.	5.1, 5.2, 5.3, 5.6, 5.8, 5.9
26	d	Lifecycle management requirements of assets.	4	Compliant	AMS Section 5.4 Sustainability provides a statement about asset lifecycle management with a reference to Section 6 of the AMP. It could be strengthened by identifying the key asset issues for Westpower.	5.4
27	e	Asset related risks, and asset and asset system criticalities.	4	Compliant	AMS Section 5.7 details the risk processes Westpower undertakes with five associated documents. Asset risk is covered under the regular inspection and the design standards in place. It is also covered with asset risk management assessment summarised in Section 5.7 with detail in Risk Management Analysis and Process. Critical assets are summarised in AMS Section 5.7 with detail in the Risk Management Analysis.	5.7
28	f	Identifies the function, performance and condition of existing and critical assets.	4	Compliant	The assessment of performance and condition of existing and critical assets is covered in AMS Section 5.2 Reliability. Performance is discussed at a high level but does not cover critical assets as required. We suggest that there is detail on the actual performance of the critical assets. References can be made to the relevant AMP section so there is no repetition of material. There is good discussion on asset condition of the existing and critical assets.	5.2
29	g	State future function, performance and condition.	4	Compliant	The desired future function, performance and condition of the existing and critical assets is summarised in AMS Section 5.2 Reliability. This includes a statement that your customers are satisfied with the current asset performance from recent surveys and do not wish their costs to increase. Asset performance is measured by SAIDI and SAIFI which is consistent with your Strategic Plan (for SAIDI).	5.2

30	h	Clearly states principle methods of asset management.	4	Compli-ant	The strategy provides the principles for asset management in some areas and is weak in other areas as follows: Security of supply principles are discussed adequately in AMS Section 5.3 Security. The four well beings are discussed adequately in AMS Section 5.4 Sustainability. Risk management principles are discussed adequately in AMS Section 5.7. Whole of life costings is stated in AMS Sections 5.4 Sustainability.	5.3, 5.4, 5.7
31	i	Provides sufficient guidance for AM objectives and AMP to be produced.	4	Compli-ant	There is guidance at quite high level including security programmes such as Transpower's WCGUP and regular equipment inspection programme.	5.3, 5.7
32	j	Criteria for optimising AM objectives and plans.	4	Compli-ant	The optimisation and prioritisation of AM objectives and plans is summarised in draft AM Section 5.4. This is monitored with the AMS Review Process. This should be added formally as an associate document.	5.4
33	k	Communicated to stakeholders AM strategy related obligations.	4	Compli-ant	Communication with stakeholders is summarised in AM Strategy Section 5 about awareness of their strategy related obligations. AMS Section 5.1 states that there are specific forums where staff obligations are discussed at toolbox meetings with the CEO. There is a specific section on communication with stakeholders, Section 5.9.	5.1, 5.8, 5.9
34	l	Reviewed periodically for effectiveness	4	Compli-ant	The review process for the strategy is stated in Section 5.10. It is reviewed December each year.	17

Review against PAS-55 Requirements



Observations and Improvement Opportunities

In the PAS-55 context, asset strategies refer to the overall approach to managing an asset class i.e. defining how the asset is to be managed, so that detailed operational plans for individual assets can be derived. The Westpower asset management system contains a description of asset strategies by asset class. Improvements could be made by linking asset strategies to a risk management process.

Recommended Actions

That Westpower continue its development of a formal risk management system which provides input to the asset strategy process (see later recommendations).

Document responsibility and target timeframes for implementation of the asset management strategy (for example an annual asset planning calendar) for the development of detailed operational plans.

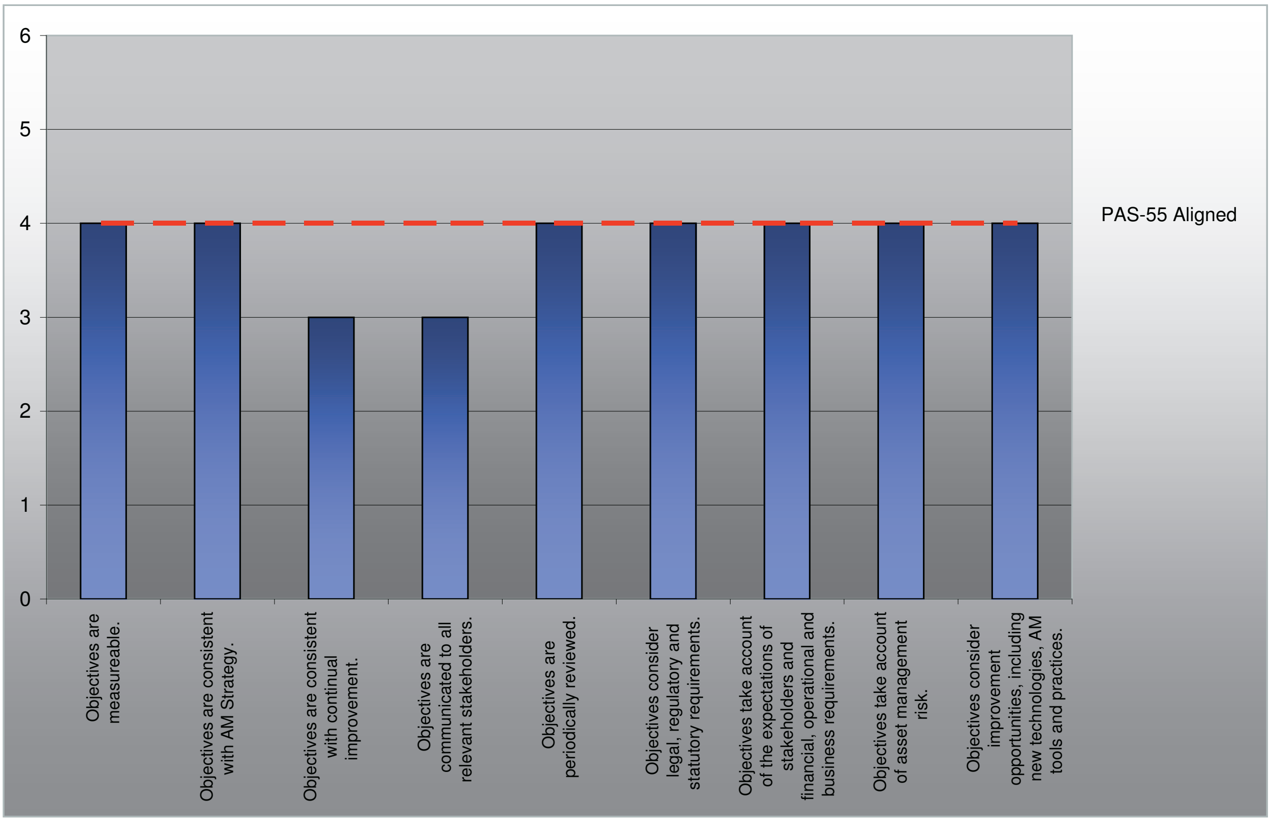
8.12.5 Asset Management Objectives

"The organisation shall establish and maintain documented asset management objectives which shall be measureable, consistent with the strategy, communicated to stakeholders and periodically reviewed."

Table 8.7 - Asset Management Objectives

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
35	a	Objectives are measureable.	4	Compliant	The objectives are summarised under each strategy area in bullet point format with good links to associated documents. The objective measures for each area are listed, relevant for Westpower, and currently measured. It would be helpful if the objectives were stated in measurable terms for each objective. Some are and some are just referenced. The PAS55 example is: To achieve an average of 97% system availability on the route. Optimisation between performance, condition, cost and risk is addressed at a high level under Sustainability.	6, 6.1, 6.2, 6.3, 6.4, 6.5, 6.7, 6.8
36	b	Objectives are consistent with AM Strategy.	4	Compliant	The objectives are linked to each strategy, ie safety, reliability.	6
37	c	Objectives are consistent with continual improvement.	3	Developing	The objectives are reviewed annually as stated in Section 6.11. This could be strengthened with a statement that this continual improvement is undertaken with the AMP update in the LOS section every year.	6.11
38	d	Objectives are communicated to all relevant stakeholders.	3	Developing	Communication of the objectives to all relevant stakeholders is stated in AMS Section 6.9. It is stated that communication has been limited to date but there are future plans. This criterion is scored as developing until these are implemented.	6.9
39	e	Objectives are periodically reviewed.	4	Compliant	The objectives are reviewed annually as stated in Section 6.11.	6.11
40	f	Objectives consider legal, regulatory and statutory requirements.	4	Compliant	AMS Section 6.7 summarises legislative compliance. It is noted that a compliance report will be added as an associate document.	6.7
41	g	Objectives take account of the expectations of stakeholders and financial, operational and business requirements.	4	Compliant	Stakeholders and financial, operational and business requirements are considered under Reliability, Security, Sustainability and Cost efficiency Objectives. These are reported to stakeholder through Information Disclosure.	6.2, 6.3, 6.4, 6.5
42	h	Objectives take account of asset management risk.	4	Compliant	Risk management objectives are summarised in AMS Section 6.6 including the management of risk, critical assets and emergency planning.	6.1, 6.2, 6.3, 6.6, 6.7
43	i	Objectives consider improvement opportunities, including new technologies, AM tools and practices.	4	Compliant	AMS Section 6.10 summarises improvement opportunities with current initiatives.	6.1

Review against PAS-55 Requirements



Observations and Improvement Opportunities

The intent of this requirement is that the asset management organisation identifies a small number of key asset management objectives that set the direction for the detailed planning process. These could be high level direction statements regarding asset performance, asset creation/replacement, safety and risk and financial performance.

Westpower has a number of objectives published in the asset management plan (levels of service section) and in the SCI that meet the intent of providing broad objectives that can be further broken down into specific operational targets and plans. Westpower's draft asset management system clearly and concisely identifies and documents key asset management objectives flowing directly from the corporate strategy.

Recommended Actions

That Westpower further develops key asset management objectives and clearly communicates these with stakeholders. Ensure that when developing objectives that all requirements of PAS-55 1 4.3.2 are taken into consideration and documented.

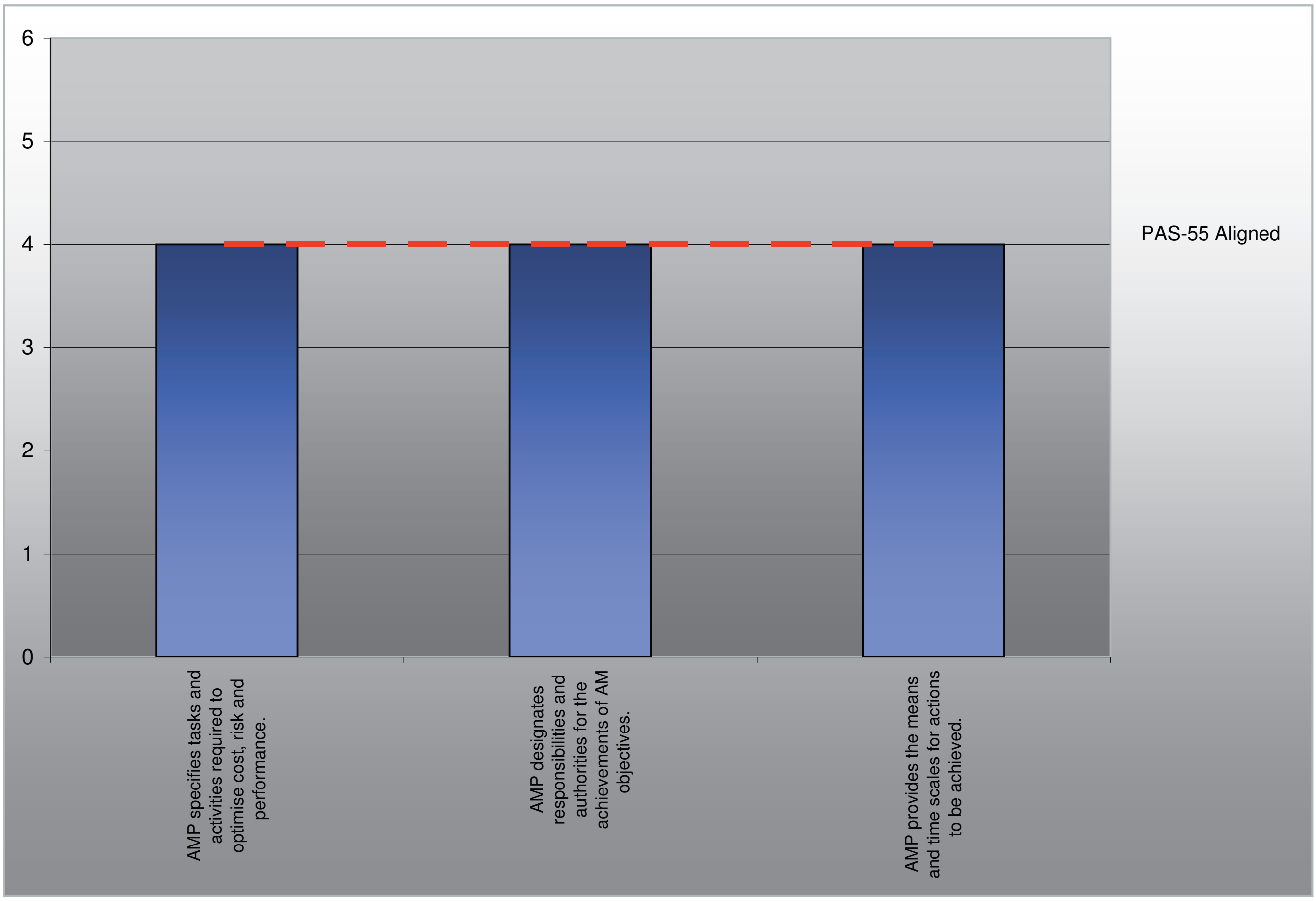
8.12.6 Asset Management Plans

"The organisation shall establish, document and maintain AMPs to achieve the asset management strategy and deliver the objectives across the life cycle activities."

Table 8.8 - Asset Management Plans

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMP Section
44	a	AMP specifies tasks and activities required to optimise cost, risk and performance.	4	Compliant	The optimisation of cost and risk is stated in AMS Section 7 with good referencing to the AMP. Asset performance is discussed well in draft AMS Section 7, supported with good referencing to the AMP.	7
45	b	AMP designates respon-sibilities and authorities for the achievements of AM objectives.	4	Compliant	The responsibilities and authorities for the achieve-ment of AM objectives are covered in the draft AMS Section 7 by Westpower's Asset Manager with support from ElectroNet Service Ltd.	7
46	c	AMP provides the means and time scales for ac-tions to be achieved.	4	Compliant	The development of the work plan is discussed well in draft AMS Section 7, supported with good referencing to the AMP.	7

Review against PAS-55 Requirements



Observations and Improvement Opportunities

While it is almost certain that activities are optimised and prioritised by the asset management team using collective experience, Westpower should consider implementing a formal project ranking/prioritisation scheme incorporating the risk management methodology. Such an approach could be of assistance in managing any gap between available funds/resources and proposed projects. It was not apparent from the material presented that Westpower clearly allocates accountability to individuals for all asset management objectives or outcomes, if this is the case then clear benefits can be obtained by clarifying this point. Also not apparent from material provided is a process to clearly control and manage project timing and costs.

Recommended Actions

That Westpower implement a methodology for ranking/rating asset management initiatives to assist in the optimisation, and documentation of the optimisation process.

That Westpower confirms that it has in place a detailed programme of work defining projects and inspection and maintenance programmes. The programme should allocate accountability for outcomes, target dates, and budgets. The program should be supported by a robust process for monitoring delivery, quality, safety and cost. This is driven further in information disclosure requirements 2008.

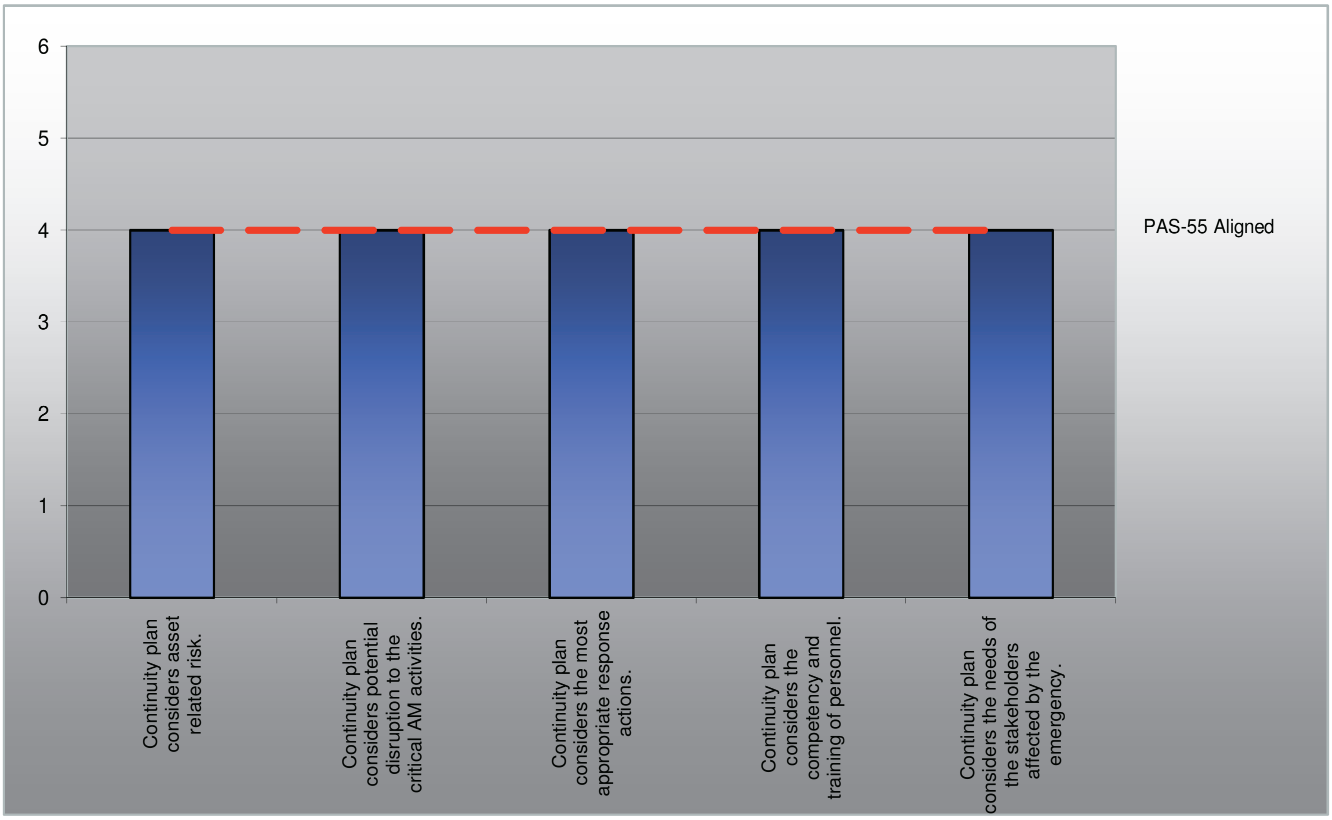
8.12.7 Contingency Planning

"The organisation shall establish, implement and maintain appropriate plans and procedures for identifying and responding to incidents and emergency situations and maintaining the continuity of critical management activities."

Table 8.9 - Contingency Planning

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
47	a	Continuity plan considers asset related risk.	4	Compliant	The draft AMS Section 8 on the Contingency Planning summarises Westpower's contingency planning. The Emergency Response Plan (ERP) is listed as an associated document. Asset related risk is detailed in draft AMS Section 8.1 which is mainly focused on Transpower's GXPs.	8.1
48	b	Continuity plan considers potential disruption to the critical AM activities.	4	Compliant	The draft AMS Section 8.1 considers disruption to critical AM activities especially GXPs and CBD areas.	8.1
49	c	Continuity plan considers the most appropriate response actions.	4	Compliant	Response actions are covered in draft AMS Section 8.3 and in the ERP, Section 4 Planning.	8.3
50	d	Continuity plan considers the competency and training of personnel.	4	Compliant	The competency and training of personnel in an emergency response is summarised in draft AMS Section 8.4. The link to other sections should be stated, ie Section 10.	8.4
51	e	Continuity plan considers the needs of the stakeholders affected by the emergency.	4	Compliant	Stakeholder needs are summarised in draft AMS Section 8.5 with the emergency contact list. There is also a statement about Civil Defence Emergency Management (CDEM) requirements as a lifeline utility.	8.3

Review against PAS-55 Requirements



Observations and Improvement Opportunities

PAS-55 requires that credible emergency scenarios are considered and that contingency planning is in place.

Recommended Action

That the contingency plans currently in place be formally reviewed and documented for effectiveness.

8.12.8 Contingency Planning Information

"The plans and procedures shall identify how the organisation will respond to, and manage, incidents and emergency situations."

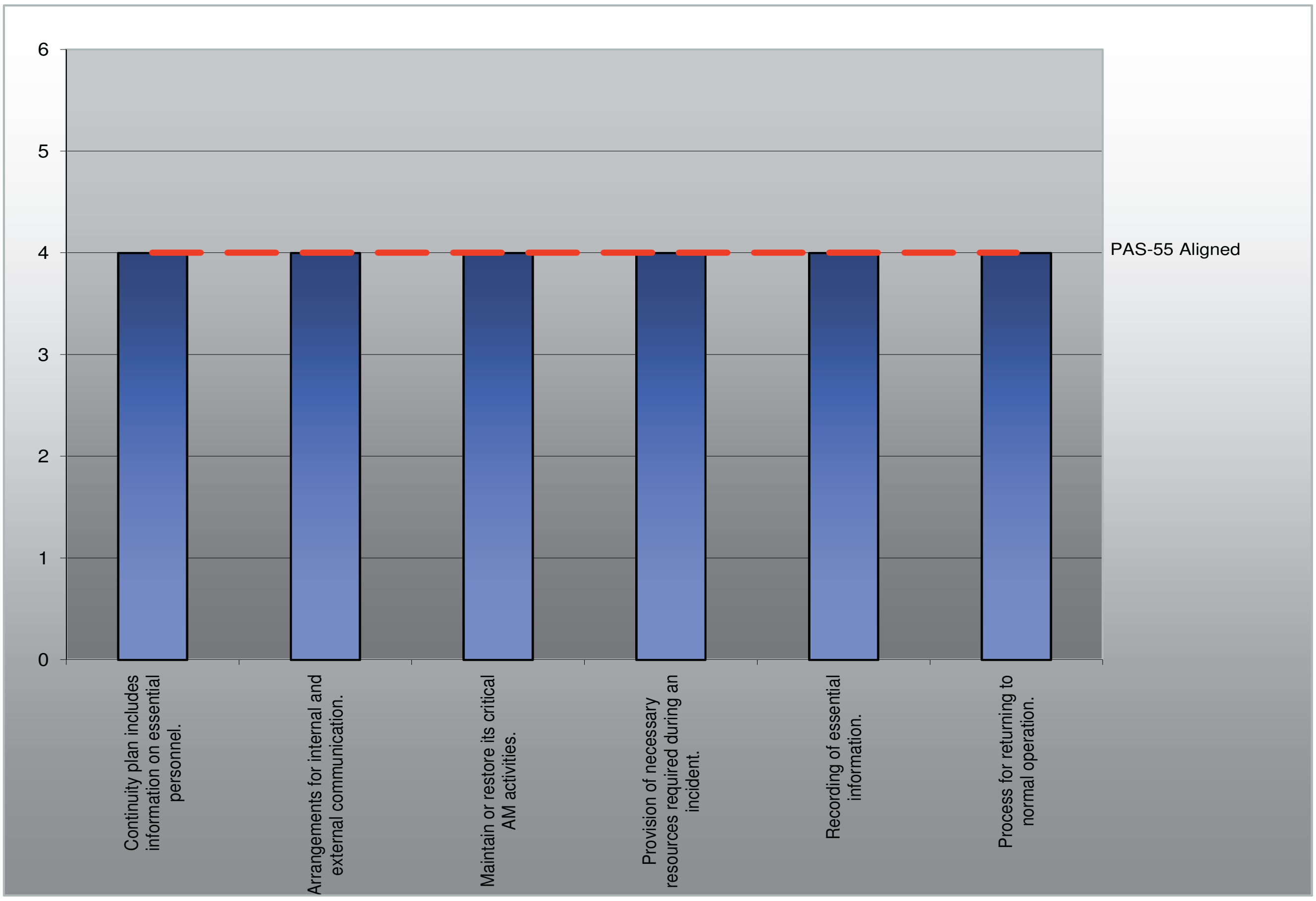
Table 8.10 - Contingency Planning

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
52	1	Continuity plan includes information on essential personnel.	4	Compliant	The Summary BCP shows the organisation structure and designated staff details in Section 3 ERP with contact list in Annex E. It is also summarised in draft AMS Section 8.1.	8.1
53	2	Arrangements for internal and external communication.	4	Compliant	Internal and external communication is provided in ERP Section 5.6.	8
54	3	Maintain or restore its critical AM activities.	4	Compliant	Restoration of critical AM activities is provided in ERP Section 4 and in draft AMS Section 8.1 with mobile substation.	8.1

Table 8.10 - Contingency Planning

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
55	4	Provision of necessary resources required during an incident.	4	Compliant	Required resources are provided in ERP Section 3 and Annex E for personnel, internal items in Annex D, and external items and personnel in Annex F.	8
56	5	Recording of essential information.	4	Compliant	Essential information is provided in ERP Annex B.	8
57	6	Process for returning to normal operation.	4	Compliant	Process for returning to normal operation is provided in ERP Section 4 and in draft AMS Section 8.3.	8.3

Review against PAS-55 Requirements



Observations and Improvement Opportunities

PAS-55 requires that credible emergency responses are considered and that contingency planning information is in place.

Recommended Action

That the contingency planning information currently in place be reviewed for effectiveness.

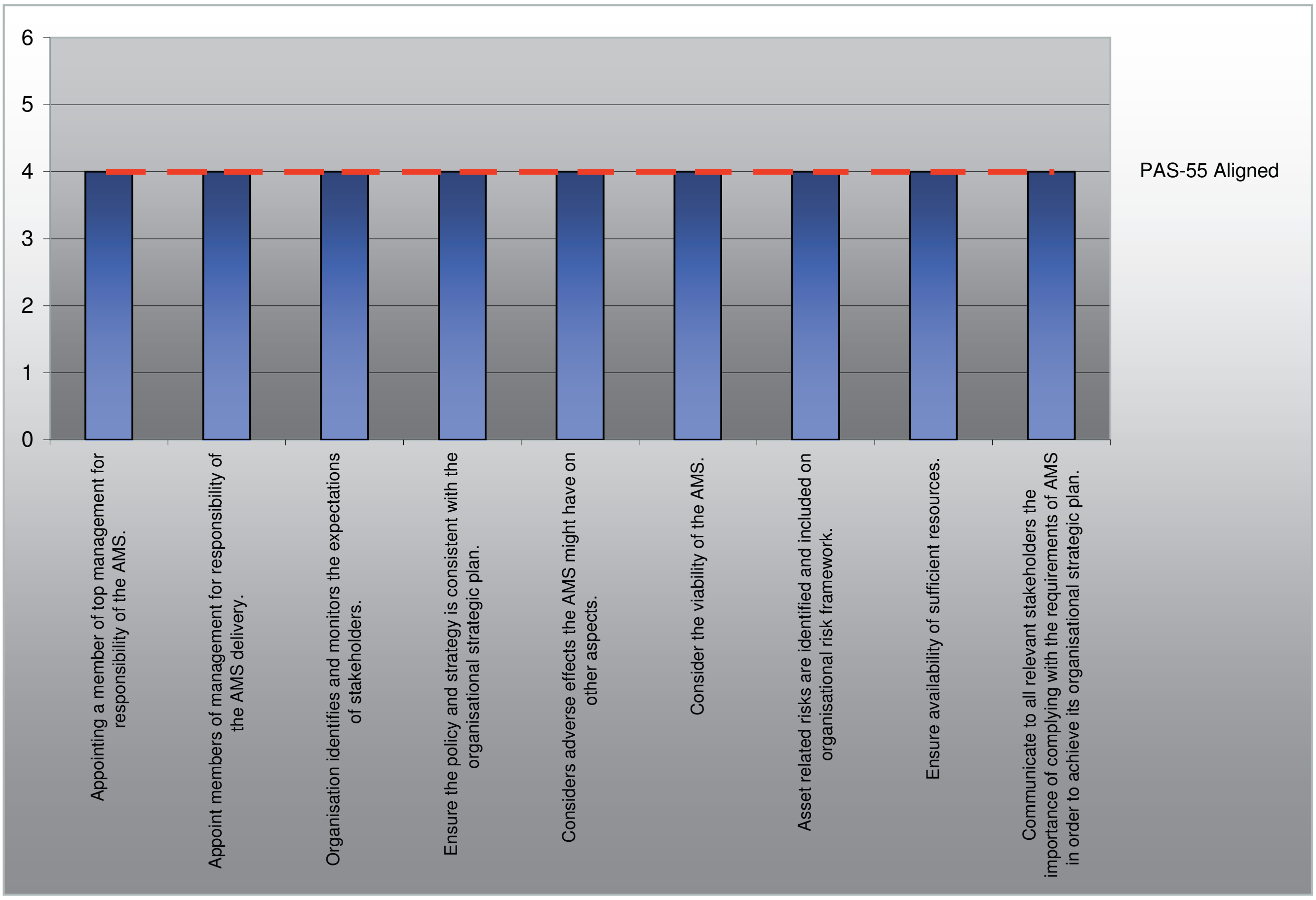
8.12.9 Structure, Authority and Responsibility

"The organisation shall establish and maintain an organisational structure of roles, responsibilities and authorities consistent with the achievement of its asset management policy strategy, objectives and plans."

Table 8.11 - Structure, Authority and Responsibilities

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
58	a	Appointing a member of top management for responsibility of the AMS.	4	Compliant	AMS responsibility is Westpower's Asset Manager with support from ElectroNet Service Ltd as detailed in draft AMS Sections 2 and 9. We recommend that the PAS 55 requirements at the start of Section 9 be removed as it is unnecessary. Also remove the second organisation structure.	2, 9
59	b	Appoint members of management for responsibility of the AMS delivery.	4	Compliant	AMS responsibility is supported with ElectroNet Service Ltd as detailed in draft AMS Sections 2 and 9.	2, 9
60	c	Organisation identifies and monitors the expectations of stakeholders.	4	Compliant	Stakeholder expectations are summarised in AMS Section 9 including a statement on the independent survey of stakeholders every two years. The Consumer Engagement Results is linked as an associated document.	5, 9
61	d	Ensure the policy and strategy is consistent with the organisational strategic plan.	4	Compliant	The policy and strategy are aligned with the SCI through the same categories and direction set by the SCI. Draft AMS Section 9 states that the achievement of the strategic plan is communicated with stakeholders.	3, 4, 5, 9
62	e	Considers adverse effects the AMS might have on other aspects.	4	Compliant	A gap analysis tool is used to manage the adverse effects created by the AMS.	9
63	f	Consider the viability of the AMS.	4	Compliant	The viability of this AMS will be dependent on its review to ensure it is a live and useful document. The AMS is controlled by the Asset Manager as stated in AMS Section 2 with resources from the Asset Management Group (AMG) as stated in Section 9.	2, 9
64	g	Asset related risks are identified and included on organisational risk framework.	4	Compliant	The process and framework for asset risk assessment is summarised in draft AMS Section 9.	5.7, 9
65	h	Ensure availability of sufficient resources.	4	Compliant	There are sufficient resources with the AMG led by the Asset Manager as stated in draft AMS Sections 2 and 9.	2, 9
66	i	Communicate to all relevant stakeholders the importance of complying with the requirements of AMS in order to achieve its organisational strategic plan.	4	Compliant	The communication to stakeholders and the importance of complying with the requirements of AMS are discussed in Sections 9 and 11. The main formal communication is with the West Coast Electric Power Trust supported by consumer survey.	9, 11

Review against PAS-55 Requirements



Observations and Improvement Opportunities

Westpower has an appropriate organisational structure within which to implement an effective asset management system. Areas for improvement are centred on implementation of policy and strategy documents and an effective risk management system.

Recommended Actions

- Implement risk management methodology. In addition to asset related risks, include some assessment of intangible risks such as reputation, staff morale etc.
- Consider benefits of providing a regular summary risk report to senior management and board for consideration. This should form part of the recommended risk management process.
- Ensure that management communicates the importance of delivering AMPs (e.g. work programs) to achieve the organisations goals.
- Improve communication throughout the organisation of asset management system strategy and policy.

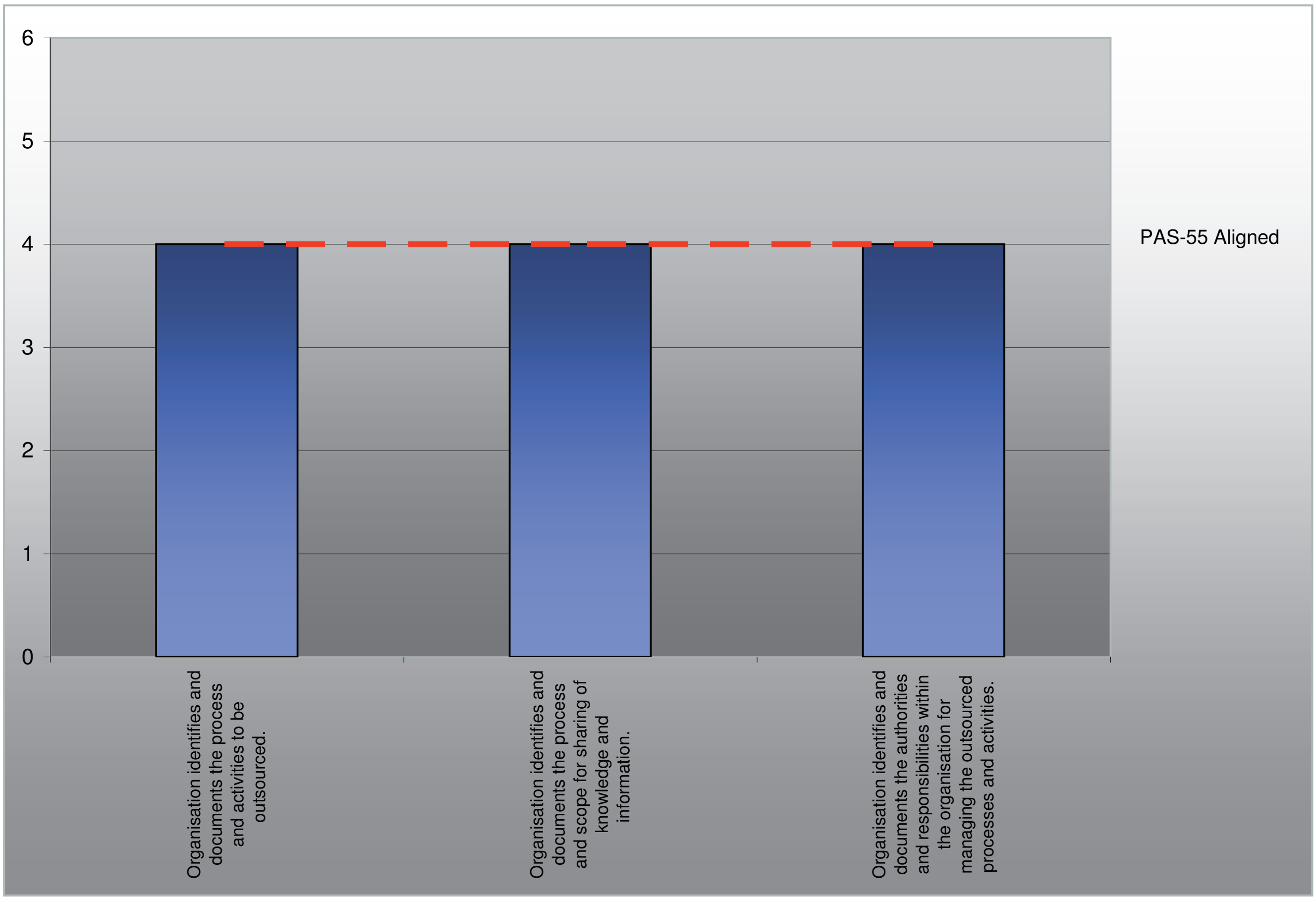
8.12.10 *Outsourcing of Asset Management Activities*

"Where asset management activities are outsourced the organisation shall ensure control over such aspects."

Table 8.12 - Outsourcing of Asset Management Activities

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
67	a	Organisation identifies and documents the process and activities to be outsourced.	4	Compliant	The outsourced AMG at Electronet led by Westpower's Asset Manager is stated in AMS Sections 2 and 9.	2, 9
68	b	Organisation identifies and documents the process and scope for sharing of knowledge and information.	4	Compliant	Westpower has SharePoint and The Vault where most information is stored and accessed as stated in draft AM Section 9. The AMG is located in the Greymouth Westpower offices as stated in Sections 9 and 11.	2, 9
69	c	Organisation identifies and documents the authorities and responsibilities within the organisation for managing the outsourced processes and activities.	4	Compliant	The authority and responsibility within the organisation for managing the outsourced processes and activities is clearly assigned to Westpower's Asset Manager as stated in AMS Sections 2 and 9.	10

Review against PAS-55 Requirements



Observations and Improvement Opportunities

Westpower has outsourced its asset management activities to ElectroNet Services Limited (100% owned by Westpower) and Westpower's General Manager, Assets and Engineering Services heads the asset management group in ElectroNet. This structure ensures that control of the asset management activities remain firmly with Westpower.

Recommended Actions

That discussion between the two parties are fully documented and periodically reviewed for effectiveness.

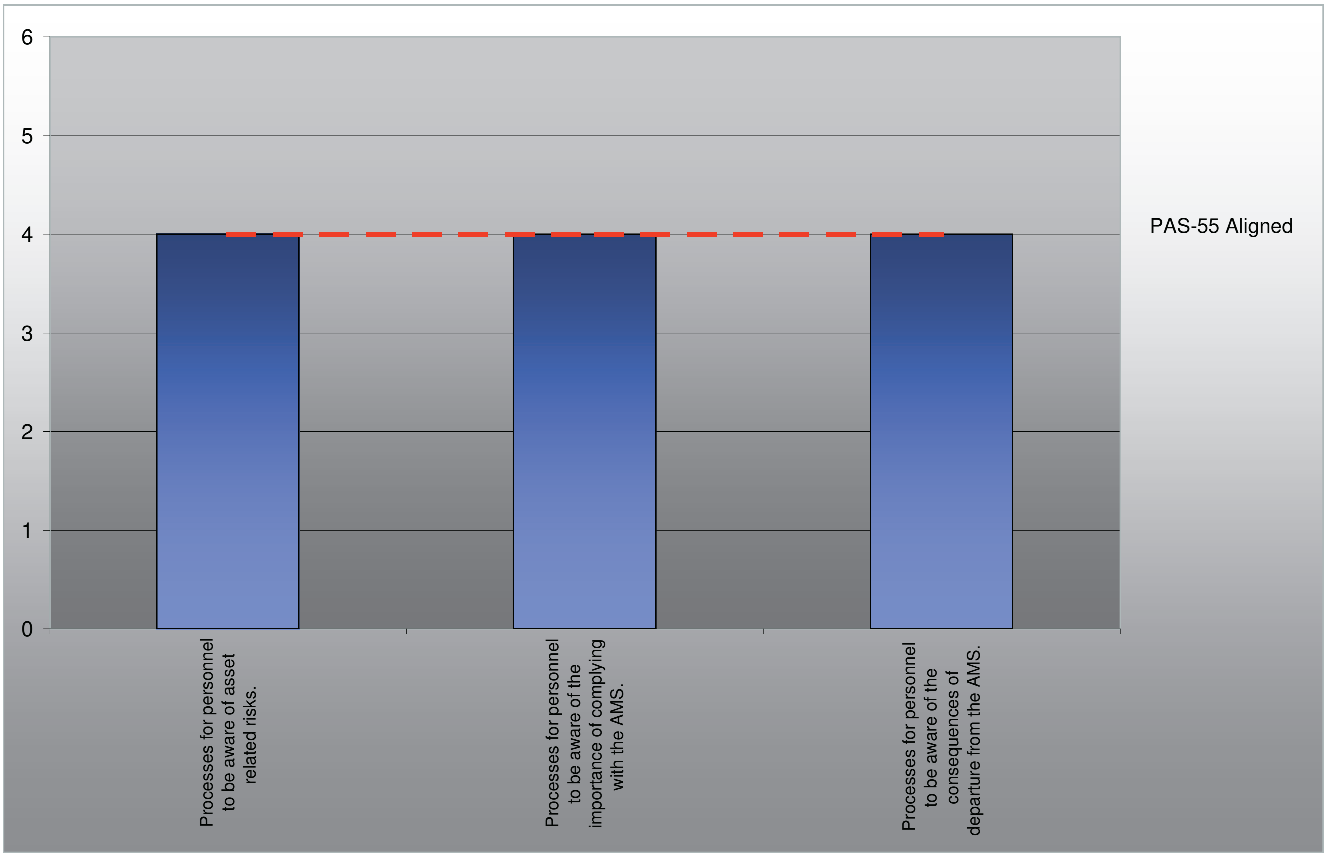
8.12.11 Training, Awareness and Competence

"The organisation shall ensure that personnel under its direct control undertaking asset management related activities have an appropriate level of competence in terms of education, training or experience."

Table 8.13 - Training, Awareness and Competence

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
70	a	Processes for personnel to be aware of asset related risks.	4	Compliant	AMS Section 10 details the staff training in asset management. These are discussed at regular meetings. We are unable to verify if this is correct with a desktop review only.	10
71	b	Processes for personnel to be aware of the importance of complying with the AMS.	4	Compliant	AMS Section 10 details the Asset Management Group which is responsible for ensuring that all personnel understand the importance of complying with the AMS. Again, we are unable to verify if this is correct with a desktop review only.	10
72	c	Processes for personnel to be aware of the consequences of departure from the AMS.	4	Compliant	Weekly meetings are held with management and staff for staff awareness of departure from AMS.	10

Review against PAS-55 Requirements



Observations and Improvement Opportunities

The intent of this group of requirements is to ensure that personnel involved in the asset management system have the appropriate skills and competencies necessary to operate all aspects of the asset management system.

Recommended Actions

- Identify policies, procedures and requirements that are relevant to each part of the organisation.
- Implement a program of process/procedure discussion and review. Ensure that discussions cover individual's roles and responsibilities and that records are kept.
- Ensure that staff are aware of why key asset management activities are necessary and the consequences of not performing the activity as required.
- Develop a long term skill development plan to ensure that key skills are available to Westpower into the longer term.

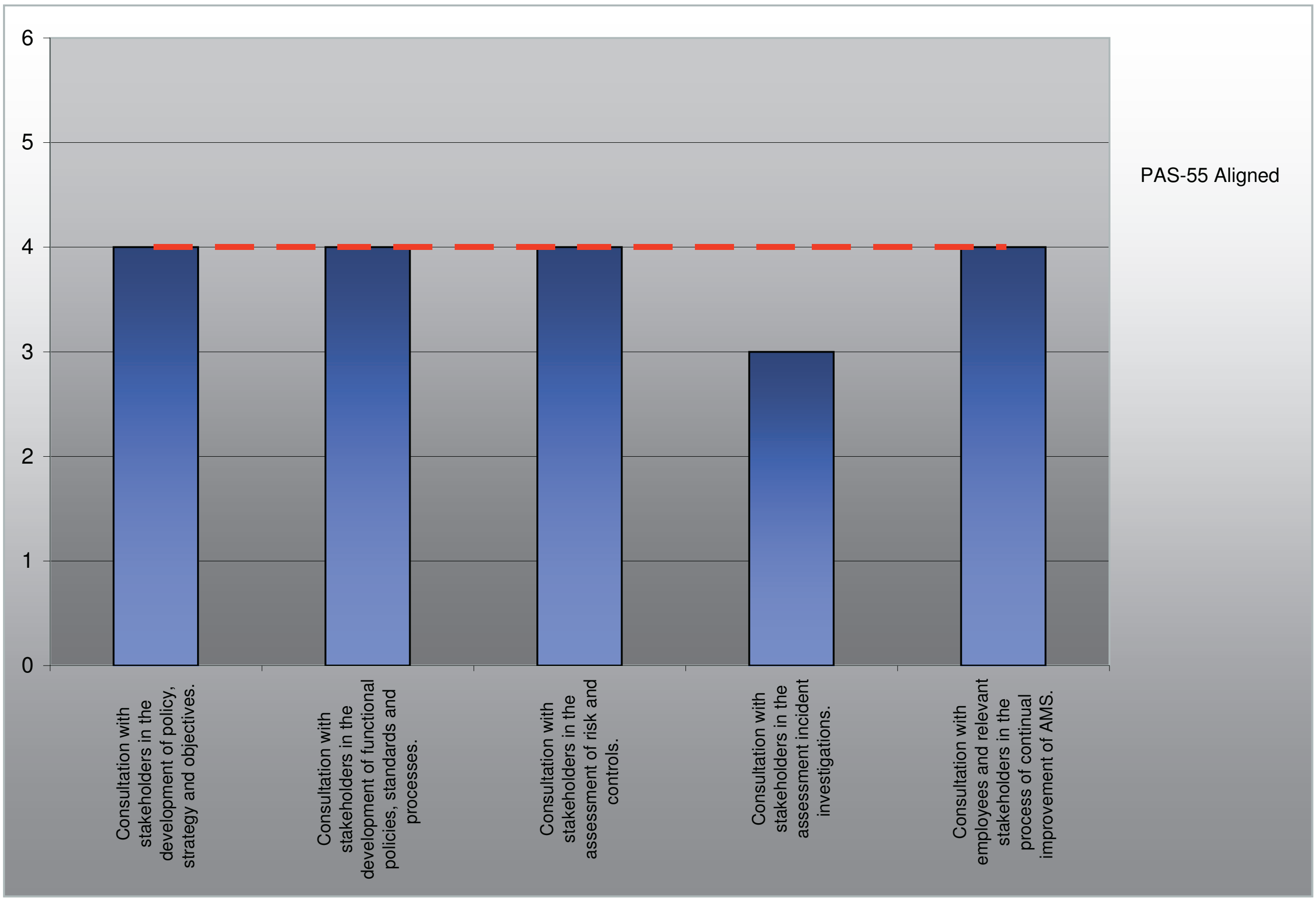
8.12.12 *Communication, Participation and Consultation*

"The organisation shall ensure pertinent asset management information is effectively communicated to and from employees and other relevant stakeholders, including contracted service providers."

Table 8.14 - Communication, Participation and Consultation

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
73	a	Consultation with stake-holders in the develop-ment of policy, strategy and objectives.	4	Compliant	There is formal consultation with Westpower's single shareholder West Coast Electric Power Trust, the Board, AMG, Transpower and major users, as detailed in draft AMS Section 11. There is good communication with employees and service provider.	11
74	b	Consultation with stake-holders in the devel-opment of functional policies, standards and processes.	4	Compliant	AMG consults with stakeholders in the develop-ment of functional polices as stated in draft AMS Section 11.	11
75	c	Consultation with stake-holders in the assessment of risk and controls.	4	Compliant	There is a general statement in draft AMS Section 11 consultation with stakeholders in risk manage-ment. This could be strengthened with stake-holder involvement on the assessment of risk and controls, particularly Transpower and large users.	11
76	d	Consultation with stake-holders in the assessment incident investigations.	3	Developing	There is no explicit statement in draft AMS Section 11 on the consultation with stakeholders in the assessment of incident investigations. It is good practice to involve staff in incident investigations. This should be stated draft AMS Section 11 (or similar statement).	11
77	e	Consultation with employ-ees and relevant stake-holders in the process of continual improvement of AMS.	4	Compliant	The diagram in draft AMS Section 11 shows how the information interacts with stakeholders. This is supported by a statement about continuous improvement.	11

Review against PAS-55 Requirements



Observations and Improvement Opportunities

Westpower appears to have a consultation and communication program with respect to its AMP, appropriate to the scale and scope of its asset management business.

Recommended Actions

That communication, participation and consultation be expanded for all aspects of the asset management system, including the policies, strategies and objectives.

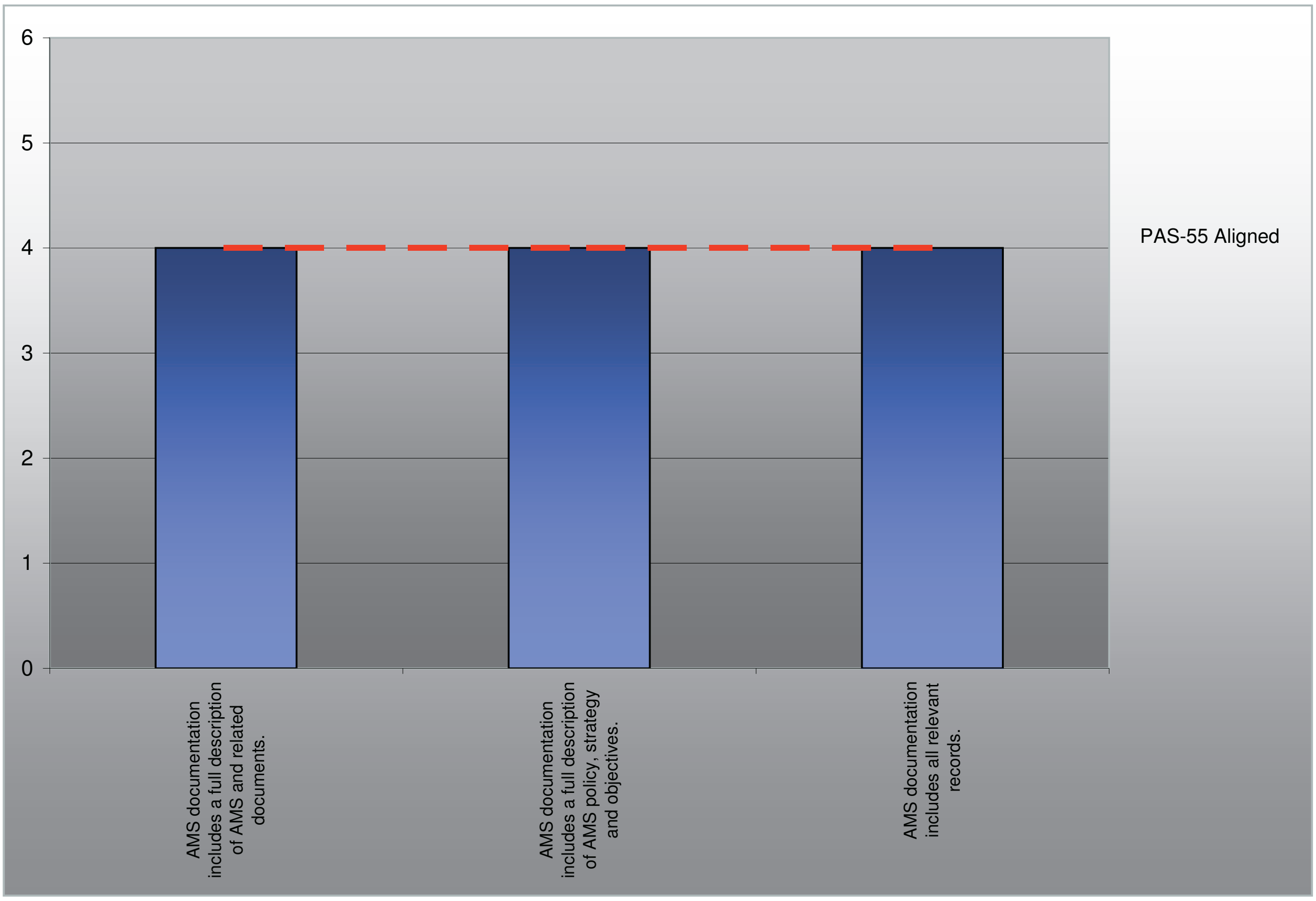
8.12.13 *Asset Management System Documentation*

"The organisation shall establish, implement and maintain up-to-date documentation to ensure its AMS can be adequately understood, communicated and operated."

Table 8.15 - Asset Management System Documentation

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
78	a	AMS documentation includes a full description of AMS and related documents.	4	Compliant	The draft AMS is well presented and easy to read. There are good links to associated documents at the end of sections. There is good layout and it flows well. The draft AMS is not a large document and is appropriate for Westpower's asset size.	All
79	b	AMS documentation includes a full description of AMS policy, strategy and objectives.	4	Compliant	The draft AMS includes the policy, strategy and objectives in one document. It is summarised in draft AMS Section 12.	12
80	c	AMS documentation includes all relevant records.	4	Compliant	The supporting records are kept in The Vault and Westpower's document management system, Sharepoint.	12

Review against PAS-55 Requirements



Observations and Improvement Opportunities

Westpower's asset management system provides references to all relevant internal policies and procedures and the document's language is direct and in line with PAS-55 phraseology. The documentation is held within Sharepoint which provides excellent control.

Recommended Actions

That wide spread training is provided to all participants in asset management in the use of Sharepoint and its capabilities.

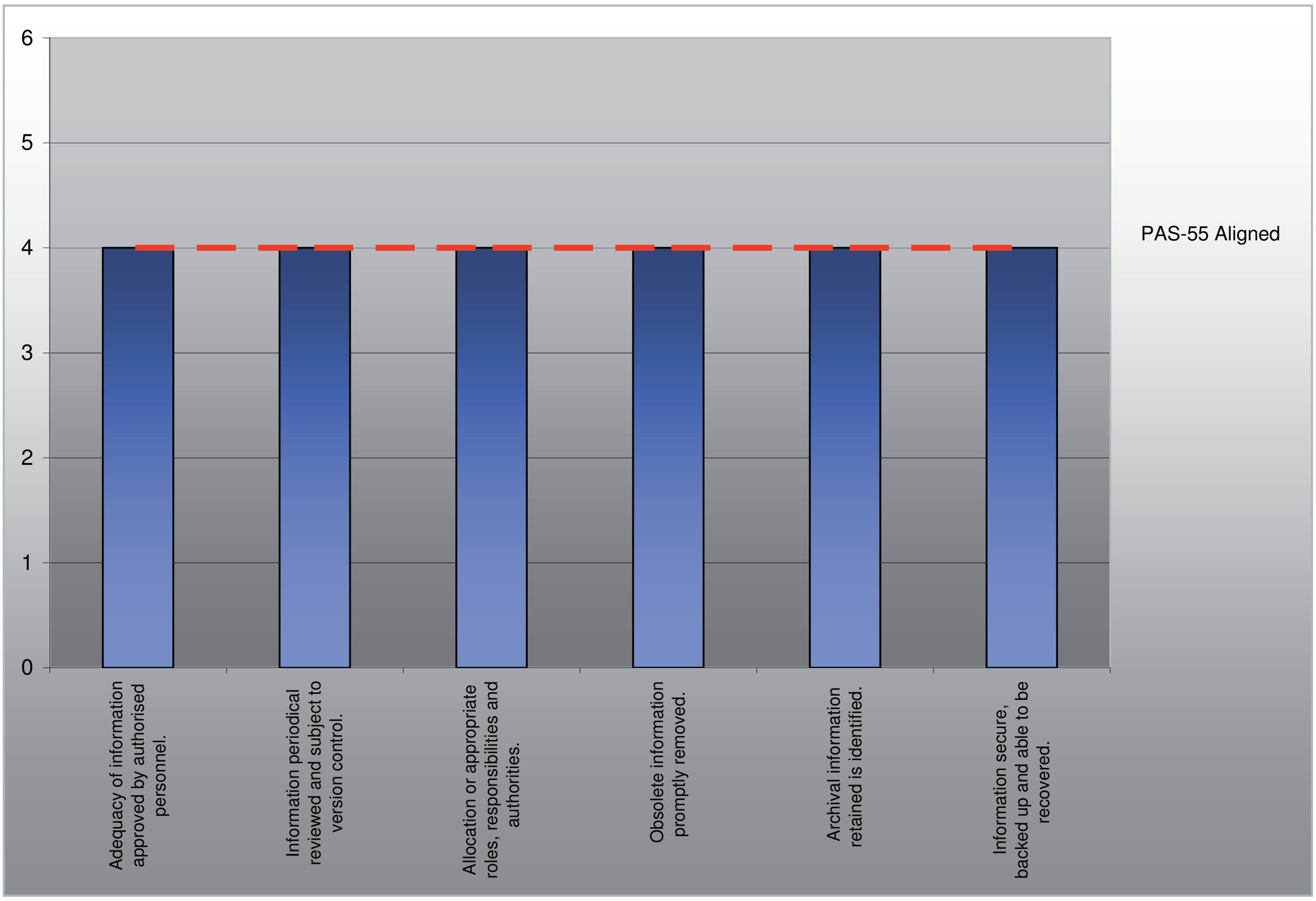
8.12.14 Information Management

"The organisation shall design, implement and maintain a system for managing asset management information."

Table 8.16 - Information Management

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
81	a	Adequacy of information approved by authorised personnel.	4	Compliant	Overall, the draft AMS Section 13 Information Management is well written. The information is controlled by the AMG as stated in this Section 13.	13
82	b	Information periodical reviewed and subject to version control.	4	Compliant	Document version control is provided by Share-point. Maximo manages accurate records for works orders as stated in Section 11.	13
83	c	Allocation or appropriate roles, responsibilities and authorities.	4	Compliant	AMG is responsible for information management as stated in this draft AMS Section 13.	13
84	d	Obsolete information promptly removed.	4	Compliant	The removal of obsolete information by Share-point is stated in draft AMS Section 13.	13
85	e	Archival information re-tained is identified.	4	Compliant	The process for archiving information is sum-marised in draft AMS Section 13. Note that archived has been spelt achieved in the first paragraph on page 35.	13
86	f	Information secure, backed up and able to be recov-ered.	4	Compliant	Information security and back up is well covered in draft AMS Section 13.	13

Review against PAS-55 Requirements



Observations and Improvement Opportunities

In evaluating these criteria, consideration must be given to the size and complexity of the business and asset base and the strategies that are to be used to manage the assets. Westpower has introduced Microsoft Sharepoint for information management. This creates documentary evidence to demonstrate compliance where it exists, create a justification where it is deemed appropriate to not collect data, and identify areas where improved data would improve asset management capability and outcomes.

Recommended Actions

Sharepoint is appropriate software for information management but it requires appropriate roles, responsibilities and authorities be allocated and policies be introduced to deal with obsolete and archival information.

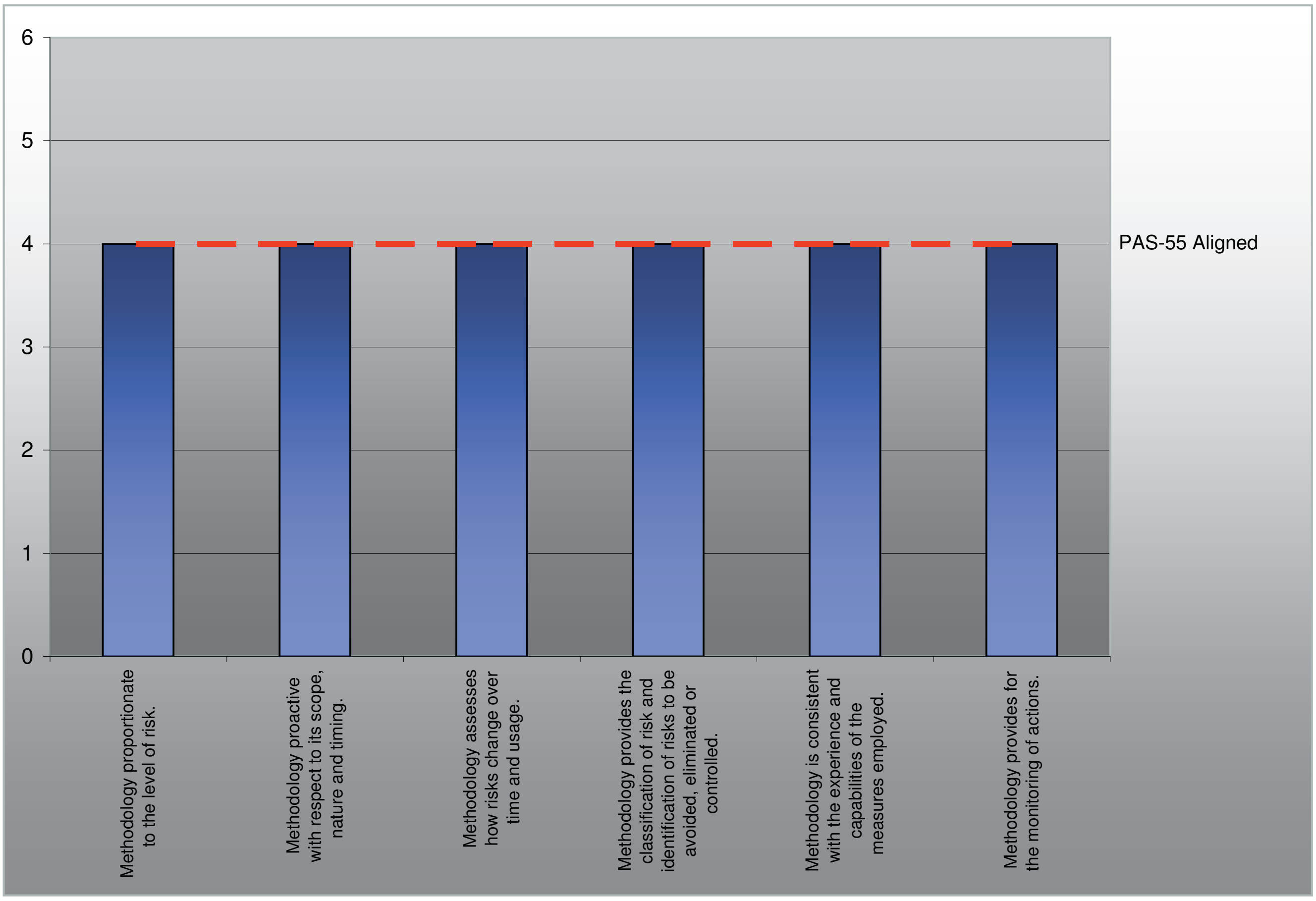
8.12.15 *Risk Management Methodology*

"The organisation shall establish, implement and maintain documented processes and procedures for the on-going identification and assessment of asset related and asset management related risks."

Table 8.17 - Risk Management Methodology

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
87	a	Methodology proportionate to the level of risk.	4	Compliant	Westpower has a very sound and established risk methodology. Although Westpower is a small EDB, it still provides an essential service to the West Coast community so the methodology is appropriate.	5.7
88	b	Methodology proactive with respect to its scope, nature and timing.	4	Compliant	It is stated that the Risk Management Plan is regularly updated so this covers being proactive document to address changes.	5.7
89	c	Methodology assesses how risks change over time and usage.	4	Compliant	The risk profile is reviewed annually through the Risk Management Analysis summarised in draft AMS Section 5.7.	5.7
90	d	Methodology provides the classification of risk and identification of risks to be avoided, eliminated or controlled.	4	Compliant	Risk classification is provided in Section 9.2, Risk Management Plan.	5.7
91	e	Methodology is consistent with the experience and capabilities of the measures employed.	4	Compliant	Current control effectiveness was assessed by Westpower staff with the interview process.	5.7
92	f	Methodology provides for the monitoring of actions.	4	Compliant	The Risk Management Team monitors the actions for risk with rating at 40 or above, as stated in the Risk Management Plan.	5.7

Review against PAS-55 Requirements



Observations and Improvement Opportunities

PAS-55 recognises risk management as a critical feature of an overall asset management system, and requires a comprehensive process be in place to ensure key risks are identified, appropriately considered and acted on. Westpower at present manages asset related risk through several separate means including the safety management system, periodic external reviews and informal processes that occur during the routine asset management process. Westpower has developed an overarching risk management strategy aligned with AS/NZS ISO 31000:2008, risk management – principles and guidelines that transparently group asset related risks for assessment and treatment.

Recommended Actions

That Westpower reviews its overarching risk management process based upon the requirements of AS/NZS ISO 31000:2008, risk management – principles and guidelines.

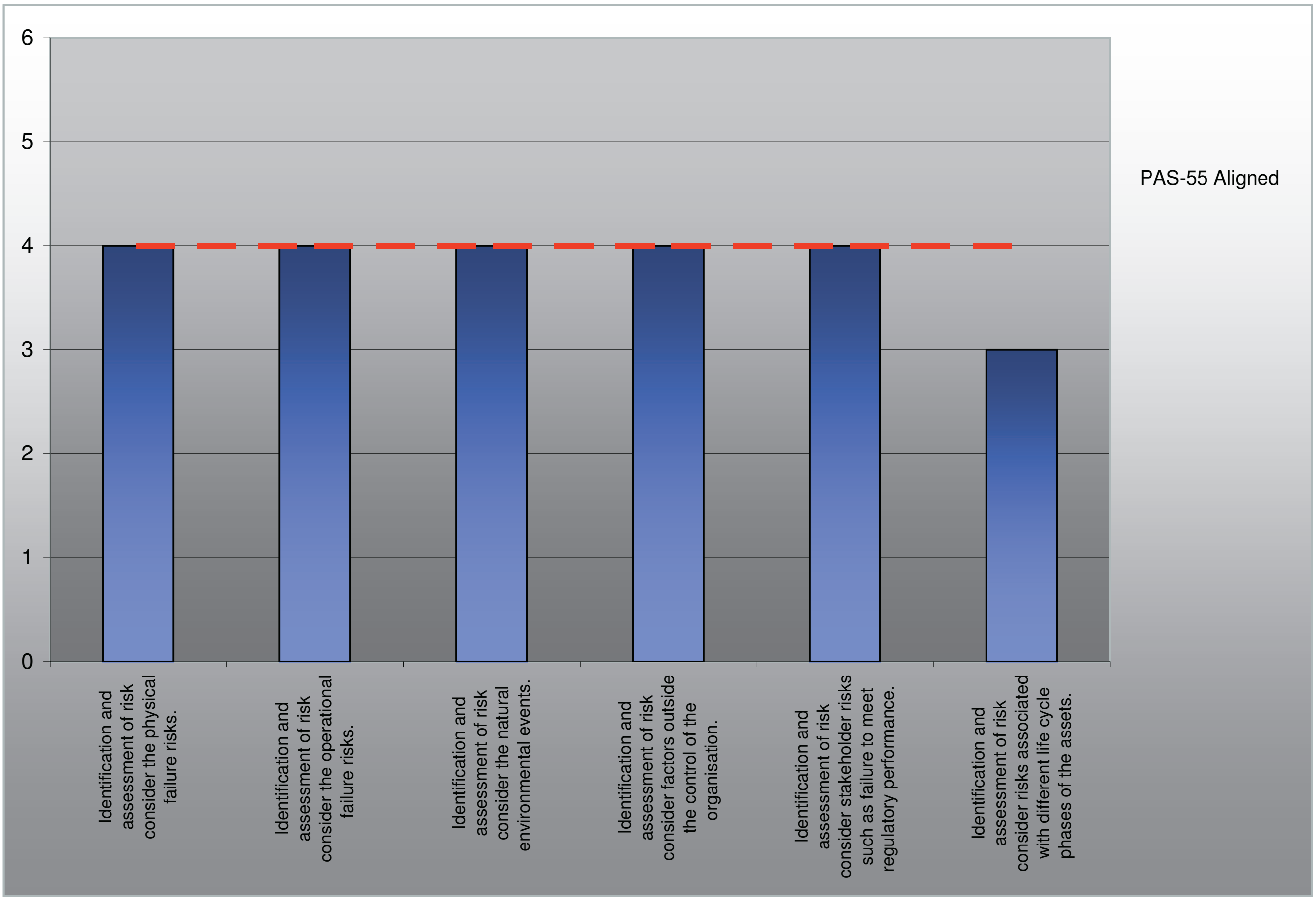
8.12.16 Risk Identification and Assessment

"The identification and assessment of risks shall consider the probability of credible events and their consequences."

Table 8.18 - Risk Identification and Assessment

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
93	a	Identification and assessment of risk consider the physical failure risks.	4	Compliant	Functional failure is provided in the 2011 AMP, Sections 3 and 6. The detailed risk assessment covers the other physical risks.	5.7
94	b	Identification and assessment of risk consider the operational failure risks.	4	Compliant	Operational risks are covered in the 2011, AMP Section 6.	5.7
95	c	Identification and assessment of risk consider the natural environmental events.	4	Compliant	Natural environmental events were assessed with the detailed risk assessment in the Risk Management Plan. This resulted in climatic and seismic factors as the key risks for Westpower.	5.7
96	d	Identification and assessment of risk consider factors outside the control of the organisation.	4	Compliant	The risk factors outside the control of the organisation were assessed as part of detailed risk assessment including new technologies, exchange rate, and earthquakes.	5.7
97	e	Identification and assessment of risk consider stakeholder risks such as failure to meet regulatory performance.	4	Compliant	The risk assessment considers environmental, unethical behaviour and financial factors with stakeholder risks.	5.7
98	f	Identification and assessment of risk consider risks associated with different life cycle phases of the assets.	3	Developing	This is covered by the 2011 AMP but this could be strengthened with an explicit statement in the draft AMS Section 5.7. Regular inspections are stated as a strategy in draft AMS Section 5.7. This is still outstanding	5.7

Review against PAS-55 Requirements



Observations and Improvement Opportunities

Westpower's risk management identifies and assesses the risks of physical failure, operational failure and natural environmental events but further improvements can be made for risks beyond the control of the organisation and other stakeholder risks

Recommended Actions

That Westpower implement an overarching risk management process based upon the requirements of PAS-55 1 and AS/NZS ISO 31000:2008, Risk Management – Principles and Guidelines.

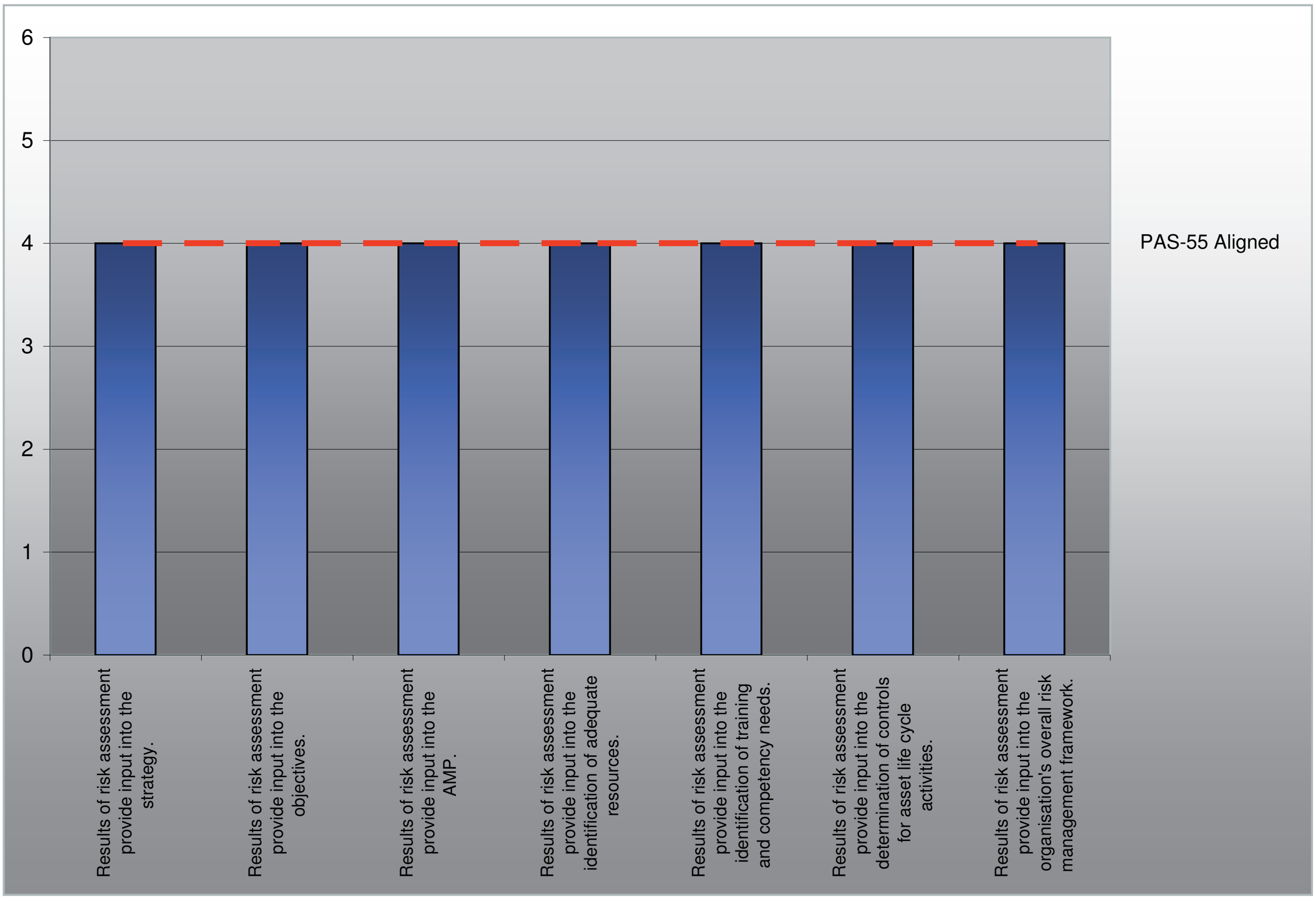
8.12.17 *Use and Maintenance of Asset Risk Information*

"The organisation shall ensure the results of risk assessments and the effects of risk control measures are considered."

Table 8.19 - Use and Maintenance of Asset Risk Information

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
99	a	Results of risk assessment provide input into the strategy.	4	Compliant	Strategies are developed to mitigate risks as stated in draft AMS Section 5.7. The Risk Management Plan Section 1.3 states the integration of risk processes including that risk assessment provides input into the strategy.	5.7
100	b	Results of risk assessment provide input into the objectives.	4	Compliant	The Risk Management Plan Section 1.3 states the integration of risk processes including that risk assessment provides input into the objectives.	5.7
101	c	Results of risk assessment provide input into the AMP.	4	Compliant	The Risk Management Plan Section 1.3 states the integration of risk processes including that risk assessment provides input into the AMP.	5.7
102	d	Results of risk assessment provide input into the identification of adequate resources.	4	Compliant	This is detailed in the Risk Management Plan, an associated document.	5.7
103	e	Results of risk assessment provide input into the identification of training and competency needs.	4	Compliant	Regular staff training for system operation and permit issuing is detailed in draft AMS Section 5.7.	5.7
104	f	Results of risk assessment provide input into the determination of controls for asset life cycle activities.	4	Compliant	Strategies are developed to mitigate risks as stated in draft AMS Section 5.7, such as regular inspection, and distribution automation.	5.7
105	g	Results of risk assessment provide input into the organisation's overall risk management framework.	4	Compliant	The Risk Management Plan states that it is part of overall business planning strategy and provides input into the organisation's overall risk management framework.	5.7

Review against PAS-55 Requirements



Observations and Improvement Opportunities

In order to manage risks effectively, the consideration of risk should be embedded into all activities and procedures throughout the asset management system and preferably asset related risks should be addressed as part of the organisation's corporate risk management framework

Recommended Actions

That Westpower reviews its overarching risk management process based upon the requirements of PAS-55 1 and AS/NZS ISO 31000:2008, Risk Management – Principles and Guidelines.

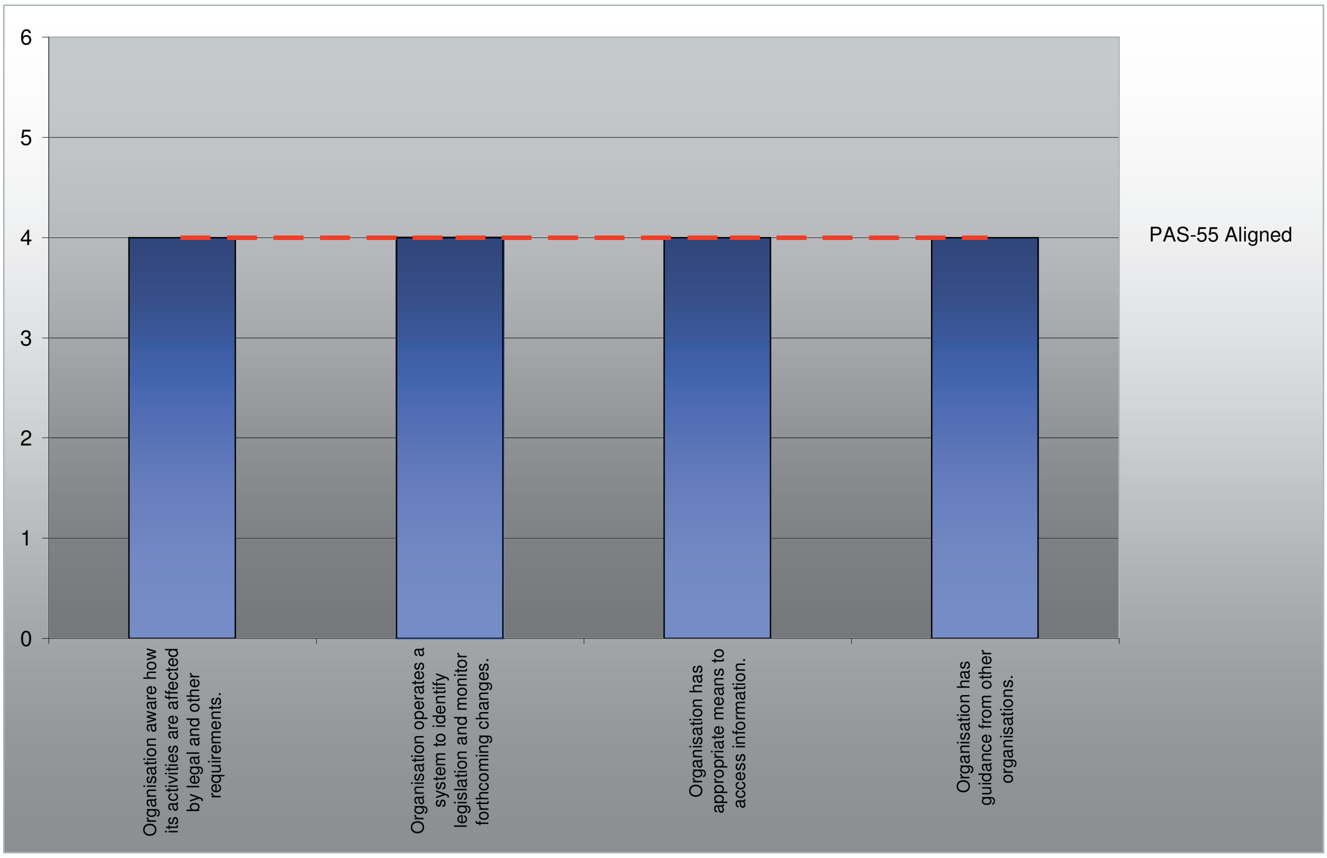
8.12.18 *Legal and Other Requirements*

"The organisation shall establish, implement and maintain processes and procedures for identifying and accessing the legal, regulatory, statutory and other asset management requirements."

Table 8.20 - Legal and Other Requirements

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
106	a	Organisation aware how its activities are affected by legal and other requirements.	4	Compliant	Westpower's legal requirements are summarised in draft AMS Section 5.8.	5.8
107	b	Organisation operates a system to identify legislation and monitor forthcoming changes.	4	Compliant	Westpower belongs to two organisations ENA and EEA that monitor legislation as stated in draft AMS Section 5.8.	5.8
108	c	Organisation has appropriate means to access information.	4	Compliant	Westpower accesses required information through service provider ENA as stated in draft AMS Section 5.8.	5.8
109	d	Organisation has guidance from other organisations.	4	Compliant	Guidance from other organisations is mainly through service provider ENA as stated in draft AMS Section 5.8.	5.8

Review against PAS-55 requirements



Observations and Improvement Opportunities

This element requires that the organisation have a process for monitoring relevant legislation, codes, guides and standards. Any changes should be assessed for relevance and required actions implemented. Westpower has developed a register of legislation, codes, guidelines and standards that are of sufficient importance to the asset management system. A legislation sign off was viewed, which indicates that Westpower is aware of its obligations and that it has assessed compliance. No evidence was presented indicating an on-going process for monitoring and reacting to changes.

Recommended Actions

That Westpower develop an on-going process for monitoring and reacting to changes that are of sufficient importance to the asset management system to warrant monitoring and assign responsibility to an individual to periodically check for amendments, revisions etc. Each revision/amendment would be checked for relevance and required action identified and documented.

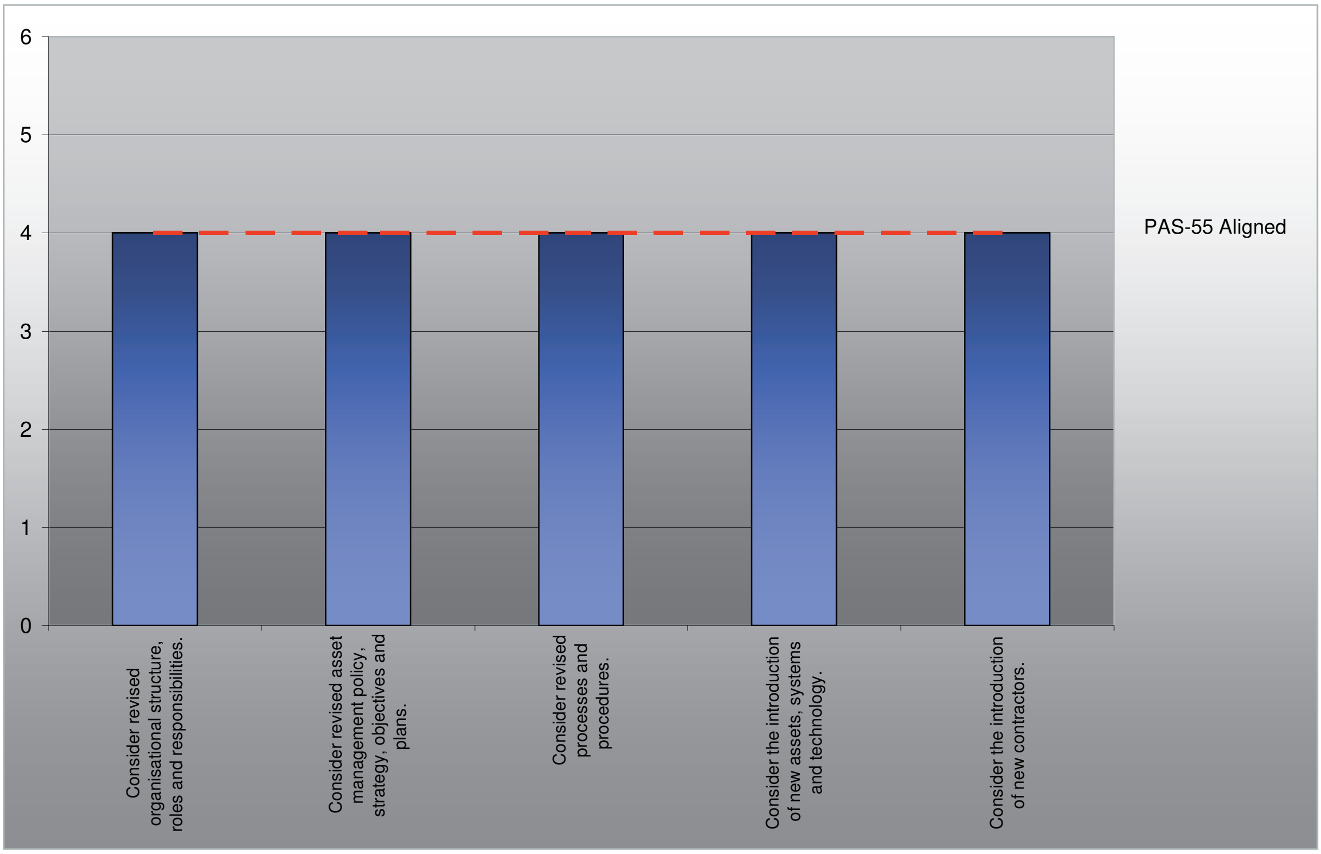
8.12.19 Management of Change

"Where existing arrangements are revised or new arrangements are introduced that could have an impact on asset management activities, the organisation shall assess the associated risks before the arrangements are implemented."

Table 8.21 - Management of Change

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
110	a	Consider revised organisational structure, roles and responsibilities.	4	Compliant	The Material Evaluation Group (MEG) is a sub group of the Asset Management Group and is responsible for monitoring and controlling change.	14
111	b	Consider revised asset management policy, strategy, objectives and plans.	4	Compliant	The MEG covers all aspects of change within the AMS.	14
112	c	Consider revised processes and procedures.	4	Compliant	This is covered in draft AMS Section 14 and in the supporting change management document. Material Evaluation Group (MEG) meets monthly and considers new processes.	14
113	d	Consider the introduction of new assets, systems and technology.	4	Compliant	The MEG controls the management of new products to be used on the Westpower network. Changes to assets are tracked in GIS as stated in draft AMS Section 14.	14
114	e	Consider the introduction of new contractors.	4	Compliant	The MEG controls the introduction of new contractors as stated in draft AMS Section 14.	14

Review against PAS-55 requirements



Observations and Improvement Opportunities

The organisation should ensure that risk assessments are performed for any significant changes to elements of asset management systems. This does not necessitate additional risk management processes but ensures there are existing arrangements in place to provide assurance that risk assessment is carried out. Westpower carries out this function through its Change Management Group (CMG) and carries this over to the introduction of new contractors.

Recommended Actions

That Westpower ensure all new processes and procedures are evaluated via the CMG committee.

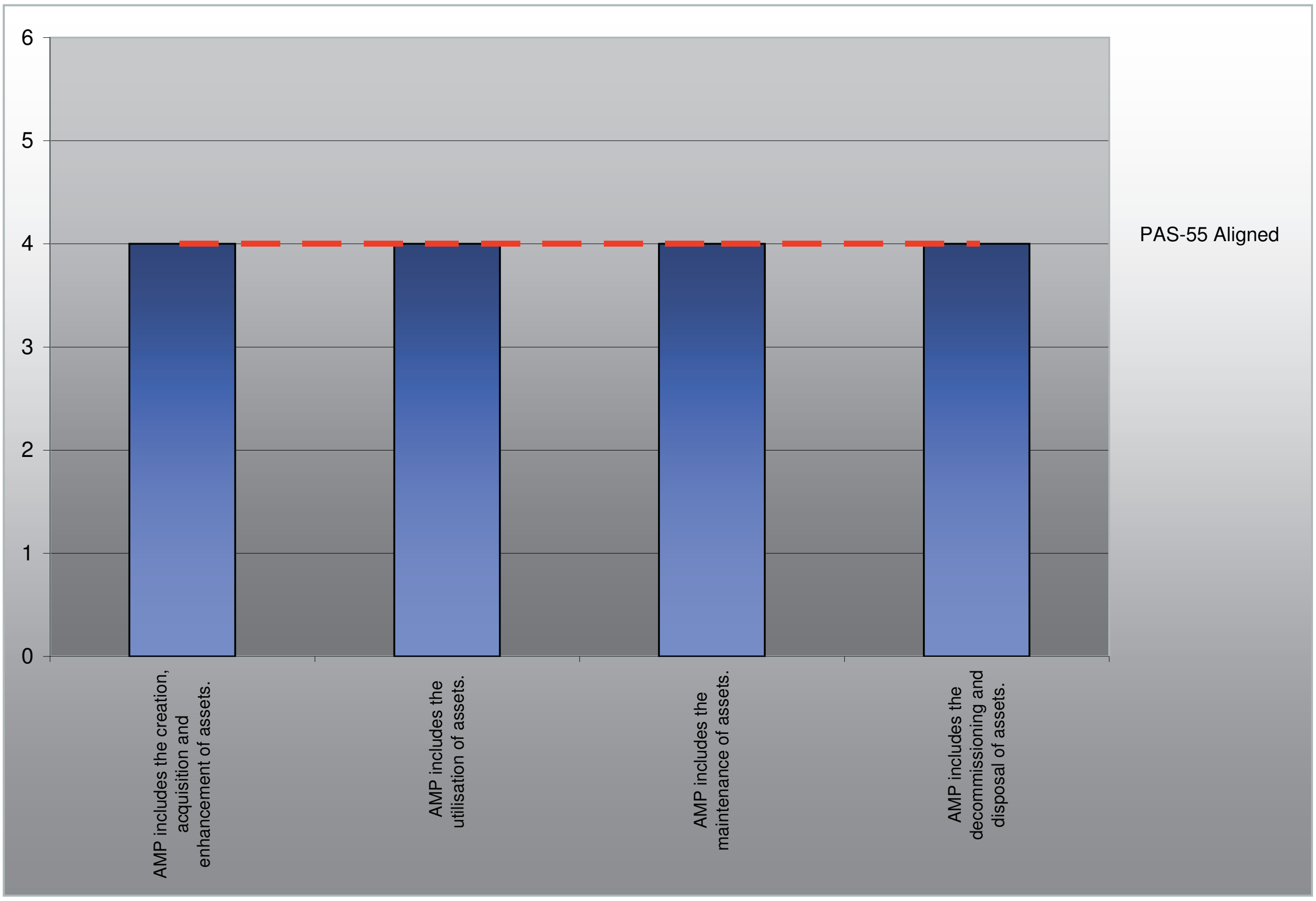
8.12.20 *Life Cycle Activities*

"The organisation shall establish, implement and maintain processes and procedures for the implementation of its asset management plan and control of activities across the whole life cycle."

Table 8.22 - Life Cycle Activities

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
115	a	AMP includes the creation, acquisition and enhance-ment of assets.	4	Compliant	This is provided in the 2011 AMP in Sections 5 and 6. The statement about not delivering the planned capital programme in Requirement 4.1.2 e should be located in Section 15.	15
116	b	AMP includes the utilisation of assets.	4	Compliant	This is provided in the 2011 AMP in Section 5.	15
117	c	AMP includes the mainte-nance of assets.	4	Compliant	This is provided in the 2011 AMP in Section 6.	15
118	d	AMP includes the decom-missioning and disposal of assets.	4	Compliant	This is provided in the 2011 AMP in Section 6.	15

Review against PAS-55 requirements



Observations and Improvement Opportunities

The organisation should ensure the planned arrangements, functional policies, standards, processes and procedures, asset management enablers and resources are utilised for the efficient and cost effective implementation of asset management across the full life cycle of the assets. Westpower carries out these activities in compliance with the requirements of PAS-55.

Recommended Actions

That Westpower periodically reviews these activities to continually improve life cycle activities.

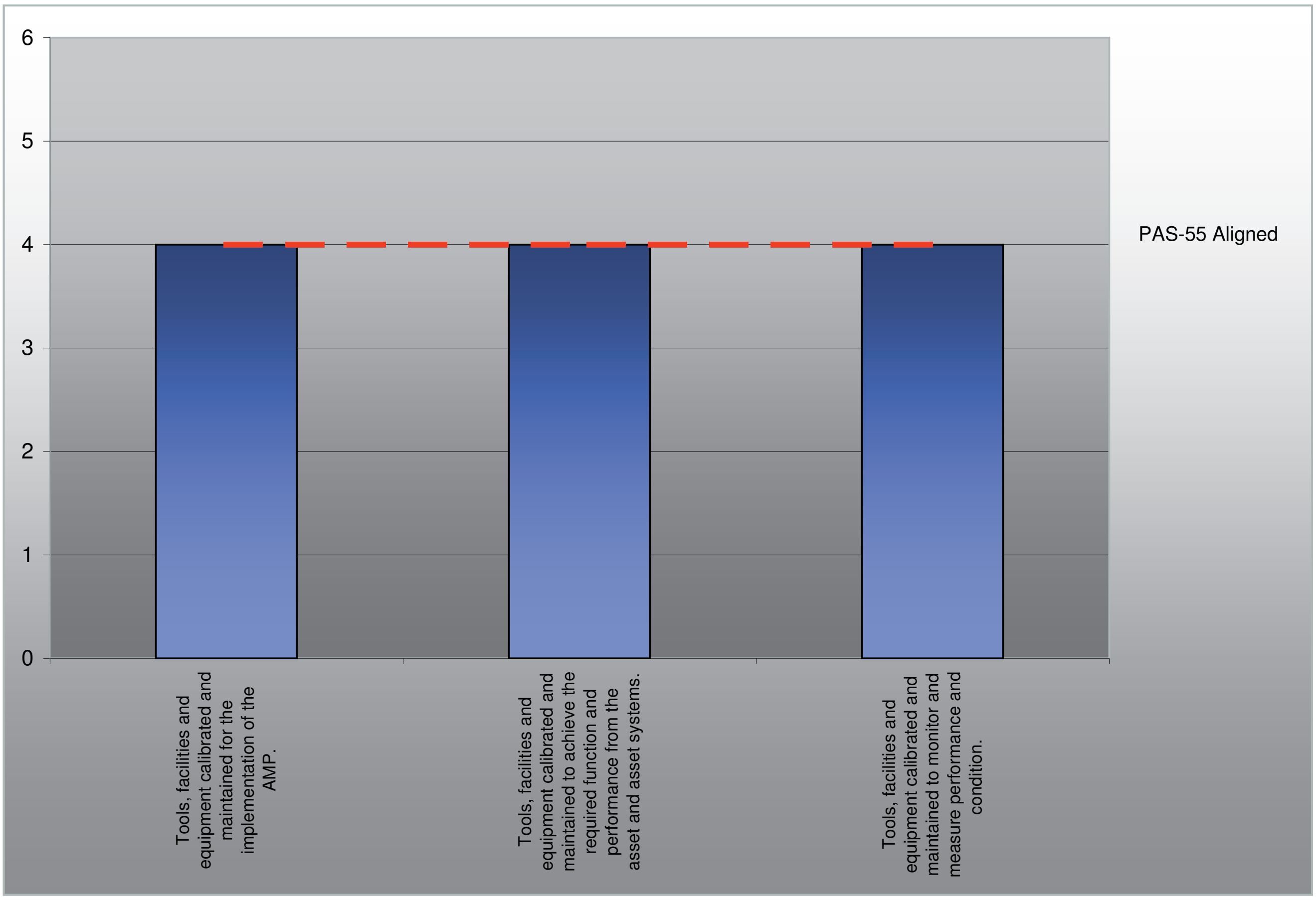
8.12.21 Tools, Facilities and Equipment

"The organisation shall ensure tools, facilities and equipment are maintained and, where appropriate, calibrated."

Table 8.23 - Tools, Facilities and Equipment

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
119	a	Tools, facilities and equipment calibrated and maintained for the implementation of the AMP.	4	Compliant	This is detailed in AMS Section 15 software programmes, Maximo and Sharepoint, for the implementation of the AMP.	15
120	b	Tools, facilities and equipment calibrated and maintained to achieve the required function and performance from the asset and asset systems.	4	Compliant	This is detailed in AMS Section 15 with real time monitoring.	15
121	c	Tools, facilities and equipment calibrated and maintained to monitor and measure performance and condition.	4	Compliant	This is detailed in AMS Section 15 with Maximo. Equipment is identified and tracked through the test room and recorded in an asset register.	15

Review against PAS-55 requirements



Observations and Improvement Opportunities

The organisation should establish and maintain processes and procedures to control these maintenance and calibration activities where such tools, facilities and equipment are necessary for the implementation of asset management. Westpower carries out such activities and formally documents the maintenance and calibration results as required by PAS-55.

Recommended Actions

That Westpower formally review the documented maintenance and calibration activities.

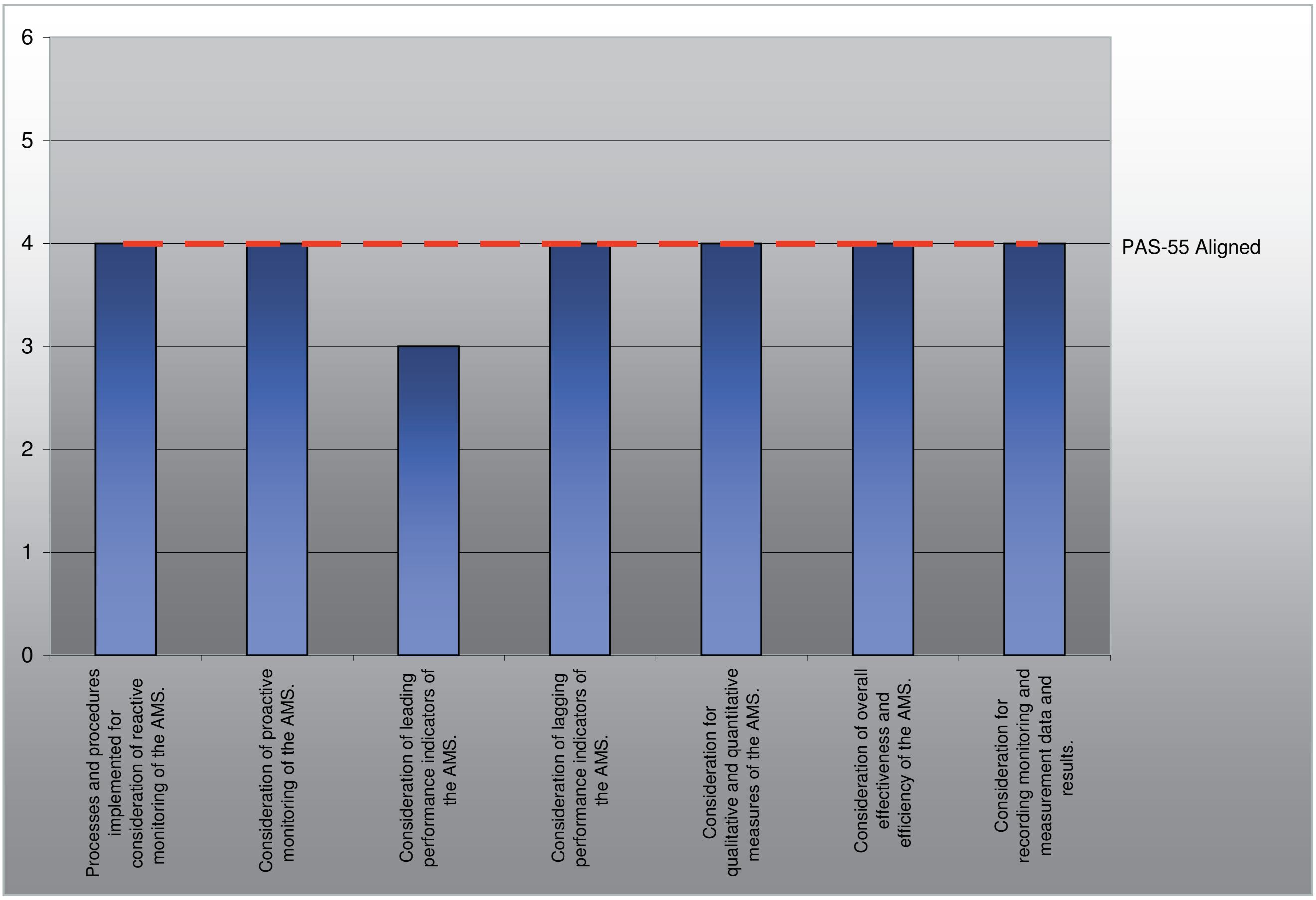
8.12.22 Performance and Condition Monitoring

"The organisation shall establish, implement and maintain processes and procedures to monitor and measure the performance of the asset management system and/or condition of the assets."

Table 8.24 - Performance and Condition Monitoring

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
122	a	Processes and procedures implemented for consider-ation of reactive monitoring of the AMS.	4	Compliant	Reactive monitoring of asset performance is detailed in draft AMS Section 16.1. This also includes how the AMS is measured using the gap analysis.	16.1
123	b	Consideration of proactive monitoring of the AMS.	4	Compliant	Proactive monitoring of asset performance is detailed in draft AMS Section 16.1. The AMS ef-fectiveness is reviewed annually.	16.1
124	c	Consideration of leading performance indicators of the AMS.	3	Developing	The leading performance indicator for asset performance is asset inspection as detailed in draft AMS Section 16.1. Staff morale is suggested as the leading KPI for the AMS. Perhaps harder or direct measures are more appropriate such as specific customer feedback trends, trends in number of reports of non compliance, and AMS audit results.	16.1
125	d	Consideration of lagging performance indicators of the AMS.	4	Compliant	The lagging performance indicator for asset performance is SAIDI and SAIFI as detailed in draft AMS Section 16.1. The lagging performance indicator for AMS is annual audits of PAS 55 gap analysis.	16
126	e	Consideration for quali-tative and quantitative measures of the AMS.	4	Compliant	The AMS is measured qualitatively and quantita-tively. The AMS is measured qualitatively through the Commerce Commission reviews and com-parisons. The AMS is measured quantitatively through SAIDI and reported to the Board monthly.	16
127	f	Consideration of overall effectiveness and efficiency of the AMS.	4	Compliant	The effectiveness and efficiency of the AMS is measured through the PAS 55 gap analysis and annual audit, and the Commerce Commission reviews and comparisons.	16
128	g	Consideration for recording monitoring and measure-ment data and results.	4	Compliant	The recording of data is detailed in draft AMS Section 16.1 including data collection programme and outage information to allow for analysis.	16

Review against PAS-55 requirements



Observations and Improvement Opportunities

The intent of this group of requirements is to ensure that the asset management system has effective feedback loops for measurement control and continual improvement. Westpower has a number of key performance indicators in place for essentials such as SAIDI and SAIFI, but it is not clear that all information necessary for operational control and continual improvement of the overall asset management system is in place.

Recommended Actions

That Westpower implement performance measures to provide improved measurement and control of the asset management processes. In developing KPI ensure that the results of risk assessments are taken into consideration to ensure that risk issues have appropriate levels of measurement and control.

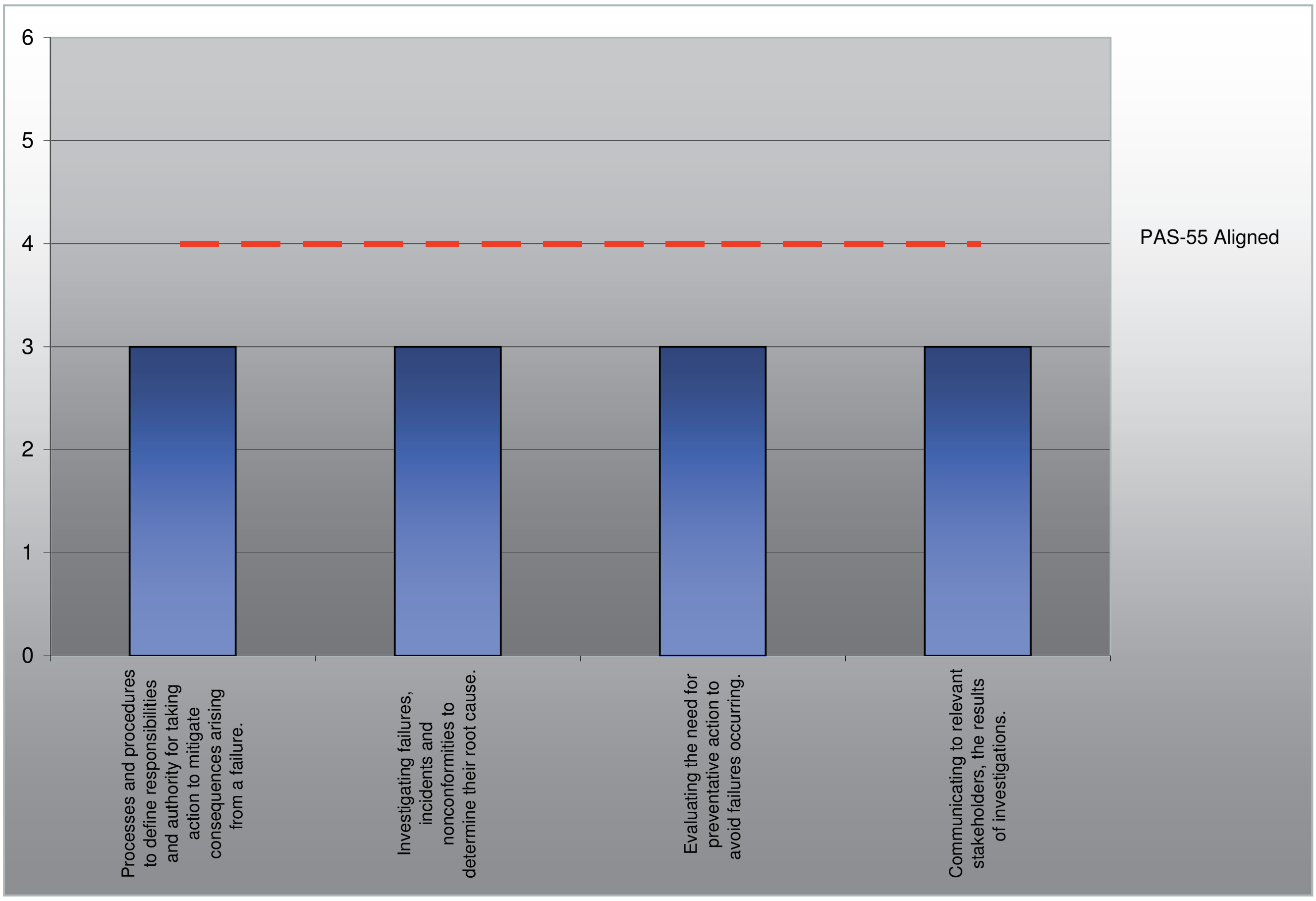
8.12.23 Investigation of Asset Related Failures, Incidents and Non-Conformities

"The organisation shall establish, implement and maintain processes and procedures for the handling of investigations of failures, incidents and nonconformities associated with assets and asset management system."

Table 8.25 - Investigation of Asset-related Failures, Incidents and Nonconformities

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
129	a	Processes and procedures to define responsibilities and authority for taking action to mitigate consequences arising from a failure.	3	Developing	The AMG is responsible for debriefing sessions for investigating asset related failures, incidences and nonconformities as summarised in draft AMS Section 16.2. There is no formal documentation for this process but minutes are taken of these meetings. Formal documentation covering all matters (asset failures and AMS non conformities) is required to rate as compliant.	16.2
130	b	Investigating failures, incidents and nonconformities to determine their root cause.	3	Developing	Root causes are determined through the debriefing sessions as above. There is a new Incident Investigation Report set up to document the findings.	16.2
131	c	Evaluating the need for preventative action to avoid failures occurring.	3	Developing	Major asset failures are investigated with corrective actions are summarised in draft AMS Section 16.2.	16.2
132	d	Communicating to relevant stakeholders, the results of investigations.	3	Developing	The results of investigations are communicated to stakeholders as summarised in draft AMS Section 16.2.	16.2

Review against PAS-55 requirements



Observations and Improvement Opportunities

Westpower has a formalised process for investigating, learning from and correcting the root causes of equipment failures and process non-conformances. Such a process provides guidance on what level issues need to be escalated based on severity, provide for timeframes for completion of investigations and process for tracking the progress of corrective actions.

Recommended Action

That Westpower summarises and reviews its process for investigating asset failures and asset management system non-conformances including a process for tracking the progress of corrective actions.

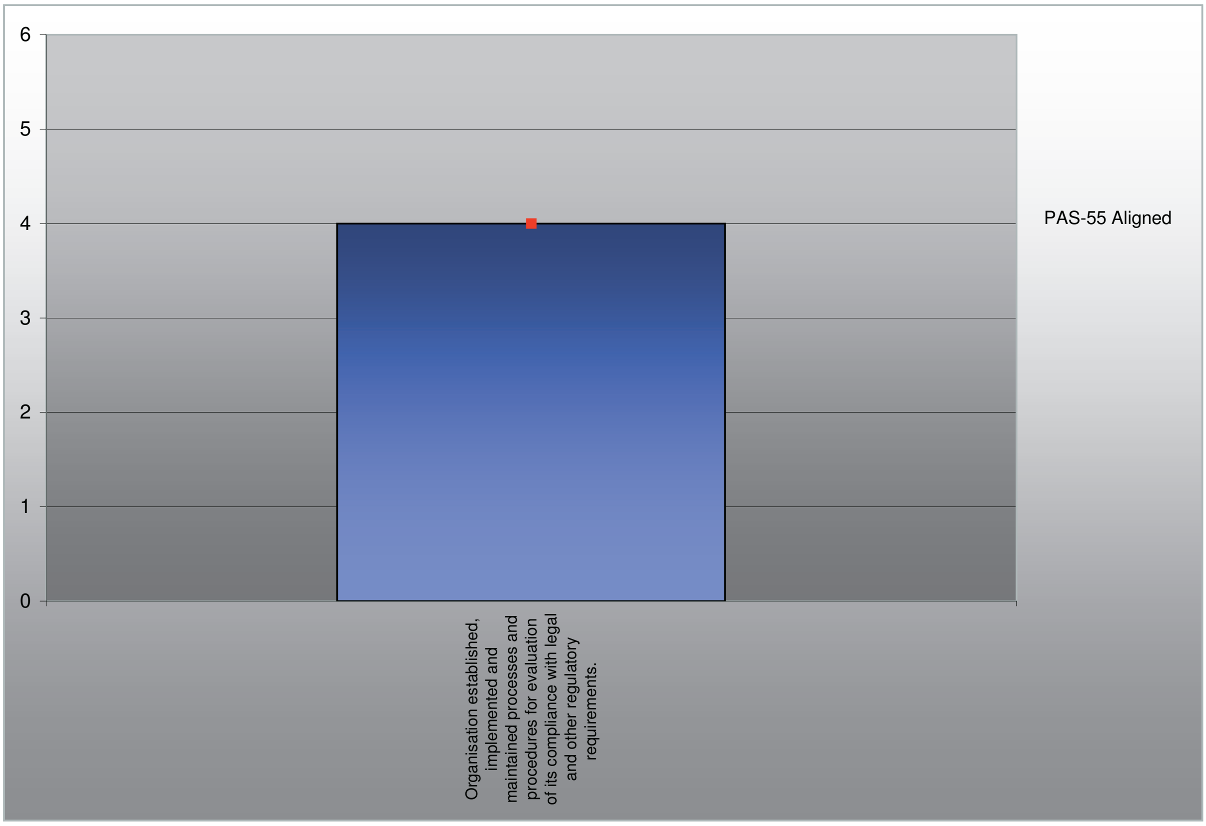
8.12.24 Evaluation of Compliance

"The organisation shall establish, implement and maintain processes and procedures for evaluation of its compliance with applicable legal and other regulatory requirements."

Table 8.26 - Evaluation of Compliance

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
133	a	Organisation established, implemented and maintained processes and procedures for evaluation of its compliance with legal and other regulatory requirements.	4	Compliant	Legal compliance is reported to the Board as detailed in draft AMS Section 17 along with KPI on zero regulatory breaches.	16

Review against PAS-55 Requirements



Observations and Improvement Opportunities

It is understand that Westpower operates under heavy regulatory requirements and has processes and procedures in place to evaluate its compliance.

Recommended Actions

That Westpower summarises its compliance reports and holds the documentation in Sharepoint so the review process can monitor compliance.

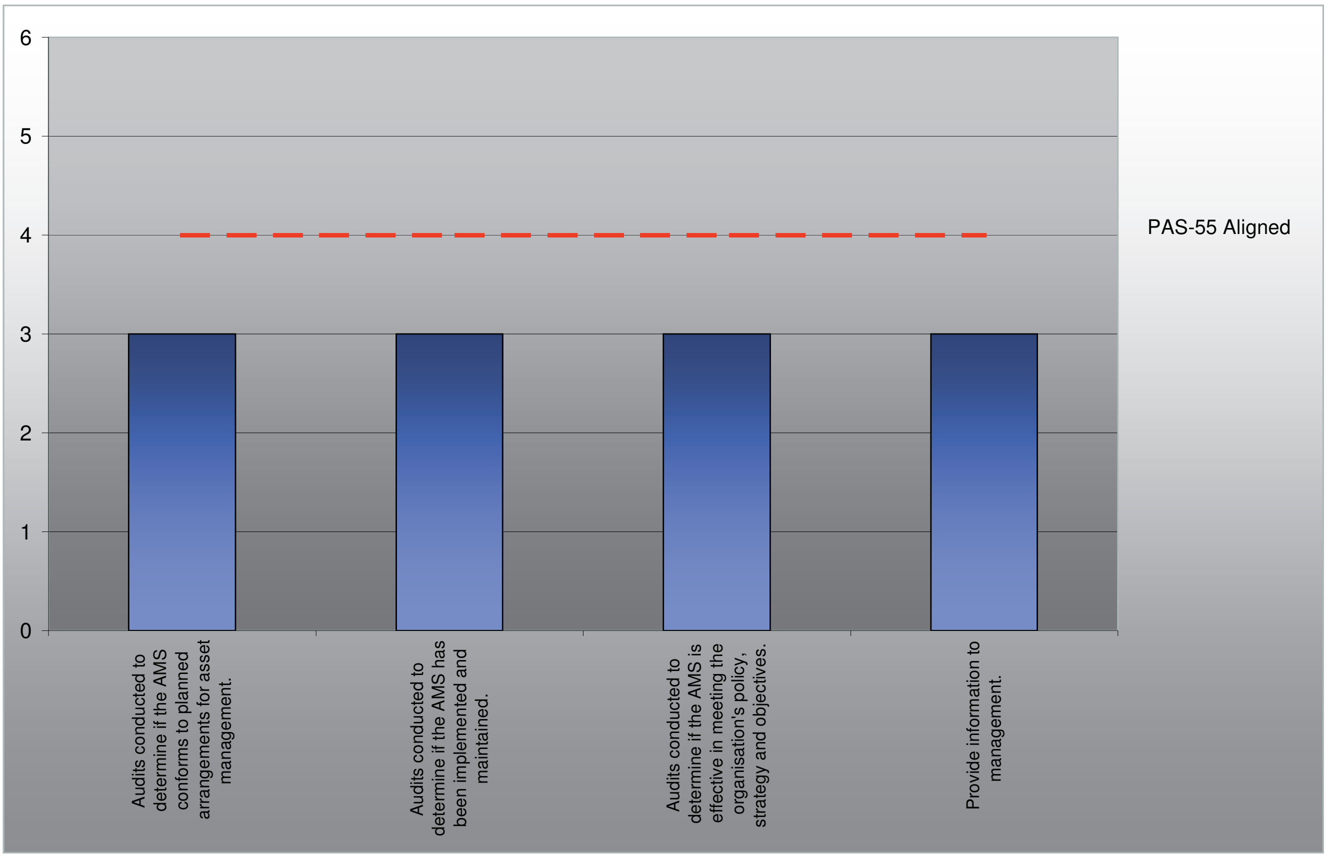
8.12.25 Audit

“Audit programs shall be planned, established, implemented and maintained by the organisation, based on the results of risk assessments and previous audits.”

Table 8.27 - Audit

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
134	a	Audits conducted to determine if the AMS conforms to planned arrangements for asset management.	3	Developing	There have been ongoing audits for AM planning including PAS 55 audits and reviews as summarised in draft AMS Section 18 . The AMS is still not compliant so unable to rate as compliant until fully implemented.	18
135	b	Audits conducted to determine if the AMS has been implemented and maintained.	3	Developing	There have been ongoing audits including gap analysis for Westpower to seek full PAS 55 compliance as summarised in draft AMS Section 18. Unable to get full marks until fully implemented.	18
136	c	Audits conducted to determine if the AMS is effective in meeting the organisation’s policy, strategy and objectives.	3	Developing	This cannot be evaluated until the AMS is fully implemented. It is expected that future audits will evaluate the AMS effectiveness so unable to rate as compliant until fully implemented.	18
137	d	Provide information to management.	3	Developing	The audits findings need to be formally provided to management (and the Board). This should be explicitly stated in draft AMS Section 18.	18

Review against PAS-55 Requirements



Observations and Improvement Opportunities

Westpower does not appear to have a formal programme of audits of the asset management system and its processes. It is recommended that an audit program of key processes and activities be implemented following the implementation of formal asset management system.

Recommended Action

That Westpower implement an audit program to identify non-conformities and improvement opportunities for key asset management system processes.

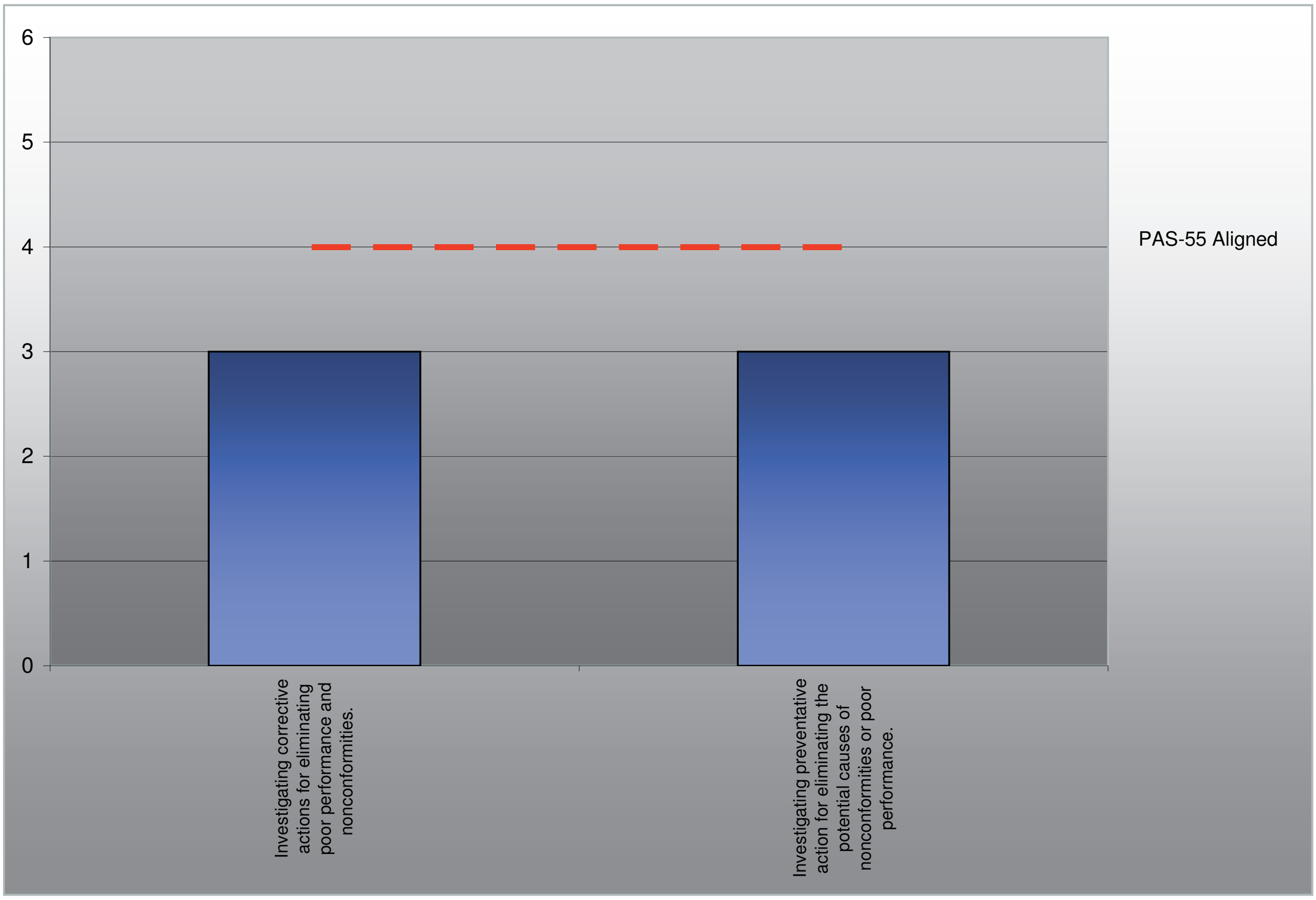
8.12.26 *Corrective and Preventative Action*

"The organisation shall establish, implement and maintain processes and procedures for investigating corrective action for eliminating the causes of poor performance and nonconformities."

Table 8.28 - Corrective and Preventative Action

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
138	a	Investigating corrective actions for eliminating poor performance and nonconformities.	3	Developing	The process for investigating corrective actions is summarised in draft AMS Section 16.2 for asset failures and larger faults. There needs to be more actions to address the root causes of identified non conformances to rate as compliant. This may include changes to process or risk profiles.	16.2
139	b	Investigating preventative action for eliminating the potential causes of nonconformities or poor performance.	3	Developing	There are debriefing sessions for larger faults with minutes taken. The Incident Investigation Report includes corrective action. There needs to be more actions to address the root causes of identified non conformances before the incidents occur to rate as compliant.	16.2

Review against PAS-55 Requirements



Observations and Improvement Opportunities

Where corrective or preventative action identifies new or changed risks or the need for new or changed procedures, the proposed actions shall be risk assessed prior to implementation.

Recommended Action

That Westpower formally introduce processes and procedures that assess the risk of corrective and preventative actions.

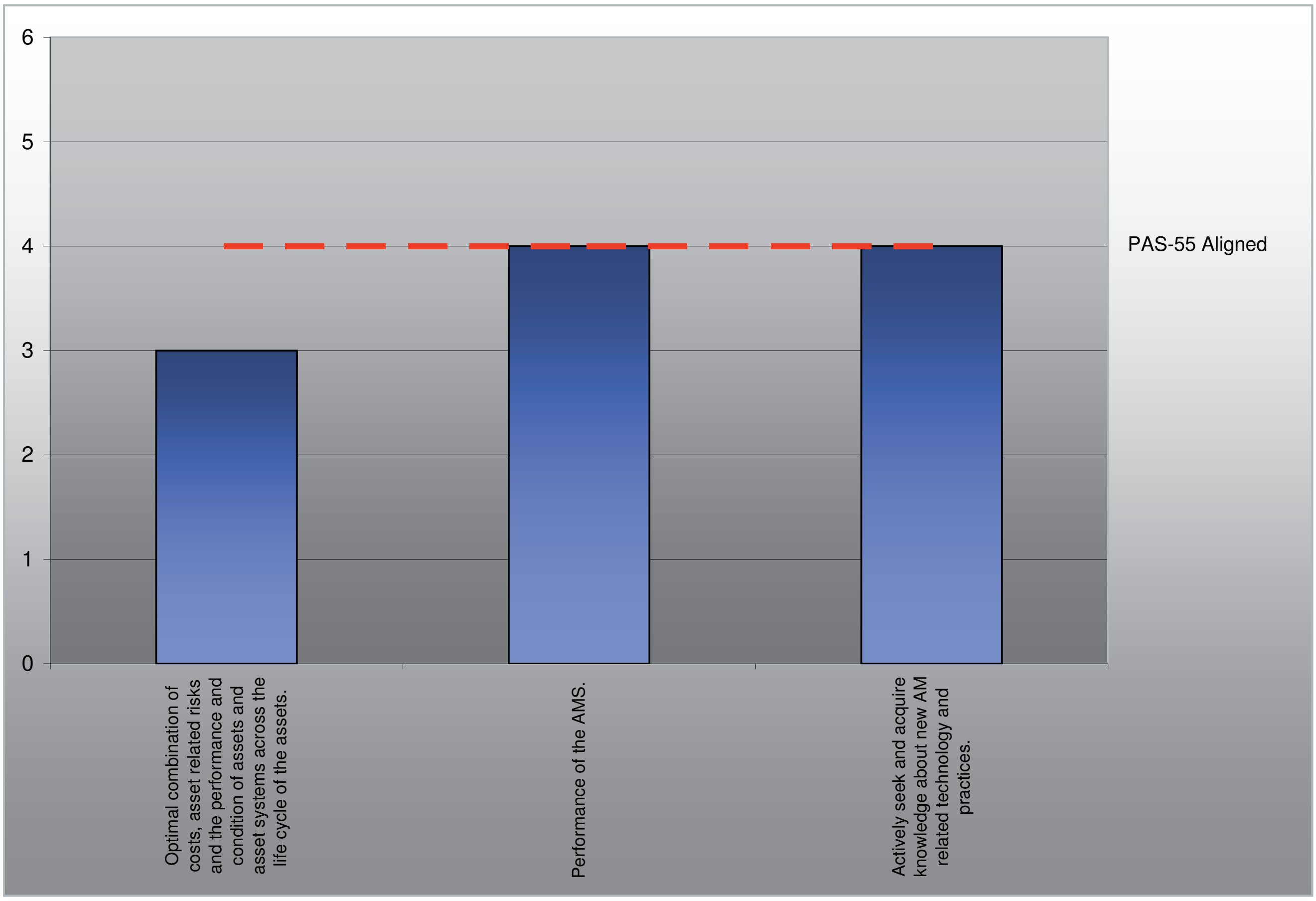
8.12.27 Continual Improvement

"The organisation shall establish, implement and maintain processes and procedures for identifying opportunities and assessing, prioritising and implementing actions to achieve continual improvement."

Table 8.29 - Continual Improvement

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
140	a	Optimal combination of costs, asset related risks and the performance and condition of assets and asset systems across the life cycle of the assets.	3	Developing	The continuous improvement process is through the AMP process and the AMG as stated in draft AMS Section 19. It is iterative but it is recognised that there is no formal documentation for the review process so unable to achieve compliance status.	19
141	b	Performance of the AMS.	4	Compliant	Westpower monitors the performance of the AMS through their PAS 55 gap analysis, as stated in draft AMS Section 19.	19
142	c	Actively seek and acquire knowledge about new AM related technology and practices.	4	Compliant	Westpower are active in this area including EEA conferences, subscribing to technical journals as detailed in draft AMS Section 19.	19

Review against PAS-55 Requirements



Observations and Improvement Opportunities

The organisation shall actively seek and acquire knowledge about new asset management-related technology and practices, including new tools and techniques, and these shall be evaluated to establish their potential benefit to the organisation.

Recommended Action

That Westpower continue improvement as an on-going process and document the activities undertaken.

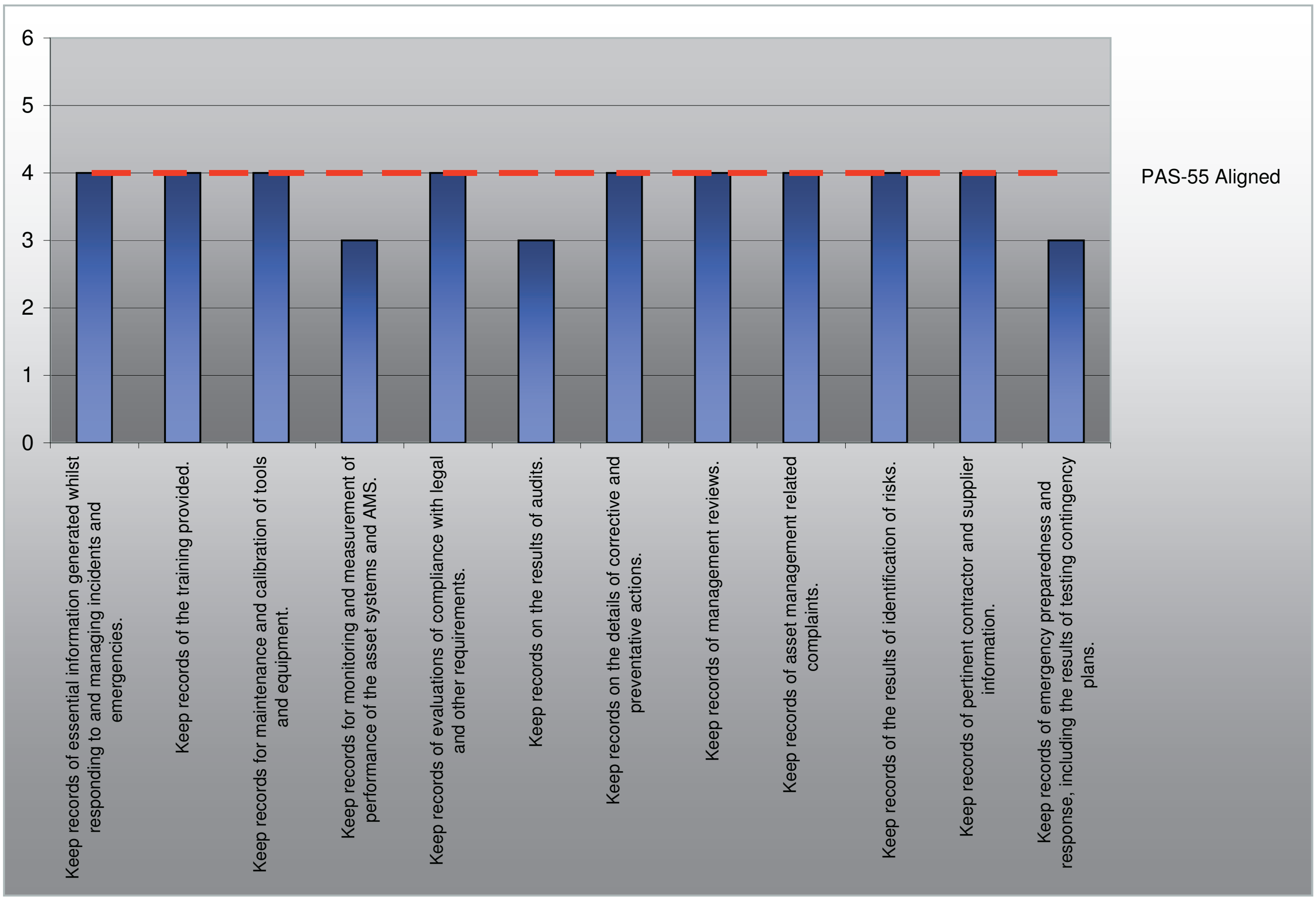
8.12.28 *Records*

"The organisation shall establish and maintain records as necessary to demonstrate conformance to the requirements of its AMS and of PAS-55."

Table 8.30 - Records

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
143	a	Keep records of essential information generated whilst responding to and managing incidents and emergencies.	4	Compliant	All incidents are fully investigated and records are kept of actions in The Vault.	20
144	b	Keep records of the training provided.	4	Compliant	The training records are held in The Vault for contractor and AMG. The associated document AMG training records were provided for this review.	20
145	c	Keep records for maintenance and calibration of tools and equipment.	4	Compliant	The test room holds records of the maintenance and calibration of tools and equipment. These are to be scanned and put onto Sharepoint.	20
146	d	Keep records for monitoring and measurement of performance of the asset systems and AMS.	3	Developing	Records for monitoring and measurement of performance of the asset systems and AMS have not yet started as it is a new process. The records will be kept in Sharepoint as stated in draft AMS Section 20. This criterion cannot achieve compliance yet as not underway.	20
147	e	Keep records of evaluations of compliance with legal and other requirements.	4	Compliant	The Regulation Register records evaluations of compliance with legal and other requirements.	20
148	f	Keep records on the results of audits.	3	Developing	A formal AMS audit is still to be completed but the audit findings will be recorded in Sharepoint. This criterion cannot achieve compliance yet as not underway.	20
149	g	Keep records on the details of corrective and preventative actions.	4	Compliant	Records are kept in Maximo of all corrective and preventative actions. Also refer to the new AM Review Process report.	16.2
150	h	Keep records of management reviews.	4	Compliant	Current and future planned management reviews are detailed in draft AMS Section 21. There is a new AM Review Process template which is linked as an associated document.	21
151	i	Keep records of asset management related complaints.	4	Compliant	There is a formal complaints system that is recorded in The Vault. There is a Complaint Guideline which should be added as an associated document.	20
152	j	Keep records of the results of identification of risks.	4	Compliant	Risk identification is detailed in the Risk Management Analysis, an associated document. The associated documents contractor and supplier records were provided for this review.	20
153	k	Keep records of pertinent contractor and supplier information.	4	Compliant	Contractor and supplier records are approved by AMG and maintained. The associated documents contractor and supplier records were provided for this review.	20
154	l	Keep records of emergency preparedness and response, including the results of testing contingency plans.	3	Developing	The ERP is Westpower's formal emergency preparedness and response plan. It needs to be clear where the emergency debrief records are kept. Contingency plan testing has not been recorded to date but we understand that Westpower has identified this as a future action.	20

Review against PAS-55 Requirements



Observations and Improvement Opportunities

Westpower has introduced Sharepoint as a means of compliance with record keeping. This process needs to be fully developed to comply with PAS-55.

Recommended Action

That Westpower continue to develop and implement Sharepoint for the management of asset and AMS and records.

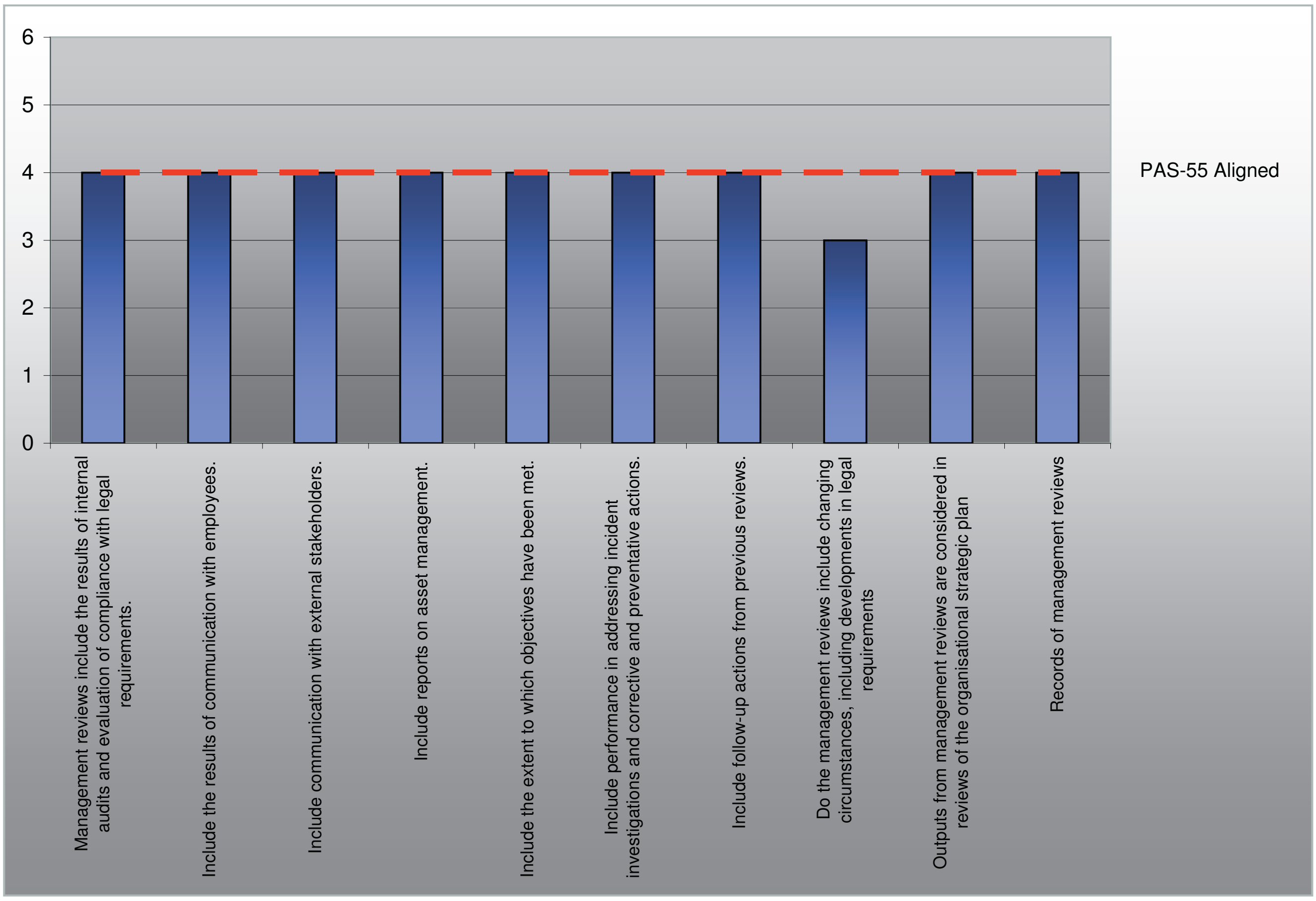
8.12.29 Management Review

"The organisation shall review the AMS to ensure its continuing suitability, adequacy and effectiveness."

Table 8.31 - Management Review

Q#	PAS-55	Criteria	Score	Maturity Level	Comments	AMS Section
155	a	Management reviews include the results of internal audits and evaluation of compliance with legal requirements.	4	Compliant	PAS 55 gap analysis and the OSP are the current internal systems for AMS management reviews as detailed in draft AMS Section 21. A new Review Process template has been developed to formalise the process further. The evaluation of legal compliance is summarised in draft AMS Section 17. A sample compliance report is still to be provided as an associated document.	17, 21
156	b	Include the results of communication with employees.	4	Compliant	There is full participation of those involved with all incident investigations as stated in draft AMS Section 21. Other results of communication with employees and stakeholders on AMS are evaluated in the AMS Review Process Report	21
157	c	Include communication with external stakeholders.	4	Compliant	Management review communication with external stakeholders is evaluated in the AMS Review Process Report.	21
158	d	Include reports on asset management.	4	Compliant	Asset management is reviewed on an annual basis through AMP and OSP processes as stated in draft AMS Section 21.	21
159	e	Include the extent to which objectives have been met.	4	Compliant	The achievement of the objectives is evaluated in the AMS Review Process Report.	21
160	f	Include performance in addressing incident investigations and corrective and preventative actions.	4	Compliant	All incident investigations include corrective and preventative actions as detailed in draft AMS Section 16.2 and are recorded in the Incident Investigation Report. The performance of Incident investigations is evaluated in the AMS Review Process Report.	16.2, 21
161	g	Include follow-up actions from previous reviews.	4	Compliant	The follow-up actions from previous reviews are evaluated in the AMS Review Process Report.	21
162	h	Do the management reviews include changing circumstances, including developments in legal requirements	3	Developing	Changing circumstances is inferred with the iterative nature of the management process as shown in the diagram in draft AMS Section 21. This could be strengthened by explicitly stating this.	21
163	i	Outputs from management reviews are considered in reviews of the organisational strategic plan	4	Compliant	Management reviews feed into the review of the OSP as shown in the diagram in draft AMS Section 21.	21
164	j	Records of management reviews	4	Compliant	The results of the management reviews are documented in the AMS Review Process Report.	21

Review against PAS-55 Requirements



Observations and Improvement Opportunities

Reviews shall include assessing the need for changes to the asset management system, including asset management policy, strategy and objectives.

Recommended Action

That Westpower review its AMS on an annual basis.

8.12.30 Conclusions and Recommendations

The intent of the PAS-55 specification is to define a suite of requirements which form an effective asset management system intended to ensure the consistent delivery of the organisations asset dependent objectives. The focus of PAS-55 is therefore an end to end process of discipline, governance and control.

It should be noted that PAS-55 is intended to apply to the management of physical assets by organisations of all sizes, ranging from large national infrastructure providers in heavily populated countries (for example the UK National Grid) to small regional infrastructure providers. Organisations of such varying size will have different needs for the level of corporate governance and process documentation. It is important that a relatively small regional infrastructure manager such as Westpower interpret PAS-55 in a manner that will assure consistent risk managed performance, without creating unnecessary administrative burden and cost.

The key findings of this review are centred on Westpower formally identifying, reviewing, documenting and implementing key asset management processes to form an overall asset management system. If done sensitively, Westpower will be able to design a PAS-55 compliant system that minimises the need for administrative burden while assuring consistent risk managed outcomes.

Westpower has consciously decided and documented how it will respond to each PAS-55 requirement taking into consideration the size and scope of the asset management operation and the resources available.

A summary of Westpower's current position with respect to documentation of PAS-55 requirements is shown in Figure 8.4. This chart highlights a number of areas where Westpower's documentation and systems address 95% of PAS-55 requirements with some minor additional work required to taking this score to 100%

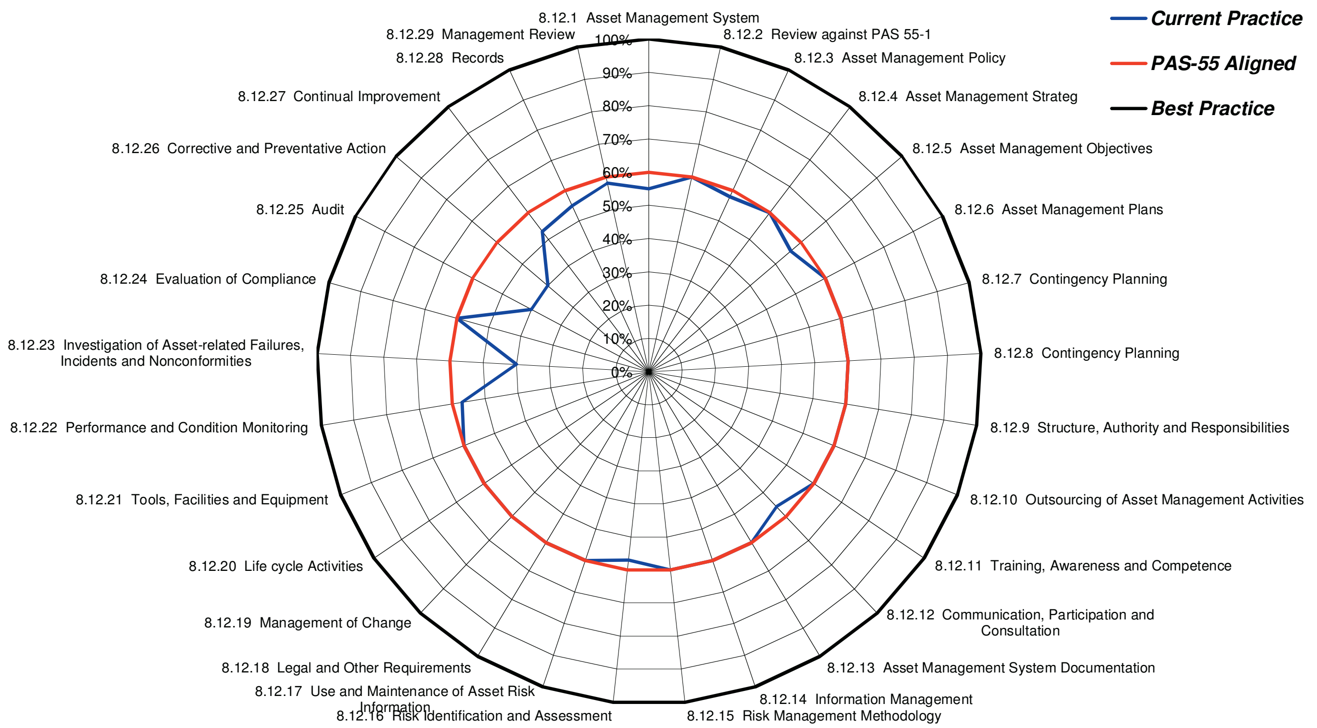


Fig 8.4 Summary Chart Showing Westpower's Current Compliance With the Requirements of PAS-55

In order to progress towards full PAS-55 conformance, it is recommended that Westpower take the following broad approach:

1. Identify, and set up a program of work, including timelines and responsibilities, for full implementation of the documented processes;
2. Consider the data requirements and information flow for each of the identified processes to identify and document the 'must have' data and information requirements. If gaps exist implement a data improvement plan; and
3. Implement a formal risk management process integrated with the above processes. It is suggested that a formalised risk management process would assist in:

- Providing assurance that the key asset related risks are identified and understood; and
- Transparently demonstrating the prudence of asset management decisions whether they be to apply resources to mitigate a risk, or to accept a risk as tolerable.

- Implement an audit and review program to measure process compliance and drive process improvement.

8.13 Asset and Works Management System Development

8.13.1 Background

The implementation of IBM Maximo® has been extremely successful and post implementation Westpower has started to realize genuine benefits. These changes have been successfully embedded into standard business process and are being continually monitored and updated as required.

During 2011, WestpowerTs IBM Maximo® Asset and Works Management System (AWMS) was upgraded to the latest available specification. The system integrator in partnership with Westpowerss AWMS project team, provided a comprehensive solution which met functional, financial and time based targets.

Integrated with GIS and FMIS systems, Maximo ® embodies comprehensive asset management processes which support managers, contractors and customers.

Day to day asset management activities have been fully integrated into Maximo® , including monthly invoicing and work order reconciliations. Reports have been developed to assist mangerss interpretation of data and strategic planning is becoming more frequent as information and processes improve.

Figure 8.5 shows the model for the current AWMS.

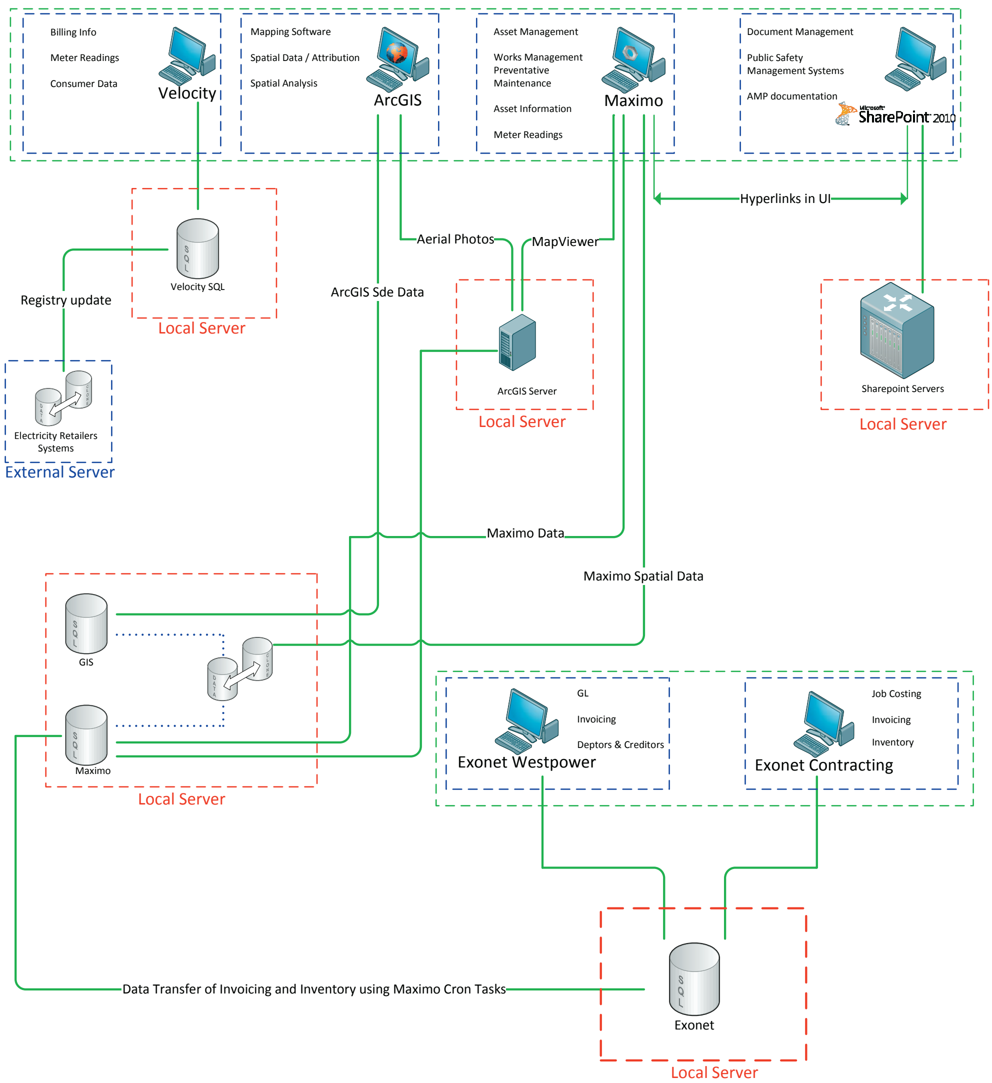


Fig 8.5 Asset Management Systems Diagram

8.13.2 Geographical Information System (GIS)

GIS is the repository for all Network spatial data. It contains and manages attribution data relating to locations, poles and cable spans, which are used to describe the nature and condition of the location. This data assists with the development of the preventative maintenance programme. GIS also provides network connectivity, which is used to evaluate the impact on consumers, or package work on feeders, during outages. This process minimises consumer disruption, reduces costs and facilitates safe working environments.

8.13.3 Maximo

Maximo is the repository for all asset and works management data. It also stores data relating to locations, which is synchronised each night from GIS. Maximo also manages the following business processes:

Budgets

Maintenance – preventative/defects

Workflows

Outage management

Condition assessment

ODV

Asset register

General maintenance

Inventory

Invoicing

Work order management and service requests

8.13.4 Maintenance

Preventative Maintenance (PM) - Considerable effort is being put toward the preventative maintenance plan. PM schedules have been developed with job plans and routes and these are now used for the majority of scheduled maintenance work programmes

Due diligence needs to be given to the structure applied to the PM process to ensure that it is not overly arduous but at the same time comprehensive. Westpower has conducted an engineering assessment of network assets and in conjunction with manufacturer's recommendations is developing a maintenance programme, which identifies the frequency of maintenance required and list maintenance tasks. The maintenance programme is monitored via the PM Report.

Defects – Fault and failures are now being reported on. A failure report which identifies the problem/cause/remedy is applied to all faults and assessed by engineers to identify recurring problems. Additionally contractors are encouraged to submit service requests to Westpower identifying any damage or repairs required to the network. Workflow processes direct these to the appropriate Asset Management department. Further development work is planned to provide better reporting of defects so that future maintenance plans are better informed.

8.13.5 Workflows

Workflows are an integral part of MXES and provide significant benefits to both Westpower and ENS. A number of workshops have been conducted discussing business processes and formulating workflows. Workflows provide the greatest challenges and have the potential to produce the most significant benefits to business processes.

Westpower has assumed ownership of Workflow creation and maintenance. Having staff within the organisation with these skills simplifies customisation and ensures that changes are timely.

8.13.6 Outage Management

Through regulatory legislation, Westpower is obliged to maintain transparent outage management systems. In-house systems based on the GIS system have been developed to carry out this function.

8.13.7 Condition Assessment

An add-on to the GIS system has provided for condition assessment data capture. ArcPad, an "out of the box" GIS package, has provided considerable benefits over customised programming.

The development of ArcPad to meet the requirements of Westpower's condition assessment has primarily been done in house.

8.13.8 Asset Register

The asset register is the primary repository for information relating to asset life cycle management and technical performance. The asset register provides the Westpower asset management group with the ability to track equipment, associated costs, histories and failures of all assets.

8.13.9 Assets Held in Maximo

Attribution, meter and condition data is held for the following asset types:

During the implementation of Maximo data was transferred from Gentrack to Maximo Systems. The majority of this data has since been purified and will continue to be assessed and corrected as required.

Generally all high voltage locations and assets are recorded in GIS and Maximo. Recently a programme has been started to load all 400 V location and asset data. This programme is ongoing and expected to be completed within the next year.

8.13.10 General Maintenance

Continual improvement is being made to all Maximo® integrated software modules. A dedicated Maximo/GIS administrator is facilitating coordinated system management, which will guarantee constant improvement and longevity.

8.13.11 Strategic Management

All the elements of Maximo® and GIS systems mentioned above have provided Westpower with accurate and timely information to support the decision making process. Reports have been structured for managers at various levels of the organisation to assist them in effectively managing their respective departments. Improved planning, maintenance and reporting are contributing to a well performing network along with improved security of supply for consumers.

9.0 RISK MANAGEMENT PLAN

Westpower has a separate Risk Management Plan (RMP) completed as part of its overall business planning strategy. This includes Business Impact Analysis and Business Continuity Planning.

In addition, Westpower is actively involved in a regional Lifelines project looking at ways of managing the risks involved with major disasters and ensuring that plans are in place to deal with most of the likely scenarios.

A general overview of the risk management process is included below to demonstrate the robust and professional approach taken to this important aspect of planning.

The RMP is a living document that is regularly updated.

9.1 Risk Management Planning Framework

A detailed risk assessment was conducted which:

- Defined specific risks;
- Assessed the potential impact of each risk on a six-point scale from 100 [Minor] to 600 [Critical];
- Assigned management responsibility to each risk;
- Identified current control measures for all risks with a potential impact of 300 [Major] or above and rated the effectiveness of the controls;
- Documented the results.

The methodology adopted was consistent with the joint Australian and New Zealand Standard AS/NZS ISO 31000:2009. It is a simple and effective method, but remains subjective. The validity of the risk control assessments may require further investigation and analysis by Westpower, particularly where the risk is critical to the business.

9.2 Risk Planning Methodology

The risk management team facilitated a workshop with Westpower's management to work through and assess the impact of 60 risks presented in a framework under 13 categories.

Figure 9.1 (overleaf) charts the methodology used for Westpower. In this diagram, the process boxes, numbered 1 to 10, correspond with the process methodology stage descriptions that follow.

Stage 1. Assess Scale of Effect

Risk is measured in terms of scale of effect, which is a combination of consequence and likelihood. At the workshop, Westpower management assessed the potential impact of each risk on the organisation. Their assessment of the potential scale of effect was based on the following table developed in consultation with senior Westpower management.

Table 9.1 - Scale of Effect

Scale of Effect	Undudgeted Cost, Unforecast Revenue Loss or Loss of Value		Multiplier
	From	To	
Low	$0	$500,000	180
Moderate	$500,001	$1,000,000	200
High	$1.000,001	$5,000,000	300
Severe	$5,000,001	$10,000,000	400
Critical	Greater Than $10,000,001		500

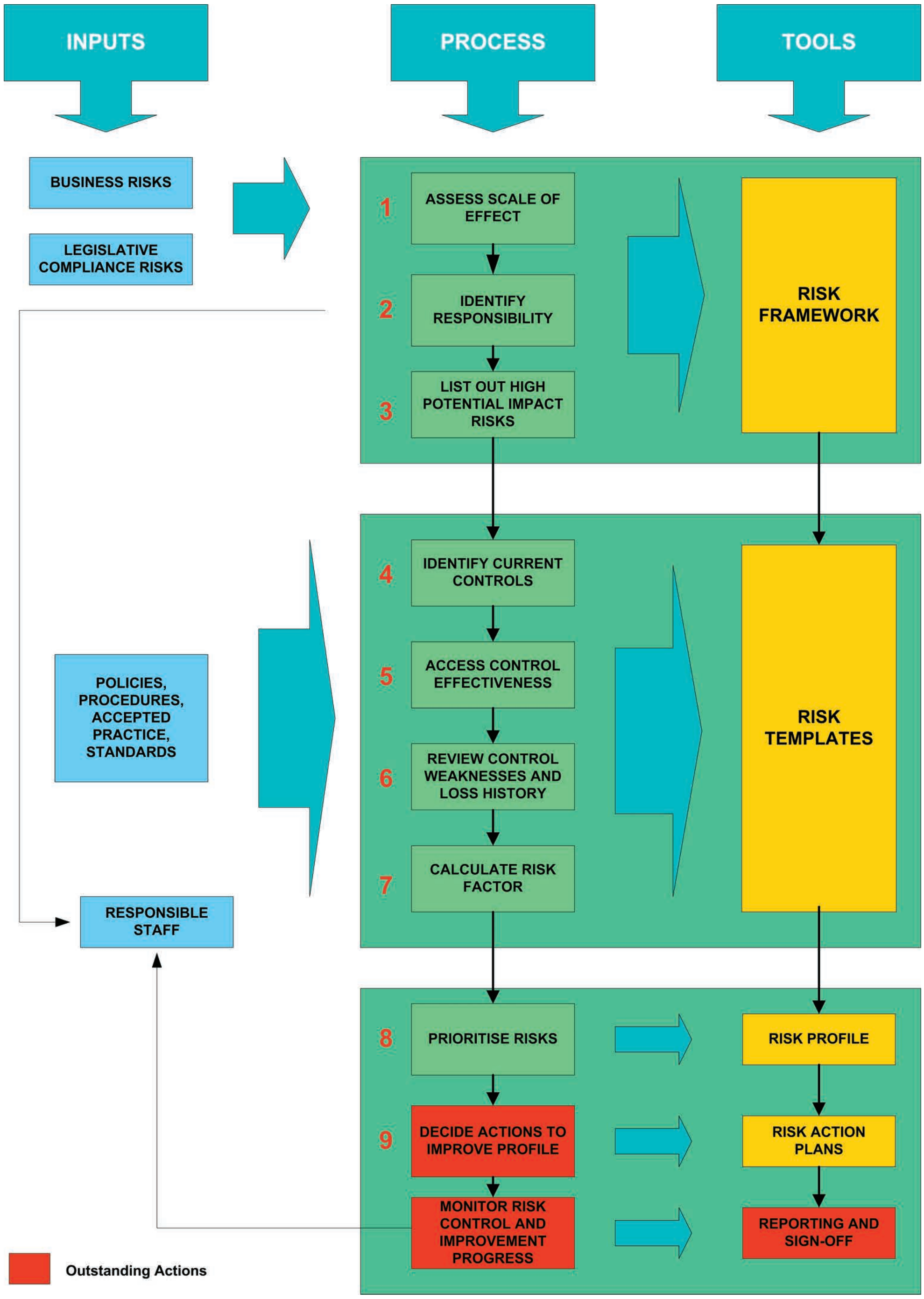


Fig 9.1 Westpower Risk Planning Methodology

Stage 2. Identify Responsibility

One of the tasks completed at the workshop was to identify the responsible person for each of the risks given a consequence rating. It is the person identified that is best able to rate the current control effectiveness.

Stage 3. Identify High Consequence Risks

A key aim of the risk workshop was to separate out the significant, high-impact risks for further attention from those with lesser impacts.

Stage 4. Identify Current Controls

As part of the interview process, each high impact risk was discussed in detail and a description of the current control methods developed. These results were captured in risk templates.

Stage 5. Assess Control Effectiveness

Next, the control effectiveness of the current control methods was assessed using the following rating scale.

Table 9.2 - Control Effectiveness

Assesment	Effectiveness of Controls	Effectiveness of Preparations	Multiplier
Unacceptable	Few, if any, control points covered	No plan in place	0.8
Adequate	One or two key control points covered	One or two likely key scenarios covered	0.5
Reasonably Good	Majority of key contol points covered	Majority of likely key scenarious covered	0.33
Good	All control points covered	All likely key scenarious covered	0.25
Very Good	Enhanced controls introduced for key control points	All likely scenarios covered	0.2
Excellent	Enhanced control points introduced for all control points	All likely plus less likely scenarios covered	0.15

Stage 6. Review Control Weakness and Loss History

Also, as a part of the interview process, an assessment was made of the weaknesses associated with the current control measures. At the same time, suggestions for improvements were put forward by managers and a brief review of the recent loss history for this risk was noted.

Stage 7. Calculate Risk Factor

The risk factor value can be calculated using the following formula:

Scale of Effect X Control Effectiveness = Risk Factor

Stage 8. Prioritise Risks

By using the risk assessment formula shown above, we were able to prioritise the top risks for Westpower based upon the risk factor. The risks are shown in order in Table 9.3.

Table 9.3 - Risk Priority

Controllable and Contingency Risks	Risk Factor	Rank
Unauthorised Access to Company Property	100	1
Health and Safety Governance and Management	100	2
Health and Safety Culture	100	3
Safety by Design	100	4
Fatigue	100	5
Emergency Response Procedures [Company Property][Contingency]	100	6
Contractors, Sub-contractors and Service Providers	100	7

Stage 9. Action Plan Development

The Risk Management Team believes that any risk with a risk factor of 100 or above should be matched by a corresponding Action Plan. There are seven risks in the above category.

The suggested action plans were formulated from discussions held with key staff during the interview phase. These will be further developed by Westpower as this is effectively a living document.

9.3 Failure Mode and Effects: Criticality Analysis

Asset failure will be managed using the failure mode and effects criticality analysis process. This forms part of the "desired practice" for an optimised renewal strategy.

Having identified the failure modes, risk costs and treatment options for key assets, the appropriate risk treatment option will be included in the AMP. This process and the typical failure modes, effects and treatments are summarised in Figures 9.2 and 9.3.

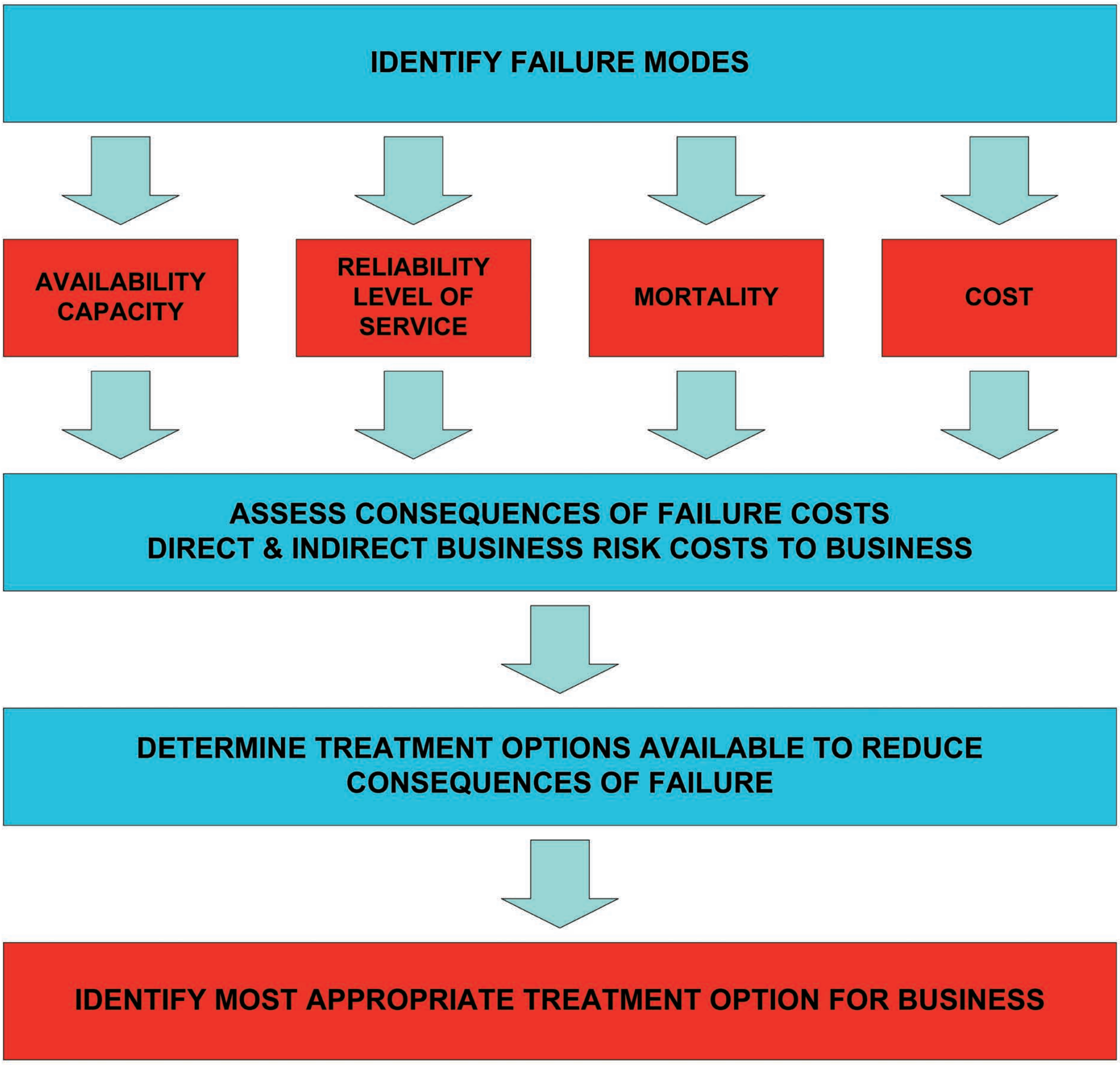


Fig 9.2 Failure Modes Analysis Process

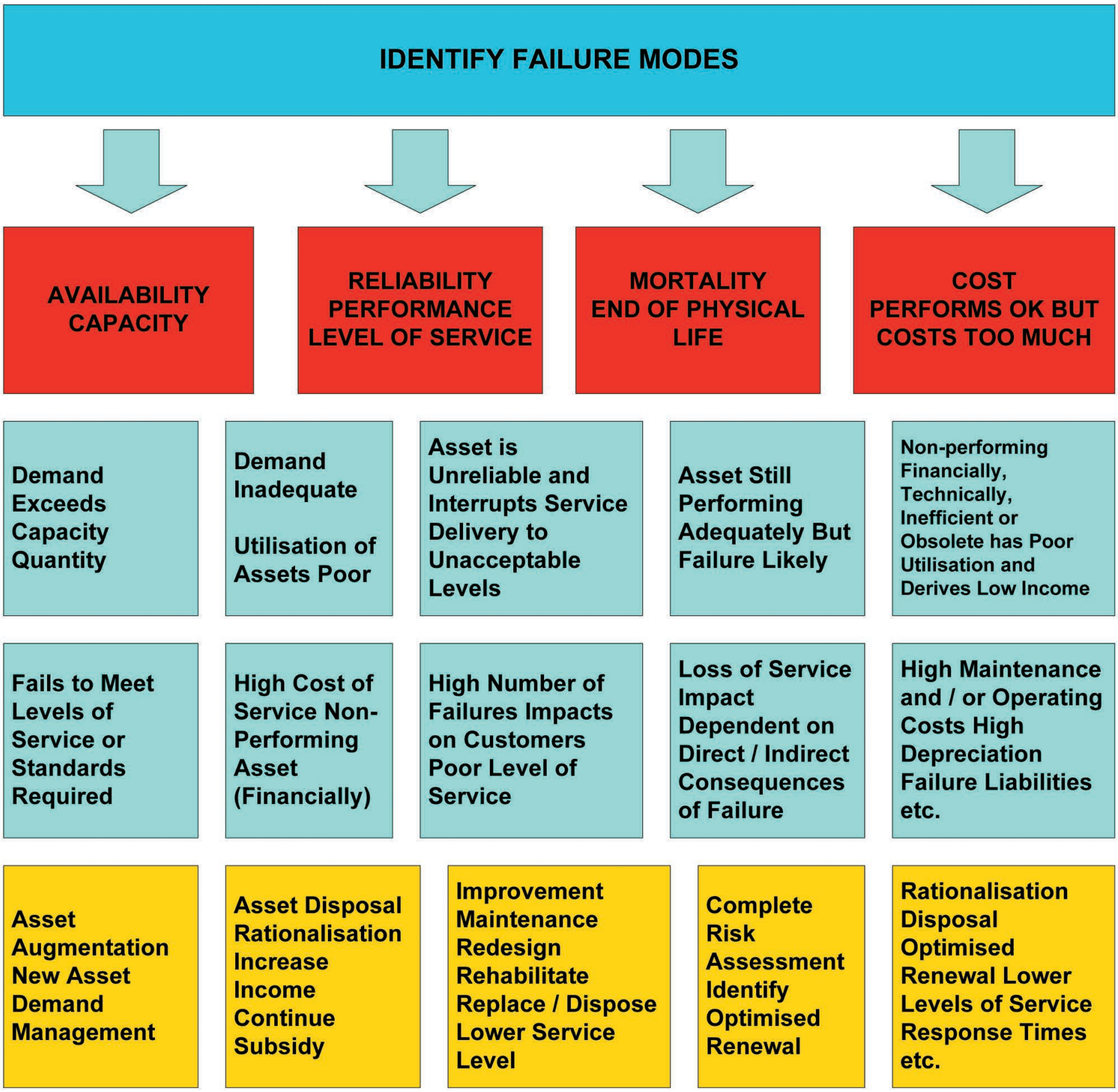


Fig 9.3 Typical Failure Modes, Effects and Treatments

9.4 Safety

Safety is always a prime driver in any risk management strategy and Westpower takes this seriously. To ensure that these matters are properly addressed, a formal health and safety committee structure has been created and this committee comprises a wide range of staff from all areas of the business.

In addition, Westpower's contractor, ElectroNet Services Ltd, has been audited by the Accident Compensation Commission, (ACC) and received a tertiary level grading for its safety processes and systems, the highest grading available.

Safety is kept to the fore through regular refresher courses and staff training programmes designed to enhance the awareness of safety issues throughout all aspects of the workplace.

In addition to the above, Westpower ensures that an active hazard identification programme is in place, including the development of registers for specific types of hazard. At zone substations, hazard identification notice boards are used to inform all personnel coming on to site of identified hazards. They are encouraged to add any new hazards that present themselves to the list.

New equipment is always checked for safety and specific operational procedures developed where necessary. All manufacturers are required to supply material safety data sheets for substances used in the workplace, and these are kept in a readily available register.

9.5 Environmental

Oil spills are the most likely form of environmental damage to occur as a result of Westpower's activities. This risk has been specifically identified for further attention and has been reported at Board level.

To mitigate this risk, Westpower has installed bunding at all major substations where there are oil containment vessels with a capacity of more than 1500 litres. All zone substations are now compliant.

Spill response kits are supplied to all major sites and staffs are trained in their use to mitigate the impact of any potential spill.

9.6 Key Risks Identified

Key risks for Westpower are similar for most lines businesses and are mainly due to climatic and seismic factors.

Westpower has identified the following major risks to its ability to supply electricity:

- Earthquakes,
- Storms (including high winds),
- Lightning,
- Flooding,
- Ripple injection system failure.

9.6.1 Earthquake

The likelihood of a major earthquake on the West Coast due to slippage on the Alpine Fault within the next 50 years is considered to be relatively high. There is very little that can be done to minimise the risk to overhead lines and cables in the event of an earthquake, but it is also relatively straightforward to straighten poles and restring conductors, as long as access and materials are available.

A Seismic Withstand report was prepared for most zone substations in the 2003/04 year to identify any seismic strengthening measures that can be taken to mitigate the impact of a major earthquake. Recommended strengthening measures identified in this report have been assessed and actioned where necessary.

In addition, Westpower closely co-operates with other ELBs and uses similar industry standard equipment to ensure that a ready supply of spares will be available if required.

9.6.2 Storm Damage

Westpower faces this risk regularly, with several major storms experienced in any one year.

Damage is caused by poles being blown over and/or trees or other large objects being blown into the overhead lines.

Westpower mitigates this risk by maintaining a regular pole inspection programme to check that poles are adequately rated and in good condition. Any poles that are found to be substandard are replaced quickly.

A wide range of spares are kept by Westpower's contractor, including poles, conductors, fittings and transformers to ensure that storm damage can be readily dealt with. The level of spares held for various types of equipment has been developed through experience over a number of years, and a regular reporting and reordering programme is maintained to ensure that minimum quantities are maintained.

In addition, regional depots are maintained at Reefton, Hokitika and Harihari so that a rapid response can be provided throughout Westpower's area.

9.6.3 Lightning

The West Coast is renowned as a significant lightning-prone region of New Zealand, both in terms of strike density and intensity.

As Westpower has had to live with this phenomenon over many years, it has developed design practices to minimise the damage caused by lightning strikes. These include the fitting of modern surge diverters on all distribution substations, something not common in many parts of the country.

For zone substations, station class (line discharge level 3) arrestors are fitted on the terminals of all major power transformers, and overhead shield wires are fitted on incoming overhead circuits.

A substantial quantity of spares are held for transformers as lightning is a common cause of damage for this plant and severe lightning events can sometimes last for several days.

9.6.4 Flooding

This risk mainly affects ground-mounted assets such as pad mount distribution transformers and ring main units.

Where possible, the location of this equipment is chosen so that it is at least 300 mm above maximum recorded flood levels, although this is not always feasible in areas such as the CBD of Greymouth.

In the event of a major flood, operational plans are in place to make sure that power is isolated from plant prior to flooding reaching levels where it could cause an electrical fault and possible hazards to workers and the public. Of course, this is in addition to the normal protection systems used to isolate equipment in the event of a fault.

9.6.5 Ripple Injection System Failure

The ripple injection system is an integral part of Westpower's control system for managing demand on the network and providing tariff switching signals for retailers. A failure of the ripple system could result in unmanageable peaks being applied to the system, eventually resulting in brown-outs or, under extreme circumstances, black-outs.

Over recent years, Westpower has diversified its base of ripple injection plants and now has units installed at Hokitika, Greymouth, Dobson and Reefton. These are synchronised so that if one unit should fail, coverage is provided from the remaining units. In addition, each unit can be operated locally in an emergency.

9.7 General Mitigation Measures

A number of general strategies and plans are in place to mitigate the risks identified to Westpower's network and operational capability:

1. Regular inspection, service and testing is carried out to check the operational capability of all equipment. This includes checking of vegetation in close proximity to overhead lines and active vegetation management.
2. Distribution automation has been progressively expanded throughout the network over recent years and this has allowed additional plant to be regularly monitored to give indications of an early failure.
3. Westpower has network design and construction standards as well as a materials approval system to ensure that only quality materials are used and that a high standard of workmanship is maintained. This ensures that the integrity of the network is protected.
4. Regular staff training is implemented in system operation and the issue of permits so that access to the network is always carried out in a safe manner.

5. Contingency plans and emergency procedures are in place. Included within these plans are the following:

- Emergency Response Plan (ERP)
- Regional emergency load shedding plan
- Electrical industry emergency contact list
- Zone substations - emergency operating order templates. A number of engineering measures have been taken to mitigate risk including:
  - A healthy complement of spares is maintained so that most eventualities can be covered without resorting to external support.
  - A seismic strengthening programme will continue at zone substations during the current financial year.
  - A fully mobile 33/11 kV substation, called the Westpower Mobile Substation (WMS) has been built to provide coverage for single-transformer zone substations. Sufficient spare power transformers are available to cover long-term faults.
  - Spare circuit breakers and controllers have been purchased to cover expected failure rates.

9.8 West Coast Engineering Lifelines Plan: Survey 2004/2005

Executive Summary

As a necessary part of Westpower's ongoing commitment to the risk management of its West Coast electricity distribution network, a selection of critical facilities within their operating area were surveyed to assess their vulnerability to damage from a number of predetermined natural hazards, e.g. wind storms and severe earthquakes.

This survey is part of Westpower's means of compliance with the requirements of the Civil Defence and Emergency Management Act 2002. The new act seeks to improve New Zealand's resilience to emergencies through promoting a comprehensive all-hazards approach to managing risk.

Compliance with the above Act is based upon four "R's", Reduction, Readiness, Response and Recovery.

The full report contains a detailed summary of findings together with completed vulnerability charts that quantify risk and importance in a systematic way. These charts are based upon the system originally employed for the Wellington and Christchurch engineering lifeline studies. The quantification level is sufficient to enable relative risk to be assessed to assist a process of mitigating areas of risk in a progressive manner from highest risk/ vulnerability/importance to lowest.

The Westpower network is operated from a Control Centre in the offices at their depot on Tainui Street, Greymouth. The Control Centre is an essential part of Westpower's lifeline readiness and is designed for maximum resilience in the event of a major disaster. The Control Room and associated facilities have been brought up to the requirements of the latest loadings and materials standards.

The following main substations and switchyards were surveyed as part of the exercise:

- Greymouth substation,
- Dobson substation,
- Arnold power station switchyard,
- Rapahoe substation,
- Kumara power stations switchyard,
- Hokitika substation,
- Franz Josef substation,
- Fox substation.

In addition to the above, a selection of less important substations were surveyed to gain an assessment of the overall network. These included substations/switchyards at Badger Lane, Harihari, Mawhera Quay, Ross, Wahapo Power Station, Waitaha and Wilson Lane.

9.9 Transmission Lines

The major transmission lines feeding into the Westpower portion of the West Coast Civil Defence Emergency Management (CDEM) area are:

- Inangahua–Blackwater A 110 kV single-circuit on poles
- Dobson–Blackwater A 110 kV single-circuit on poles
- Arahura (Hokitika)–Otira A 66 kV double-circuit on poles
- Arahura (Hokitika)–Dobson A 66 kV single-circuit on poles (between Dobson and Greymouth)

The major Transmission Lines that Westpower own themselves are:

- Greymouth–Kumara 66 kV single-circuit on poles 25 km
- Kumara–Kawaka 66 kV double-circuit on poles 11 km
- Hokitika–Harihari 66 kV single-circuit on poles 64 km
- Two-Mile–Hokitika 66 kV single-circuit on poles 8 km

Westpower's transmission/distribution lines cover several routes over widely varying terrain from coastal plains to relatively unstable and rugged hill country. Some redundancy is built into portions of the system whereby an outage on any one particular line, depending upon time of day/time of year, may not affect supply to other areas of the network.

Most poles supporting transmission and distribution lines are well founded to prevent collapse under high winds/ice conditions, and therefore are only moderately vulnerable to earthquake-induced slope instability.

Figure 9.4 shows the main lines feeding into the Westpower network from Reefton and Otira.

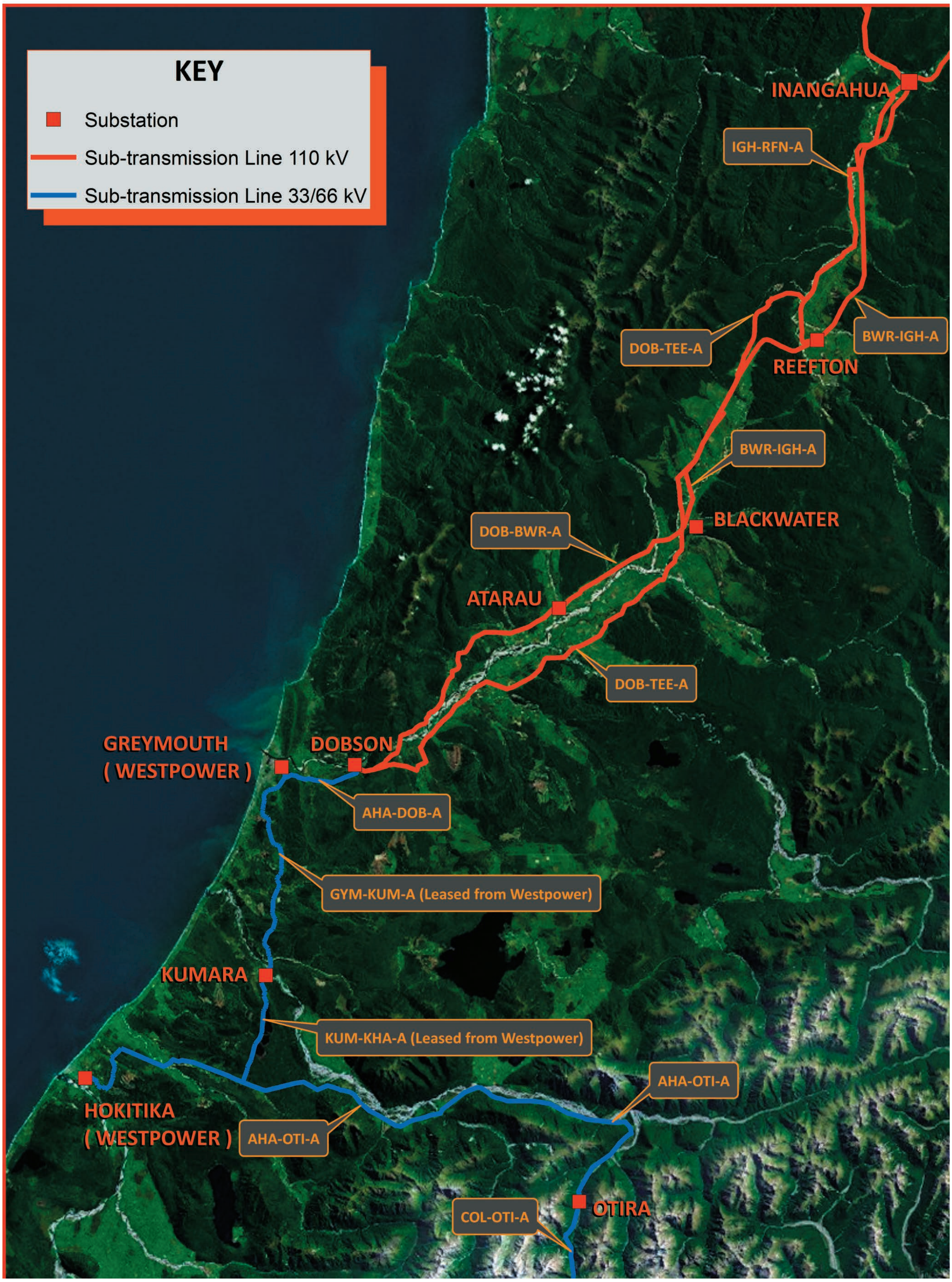


Fig 9.4 Transpower Lines and Substation Assets

9.10 Communications

Westpower is able to use a number of independent means of communication to control its network, namely:

- Two-way radio,
- Telecom landline telephone network,
- Cellular phone network (in some areas).

Each system is essentially independent of each other and therefore there is significant redundancy in the event of disruption.

The following table (Table 9.4) is a summary of common findings throughout Westpower's network, with suggested mitigation measures.

Table 9.4 - Summary of Vulnerabilities and Suggested Mitigations

Vulnerability	Suggested Mitigation
Transmission lines passing over unstable terrain	Add diversification were ever possible (long term planning)
Some transformers and regulators not robustly held down	Modify hold down systems to current EQ standards
Some buswork vulnerable to insulator damage from supporting posts moving differentially	Provide slip joints in buswork at appropriate points
Some prefabricated control buildings not robustly restrained	Upgrade hold down systems to cope with full EQ and wind loadings
Restrain batteries from sliding with support frames and possibly damaging cables and terminals	Provide corrosion proof packing and tie down small communication batteries
Some two way radios and access manuals unrestrained	Provide lips to storage shelves and attach radios to walls etc
Some equipment support stands ungrouted with long hold down bolts vulnerable in bending	Provide suitable non shrink grout under base plates
New control room to be as robust as possible	New control room will be up to latest standards. Ensure all VDU's, computers and communication equipment well restrained
Some critical spares unrestrained and vulnerable	Appropriately restrain all critical spares

9.11 Disaster Recovery

Westpower has adopted procedures and policies which define processes and assign responsibilities for the conduct of emergency response teams and departments in the event of a disaster.

These procedures and policies include comprehensive EMT Standard Operating Procedure (SOP) and Departmental Business Continuity Plans (DBCP) as well as the Emergency Response Plan (ERP) and Load Shedding Plan (LSP) as discussed in Section 9.7, Mitigation Measures.

9.11.1 Emergency Management Team

The EMT SOPs prescribes the appropriate processes and assigns responsibilities for the conduct of the EMT in the event of a disaster of such proportions that requires coordinated command and control.

The SOP applies to all elements of ElectroNet when performing duties assigned by the EMT. The structure of the EMT may alter subject to the nature of the disaster, resources available and the tactical situation.

The EMT is categorised as follows;

- Command & Control: Includes definition of roles and responsibilities, operating control and overall command once a disaster is declared.
- Planning: When a disaster has been declared, EMT operations will be conducted in three phases.

- Admin and Logistics: Defines the location of the EMT base of operations, including all communications and materials available and a list of priority services. Also included is a list of personnel available and their contacts.

Please refer to the document *"Standard Operating Procedure WP-01 SOP - Emergency Management Team Procedures".*

9.11.2 Business Continuity Plans

The BCPs are defined by each department and enable the re-establishment of normal processes and procedures following a major disruptive event which results in either the loss of business premises, resources or people.

Each department has developed a workable plan that can be used to prevent the interruption of critical business functions in the event of a major interruption.

The departments include stores, financial, asset management, electricians and lines. For an overview of the BCP structure, refer to Figure 9.5.

The Objective of the BCPs is as follows:

- To define and prioritise the critical functions of the department;
- To analyse the emergency risks to the department;
- To detail the agreed response to an emergency;
- To identify key contacts during an emergency.

For further information, please refer to the document *"Business Continuity Plan WP-BCP".*

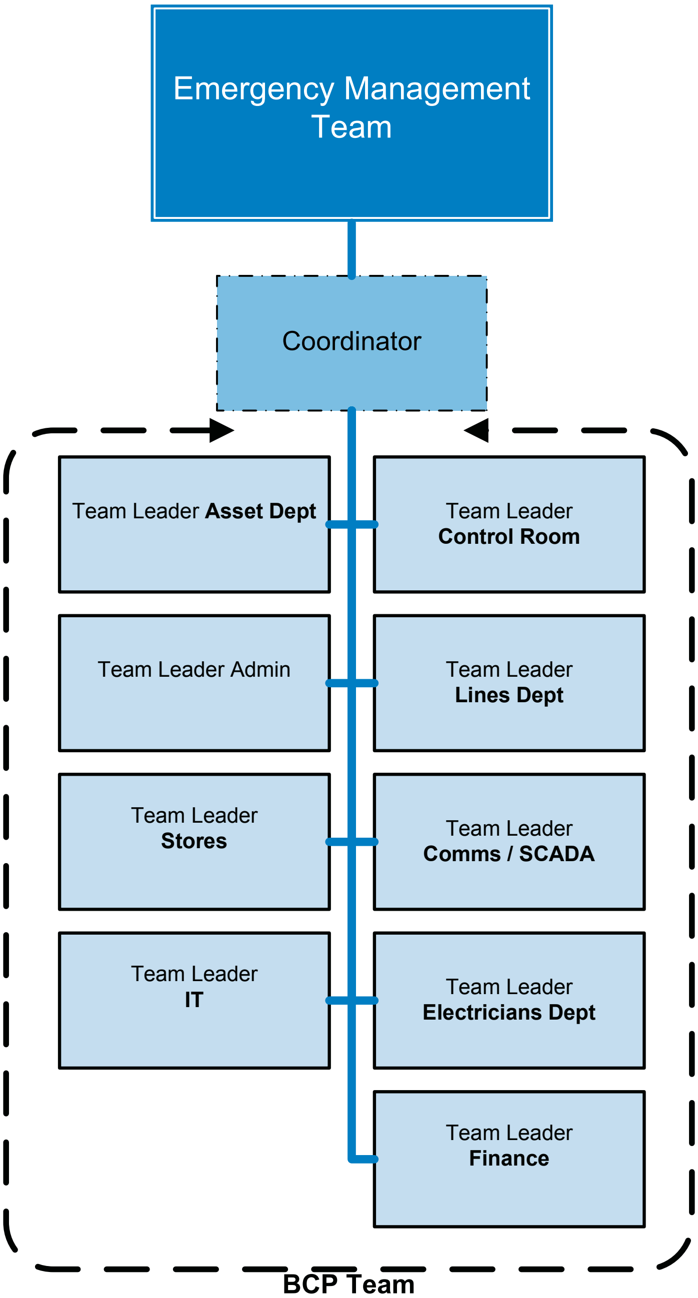


Fig 9.5 BCP Organisation Structure

Westpower

10.0 APPENDIX A: Maintenance Activity Definitions

10.1 Inspection, Service and Testing

Routine

This is expenditure on patrols, inspections, servicing and testing of assets on a routine basis. Typically, these activities are conducted at periodic intervals defined for each asset or type of asset. This work does not involve any repairs other than some minor component replacements in the course of servicing.

Special Inspection, Service and Testing

This is Expenditure on patrols, inspections, servicing and testing based on a specific need, as opposed to being time-based, as with routine inspections and servicing.

Faults

Repairs are undertaken during fault conditions to restore supply. This does not include the eventual repair of a faulted asset, where it is taken out of service in the course of repairing the fault; only the expenditure required to restore supply is included.

Planned Repairs and Refurbishment

These are Repairs to and refurbishment of an asset that may involve component replacement but not the complete replacement of the asset. This includes corrective repairs of defects identified within a year, "special" repairs (e.g. based on an identified type failure or type weakness) and planned refurbishments which may involve a significant proportion of component replacement. However, to identify refurbishments as distinct from general repairs would require identification of all specific refurbishment projects over the planning period, and this has not proved feasible for this plan.

Planned Replacement

This is Replacement of an existing asset with a modern equivalent asset providing similar capacity, or other aspect of service provided. Note that the asset need not be identical in capacity etc. but should be materially similar.

Maintenance Contingency

This is an explicit planning contingency, where it is not feasible to identify all minor work, or where it is expected that work will arise but its classification cannot be easily predicted. All contingencies are specifically identified and no implicit contingencies are included in the detailed expenditure projections for other activity classifications.

This contingency is converted into one of the above activity classifications once committed. "Maintenance Contingency" is not a real activity for reporting purposes.

10.2 Enhancement and Development Activity Definitions

Enhancement

This is the replacement of an existing asset with a modern equivalent asset, which materially improves on the original asset, or modifications to an existing asset that have this effect. Specifically, this will include improvements to the existing asset configuration, which are undertaken with the purpose of:

- Further improving the inherent safety of the system (e.g. installing smoke/heat detectors and entry alarms in substations);
- Improving the level of customer service (e.g. increasing capacity by replacing a transformer with a larger unit, or adding an extra circuit to it to increase security);

- Improving economic efficiency or investing to improve the asset by reducing operating or maintenance costs (e.g. fitting vibration dampers to specific lines to reduce the rate of component deterioration);
- Improving environmental risk management (e.g. fitting oil containment facilities at substations);
- Improving the corporate profile (e.g. landscaping station grounds, although this is also fully justifiable on the basis of reduced grounds maintenance).

Note that each aspect of improvement is related to a specific asset management performance driver.

Development

This is work which involves the installation of new assets in sites or configurations where none previously existed. This may also include substantial upgrade work (e.g. rebuilding a substation at a higher voltage) in which the original configuration is significantly altered or extended.

Development Contingency

This is an explicit planning contingency where it is not feasible to identify all minor work, or where it is expected that work will arise but its classification can not be easily predicted. No implicit contingencies are included in the detailed enhancement and development expenditure projections. For the same reasons as those discussed under "Maintenance Contingency", this activity is not included in financial reports.

10.3 Other Activity Definitions

Operating

This activity covers any disconnection of a customer's services for any reason except non-payment of electricity accounts. This includes activities such as house painting, transportation of high loads and low-voltage switching. It also includes operation of the high-voltage network where this is not directly associated with maintenance or enhancement work.

Trees

This activity covers all tree-cutting and trimming to maintain safe working clearances from power lines and any costs incurred during negotiations with customers regarding tree-trimming.

10.4 Asset Type Definitions

High-voltage Lines

This includes all power distribution and subtransmission lines with a rated voltage of 11 kV or higher, together with associated easements. Within the plan, line work is further desegregated into major line components:

- Poles
- Conductors and accessories
- Insulators and hardware.

10.5 Low-voltage Lines

This includes all low voltage lines with a rated voltage of 400 V or lower, together with associated easements, up to the customer's service fuse. As for high voltage lines, line work is further desegregated into major line components:

- Poles
- Conductors and accessories
- Insulators and hardware.

Service Lines

Includes all service lines on road reserve from the customer's service fuse to the point at which it crosses the customer's boundary:

- Fuse arm,
- Service fuses
- Service lines on road reserve.

Zone Substations

This includes substation sites and the power transformers within them with a secondary voltage of 11 kV or higher:

- Power transformers,
- Other station equipment,
- Regulator sites.

Individual items of equipment such as disconnectors, circuit breakers and bus-work are covered in other asset type definitions, which are generic for the whole network, i.e. no distinction is made between a disconnector in a substation and one on a distribution line.

Distribution Substations

These include all distribution substation equipment:

- Distribution transformers,
- DDO fuses,
- Lightning arrestors,
- Earthing systems.

Switchgear

These include all high-voltage switchgear and other items of equipment, both on lines and within substations:

- Circuit breakers,
- Structures and bus-work,
- Instrument transformers,
- Capacitors,
- Protection systems,
- Metering,
- Buildings, grounds, fences and other services.

SCADA, Communications and Protection

These Include SCADA Master Station and RTUs at individual sites. Communication equipment comprises specific communications sites with associated equipment, and radio communications equipment which may be installed in vehicles, substations or other bases. Protection assets included in this definition cover protection relays and equipment, which is generally installed at a substation site.

Buildings and Structures

This includes all building assets as well as some of the older "bunker" distribution substations.

Ripple Control

Ripple Injection Plants are installed in zone substations. This definition also includes the load control software included in the SCADA master station.

11.0 APPENDIX B: Network Reliability by Zone Substation and Feeder

The table below shows the reliability levels for each of Westpower's 19 Zone Substations.

Substation	Load (MW)	Sub-Trans Security	# HV Feeds	Feeders	Restoration Time (Hrs)	Backup	Comments
Reefton 33 kV	7.175	n-1	2	CB3012	<0.5	CB3072 at Sub	There are two transformers fed from Inangahua and Atarau through two separate 110 kV circuits. There is no problem with the backup.
				CB3072	<0.5	CB3012 at Sub	
Reefton 11 kV	3.425	n-1	2	CB4	< 0.5	CB5 at Sub	
				CB5	< 0.5	CB4 at Sub	
						BWR CB1 to Reefton town	
Globe 11 kV	1.515	n	1	CB2	<1		Accepted by Customer. Backup is available just for 11 kV.
				CB3	<1		
				CB4	<1		
						Mobile Sub for all feeders	
Globe 6.6 kV	4.000	n	1	CB39		No Backup	The 6.6 kV feeder only supplies the Globe Ball Mill and there is no back-up, which is accepted by Customer.
Ngahere	2.067	n	1	CB1	<1	DOB CB1	There is a backup feed from Reefton for a 33 kV feeder fault. Backup is available for the Blackball feed from Dobson or Arnold. The CB3 feeder can be fed from Blackwater. Repair times are short. A backup transformer is available. In a substation fault, alternate feeds are not large enough to supply the major connected load, the Ngahere Gold Dredge.
						ALD CB3	
				CB3	<1	BWR CB2	
						Mobile Sub for both feeders	
Rapahoe	1.758	n	1	CB1	<1	CB3 at Sub	There is no backup for a 33 kV feeder fault. Backup is available via a bypass switch for 33 kV and 11 kV circuit breaker faults. Dobson is able to sup-ply the domestic 11 kV load, and mini-mal industrial load, e.g. mine pumps. A backup transformer is available.
				CB3	<1	DOB CB1	
					<1	Mobile Sub for both feeders	
Dobson 33 kV	8.701	n - 1	2	CB1322	< 0.5	CB1362 at Sub	This is the major 33 kV supply point for the Grey Valley and is supplied direct from the Trans Power network. The radial 33 kV feeders can be bypassed at the substation for circuit breaker faults but there are no alter-nate feed for the feeders themselves. Repair times are short. CB1382 is not provided with a bypass, as Arnold Power Station provides an alternate source on the 11 kV network. The mobile substation can be used as a backup for CB1342 and T1.
				CB1342	< 0.5	Mobile Sub	
				CB1362	< 0.5	CB1322 at Sub	
				CB1382	< 0.5	33kV Tie to Arnold	
						CB3072 Reefton	

Substation	Load (MW)	Sub-Trans Security	# HV Feeds	Feeders	Restoration Time (Hrs)	Backup	Comments
Dobson 11 kV	2.927	n	1	CB1	<0.5	RAP CB3	This substation is fed directly from the Transpower Dobson 33 kV bus, and so is not subject to Westpower Subtransmission Line Faults. The 33/11 kV transformer also acts as a spare, which can be transported to Ngahere, Rapahoe, Hokitika, Wahapo or Franz Josef if required. Several 11 kV ties exist for the feeders out of this substation and repair times are short.
						ALD CB3	
						NGH CB1	
				CB3	<0.5	GYM CB13	
						Mobile Sub for both feeders	
Blackwater	1.66	n	1	CB1	<1	RFN CB5	The 33 kV feeder backup is available from Reefton or Dobson.
				CB2	<1	NGH CB3	
						Mobile Sub for both feeders	
Arnold	3.231	n	1	CB3	< 0.5	DOB CB1	The backup for a 33 kV feeder fault is the local generating station tied in through the 11 kV network. Backup is available for the Stillwater feed from Dobson, and for the Moana feed from Kumara. Partial back feed to Dobson or Turiwhate is possible. Repair times are short. A backup transformer is available.
				CB4	< 0.5	DIL 4	
					< 0.5	Mobile Sub	
Greymouth	13.170	n-1	2	CB7	< 0.5	CB12 & CB9	This is Westpower's largest Point of Supply that feeds the Greymouth Central Business District (CBD). There are several radial 11 kV feeders that are intermeshed at several points providing a significant amount of diversity. The Cobden Feeder has no backup once it crosses the Grey River, however the reticulation is all overhead with low repair times. The 11 kV cable network in the CBD is highly intermeshed with a "double-ring" construction. All substations have two, and many three, 11 kV cable feeds.
				CB13	< 0.5	CB6	
						DOB CB3	
				CB6	< 0.5	CB13	
						CB11	
						KUM CB1	
				CB12	< 0.5	CB9	
						CB6	
				CB11	< 0.5	CB6	
						CB12	
				CB9	< 0.5	CB7	
						CB12	
Kumara	1.632	n	1	CB1	< 1	GYM CB6	This supply is fed directly from the Kumara 11 kV bus, which is in turn supplied by a very reliable Transpower 66 kV bus. Both 11 kV feeders can be back fed from Greymouth, Arnold or Hokitika Substations. A spare transformer is available from Greymouth Substation.
				CB2	< 1	ALD CB4	
						HKK CB10	

Substation	Load (MW)	Sub-Trans Security	# HV Feeds	Feeders	Restoration Time (Hrs)	Backup	Comments
Hokitika	19.277	n-1	2	CB10	< 0.5	CB4	This substation feeds Hokitika and all of South Westland down to Paringa. In addition, it supplies three feeders to the Westland Dairy. Hokitika can be supplied on reduced load from Wahapo and Amethyst Power Stations, depending on availability, should the 66 kV feed be interrupted.
				CB4	< 0.5	CB10	
						CB12	
				CB12	< 0.5	CB4	
				CB5	< 0.5	CB9	
						CB11	
				CB9	< 0.5	CB5	
						CB11	
				CB11	< 0.5	CB5	
						CB9	
Ross	0.488	n	1	CB1	< 0.5	CB3 at Sub	The 33 kV substation feed can be from Hokitika, Amethyst or Wahapo, depending on Power Station availability. Domestic load on CB1 and CB3 can be fed from Hokitika CB10. Both feeders have a short repair time.
				CB3	< 0.5	HKK CB10	
						CB1 at Sub	
Waitaha	0.331	n	1	CB1	< 5	No Backup	The 33 kV substation feed can be from Hokitika, Amethyst or Wahapo, depending on Power Station availability. This is a very small and isolated substation and no backup is possible for the 11 kV feeders. A spare transformer is available.
						Mobile Sub	
Harihari	1.021	n	1	CB1	< 0.5	CB3 at Sub	The 33 kV substation feed can be from Hokitika, Amethyst or Wahapo, depending on Power Station availability. This is a small and isolated substation and no backup is possible for the 11 kV feeders apart from a bypass for the 11 kV circuit breakers. A spare transformer is available.
				CB3	< 0.5	CB1 at Sub	
						Mobile Sub	
Whataroa	0.794	n	1	CB1	< 5	No Backup	The 33 kV substation feed can be from Hokitika, Amethyst or Wahapo, depending on Power Station availability. The mobile substation can backup the 11kV feeder. A spare transformer is available as well.
						Mobile Sub	
Wahapo	3.104	n	1	CB1	< 5	No Backup	The 11 kV substation bus can be fed from Hokitika, Amethyst or Wahapo, depending on Power Station availability. This is an isolated substation and no backup is possible for the 11 kV. A spare transformer is available from Dobson. This substation also connects Wahapo Power Station into Westpower's sub-transmission network.
						Mobile Sub	

Substation	Load (MW)	Sub-Trans Security	# HV Feeds	Feeders	Restoration Time (Hrs)	Backup	Comments
Franz Josef	1.639	n	1	CB1	< 1.5	CB3 at Sub	This substation is fed from Hokitika, Amethyst or Wahapo, depending on Power Station availability, and feeds the Franz Josef area. There are two sections of Hendrix covered conductor in this circuit, which have significant repair times. There is no feasible subtransmission backup. The mobile substation can backup both 11kV feeders.
				CB3	< 1.5	CB1 at Sub	
						Mobile Sub	
Fox Glacier	0.845	n	1	CB1	< 5	No Backup	Similar to Franz Josef substation, this substation is fed from Hokitika, Amethyst or Wahapo, depending on Power Station availability, and feeds the Fox area. There is no feasible subtransmission backup. The mobile substation can backup the 11kV feeder. The substation was constructed in 2003 to supply the Fox Glacier area and south to Paringa.
						Mobile Sub	
Logburn Rd 33 kV	0.277	n	1	CB3602		No Backup	There is no backup available.
Logburn Rd 11 kV	0.323	n	1	CB1	< 1	NGH CB1	Backup for CB1 is available from Ngahere CB1 via DD22. CB2 and CB3 can also be partially backed up from NGH CB1.
				CB2		No Backup	
				CB3		No Backup	
Pike 11 kV	0.277	n	1	CB1		No Backup	Accepted by Customer. In emergency, the mobile sub could be installed to supply these feeders.
				CB2		No Backup	
				CB3		No Backup	
				CB4		No Backup	
				CB5		No Backup	
				CB6		No Backup	
				CB7		No Backup	

12.0 APPENDIX C: Expenditure Forecast and Reconciliation

For year ended	Actual for most recent Financial Year ($000)	Previous forecast for Current Financial Year ($000)	Forecast Year									
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Capital Expenditure: Customer Connection	519	90	95	101	107	114	120	128	135	144	152	68
Capital Expenditure: System Growth	258	414	396	418	442	467	493	522	552	584	617	617
Capital Expenditure: Asset Replacement and Renewal	1,997	648	1,212	1,125	877	827	920	546	1,580	1,437	821	863
Capital Expenditure: Reliability, Safety and Environment	1,082	471	700	843	712	685	677	2,449	690	648	628	618
Capital Expenditure: Asset Relocations	2	-	-	-	-	-	-	-	-	-	-	-
Subtotal - Capital Expenditure on Asset Management	**3,858**	**1,623**	**2,403**	**2,487**	**2,138**	**2,093**	**2,211**	**3,645**	**2,957**	**2,813**	**2,218**	**2,166**
Operational Expenditure: Routine and Preventative Maintenance	3,534	3,971	4,413	4,068	4,070	4,074	4,137	4,142	4,250	4,450	4,568	4,638
Operational Expenditure: Refurbishment and Renewal Maintenance	331	357	331	281	268	279	284	287	281	296	300	303
Operational Expenditure: Fault and Emergency Maintenance	917	794	794	798	798	836	849	864	882	937	955	961
Subtotal - Operational Expenditure on Asset Management	**4,782**	**5,122**	**5,538**	**5,148**	**5,136**	**5,189**	**5,270**	**5,293**	**5,413**	**5,683**	**5,823**	**5,902**
Total Direct Expenditure on Distribution Network	**8,640**	**6,745**	**7,941**	**7,635**	**7,274**	**7,281**	**7,481**	**8,938**	**8,370**	**8,496**	**8,041**	**8,068**
Overhead to Underground Conversion Expenditure	4	-	-	-	-	-	-	-	-	-	-	-

	Actual for most recent Financial Year ($000)	Previous forecast for Recent Financial Year ($000)	% Variance
Capital Expenditure: Customer Connection	519	500	3.8%
Capital Expenditure: System Growth	258	509	-49.3%
Capital Expenditure: Asset Replacement and Renewal	1,997	2,414	-17.3%
Capital Expenditure: Reliability, Safety and Environment	1,082	2,539	-57.4%
Capital Expenditure: Asset Relocations	2	-	Not defined
Subtotal - Capital Expenditure on Asset Management	**3,858**	**5,962**	**-35.3%**
Operational Expenditure: Routine and Preventative Maintenance	3,534	3,602	-1.9%
Operational Expenditure: Refurbishment and Renewal Maintenance	331	578	-42.7%
Operational Expenditure: Fault and Emergency Maintenance	917	843	8.8%
Subtotal - Operational Expenditure on Asset Management	**4,782**	**5,023**	**-4.8%**
Total Direct Expenditure on Distribution Network	**8,640**	**10,985**	**-21.3%**

13.0 APPENDIX D: Glossary of Terms

AAAC: All Aluminium Alloy Conductor - Used as bare overhead conductor for primary and secondary distribution. Designed utilizing a high strength aluminum alloy to achieve a high strength-to-weight ratio; affords better sag characteristics. Aluminum alloy gives AAAC higher resistance to corrosion than ACSR.

AAC: All Aluminium Conductor - Compact strand conductor for use in bare overhead applications or for use with weather-resistant coverings or insulations is also available.

ACSR: Aluminium Conductor Steel Reinforced - Used as bare overhead transmission cable and as primary and secondary distribution cable. ACSR offers optimal strength for line design. Variable steel core stranding enables desired strength to be achieved without sacrificing ampacity.

Ampere (A): Unit of electrical current flow, or rate of flow of electrons.

AMP: Asset Management Plan

CAIDI: An international index which measures the average duration of an interruption to supply for consumers that have experienced an interruption. Usually calculated on a per annum basis.

CAIDI = Sum of (number of interrupted customers x interruption duration) / Number of interrupted customers

Capacity Utilisation: a ratio which measures the utilisation of transformers in the network. Calculated as the maximum demand experienced on an electricity network in a year divided by the transformer capacity on that network.

Circuit Breaker (CB): a device which detects excessive power demands in a circuit and cuts off power when they occur. Nearly all of these excessive demands are caused by a fault of some description on the network. In the urban network, where most of these CBs are, they do not attempt a reclose after a fault as the LCBs do on the rural overhead network.

Continuous Rating: the constant load which a device can carry at rated primary voltage and frequency without damaging and/or adversely effecting it characteristics.

Conductor: is the ‘wire’ that carries the electricity and includes overhead lines which can be covered (insulated) or bare (not insulated), and underground cables which are insulated.

Current: the movement of electricity through a conductor, measured in amperes (A).

Discounted Cash Flow (DCF): - Method for evaluating profitability of an investment decision.

Dominion Drop Out (DDO): Fuse used on overhead lines to provide a point of isolation and protection for distribution substations and feeders.

Dissolved Gas Analysis (DGA): - Test carried out on transformer oil quality to measure the levels of dissolved gasses in the oil, this gives an indication of transformer condition.

Distribution Substation: is either a building, a kiosk, an outdoor substation or pole substation taking its supply at 11 kV and distributing at 400 V.

District Substation: A major building substation and/or switchyard with associated high voltage structure where either; voltage is transformed from 66 or 33 kV to 11 kV, two or more incoming 11 kV feeders from a grid exit point are redistributed or a ripple injection plant is installed.

ELB: Electricity Lines Business as defined by the Commerce commission and excluding Transpower.

EPDM: Ethylene Propylene Diene Monomer rubber is used on dead end insulators. It exhibits satisfactory compatibility with fireproof hydraulic fluids, ketones, hot and cold water, and alkalis, and unsatisfactory compatibility with most oils, gasoline, kerosene, aromatic and aliphatic hydrocarbons, halogenated solvents, and concentrated acids.

Fault Current: the current from the connected power system that flows in a short circuit caused by a fault.

Feeder: a physical grouping of conductors that originates from a district substation circuit breaker.

Flashover: a disruptive discharge around or over the surface of an insulator.

Frequency: on AC circuits, the designated number of times per second that polarity alternates from positive to negative and back again, expressed in Hertz (Hz)

Fuse: a device that will heat up, melt and electrically open the circuit after a period of prolonged abnormal current flow.

GIS: Graphical Information System used by Westpower to show the physical location of assets in their network is used as a tool with the Asset Works Management System.

Gradient, Voltage: the voltage drop, or electrical difference, between two given points.

Grid Exit Point (GXP): a point where Westpower's network is connected to Transpower's transmission network.

Harmonics (Wave Form Distortion): changes an AC voltage waveform from sinusoidal to complex and can be caused by network equipment and equipment owned by consumers including electric motors or computer equipment.

High Voltage: voltage exceeding 1,000 volts (1 kV), in Westpower's case generally 11 kV, 33 kV or 66 kV.

Insulator: supports live conductors, is made from material which does not allow electricity to flow through it.

kVA: the kVA, or Kilovolt-ampere, output rating designates the output which a transformer can deliver for a specified time at rated secondary voltage and rated frequency.

Line Circuit Breaker (LCB): a circuit breaker mounted on an overhead line pole which quickly cuts off power after a fault so that no permanent damage is caused to any equipment. It switches power back on after a few seconds and if the cause of the fault has gone (eg. a branch has blown off a line) then the power will stay on. If the offending item is still there then power will be cut again. This can happen up to three times before power will stay off until the fault repaired. Sometimes a LCB is known as a recloser.

Low Voltage: voltage not exceeding 1,000 volts, generally 230 or 400 volts.

Maximum Demand: the maximum demand for electricity, at any one time, during the course of the year.

MOCHED: Major outage causing huge economic damage.

Network Deliveries: total energy supplied to our network through Transpower's grid exit points, usually measured as energy supplied over the course of a year.

Outage: an interruption to the supply of electricity.

Proven Voltage Complaint: a complaint from a consumer concerning a disturbance to the voltage of their supply which has proven to be caused by the network company.

PILCSWA: Form of Cable construction - Paper Insulated Lead Covered Steel Wire Armoured cable.

ROI: Return on Investment - financial ratio for expected return for a given investment usually expressed as a percentage per year.

Ripple Control System: a system used to control the electrical load on the network by, for example, switching domestic water heaters, or by signaling large users of a high price period. Also used to control streetlights.

RTU (Remote Terminal Unit): An RTU is a device installed at a remote location that collects data, codes the data into a format that is transmittable and transmits the data back to a central station, or master. A RTU also collects information from the master device and implements processes that are directed by the master. RTUs are equipped with input channels for sensing or metering, output channels for control, indication or alarms and a communications port.

SAIDI: System Average Interruption Duration Index; an international index which measures the average duration of interruptions to supply that a consumer experiences in a given period.

SAIDI = Sum of (total system minutes lost x number of customers affected) / Total number of customers

SAIFI: System Average Interruption Frequency Index; an international index which measures the average number of interruptions that a consumer experiences in a given period.

SAIFI = Number of customer interruptions / Total number of customers

SCADA: System Control and Data Acquisition.

Transformer: a device that changes voltage up to a higher voltage or down to a lower voltage.

Transpower: the state owned enterprise that operates New Zealand's transmission network. Transpower delivers electricity from generators to various networks around the country.

Voltage: electric pressure; the force which causes current to flow through an electrical conductor.

Voltage Regulator: an electrical device that keeps voltage which is supplied to consumers at a constant level, regardless of load fluctuations.

XLPE: Cross linked Polyethylene - type of cable insulation XLPE contains cross-link bonds which are introduced into the polymer structure, changing the thermoplastic into an elastomer. XLPE-insulated cables have a rated maximum conductor temperature of 90 °C and an emergency rating of up to 140 °C, depending on the standard used to rate XLPE-insulated cables. Cables insulated with XLPE also have a conductor short-circuit rating of 250 °C. XLPE has excellent dielectric properties making it useful for a large range of voltage applications from 600 V to 500 kV.

Zone Substation: Zone Substations are used to transform power from transmission and sub-transmission voltages of 33 kV and higher down to Westpower's standard distribution voltage of 11 kV.

Company Name	**Westpower**
AMP Planning Period	**1 April 2014 – 31 March 2024**

SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)
EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).
This information is not part of audited disclosure information.

sch ref			Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
8		for year ended	**31 Mar 14**	**31 Mar 15**	**31 Mar 16**	**31 Mar 17**	**31 Mar 18**	**31 Mar 19**	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**
9		**11a(i): Expenditure on Assets Forecast**	**$000 (in nominal dollars)**										
10		Consumer connection	90	95	105	117	130	144	159	176	195	216	225
11		System growth	464	396	437	483	533	588	651	719	795	878	918
12		Asset replacement and renewal	1,553	1,182	1,144	925	909	1,058	638	2,009	1,901	1,108	1,220
13		Asset relocations	-	-	-	-	-	-	-	-	-	-	-
14		Reliability, safety and environment:											
15		Quality of supply	434	510	701	634	537	646	678	711	683	684	700
16		Legislative and regulatory	-	-	-	-	-	-	-	-	-	-	-
17		Other reliability, safety and environment	179	190	180	143	244	161	2,374	187	198	209	219
18		**Total reliability, safety and environment**	613	700	881	777	781	807	3,052	898	881	893	919
19		**Expenditure on network assets**	2,720	2,373	2,568	2,302	2,353	2,597	4,500	3,803	3,772	3,096	3,282
20		Non-network assets											
21		**Expenditure on assets**	2,720	2,373	2,568	2,302	2,353	2,597	4,500	3,803	3,772	3,096	3,282
22													
23	*plus*	Cost of financing											
24	*less*	Value of capital contributions											
25	*plus*	Value of vested assets											
26													
27		**Capital expenditure forecast**	2,720	2,373	2,568	2,302	2,353	2,597	4,500	3,803	3,772	3,096	3,282
28													
29		Value of commissioned assets	2,720	2,373	2,568	2,302	2,353	2,597	4,500	3,803	3,772	3,096	3,282
30			*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
		for year ended	**31 Mar 14**	**31 Mar 15**	**31 Mar 16**	**31 Mar 17**	**31 Mar 18**	**31 Mar 19**	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**
32			**$000 (in constant prices)**										
33		Consumer connection	90	95	101	107	114	120	128	135	143	152	152
34		System growth	464	396	418	442	467	493	523	552	584	618	618
35		Asset replacement and renewal	1,553	1,182	1,095	847	796	887	512	1,543	1,397	779	821
36		Asset relocations	-	-	-	-	-	-	-	-	-	-	-
37		Reliability, safety and environment:											
38		Quality of supply	434	510	671	581	471	542	544	546	502	481	471
39		Legislative and regulatory	-	-	-	-	-	-	-	-	-	-	-
40		Other reliability, safety and environment	179	190	172	131	214	135	1,905	144	146	147	147
41		**Total reliability, safety and environment**	613	700	843	712	685	677	2,449	689	647	628	618
42		**Expenditure on network assets**	2,720	2,373	2,457	2,108	2,062	2,178	3,611	2,920	2,772	2,177	2,208
43		Non-network assets	-	-	-	-	-	-					
44		**Expenditure on assets**	2,720	2,373	2,457	2,108	2,062	2,178	3,611	2,920	2,772	2,177	2,208
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	50	50	-	-	-	-	-	-	-	-	-
49		Research and development											

Company Name	Westpower	
AMP Planning Period	1 April 2014 – 31 March 2024	

SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)

EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).

This information is not part of audited disclosure information.

sch ref		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
58	for year ended	**31 Mar 14**	**31 Mar 15**	**31 Mar 16**	**31 Mar 17**	**31 Mar 18**	**31 Mar 19**	**31 Mar 20**	**31 Mar 21**	**31 Mar 22**	**31 Mar 23**	**31 Mar 24**
59	**Difference between nominal and constant price forecasts**	**$000**										
60	Consumer connection	-	-	5	10	16	23	31	41	52	64	74
61	System growth	-	-	19	41	66	95	129	167	211	261	300
62	Asset replacement and renewal	-	-	49	78	112	171	126	466	504	329	399
63	Asset relocations	-	-	-	-	-	-	-	-	-	-	-
64	Reliability, safety and environment:											
65	Quality of supply	-	-	30	53	66	104	134	165	181	203	229
66	Legislative and regulatory	-	-	-	-	-	-	-	-	-	-	-
67	Other reliability, safety and environment	-	-	8	12	30	26	469	43	53	62	71
68	**Total reliability, safety and environment**	-	-	38	65	97	130	603	208	234	265	300
69	**Expenditure on network assets**	-	-	111	194	291	419	889	883	1,000	919	1,073
70	Non-network assets	-	-	-	-	-	-	-	-	-	-	-
71	**Expenditure on assets**	-	-	111	194	291	419	889	883	1,000	919	1,073
72												

73		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
	for year ended	**31 Mar 14**	**31 Mar 15**	**31 Mar 16**	**31 Mar 17**	**31 Mar 18**	**31 Mar 19**
74	**11a(ii): Consumer Connection**						
75	*Consumer types defined by EDB**	**$000 (in constant prices)**					
76	Cat1 Domestic	45	48	50	54	57	60
77	Cat1 Non-domestic (< 15kVA)	30	32	34	36	38	40
78	Cat2 Non-Domestic (>15kVA)	15	16	17	18	19	20
79	Generator Connection	-	-				
80	[EDB consumer type]						
81	**include additional rows if needed*						
82	**Consumer connection expenditure**	90	95	101	107	114	120
83	*less* Capital contributions funding consumer connection						
84	**Consumer connection less capital contributions**	90	95	101	107	114	120
85	**11a(iii): System Growth**						
86	Subtransmission						
87	Zone substations						
88	Distribution and LV lines						
89	Distribution and LV cables	50					
90	Distribution substations and transformers	414	396	418	442	467	493
91	Distribution switchgear						
92	Other network assets						
93	**System growth expenditure**	464	396	418	442	467	493
94	*less* Capital contributions funding system growth						
95	**System growth less capital contributions**	464	396	418	442	467	493

Company Name: **Westpower**
AMP Planning Period: **1 April 2014 – 31 March 2024**

SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

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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).
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sch ref			Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
104		for year ended	31 Mar 14	31 Mar 15	31 Mar 16	31 Mar 17	31 Mar 18	31 Mar 19
105		**11a(iv): Asset Replacement and Renewal**	$000 (in constant prices)					
106		Subtransmission	190	245	191	146	118	124
107		Zone substations	753	406	375	297	298	364
108		Distribution and LV lines	407	409	371	305	280	295
109		Distribution and LV cables	100	50	50	50	50	50
110		Distribution substations and transformers	30	30	-	-	-	-
111		Distribution switchgear	38	42	108	49	51	54
112		Other network assets	35	-	-	-	-	-
113		**Asset replacement and renewal expenditure**	1,553	1,182	1,095	847	796	887
114	less	Capital contributions funding asset replacement and renewal						
115		**Asset replacement and renewal less capital contributions**	1,553	1,182	1,095	847	796	887
116		**11a(v):Asset Relocations**						
117		*Project or programme**						
118		[Description of material project or programme]						
119		[Description of material project or programme]						
120		[Description of material project or programme]						
121		[Description of material project or programme]						
122		[Description of material project or programme]						
123		**include additional rows if needed*						
124		All other asset relocations projects or programmes						
125		**Asset relocations expenditure**	-	-	-	-	-	-
126	less	Capital contributions funding asset relocations						
127		**Asset relocations less capital contributions**	-	-	-	-	-	-
128								
129		**11a(vi):Quality of Supply**						
130		*Project or programme**						
131		Fox Glacier Township - Develop 11 kV Ring	-	-	50	-	-	-
132		Conductor Replacement	100	100	100	100	100	120
133		Mt Bonar, Upgrade Repeater Site	-	20	80	60	-	-
134		HKK Protection upgrade	-	-	-	-	-	50
135		HKK-PAP Radio Link	-	-	-	-	-	70
		SCADA Master Station Replacement	-	20	60	60	100	100
		New main line recloser sites	-	-	87	-	-	-
		Automate Capacitors at various locations	44	50	25	26	-	-
136		**include additional rows if needed*						
137		All other quality of supply projects or programmes	290	320	269	335	271	202
138		**Quality of supply expenditure**	434	510	671	581	471	542
139	less	Capital contributions funding quality of supply						
140		**Quality of supply less capital contributions**	434	510	671	581	471	542
141								

Company Name	**Westpower**
AMP Planning Period	**1 April 2014 – 31 March 2024**

SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)

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This information is not part of audited disclosure information.

sch ref								
142	**11a(vii): Legislative and Regulatory**							
143	*Project or programme**							
144	[Description of material project or programme]							
145	[Description of material project or programme]							
146	[Description of material project or programme]							
147	[Description of material project or programme]							
148	[Description of material project or programme]							
149	**include additional rows if needed*							
150	All other legislative and regulatory projects or programmes							
151	**Legislative and regulatory expenditure**		-	-	-	-	-	-
152	*less*	Capital contributions funding legislative and regulatory						
153	**Legislative and regulatory less capital contributions**		-	-	-	-	-	-

Company Name	Westpower	
AMP Planning Period	1 April 2014 – 31 March 2024	

SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)
EDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).
This information is not part of audited disclosure information.

sch ref		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
161							
162	for year ended	31 Mar 14	31 Mar 15	31 Mar 16	31 Mar 17	31 Mar 18	31 Mar 19
163	**11a(viii): Other Reliability, Safety and Environment**						
164	*Project or programme**	$000 (in constant prices)					
165	[Description of material project or programme]						
166	[Description of material project or programme]						
167	[Description of material project or programme]						
168	[Description of material project or programme]						
169	[Description of material project or programme]						
170	**include additional rows if needed*						
171	All other reliability, safety and environment projects or programmes	179	190	172	131	214	135
172	**Other reliability, safety and environment expenditure**	179	190	172	131	214	135
173	*less* Capital contributions funding other reliability, safety and environment						
174	**Other reliability, safety and environment less capital contributions**	179	190	172	131	214	135
175							
176							
177							
178	**11a(ix): Non-Network Assets**						
179	**Routine expenditure**						
180	*Project or programme**						
181	[Description of material project or programme]						
182	[Description of material project or programme]						
183	[Description of material project or programme]						
184	[Description of material project or programme]						
185	[Description of material project or programme]						
186	**include additional rows if needed*						
187	All other routine expenditure projects or programmes						
188	**Routine expenditure**	-	-	-	-	-	-
189	**Atypical expenditure**						
190	*Project or programme**						
191	[Description of material project or programme]						
192	[Description of material project or programme]						
193	[Description of material project or programme]						
194	[Description of material project or programme]						
195	[Description of material project or programme]						
196	**include additional rows if needed*						
197	All other atypical projects or programmes						
198	**Atypical expenditure**	-	-	-	-	-	-

The following inflation factors have been applied in calculating the nominal expenditure forecasts on Schedule 11a and 11b

- Network Operational Expenditure 3.7%
- Non Network Operational Expenditure 2-2.5%
- Network Capital Expenditure 4.5%

These inflation factors take in to account the forecast movement in prices for key inputs including labour, materials and plants costs.

Westpower

Company Name	Westpower
AMP Planning Period	1 April 2014 – 31 March 2024

SCHEDULE 11b: REPORT ON FORECAST OPERATIONAL EXPENDITURE

This schedule requires a breakdown of forecast operational expenditure for the disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms.
EDBs must provide explanatory comment on the difference between constant price and nominal dollar operational expenditure forecasts in Schedule 14a (Mandatory Explanatory Notes).
This information is not part of audited disclosure information.

sch ref		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
8	for year ended	31 Mar 14	31 Mar 15	31 Mar 16	31 Mar 17	31 Mar 18	31 Mar 19	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23	31 Mar 24
9	**Operational Expenditure Forecast**	**$000 (in nominal dollars)**										
10	Service interruptions and emergencies	484	478	496	518	572	600	633	667	739	779	814
11	Vegetation management	486	486	504	527	576	610	638	667	697	738	771
12	Routine and corrective maintenance and inspection	3,883	3,491	3,447	3,581	3,706	3,945	4,187	4,533	5,012	5,391	5,734
13	Asset replacement and renewal	357	331	388	290	316	336	355	363	399	423	447
14	**Network Opex**	5,210	4,786	4,834	4,916	5,170	5,492	5,812	6,230	6,847	7,331	7,766
15	System operations and network support	1,649	2,298	2,286	2,375	2,463	2,545	2,576	2,650	2,750	2,853	2,950
16	Business support	1,741	1,827	1,768	1,810	1,864	1,910	1,959	2,008	2,071	2,124	2,176
17	**Non-network opex**	3,390	4,125	4,054	4,185	4,327	4,455	4,535	4,658	4,821	4,976	5,126
18	**Operational expenditure**	8,600	8,911	8,888	9,101	9,497	9,947	10,348	10,888	11,667	12,308	12,892
19		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
20	for year ended	31 Mar 14	31 Mar 15	31 Mar 16	31 Mar 17	31 Mar 18	31 Mar 19	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23	31 Mar 24
21		**$000 (in constant prices)**										
22	Service interruptions and emergencies	484	478	478	478	505	507	512	516	547	552	552
23	Vegetation management	486	486	486	486	509	516	516	516	516	523	523
24	Routine and corrective maintenance and inspection	3,883	3,491	3,324	3,304	3,272	3,334	3,385	3,508	3,711	3,820	3,888
25	Asset replacement and renewal	357	331	374	268	279	284	287	281	296	300	303
26	**Network Opex**	5,210	4,786	4,662	4,536	4,565	4,641	4,700	4,821	5,070	5,195	5,266
27	System operations and network support	1,649	2,298	2,225	2,245	2,262	2,269	2,234	2,232	2,248	2,263	2,271
28	Business support	1,741	1,827	1,727	1,727	1,735	1,736	1,738	1,739	1,749	1,750	1,750
29	**Non-network opex**	3,390	4,125	3,952	3,973	3,997	4,006	3,972	3,971	3,997	4,013	4,021
30	**Operational expenditure**	8,600	8,911	8,614	8,509	8,563	8,646	8,672	8,792	9,067	9,208	9,287
31	**Subcomponents of operational expenditure (where known)**											
32–33	Energy efficiency and demand side management, reduction of energy losses											
34	Direct billing*											
35	Research and Development											
36	Insurance		215	215	215	215	215	215	215	215	215	215
37	* *Direct billing expenditure by suppliers that direct bill the majority of their consumers*											
38												
39		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
40	for year ended	31 Mar 14	31 Mar 15	31 Mar 16	31 Mar 17	31 Mar 18	31 Mar 19	31 Mar 20	31 Mar 21	31 Mar 22	31 Mar 23	31 Mar 24
41	**Difference between nominal and real forecasts**	**$000**										
42	Service interruptions and emergencies	-	-	18	40	67	93	121	151	192	227	262
43	Vegetation management	-	-	18	41	67	95	122	151	181	215	248
44	Routine and corrective maintenance and inspection	-	-	123	276	433	611	801	1,025	1,301	1,571	1,846
45	Asset replacement and renewal	-	-	14	22	37	52	68	82	104	123	144
46	**Network Opex**	-	-	172	380	605	851	1,112	1,409	1,777	2,136	2,500
47	System operations and network support	-	-	61	129	201	276	343	418	502	590	679

Westpower

Company Name	**Westpower**
AMP Planning Period	**1 April 2014 – 31 March 2024**

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.	0.01%	0.64%	4.95%	92.68%	1.70%	3	
11	All	Overhead Line	Wood poles	No.	1.13%	13.91%	23.04%	55.53%	6.39%	3	
12	All	Overhead Line	Other pole types	No.						4	
13	HV	Subtransmission Line	Subtransmission OH up to 66kV conductor	km			27.92%	35.13%	36.96%	2	
14	HV	Subtransmission Line	Subtransmission OH 110kV+ conductor	km			100.00%			4	
15	HV	Subtransmission Cable	Subtransmission UG up to 66kV (XLPE)	km				100.00%		4	
16	HV	Subtransmission Cable	Subtransmission UG up to 66kV (Oil pressurised)	km						[Select one]	
17	HV	Subtransmission Cable	Subtransmission UG up to 66kV (Gas pressurised)	km						[Select one]	
18	HV	Subtransmission Cable	Subtransmission UG up to 66kV (PILC)	km						[Select one]	
19	HV	Subtransmission Cable	Subtransmission UG 110kV+ (XLPE)	km						[Select one]	
20	HV	Subtransmission Cable	Subtransmission UG 110kV+ (Oil pressurised)	km						[Select one]	
21	HV	Subtransmission Cable	Subtransmission UG 110kV+ (Gas Pressurised)	km						[Select one]	
22	HV	Subtransmission Cable	Subtransmission UG 110kV+ (PILC)	km						[Select one]	
23	HV	Subtransmission Cable	Subtransmission submarine cable	km						[Select one]	
24	HV	Zone substation Buildings	Zone substations up to 66kV	No.	-	-	80.00%	20.00%	-	4	
25	HV	Zone substation Buildings	Zone substations 110kV+	No.	-	-	-	100.00%	-	4	
26	HV	Zone substation switchgear	22/33kV CB (Indoor)	No.	-	-	-	100.00%	-	4	
27	HV	Zone substation switchgear	22/33kV CB (Outdoor)	No.	-	-	35.00%	65.00%	-	4	
28	HV	Zone substation switchgear	33kV Switch (Ground Mounted)	No.	-	-	-	-	-	4	
29	HV	Zone substation switchgear	33kV Switch (Pole Mounted)	No.	-	-	55.00%	30.00%	15.00%	3	
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.	-	-	50.00%	50.00%	-	4	
33	HV	Zone substation switchgear	3.3/6.6/11/22kV CB (ground mounted)	No.	-	5.00%	27.00%	68.00%	-	4	
34	HV	Zone substation switchgear	3.3/6.6/11/22kV CB (pole mounted)	No.	-	10.00%	16.00%	74.00%	-	4	10.00%

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.	-	-	80.00%	20.00%	-	4	
46	HV	Distribution Line	Distribution OH Open Wire Conductor	km	-	2.69%	6.70%	29.42%	61.18%	2	
47	HV	Distribution Line	Distribution OH Aerial Cable Conductor	km	-	-	-	100.00%	-	4	
48	HV	Distribution Line	SWER conductor	km	-	-	-	-	-	4	
49	HV	Distribution Cable	Distribution UG XLPE or PVC	km	-	1.01%	22.98%	17.59%	58.42%	3	
50	HV	Distribution Cable	Distribution UG PILC	km	-	2.73%	88.94%	1.07%	7.27%	3	
51	HV	Distribution Cable	Distribution Submarine Cable	km	-	-	-	-	-	[Select one]	
52	HV	Distribution switchgear	3.3/6.6/11/22kV CB (pole mounted) - reclosers and sectionalisers	No.	-	-	10.00%	90.00%	-	4	
53	HV	Distribution switchgear	3.3/6.6/11/22kV CB (Indoor)	No.						[Select one]	
54	HV	Distribution switchgear	3.3/6.6/11/22kV Switches and fuses (pole mounted)	No.	-	10.00%	40.00%	50.00%	-	4	
55	HV	Distribution switchgear	3.3/6.6/11/22kV Switch (ground mounted) - except RMU	No.	-	-	-	-	-	[Select one]	
56	HV	Distribution switchgear	3.3/6.6/11/22kV RMU	No.	-	-	35.00%	65.00%	-	4	
57	HV	Distribution Transformer	Pole Mounted Transformer	No.	1.14%	10.52%	11.96%	22.77%	53.61%	1	
58	HV	Distribution Transformer	Ground Mounted Transformer	No.	3.64%	13.82%	56.74%	14.90%	10.90%	2	
59	HV	Distribution Transformer	Voltage regulators	No.	-	11.00%	56.00%	33.00%	-	4	22.00%
60	HV	Distribution Substations	Ground Mounted Substation Housing	No.						[Select one]	
61	LV	LV Line	LV OH Conductor	km	-	3.45%	23.98%	33.76%	38.80%	2	
62	LV	LV Cable	LV UG Cable	km	-	0.01%	49.31%	10.87%	39.82%	2	
63	LV	LV Streetlighting	LV OH/UG Streetlight circuit	km					100.00%	1	
64	LV	Connections	OH/UG consumer service connections	No.		5.78%	47.34%	40.62%	6.26%	3	
65	All	Protection	Protection relays (electromechanical, solid state and numeric)	No.	-	10.00%	20.00%	70.00%	-	4	10.00%
66	All	SCADA and communications	SCADA and communications equipment operating as a single system	Lot				100.00%		4	
67	All	Capacitor Banks	Capacitors including controls	No.	-	-	100.00%	-	-	4	
68	All	Load Control	Centralised plant	Lot	-	-	100.00%	-	-	4	
69	All	Load Control	Relays	No.						[Select one]	
70	All	Civils	Cable Tunnels	km						[Select one]	

Company Name: **Westpower**
AMP Planning Period: **1 April 2014 – 31 March 2024**

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
8										
9	Arnold	3	6	N	1	52%	6	52%	No constraint within +5 years	
10	Blackwater	2	5	N-1 switched	2	33%	5	35%	No constraint within +5 years	
11	Dobson	3	5	N-1 switched	3	59%	5	64%	No constraint within +5 years	
12	Fox Glacier	1	5	N	-	17%	5	19%	No constraint within +5 years	
13	Franz Josef	2	5	N	-	33%	5	36%	No constraint within +5 years	
14	Globe	6	10	N	-	55%	10	5%	No constraint within +5 years	
15	Greymouth	13	15	N-1	2	88%	15	97%	No constraint within +5 years	
16	Harihari	1	1	N	-	102%	1	107%	Transformer	
17	Hokitika	19	20	N-1	0	96%	20	129%	Transformer	
18	Kumara	9	10	N	1	92%	10	93%	No constraint within +5 years	
19	Logburn	1	30	N	0	2%	30	2%	No constraint within +5 years	
20	Ngahere	2	5	N-1 switched	2	41%	5	48%	No constraint within +5 years	
21	Pike	0	20	N	-	1%	20	1%	No constraint within +5 years	
22	Rapahoe	2	5	N-1 switched	2	35%	5	63%	No constraint within +5 years	
23	Reefton	11	30	N-1	1	35%	30	20%	No constraint within +5 years	
24	Ross	0	1	N-1 switched	0	49%	1	54%	No constraint within +5 years	
25	Wahapo	3	5	N	-	62%	5	62%	No constraint within +5 years	
26	Waitaha	0	1	N	-	33%	1	36%	No constraint within +5 years	
27	Whataroa	1	1	N	-	79%	1	87%	No constraint within +5 years	
28						-				

29 [1] *Extend forecast capacity table as necessary to disclose all capacity by each zone substation*

30 **12b(ii): Transformer Capacity**

sch ref		(MVA)
31		(MVA)
32	Distribution transformer capacity (EDB owned)	151
33	Distribution transformer capacity (Non-EDB owned)	35
34	**Total distribution transformer capacity**	186
35		
36	**Zone substation transformer capacity**	187

Company Name	**Westpower**
AMP Planning Period	**1 April 2014 – 31 March 2024**

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 14**	**31 Mar 15**	**31 Mar 16**	**31 Mar 17**	**31 Mar 18**	**31 Mar 19**	
11	*Consumer types defined by EDB**							
12	CAT 1 DOMESTIC	10,465	10,517	10,570	10,623	10,676	10,729	
13	CAT 1 NON-DOMESTIC	1,850	1,859	1,869	1,878	1,887	1,897	
14	CAT 2 NON-DOMESTIC	830	834	838	843	847	851	
15	CAT 3 NON-DOMESTIC	21	21	21	21	21	22	
	CAT 4 NON-DOMESTIC	3	3	3	3	3	3	
	CAT 5 NON-DOMESTIC	1	1	1	1	1	1	
	Connections total	13,169	13,235	13,301	13,367	13,434	13,501	
16	**include additional rows if needed*							
17	**Distributed generation**							
18	Number of connections	8	8	9	9	9	9	
19	Installed connection capacity of distributed generation (MVA)	19	19	20	20	20	20	
20	**12c(ii) System Demand**							
21		*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	
22	**Maximum coincident system demand (MW)** — for year ended	**31 Mar 14**	**31 Mar 15**	**31 Mar 16**	**31 Mar 17**	**31 Mar 18**	**31 Mar 19**	
23	GXP demand	23	24	24	25	26	27	
24	*plus* Distributed generation output at HV and above	26	26	26	26	26	26	
25	**Maximum coincident system demand**	48	49	50	51	52	53	
26	*less* Net transfers to (from) other EDBs at HV and above							
27	**Demand on system for supply to consumers' connection points**	48	49	50	51	52	53	
28	**Electricity volumes carried (GWh)**							
29	Electricity supplied from GXPs	196	206	206	212	222	232	
30	*less* Electricity exports to GXPs	28	26	26	25	24	23	
31	*plus* Electricity supplied from distributed generation	110	110	112	112	112	112	
32	*less* Net electricity supplied to (from) other EDBs	-	-	-	-	-	-	
33	**Electricity entering system for supply to ICPs**	278	289	292	299	310	322	
34	*less* Total energy delivered to ICPs	263	275	278	284	295	306	
35	**Losses**	15	14	15	15	16	16	
36								
37	**Load factor**	66%	67%	66%	67%	68%	69%	

Company Name	Westpower
AMP Planning Period	1 April 2014 – 31 March 2024
Network / Sub-network Name	

SCHEDULE 12d: REPORT FORECAST INTERRUPTIONS AND DURATION

This schedule requires a forecast of SAIFI and SAIDI for disclosure and a 5 year planning period. The forecasts should be consistent with the supporting information set out in the AMP as well as the assumed impact of planned and unplanned SAIFI and SAIDI on the expenditures forecast provided in Schedule 11a and Schedule 11b.

sch ref		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
9	for year ended	**31 Mar 14**	**31 Mar 15**	**31 Mar 16**	**31 Mar 17**	**31 Mar 18**	**31 Mar 19**
10	**SAIDI**						
11	Class B (planned interruptions on the network)	49.0	49.0	49.0	49.0	49.0	49.0
12	Class C (unplanned interruptions on the network)	128.0	128.0	128.0	128.0	128.0	128.0
13	**SAIFI**						
14	Class B (planned interruptions on the network)	0.22	0.22	0.22	0.22	0.22	0.22
15	Class C (unplanned interruptions on the network)	2.11	2.11	2.11	2.11	2.11	2.11

15.0 Westpowers AMMAT Report

SCHEDULE 15: AMMAT REPORT

Question No.	Function	Question	Maturity Level 3	Why	Who	Record/documented Information	Evidence—Summary	Score
3	Asset management policy	To what extent has an asset management policy been documented, authorised and communicated?	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.	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.	There is an asset management policy that is approved by directors and widely avilable in the Asset Management Plan (AMP)	3
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?	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.	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.	There is an AM strategy document directly linked with the asset management policy	3

SCHEDULE 15: AMMAT REPORT

Question No.	Function	Question	Maturity Level 3	Why	Who	Record/documented Information	Evidence—Summary	Score
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 asset management strategy takes account of the lifecycle of all of its assets, asset types and asset systems.	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.	The asset management strategy takes account of the lifecycle of all of its assets, asset types and asset systems.	3
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?	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 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).	The Asset Management Plan is 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.	3

SCHEDULE 15: AMMAT REPORT (continued 2)

Question No.	Function	Question	Maturity Level 3	Why	Who	Record/documented Information	Evidence—Summary	Score
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)?	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.	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.	Westpower's Asset Management Group are specifically charged with theses responsibilities as set out in the AMP	3
40	Structure, authority and responsibilities	What evidence can the organisation's top management provide to demonstrate that sufficient resources are available for asset management?	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.	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.	Westpower has a team of 14 personnel dedicated at asset management. This is constantly reviewed by the General Manager, Assets and Engineering Services.	3

SCHEDULE 15: AMMAT REPORT (continued 2)

Question No.	Function	Question	Maturity Level 3	Why	Who	Record/documented Information	Evidence—Summary	Score
42	Structure, authority and responsibilities	To what degree does the organisation's top management communicate the importance of meeting its asset management requirements?	Top management communicates the importance of meeting its asset management requirements to all relevant parts of the organisation.	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.	The General Manager, Assets and Engineering Services heads the asset management group and attends monthly director's meetings	3
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?	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	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.	Technically, Westpower has outsourced its asset management to Electronet Services limited but the Asset Management Group is housed within the Westpower's offices and is headed by Westpower's General Manager, Assets and Engineering Services, so the operation is effectively "in house"	3

SCHEDULE 15: AMMAT REPORT (continued 3)

Question No.	Function	Question	Maturity Level 3	Why	Who	Record/documented Information	Evidence—Summary	Score
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 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).	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.	Westpower has a team of 14 personnel dedicated at asset management. This is constantly reviewed by the General Manager, Assets and Engineering Services.	3

SCHEDULE 15: AMMAT REPORT (continued 3)

Question No.	Function	Question	Maturity Level 3	Why	Who	Record/documented Information	Evidence—Summary	Score
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?	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.	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.	Competency requirements are identified in the individual Position Descriptions within the Asset Management Group. Regular training is completed throughout the year and the training records are held in the company's	3

SCHEDULE 15: AMMAT REPORT (continued 3)

Question No.	Function	Question	Maturity Level 3	Why	Who	Record/documented Information	Evidence—Summary	Score
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?	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.	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.	All personnel undertaking asset management duties undergo formal annual reviews to ensure they are competent and remain competent to carried out their assigned responsibilities	3
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?	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.	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.	The Asset Management Group is physically located on the same site as the company's contracting company that carry out the majority of the asset management work. Communication occurs on a daily basis	3

Westpower

SCHEDULE 15: AMMAT REPORT (continued 4)

Question No.	Function	Question	Maturity Level 2	Maturity Level 3	Why	Who	Record/ documented Information	Evidence—Summary	Score
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 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.	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.	Westpower operates several asset management systems. The GIS is updated on a daily basis by the GIS manager; the Asset and Works Management System, Maximo, provides a comprehensive solution which meets functional, financial and time based targets and the Vault contained records of accidents incidents as well as staff records for competency and training	3

SCHEDULE 15: AMMAT REPORT (continued 4)

Question No.	Function	Question	Maturity Level 2	Maturity Level 3	Why	Who	Record/ documented Information	Evidence—Summary	Score
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 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.	Effective asset management requires appropriate information to be available. Widely used AM standards therefore require the organisation to identify the asset management information it requires in order to support its asset management system. Some of the information required may be held by suppliers. The maintenance and development of asset management information systems is a poorly understood specialist activity that is akin to IT management but different from IT management. This group of questions provides some indications as to whether the capability is available and applied. Note: To be effective, an asset information management system requires the mobilisation of technology, people and process(es) that create, secure, make available and destroy the information required to support the asset management system.	The organisation's strategic planning team. The management team that has overall responsibility for asset management. Information management team. Operations, maintenance and engineering managers	Details of the process the organisation has employed to determine what its asset information system should contain in order to support its asset management system. Evidence that this has been effectively implemented.	Westpower asset management system contains all physical information related to the asset in its GIS and all work planning and history in its AMWS Maximo. Digital storage is unlimited so all historical records are held indefinitely	3

SCHEDULE 15: AMMAT REPORT (continued 4)

Question No.	Function	Question	Maturity Level 2	Maturity Level 3	Why	Who	Record/ documented Information	Evidence—Summary	Score
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?	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 response to the questions is progressive. A higher scale cannot be awarded without achieving the requirements of the lower scale. This question explores how the organisation ensures that information management meets widely used AM practice requirements (eg, s 4.4.6 (a), (c) and (d) of PAS 55).	The management team that has overall responsibility for asset management. Users of the organisational information systems.	The asset management information system, together with the policies, procedure(s), improvement initiatives and audits regarding information controls.	Information from Maximo is made available to the GIS manager on a daily basis to ensure the GIS is constantly updated. Maximo tracks all works orders from conception to completion and provides exception reports on all work outside the specified timelines set by the Asset Management Group	3
64	Information management	How has the organisation's ensured its asset management information system is relevant to its 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.	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.		2

SCHEDULE 15: AMMAT REPORT (continued 5)

Question No.	Function	Question	Maturity Level 3	Why	Who	Record/documented Information	Evidence—Summary	Score
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?	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.	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.	The risk assessment process for the asset life cycle is documented in the company's AMP	3
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?	Outputs from risk assessments are consistently and systematically used as inputs to develop resources, training and competency requirements. Examples and evidence is available.	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.	The risk assessment process is used to prioritise work in the AMP and this leads to all resourcing requirements	3

SCHEDULE 15: AMMAT REPORT (continued 5)

Question No.	Function	Question	Maturity Level 3	Why	Who	Record/documented Information	Evidence—Summary	Score
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?	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.	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	Management provide directors, on a regular basis, written assurance the company complies with all legal and regulatory requirements. A register of all requirements is maintained by the company corporate division	3
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?	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.	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.	All life cycle activities of the company's assets are provided in the annual AMP which is approved by company directors. Activities throughout the year are reported monthly to the Board so top management can monitor progress against the AMP	3

SCHEDULE 15: AMMAT REPORT (continued 6)

Question No.	Function	Question	Maturity Level 2	Maturity Level 3	Why	Who	Record/ documented Information	Evidence—Summary	Score
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 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.	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.	Constant communication between the asset management group and the contractor before, during and after the works program ensure the work is completed to the plans and procedures specifies in the AMP	3

SCHEDULE 15: AMMAT REPORT (continued 6)

Question No.	Function	Question	Maturity Level 2	Maturity Level 3	Why	Who	Record/ documented Information	Evidence—Summary	Score
95	Performance and condition monitoring	How does the organisation measure the performance and condition of its assets?	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.	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).	Asset inspection is a dedicated function within the contracting company. Targets are set and performance monitor with KPI reported to directs on a monthly basis	3

SCHEDULE 15: AMMAT REPORT (continued 6)

Question No.	Function	Question	Maturity Level 2	Maturity Level 3	Why	Who	Record/ documented Information	Evidence—Summary	Score
99	Investigation of asset-related failures, incidents and non-conformities	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 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.	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 customers. 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.	Westpower maintains a dedicated process to the investigation of asset related failures, incident and nonconformities as detailed in their documentation for Public Safety.	3

SCHEDULE 15: AMMAT REPORT (continued 6)

Question No.	Function	Question	Maturity Level 2	Maturity Level 3	Why	Who	Record/ documented Information	Evidence—Summary	Score
105	Audit	What has the organisation done to establish procedure(s) for the audit of its asset management system (process(es))?	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.	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.	Westpower has not completed a formal and documented process of audit on its asset management systems. However, all the asset management system have been upgraded over the passed three years and a full study of requirements was specified at the time the upgrades were specified. A full audit process is under development	2

SCHEDULE 15: AMMAT REPORT (continued 7)

Question No.	Function	Question	Maturity Level 3	Why	Who	Record/documented Information	Evidence—Summary	Score
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?	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.	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	All incidents of poor performance and nonconformance undergo investigation as per defined processes. Where necessary, corrective actions are recommended and entered into the Maximo Works System which monitors work progress through to completion. All corrective actions are reviewed after 12 months to ensure effectiveness	3
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?	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.	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.	The AMP is completely reviewed on an annual basis with all asset related risks reassessed	3

SCHEDULE 15: AMMAT REPORT (continued 7)

Question No.	Function	Question	Maturity Level 3	Why	Who	Record/documented Information	Evidence—Summary	Score
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 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.	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.	Westpower is very active within the national bodies of like companies (the ENA and EEA) and maintains a wide library of international magazines	3