Orion REPORT ON OPTIMISED DEPRIVAL VALUATION OF SYSTEM FIXED ASSETS AS AT 31 MARCH 2004

ISSUED 7 DECEMBER 2004

Table of Contents

Report on

Optimised Deprival Valuation

of System Fixed Assets as at 31 March 2004

1 Introduction

This report explains the basis on which Orion has valued its assets as at 31 March 2004 following the rules given in the "Handbook for Optimised Deprival Valuation of System Fixed Assets of Electricity Line Businesses" (the Handbook) issued by the Commerce Commission, 30 August 2004.

Handbook clause 2.65 prescribes the minimum information that must be contained in the ODV valuation report. This report includes all of this, plus further explanatory material. Orion's "Quality of Supply" Criteria is incorporated in Appendix J to this report.

The optimised deprival value (ODV) of a network is the depreciated value of a hypothetical *efficiently constructed* network to replace the owner's network, in the event the owner was deprived of it. Technically, it is the minimum of the optimised depreciated replacement cost (ODRC) and its economic value (EV).

The ODV calculation process involves many stages. Firstly, the modern equivalent asset (MEA) is determined for each asset. The replacement cost (RC) of the network is then calculated by multiplying the asset quantities by their unit replacement costs. The assets are then optimised by selective downsizing to remove the value of any underutilised capacity that is not required within prescribed planning periods of up to 15 years. This results in the optimised replacement cost (ORC) of the network. The asset values are then depreciated linearly over their total lives to determine their depreciated replacement cost (DRC) and their ODRC. A test is then applied to compare the economics of any lower cost alternative source of service available, generally applicable in remote locations where a diesel generator could supply loads more economically. The EV of the network is determined in comparison with the alternative source. The ODV is then the lower of the EV (if it is materially less than the ODRC) or the ODRC. In Orion's case, the EV is not materially less (1%) than the ODRC, and so the ODV equals the ODRC.

Orion determines the ODV of its assets primarily because this is mandated by the Electricity Information Disclosure Requirements, published by the Commerce Commission on 31 March 2004. However, Orion also uses the result when deriving its line prices.

In determining the valuation, Orion received independent expert advice and assistance from financial consultants Ernst & Young Corporate Finance Limited and from Maunsell Limited, on technical content. The result has been audited by PricewaterhouseCoopers.

2 Summary

2.1 Valuation Statement

Orion has published this valuation report in accordance with the "Electricity Information Disclosure Requirements 2004" (the Disclosure Requirements), issued 31 March 2004 by the Commerce Commission. Its timing complies with clause 19(9)(b) of the Disclosure Requirements, which requires Orion to publicly disclose an updated valuation report within four months of the Commerce Commission issuing a new Handbook.

As required by clause 19(5), Orion has prepared this valuation using the method set out in the Handbook. Pursuant to clause 19(6) of the Disclosure Requirements, the valuation date is given in section 2.2. As required by clause 19(7) of the Disclosure Requirements, this valuation report discloses the required information, as follows:

- Unit asset replacement costs (a)
  For standard assets, Orion has used the unit asset replacement costs prescribed in Handbook table A.1 (and detailed in Appendix D). Section 8 explains allowed adjustments to these values. For non-standard assets, where Orion has determined the unit asset replacement costs, refer to section 8 and Appendix E.
- Asset lives (a)
  For standard assets, Orion has used the total asset lives as prescribed in Handbook table A.1 (and detailed in Appendix D). Section 6 describes other aspects of asset lives used by Orion including corrections, estimates and extensions to asset lives for standard assets, (sections 6.2, 6.3 and Appendix F). Section 6.6 and Appendix E explain lives for non-standard assets, as determined by Orion.
- Asset quantities (a)
  Section 5 and Appendix A explain asset quantities.
- Replacement cost of Orion's system fixed assets (a)
  Section 2.1.1 states the total replacement cost of all assets. Appendix A provides a comprehensive list of replacement costs by asset class.
- Depreciation charged (b)
  Section 2.1.2 states the depreciation charged for all assets.
- Depreciated replacement cost (b)
  Section 2.1.1 states the depreciated replacement cost for all assets. Appendix A provides a comprehensive list of depreciated replacement costs by asset class.
- Optimisation (c)
  Section 9 and Appendix H explain the details of the components optimised.
- Optimised depreciated replacement cost (c)
  Section 2.1.1 states the optimised depreciated replacement cost for all assets. Appendix A provides a comprehensive list of optimised depreciated replacement costs by asset class.
- ODRC/EV comparisons (d)
  Section 10 provides the details, including the assumptions, for Orion's comparisons of ODRC and EV.
- Optimised deprival valuation (e)
  Section 2.1.1 states the optimised deprival value of Orion's system fixed assets.

As required by clause 19(8) of the disclosure Requirements, we advise that Orion's disclosed performance measures for year ending 31 March 2004, particularly return on funds, return on equity and return on investment, have been calculated based on the ODV in this report.

2.1.1 Valuation Summary as at 31 March 2004

System Fixed Assets	**$**
Replacement Cost (RC)	1,079,084,452
less Optimisation	(50,279,788)
gives Optimised Replacement Cost (ORC)	1,028,804,664
Depreciated Replacement Cost (DRC)	607,516,171
less Depreciated Optimisation	(27,292,153)
gives Optimised Depreciated Replacement Cost (ODRC)	580,224,018
less Economic Value Adjustment	0
***gives* Optimised Deprival Value (ODV)**	**580,224,018**

2.1.2 Depreciation Summary for the year to 31 March 2004

	$
Annual Depreciation on System Fixed Assets	20,038,054
Optimised Annual Depreciation on System Fixed Assets	19,194,895

2.2 Date of Valuation

This valuation report was prepared and issued on 7 December 2004. The effective date of the valuation is 31 March 2004.

2.3 Methodology

Orion has valued its system fixed assets using the methodology prescribed in the ODV Handbook. Handbook clause 1.9 requires Orion to describe the valuation approach used for system fixed assets and/or circumstances where the valuation method and parameters are not specifically described by the Handbook. Orion advises that the valuation method in respect of the total lives of overhead line, and in respect of the traffic management allowance for laying underground cables, differ from the approaches prescribed in the Handbook. Orion's methods are described in sections 6.5 and 7.2 respectively (pursuant to the reporting requirement in Handbook clause 2.65 (c)).

The valuation summary in section 2.1.1 shows the results at the various stages of the methodology in calculating the ODV. Initially the entire existing network is valued at current replacement cost (RC) of modern equivalent assets. Then an assessment is made to identify all assets that could be removed or downgraded, ie optimised. The value of these optimised assets, in terms of current replacement cost, is deducted from network RC to obtain network ORC.

The next main stage involves valuing the entire existing network as before, but this time recognising the actual age of the assets relative to their total useful life. This consideration produces a depreciated replacement cost (DRC) for the network. Similarly, the optimised assets can be valued 'at age' and deducted from DRC to obtain the network ODRC.

The final stage in the process considers assets that provide a service to consumers that could potentially be provided at a lower cost by other means, to establish the economic value (EV) of Orion's network. A comprehensive EV test is required only if the write-down in asset value would be greater than 1% of ODRC. Orion updated its previous EV analysis for its 31 March 2001 ODV to determine that the write-down would not be material (that is, would be less than 1% of ODRC). Therefore Orion's ODV equals its ODRC.

2.4 Valuation Summaries

The following summaries show the make-up of Orion's overall valuation by network level and asset class, including contribution to total optimisation and the average remaining life of assets.

A full breakdown (in the form of the ODV Handbook table A.1), including quantities, RC, ORC, DRC, ODRC and ODV, can be found in Appendix A to this report.

2.4.1 Network Level Summary

Orion's network is made up of four distinct levels, 66kV & 33kV subtransmission, 11kV subtransmission, 11kV distribution and low voltage distribution. The following table shows the contribution of each level:

	RC	ORC	DRC	ODRC		Remaining	Optimis-
Network Level	$m	$m	$m	$m	proportion	**Life**	**ation**
Subtransmission	90.7	90.6	53.9	53.8	9.3%	52.9%	0.1%
11kV Subtransmission	259.6	244.2	130.1	122.9	21.2%	54.9%	5.9%
11kV Distribution	405.0	394.1	233.4	226.5	39.0%	56.1%	2.7%
LV Distribution	323.8	299.9	190.1	177.0	30.5%	54.2%	7.4%
	1,079.1	1,028.8	607.5	580.2	100.0%		

2.4.2 Asset Class Summary

Within each level, Orion's network is further distinguished by asset class. On a similar basis to the network level summary above, the following table shows the contribution of each asset class:

	RC	ORC	DRC	ODRC		Remaining	Optimis-	
Asset Class	$m	$m	$m	$m	proportion	**Life**	**ation**	
Cables	438.9	397.4	265.2	241.3	41.6%	56.7%	9.5%	
Lines	177.4	173.9	94.7	93.1	16.1%	54.2%	2.0%	
Land	28.2	25.3	28.2	25.3	4.4%	100.0%	10.4%	
Substations	99.4	95.9	43.4	42.7	7.4%	46.2%	3.5%	
Transformers	140.2	139.9	76.4	76.3	13.1%	52.8%	0.2%	
Switchgear/Fusing	181.4	182.8	89.5	91.4	15.7%	47.5%	(0.8%)	*
Miscellaneous Assets	13.7	13.7	10.1	10.1	1.7%	99.9%	0.0%	
	1,079.1	1,028.8	607.5	580.2	100.0%			

* During optimisation, some streetlighting lines and cables are notionally replaced with LV overhead and underground connections. This results in a net optimisation increase in the value of Switchgear/Fusing.

3 Reconciliation with Previous Valuation

In compliance with Disclosure Requirement 19, Orion generally publishes a valuation report every three years. During the intervening years Orion updates its valuation calculation, on the basis of the ODV Handbook methodology, to provide a basis for the calculation of financial performance measures under Disclosure Requirement 14.

A formal ODV reconciliation, in the form of Disclosure Requirement schedule 1 Part 8, is provided in Orion's audited disclosure accounts (available on Orion's website, www.oriongroup.co.nz/AnnualReporting/regdisclosures/regdisclosures.asp).

The following table provides a summary reconciliation between Orion's ODV valuation report as at 31 March 2001, Orion's valuation calculations as at 31 March 2002 and 31 March 2003, and this ODV valuation report:

Year ending 31 March	**2004** $000	**2003** $000	**2002** $000	**2001** $000
ODV of assets (end of the previous financial year)	453,382	442,840	435,510	405,978
Add value of assets added	26,292	27,687	30,506	24,824
Add asset revaluations (net of assets removed)	119,745	(594)	(7,502)	19,133
Less asset depreciation	(19,195)	(16,551)	(15,674)	(14,425)
ODV of assets (end of the financial year)	580,224	453,382	442,840	435,510

The vast majority of 2004's revaluation relates to the Commerce Commission's update of unit replacement costs in the revised ODV Handbook (dated 30 August 2004) and Orion's update of unit replacement costs for non-standard assets. Additional contributions relate to updated quantity estimates, quantity corrections, the removal of the economic value adjustment, and the inclusion of a 3 year minimum remaining life for older assets. These increases are offset by asset removals and an increase in the optimisation of Orion's assets.

4 Asset Databases

4.1 Asset Management Databases

Orion maintains comprehensive *asset management databases* for the management and administration of the network. These databases record the attributes of individual assets and are updated to reflect changes to the network on an ongoing basis. Primarily, the asset databases consist of:

GIS - Orion's graphical interface system. Orion uses Intergraph GTechnology to update and maintain its electrical model. Intergraph Geomedia is then used to extract asset and spatial information from this model. With the interface to Orion's "cables database" (see below), this system provides the primary source of all valuation information in relation to Orion's lines and cables, as well as supporting detail on low voltage link boxes and low voltage connections.

Cables Database - an MS Access-based application supporting Orion's GIS and recording additional details on 66kV, 33kV, 11kV and communications cables. This database was initially populated from Orion's "cable card" records system and provides detail on age and length of individual conductor segments.

WASP - an asset management database with detailed current and historical information on all network assets (other than lines and cables). WASP records details of individual assets and includes a comprehensive "parenting" structure which records asset locations and asset associations. WASP was initially populated from previous asset databases including written records. Through asset replacement, surveys and data integrity work, the accuracy of asset information held on WASP is continually improving over time.

Connections Database - an MS Access-based application recording details of individual connections, including commissioning and decommissioning dates, capacity, number of phases, and indicating if each connection is overhead or underground.

Emergency Spares Schedule - MS Excel-based schedules recording Orion's stock items, their purchase cost, and the quantity of each item that is held as an *emergency* spare to meet Orion's Quality of Supply Criteria.

MOZAIC - Orion's accounting software package including a fixed assets register holding records of all Orion-owned land, financial and tax values, as well as rating valuations.

4.2 Asset Valuation Register

From Orion's asset management databases, Orion extracts information to compile an asset valuation register (or valuation model) that provides the basis for the calculation of Orion's ODV. Before extracting information, every effort is made to complete all data updates in respect of work completed prior to the valuation date, and data updates for work carried out after the date of valuation are delayed until the extraction is complete. The value of incomplete work, as at the valuation date, is recorded separately under "works in progress" in Orion's financial accounts.

Orion's valuation model provides a framework for carrying out all valuation calculations. It includes:

- reporting structures that aggregate assets by network level, asset class and asset subclass,
- a schedule of relevant standard assets (based on the ODV Handbook table A.1) plus non-standard assets that have been identified as the modern equivalent of Orion's installed assets,
- a schedule of terrain and location multipliers applicable to Orion's network, and
- a framework for recording asset type and quantity optimisation.

Wherever possible, individual asset records (extracted from the asset management databases) are transferred directly to the valuation model. Individual asset records include the asset ID from the source database, a description of the asset, the quantity (in metres or number), and the installation year (ending 31/3). On entry, each asset is assigned to the appropriate network level, asset class and subclass. In addition, each asset is assigned the appropriate (standard or non-standard) modern equivalent asset and, where appropriate, a terrain and location multiplier.

The valuation model also caters for grouped asset entries where total quantities are entered with an assumed age profile based on estimations (refer to sections 5.2 and 6.2 below).

To ensure transparency in the process, the valuation model calculates and records valuation information against individual asset entries. This information includes the effective valuation date, the calculated age of the asset, the combination of any multipliers applied, the total life and unit replacement cost taken from the assigned modern equivalent asset, the calculated remaining life, RC, ORC, DRC, ODRC and annual depreciation of the asset. The valuation model prompts for confirmation, displaying any changes, before updating any calculated valuation information.

All valuation reporting is then based on the simple grouping and summation of the recorded valuation information (ie no further calculation is undertaken).

4.3 Valuation Calculations

The valuation model applies valuation calculations as prescribed in the ODV Handbook. The following paragraphs summarise these calculations, and Orion's approach in areas not covered by the ODV Handbook:

Combined valuation multipliers - where lines and cables have more than one valuation multiplier applied, the multipliers are combined as prescribed in clause A.5 of the Handbook, using the equation:

(Multiplier One - 1) + (Multiplier Two - 1) + 1

Age - in calculating the age of assets, the valuation model assumes that assets are installed mid-way through the installation year (ending 31/3). Age is therefore calculated as:

Year of valuation - Year of installation (ending 31/3) + 0.5

Total Life - for most assets the total life is simply referenced from the schedule of modern equivalent assets. However, lines and cables carry two distinct total lives depending on construction materials. Asset entries for these items are weighted in favour of one or the other total life:

- For cables, total life 1 represents XLPE construction, and total life 2 represents PILC construction. Individual asset entries are weighted 100% in favour of one or the other total life, depending on the recorded cable construction.
- For lines, total life 1 represents lines with concrete poles, and total life 2 represents lines with wood poles. Line segments are weighted in favour of one or the other depending on Orion's overall proportion of concrete and wood poles for the appropriate voltage line.

This is calculated as:

Total life 1 x Proportion 1 + Total life 2 x (1 - Proportion 1)

Remaining Life - in calculating the remaining life of assets, the valuation model assumes that assets are installed mid-way through the installation year (ending 31/3). The model also takes account of the minimum 3 year residual life entered against each asset (Handbook clause 2.55). The remaining life of each asset is calculated, using the result of the age and total life calculations above, as:

Max (3 years, Total life - Age)

Replacement cost - for most assets the unit replacement cost is referenced from the schedule of modern equivalent assets, however, for some assets there is no uniform unit replacement cost (eg land and spares) and these asset entries carry their own unit replacement costs. The valuation model establishes the replacement cost by multiplying the unit replacement cost by the combined multipliers (established above) and the quantity entered against each asset:

Unit replacement cost x Combined multipliers x Quantity

Depreciated replacement cost - straight-line depreciation is applied to the replacement cost by multiplying it by the ratio of remaining life to total life (both established above):

Replacement cost x Remaining life / Total life

Depreciation - the disclosure requirements (requirements 16 and 19(7)(b)), require the calculation of annual depreciation (or "depreciation charged"), and this is not covered in the ODV Handbook. Orion's calculation establishes the depreciation and optimised depreciation on System Fixed Assets in the year to the date of valuation. For each asset, this is calculated as follows:

- If the asset does not depreciate (eg land), depreciation is nil;
- If the remaining life is less than the minimum remaining life by more than a year, the asset has reached the end of its depreciable life and depreciation is nil;
- If the asset was installed during the valuation year (ending 31 March 2004), the asset is assumed to have been in service for half a year, and depreciation is calculated as:

  Quantity x Unit RC x combined multipliers / total life / 2

- If the asset's depreciable life (defined as total life less minimum remaining life) minus its age plus 1 is between 0 and 1, the asset has completed its last (part) year of depreciable service. For these assets, most will reach the end of their depreciable lives half way through the valuation year ending 31 March 2004 (as a result of assuming that assets are installed mid way through a year), and half a year's depreciation accrues. However, some assets have a total life that is not a whole number (for example, overhead lines, where the total life is calculated as the weighted average of two different total lives).

  In both cases, the *proportion* of depreciable life in the asset's last year of service is given by its depreciable life minus age plus 1. Depreciation is therefore calculated as:

  (Quantity x Unit RC x combined multipliers / total life) x (Depreciable Life - Age + 1)

- If the valuation year (2004) is less than the installation year (ending 31/3) plus the total life less the minimum remaining life, the asset is within its depreciable life and provides a full year's depreciation, calculated as:

  Quantity x Unit RC x combined multipliers / total life

Optimised values - optimised replacement cost, optimised depreciated replacement cost and optimised depreciation are calculated in a consistent fashion, but instead referencing each asset's optimised modern equivalent asset and optimised quantity.

5 Quantities

The valuation model includes asset quantities, measured in metres or number of items (as appropriate), against each asset entry. In accordance with Handbook clause 2.65(a), Appendix A to this report includes a schedule, in a format consistent with Handbook table A.1, detailing total quantities by asset type.

Orion's asset management systems (see section 4 above) provide the primary source of all asset quantities and dates of installation. Section 5.2 covers situations where Orion has developed estimates of quantities, and section 6.2 covers estimation of asset ages, in situations where individual asset records are not available.

5.1 Quantity Corrections

Orion's network has been developed over more than a hundred years. On this scale, Orion's electronic asset databases are a relatively recent development and were initially populated from historic written asset records. Orion acknowledges that these historic records are less accurate than needed for Orion's intensive level of asset management.

To address this issue, Orion has adopted a process of continual improvement to its asset databases. The asset information is improved through:

- gradual asset replacement - new assets are recorded with significantly more detail than the retired assets which they replace,
- use of new technology - for example, advanced geographic mapping software,
- field surveys to collect information about existing assets, for example, Orion's ongoing "Poles" survey is collecting detail of all pole types, ages (from physical date stamps), location and condition. This survey is also collecting detail of equipment on poles (eg air break isolators).
- data integrity analysis - finding and correcting the more obvious errors and discrepancies within Orion's dataset. Notable corrections in the year to 31 March 2004 are:
    - A project to update and audit low voltage and streetlighting conductors resulted in a significant number of corrections to installation dates, cable construction and sizes. This project compared GIS information with historical asset records. It also verified that installation dates matched Orion's use of conductor size and conductor construction for that period.
    - Correcting a spreadsheet reference increased the total length of 66kV line installed during 1957 by 2,113 metres (or 5.2%).
    - Modification of a GIS report to correctly allow for the length of connecting assets (such as ABIs and shackles) increased the total length of 33kV line by 3,590 metres (or 1.1%).
- data migration - Orion continues to add detail to its asset management database, WASP, from historic written records, previous databases and other operational databases. For example,
    - during 2004 Orion has added individual detail on all 11kV cut-out fuses, sourced from original written installation records, and
    - Orion has extracted detail of remote terminal units (RTUs) from its SCADA system and recorded these in WASP.

These corrections ultimately influence Orion's valuation model, as each new asset register is compiled based on the up-to-date asset management databases. Orion considers that these corrections result from the availability of more accurate information, as provided for in Handbook clause 2.10 (although the corrections do not necessarily affect the estimated quantities detailed in 5.2 below).

Following the valuation date and extraction of asset information for valuation, Orion has become aware of an additional correction that cannot be included in this valuation report. A GIS report, providing detail of 11kV lines, included an adjustment for the length of connecting assets (such as ABIs and shackles). Orion is now aware that this adjustment, totalling an additional 42,000 metres, has not been included in the valuation.

5.2 Quantity Estimates

As indicated above, Orion's asset management databases do not provide the full gambit of detail required by the Handbook. This is especially evident in areas where the Handbook's requirements have changed to require a set of information different to that originally collected (for example, the split between 4 wire and 2 wire low voltage line), and where the Handbook prescribes a valuation approach that depends not only on the attributes of the asset in question, but also the attributes of other assets in the vicinity (for example, the traffic management allowance that only applies to the primary line or cable in a street).

In accordance with Handbook clauses 2.9 and 2.65(d), Appendix B to this report details the bases used, and the derived quantities and ages, in relation to Orion's estimation of assets. Estimates have been applied to the following asset types:

- Low voltage rural underbuilt lines (B1)
- Low voltage overhead road crossings and back section lines (B2)
- T-Jointed underground service mains (B4)
- The proportion of shared vs dedicated low voltage boundary boxes (B5)
- Separation between 4-wire and 2-wire low voltage lines (B7)
- Shared trenching installation of low voltage cable (B8)
- Shared trenching installation of 11kV cable (B9)
- Low voltage cable of unknown construction (B10)
- Low voltage line of unknown size (B11)
- 11kV cable of unknown construction or unknown size (B12)
- 11kV line of unknown size or phasing (B13)
- Streetlighting relays (B16)
- 11kV Rewireable Fuses (B17)
- Traffic management allowance for installation of lines and cables (B20)

5.3 Spares

Orion owns minimal stocks of spares, relying on and contracting with suppliers to carry appropriate quantities of many items (for example, lines and cables).

Of the stock that is owned by Orion, the majority is managed under a long-term contract with a storage provider (Connetics). All items are detailed on MS Excel-based schedules and regular stocktakes are undertaken. The Orion Network Quality Manager is responsible for controlling spares, ensuring that sufficient spares are held to maintain Orion's Quality of Supply Criteria.

In accordance with Handbook clause 2.43, spares that are not required to meet the Security Standard in Orion's Quality of Supply Criteria are not included in the valuation, and, on this basis, no optimisation of spares is required (refer to section 9.5.9 below).

In terms of Handbook clause 2.44, Orion's valuation does not include any stranded assets as spares, although some assets that are not in service are valued as network spares.

Of particular note within Orion's schedules of spares:

- Orion holds one spare 66kV circuit breaker. Orion has 28 66kV circuit breakers in service and 12 of these are more than 25 years old. These older circuit breakers are critical network components that utilise older technology where no supplier support remains.
- Orion holds one spare 33kV circuit breaker covering 44 in-service.
- Orion holds a total of 83 spare 11kV circuit breakers, 48 in store and 35 in substations. The spares include various models of oil, gas and vacuum circuit breakers. Twelve of the spare circuit breakers in store are maintained as complete switchboard units of varying current ratings and physical size to cater for a major failure of a complete switchboard. 11kV circuit breakers in-service total 2,035.
- Orion has two spare power transformers, one 33/11kV 2.5MVA located at Motukarara district substation, and one 66/11kV 20/40MVA located at Halswell district substation. Although technically considered as spares, at the date of valuation both transformers were in-service. Unlike most other spares, these assets have been used in the past and are therefore depreciated from their date of first installation.
- Orion has 61 spare distribution transformers in stock. These include pole and ground-mounted, single and three phase transformers covering the range of sizes (from 15kVA to 1,500kVA) commonly installed on Orion's network. These spares provide support for Orion's 9,750 distribution transformers in-service.
- Orion has three spare voltage regulators. One 20MVA covering the two large regulators installed at Heathcote district substation, and two 0.75MVA regulators covering Orion's nine other smaller voltage regulators. As with power transformers, Orion's spare regulators have previously been in-service, and are therefore depreciated from the date of first installation.

For a summary list of Orion's spares, and their value, refer to section 8.9.

5.4 Land

Land included in this valuation is based on Orion's *title* sites, excluding those sites identified as being used for non-network purposes (eg corporate or residential). In a limited number of cases, title sites are used for both network and non-network purposes. For these sites, the value has been determined according to the proportion that the area of land used for network purposes bears to the total area of that land.

Land is subject to three direct optimisation considerations relating to un-utilised or under-utilised portions, and is also affected by the optimised replacement of network substations (refer to sections 9.5.2 and 9.4.3 respectively). In relation to *quantity*, unlike other optimised assets, land that is optimised out of Orion's ODV is considered to retain its value, and is instead regarded as "investment" land, and is included in Orion's financials alongside corporate and residential properties.

In accordance with Table A.1 of the Handbook, the quantity of land is reported in this valuation as "number of titles", rather than number of sites, or area.

Orion does not usually identify any specific compensatory payment for easements and, in accordance with Handbook clause A.28, this valuation does not include any amounts in respect of Orion's easements.

6 Asset Lives

The valuation model references total lives of assets based on the:

- standard total lives provided in Handbook table A.1,
- non-standard total lives determined by Orion in accordance with Handbook clause A.30 for assets that are not represented in Handbook table A.1, and
- extended total lives for assets in situations where Orion meets the Handbook requirements for total life extensions (clauses A.32 to A.35, and A.40 to A.43).

The valuation model uses total lives to determine each asset's remaining life. Handbook clause 2.55 indicates that an asset with a remaining life less than three years is deemed to have a *residual* life of three years. Orion interprets "residual" as "remaining", and applies a minimum of 3 years in the calculation of remaining life (refer to the valuation calculations in section 4.3 above).

In terms of Handbook clause 2.48, the remaining lives of assets that do not deteriorate with age are always equivalent to their total lives. In this case there is no requirement to determine either the total life or the remaining life; it is sufficient to establish that the ratio of remaining life to total life is 1, and the asset does not depreciate. Orion applies this principle in respect of land and spares (except spare power transformers and voltage regulators).

The ratio of remaining life to total life is then used to establish the depreciated value of each asset.

6.1 Age Corrections

Orion bases each successive valuation on the latest available information recorded within its asset management databases. As described in section 5.1, in relation to quantity corrections, Orion is continually improving its asset information, and in some cases, this results in corrections to installation dates of assets. This translates to age corrections when asset information is migrated to Orion's valuation model.

The Handbook provides for corrections to commissioning dates where objective evidence is available to justify the reassessment (clause 2.52). Orion considers that the corrections applied to individual assets within its asset management databases provide an objective basis for changes to installation dates within its valuation model. From year to year, the majority of assets are not affected by data improvements and installation dates are consistently applied in successive valuations.

Updating of age estimates (which is not considered to be an age correction) is detailed in section 6.2 below.

In accordance with Handbook clause 2.65(h), the considerations noted in section 5.1 above, together with the detail in this section, provide a general description of the basis for changes to installation dates.

6.2 Age Estimates

Orion's asset management systems (see section 4 above) provide the primary source of all asset quantities and dates of installation. This section indicates the areas where Orion has estimated asset ages (see section 5.2 covering situations where Orion has estimated quantities). In many cases it is both the age and quantity that must be estimated, and in accordance with Handbook clauses 2.9, 2.10 and the reporting requirement in clause 2.65(d), Appendix B to this report details the bases used and the derived quantities and ages in relation to Orion's estimation of assets.

Specifically, age estimates have been applied to the following asset types:

- Low voltage rural underbuilt lines (B1)
- Low voltage overhead road crossings and back section lines (B2)
- Low voltage urban lines upgrade (B3)
- T-Jointed underground service mains (B4)
- Low voltage connections (B5)
- Low voltage link boxes (B6)
- Proportion of concrete poles in streetlighting, low voltage, 11kV and 33kV line (B14)
- Pole mount district substations (B15)
- Streetlighting relays (B16)
- 11kV Rewireable Fuses (B17)
- 33kV Isolation (B18)
- 11kV Disconnectors (B19)
- Traffic management allowance for installation of lines and cables (B20)

6.3 Total Life Reductions and Extensions

Orion considers that the standard total lives in Handbook table A.1 generally represent assets' useful economic lives. One notable exception is substation buildings; Orion's experience has shown that these assets provide a useful economic life of at least 70 years, considerably longer than the 50 year total life provided in the Handbook (and in this valuation).

Life Reductions
In accordance with the reporting requirements in Handbook clauses 2.65(g) and 2.65(i), Orion notes that it does not apply any total life reductions (pursuant to Handbook clauses A.32 or 2.53 respectively) to the standard lives detailed in Handbook table A.1.

Life Extensions
As provided for in Handbook clause A.33, Orion has applied extended total lives (in excess of the Handbook's standard total lives) in respect of power transformers, pad-mounted distribution transformers and their substations, and 11kV indoor switchgear. Orion has not applied life extensions to its pole mounted distribution transformers, 33kV and 66kV switchgear, nor transmission lines.

The life extensions have been applied in accordance with Handbook clauses A.34, A.35, and A.40 to A.43, and Orion has documented evidence in support of this compliance. Pursuant to the reporting requirement in Handbook clause 2.65(g), Appendix F to this report details the extended total lives and the quantity of assets to which they apply.

In general, life extensions have been applied as follows:

- For power transformers the life extension, from the standard total life of 45 years to 60 years, is based on Orion's enduring testing and maintenance program and loading levels below manufacturers' ratings.
- For pad-mounted distribution transformers and their substations the life extension, from the standard total life of 45 years to 55 years, is based on Orion's enduring inspection and maintenance program, comprehensive survival analysis on the existing population, and records of loading levels.

- For 11kV indoor switchgear, the life extension from 45 years to 55 years is applied only to units of modern sealed design with manufacturers' specifications supporting an extended number of operations without any requirement for maintenance.

6.4 Asset Refurbishments

In terms of the Handbook's reporting requirement 2.65(g), Orion has not extended the remaining lives of any assets (as provided for in Handbook clauses 2.54, A.36 and A.37) as a result of refurbishment.

The renewal of poles during rebuilding of overhead lines is captured in the age of each segment, defined in Handbook clause A.8 as the average of the age of poles within each segment, and is not considered an asset refurbishment in terms of this valuation.

The rebuilding of pad-mounted distribution transformers (as they are rotated in and out of service) is expensed as maintenance, which Orion considers necessary for the asset to achieve its extended total life as detailed in section 6.3 above. Orion does not consider this work to be refurbishment in terms of this valuation.

6.5 Total Lives of Overhead Lines

In relation to overhead lines, the Handbook provides standard total lives for lines constructed with wood poles (45 years), and for lines constructed with concrete poles (60 years). Orion's line segments contain a mixture of wood and concrete poles, and Orion applies the provisions of Handbook clause A.8 to determine a weighted average of the two standard total lives detailed in the Handbook.

Orion is undertaking a comprehensive survey collecting details of all poles on its network and, at point of preparing this valuation, has compiled information on 60,278 poles. As the survey is not complete, and as the results are not currently linked to individual segments within Orion's GIS, the proportions of wood and concrete poles have been determined for each voltage level, and applied to all segments with that voltage level. In determining these proportions, Orion has assessed the small number of steel poles in low voltage and 11kV lines as concrete, and has excluded poles that do not carry a circuit (eg poles used in aerial stays).

The resulting weighted average lives are:

Line Voltage	**Comment**	**Total Life Applied** (years)
66kV Heavy Lines (double circuit steel tower)	No weighted average applied - standard total life of steel tower lines based on Handbook table A.8	55
66kV Medium Lines (single circuit wood pole)	No weighted average required, all segments use wood pole construction	45
33kV Lines (heavy & light)	Weighted average based on survey of 3,856 poles	51.60
11kV Lines (subtransmission & distribution; heavy, medium & light; on own, underbuilt and double circuit)	Weighted average based on survey of 21,391 poles	52.20
Low Voltage Lines (heavy, medium and light; 2 wire and 4 wire; on own, underbuilt, road crossings, back sections and rural underbuilt; streetlighting)	Weighted average based on survey of 34,093 poles	49.35

Orion notes that it has used CCA treated wooden poles extensively since 1 April 1992. The Forest Research Institute of Rotorua has reviewed this form of treatment and their findings indicate very little deterioration in the condition of wooden poles which are in excess of 50 years old. In 1989, the FRI concluded, "it can be safely predicted that similar poles should have an average service life well over 50 years". The dry climate in Canterbury enables long life and there is a minimum of rotting of poles below ground level. Therefore, Orion considers that the 45 year life for wood pole construction prescribed in the Handbook is conservative.

6.6 Total Lives of Non-Standard Assets

Appendix E includes a schedule of all non-standard assets referenced in Orion's valuation model (ie Orion's assets that are not represented in the Handbook's table of standard assets (table A.1)). The table includes each asset's non-standard total life (as required by the reporting requirement in Handbook clause 2.65(f)), each asset's non-standard unit replacement cost (refer to section 8 below), and the quantity to which these non-standard valuation parameters are applied.

Generally, the non-standard total life has been based on (set to) the standard total life given in the Handbook for similar assets. Section 8 covering non-standard unit replacement costs also details individual considerations of total lives.

7 Unit Replacement Cost Adjustments

The Handbook provides for adjustments to unit replacement costs to reflect the additional costs of installing assets in adverse situations. Adjustments are applied as multipliers to the unit replacement costs (Handbook clauses A.9, A.10, A.14 and A.15), and allowances are effectively added to the unit replacement costs (Handbook clauses A.19 and A.20), by selective incorporation in the valuation model. This section details the application of adjustments in this valuation.

7.1 Valuation Multipliers for Cables and Lines

Orion has applied multipliers to standard and non-standard unit replacement costs to reflect the higher costs of installing some assets in adverse conditions or situations. The application of these multipliers is detailed in Handbook clauses A.9, A.10, A.14 and A.15. Refer to Appendix C for the Valuation Multipliers Report listing the multipliers used and the quantities of assets to which the multipliers have been applied (pursuant to the reporting requirement in Handbook clause 2.65(e)).

In summary:

Situation	Voltage	Description	Allowable range	Value used
Overhead lines in remote location	11kV	Areas more than 75km from the nearest applicable works depot. This criterion results in two areas being considered remote: • Banks Peninsula, beyond the line between Duvauchelle and the coast just east of Long Bay and just east of Little Akaloa, and • the inland area beyond the line between Springfield and Coalgate.	1.0 to 1.25	1.25
Overhead lines in urban location	11kV & 33kV	Areas within the built-up area of Christchurch (generally where roads have a speed limit less than 75 km/h) plus the built up areas of 19 small rural towns. Closer pole spacings apply.	1.5 to 1.8	1.56
Underground cable in CBD location	LV & 11kV	CBD as defined by Christchurch City Council, generally described as the area bounded by Bealey, Fitzgerald, Deans and Moorhouse avenues	1.15 to 2.0	1.96
Underground cable in high volume road location	LV, 11kV & 33kV	Arterial routes including state highways with greater than 10,000 vehicles per day.	1.15 to 2.0	1.96
Transpower type lines in hilly terrain	66kV	Areas where Orion's 66kV steel tower lines span hilly terrain on the lower slopes of the Port hills.	1.07 (fixed)	1.07
Transpower type lines in urban terrain	66kV	Areas within the built-up area of Christchurch (generally where roads have a speed limit less than 75 km/h).	1.20 (fixed)	1.20
Overhead lines in rugged terrain	11kV & 33kV	Areas where normal line construction vehicles and plant cannot be used and where it is necessary to use helicopters, tracked vehicles, boats or other specialised plant. Isolated areas are identified, where there is reticulation, at: • All hilly parts of Banks Peninsula beyond Diamond Harbour and Little River, and • The alpine foothills beyond Porters Pass	1.2 to 1.3	1.30

Situation	Voltage	Description	Allowable range	Value used
Underground cable in rocky terrain	LV & 11kV	Terrain that presents extreme difficulty with trenching, including areas that contain solid rock formed by lava or other natural forces that requires blasting to carry out trenching works. These generally are geological areas defined as rocky according to Geological Survey maps for Hurunui, Christchurch urban & Banks Peninsula. For example, just west of Hororata is Mt Misery volcanic rock and Round Top andesite. Mt Pleasant, Scarborough and a large area of Banks Peninsula is volcanic rock described as dark grey, plagiociase-pyroxene-amphibole, phyric hawaiite through to grey-green trachyte with interbedded red-brown pyroclastic deposits and dark grey to black, plagiociase-pyroxene-olivine phyric basalt through to grey-green trachyte with interbedded red-brown pyroclastic deposits. Included are the Port Hills from Halswell to Sumner, Banks Peninsula, and the rural townships of Castle Hill and Arthur's Pass.	1.5 to 2.0	2.00

Derivation of multipliers

Included in Orion's brief to the contractor for costs to derive multipliers were the requirements stipulated in clauses 2.13 and 2.14 of the Handbook, where replacement costs must be determined on the basis that construction occurs around all existing infrastructure and development, and be commensurate with a significant scale of construction rather than with piecemeal additions. The contractor advised costs for equipment purchase and construction based on those they would submit in competitive tenders.

For **cable multipliers**, Orion employed its main contractor to price 1.5km of 11kV cabling projects, using standard cable sizes used by Orion (heavy 300mm^2 Al and medium 185mm^2 Al), in situations of average urban, CBD, and rocky conditions, as defined above. Orion and the contractor considered that the costs in high volume roads are the same as for the CBD and therefore the same multiplier applies. These are high cost situations because of the congested footways and expensive road surfaces to reinstate and the lower productivity resulting from the restricted hours of work imposed by the authorities. Orion then calculated the multipliers from the ratios of the costs under adverse conditions to the unit replacement costs prescribed in Table A.1 in the Handbook. Both sets of costs were weighted by the proportions of cables sizes used by Orion, by length.

For **line multipliers**, Orion's contractor advised costs for the construction of 11kV light (Flounder conductor) lines in remote situations. For urban locations and rugged terrain, the costing basis was for light 33kV line over underbuilt medium 11kV line (both with Dog conductor), a common configuration for Orion. Orion then calculated the multipliers from the ratios of the costs under adverse conditions to the unit replacement costs prescribed in Table A.1 in the Handbook. This resulted in the multipliers shown in the above table. Note that two calculated multipliers were reduced to fit within the allowable range, from 1.4 to 1.3 for rugged terrain and from 1.34 to 1.25 for the remote location.

In all cases, the costs for temporary traffic management were omitted, as these are assessed separately (refer to section 7.2). Specifically, the *high volume road* multiplier detailed in the table above takes account of restricted access times, special reticulation requirements and areas requiring substantial reinstatement and/or special backfilling (but not the direct cost of traffic management).

7.2 Traffic Management Allowance

The Handbook (clauses A.19 and A.20) now recognises the additional cost of temporary traffic management requirements during installation of underground cables and overhead lines in roads with heavier traffic volumes. Orion is largely exposed to this cost in urban Christchurch, where the road control authorities impose temporary traffic management requirements (consistent with the Transit Code of Practice for Temporary Traffic Management) on Christchurch's significant lengths of level 1 and level 2 roads.

While the Handbook suggests the allowance should be added to the standard replacement cost of the *primary* asset in a road, Orion is not able to identify this primary cable or line. Individual conductor segments might be the primary conductor for only part of their length, and individual segments track in and out of the carriageway. It is not practicable to further divide Orion's tens of thousands of conductor segments into smaller parts to reflect this level of detail. Orion's valuation model instead adds the allowance to the total replacement cost of lines and cables.

To establish the lengths of road to which the allowance should apply, Orion has interrogated Christchurch City Council's (CCC) roading database which specifies the streets and roads subject to temporary traffic management requirements as indicated in the table below. To this, Orion has added details establishing which roads have overhead and underground conductors (on one side or both), ultimately establishing the total lengths of road subject to the specified levels of traffic management allowance. This approach ensures that the allowance is not duplicated against multiple assets in the same location.

Classification in CCC roading database	**Handbook allowance applied**
Level LV roads	No allowance applied
Level 1 roads	Level 1
Level 1P roads *(Level 1 roads classified as level 2 from 7:30am to 9am and from 4pm to 6pm)*	Level 2
Inner city (CBD)	
Level 2 roads	
State highways	

Cables in the carriageway

This approach does not provide a basis for the Handbook's traffic management allowance for cables in the carriageway of level 2 roads. Orion's practice is to install cables in carriageways only as follows:

- Roadcrossings and situations where the carriageway cannot be avoided for LV, 11kV and 33kV cables.
- All 66kV cables. Orion has always installed its 66kV cables in the carriageway because:
  - the modern equivalent is 3 single-core XLPE cables, which need a lot of width (2 to 3 metres);
  - footpaths are generally fully utilised by other power cables and other services;
  - cable joints require large areas that are available on the road, but generally not in the footpaths;
  - these are very expensive and dangerous cables critical to Orion's service, and are less likely to be disturbed by other works when installed in the carriageway.

Orion's GIS system does not include sufficient detail to determine whether cables are buried in the road/carriageway. Instead the average proportion has been established based on analysis of a representative sample of low voltage, LV, 11kV and 33kV cables, and all 66kV cables segments have been individually considered. This sampling considered approximately 9% of all level 2 roads by length. The sampled lengths included randomly selected areas from each of the relevant roading classifications in the Council's roading database as follows:

Council roading classifications	Total road length (m)	Sample road length (m)	Length of sample with cables in road (m)	Proportion in carriageway
Inner city (CBD)	90,724	10,102	825	8.2%
Level 1P	142,609	10,089	895	8.9%
Level 2	70,558	7,076	999	14.1%
State highway (urban)	72,989	5,582	1,005	18.0%
Totals	**376,880**	**32,849**	**3,724**	**11.3%**

Rural roads in CCC's area are defined as roads with a speed limit above 75 km/h on the outer fringes of Christchurch. All cables in this situation are assumed to be installed in the berm and were excluded from the sampling process.

In summary, Orion assesses (376,880m - 5,674m of 66kV cable) x 11.3% = 41,946m of road as having low voltage, 11kV or 33kV cable in the carriageway, and a further 5,674m of road has 66kV cable in the carriageway.

A summary of the lengths of road established against all traffic management allowance categories, including detail of the surrogate age profiles assigned, is included in Appendix B20 to this report. The total length and resulting value of the allowance is detailed in Appendix C, Valuation Multipliers and Allowances.

8 Unit Replacement Costs for Non-standard Assets

The Handbook provides unit replacement costs for standard assets in table A.1, and provides for situations where assets are not represented in this table (non-standard assets) in clauses 2.12 to 2.14. For non-standard assets, the Handbook prescribes the basis for selection of a modern equivalent replacement asset, and the basis for the derivation of a replacement.

This section lists each class of non-standard asset that is included in this valuation, describing the modern equivalent asset selected, the basis for determining the replacement cost and the total life assigned to the asset. It also provides detail of the replacement costs determined by Orion where standard assets are listed in Handbook table A.1 with no standard replacement cost (that is, entries marked "**").

The resulting replacement costs and total lives are scheduled in Appendix E, together with the quantities to which these results have been applied. The sections below provide a general description of the basis used in determining these results. This detail is provided pursuant to the reporting requirement in clause 2.65(f) of the Handbook.

Notes
In determining the replacement costs, and in addition to the considerations detailed in Handbook clauses 2.13 and 2.14, Orion notes that the cost of conductor terminations have been included in the cost of installing electrical components, rather than in the cost of installing the conductor.

Orion's asset management systems consistently refer to "circuit length", rather than "route length". In situations where the Handbook provides a replacement cost based on route length for double circuit conductors, Orion has halved the cost to reflect circuit length.

8.1 Subtransmission Conductors

8.1.1 66kV Lines and Cables

66kV Overhead Heavy (DCST Wolf & Hyena)

The construction of Orion's 66kV steel tower lines is consistent with that used by Transpower. On this basis, Orion has adopted the unit replacement costs provided in the Handbook for Transpower (table A.8). The lower 50^{o}C rating for the Hyena conductor is used and replacement costs are halved in order to apply them to circuit length, rather than route length. Terrain and location multipliers as specified for Transpower assets are considered and, where appropriate, applied to the unit cost (refer to section 7.1).

Orion has also adopted the 55 year total life specified in Handbook table A.8 for this type of asset.

66kV Overhead Medium (Single circuit wood pole)

This entry represents Orion's 66kV Dog (wood pole) lines in the rural area. Orion has recently accepted a tender for large scale construction of this type of line with 11kV underbuilt line included (again, using Dog conductor). To establish the unit replacement cost for the 66kV line on its own, the Handbook replacement cost for 11kV medium underbuilt is deducted from the tender price.

The 45 year total life applied is consistent with Handbook entries for lower voltage wood pole lines.

66kV Underground Extra Heavy

This entry represents Orion's 1,600mm^2 copper 160MVA 66kV cables. The latest sections of this cable were installed in September 1999 (2.4km). In the absence of any recent construction using this size cable, Orion has identified the installation component of the 1999 contract, updated it with the movement in CPI to 31 March 2004, and added a current competitive quote for the cable.

The section considered in the 1999 contract is representative of all Orion's 66kV cable and no further terrain or location multipliers are applied. Traffic management requirements have largely evolved since this construction and 66kV cable is considered in relation to this allowance (refer to section 7.2).

While the cable is armoured XLPE manufactured to a higher standard than lower voltage XLPE cables, Orion does not hold evidence suggesting that an extended total life should apply, and has adopted the 45 year total life provided in the Handbook for other XLPE cables.

66kV Underground Heavy (single and double circuit)

This entry represents Orion's small quantity of 300mm^2 copper 40MVA 66kV cables, but is also referenced as the modern equivalent replacement for Orion's 66kV oil filled cable (sizes .25Cu, .45Al, and 300Al), based on its 40MVA rating. Consistent with the Handbook's assertion for lower voltage cable (Handbook clause A.18), Orion agrees that XLPE cable is the modern equivalent replacement in this situation.

The installation cost component for this cable is comparable with that of Orion's extra heavy 66kV cable (it involves installation of three separate cores of approximately the same physical size). On this basis, Orion has adopted the installation cost derived for extra heavy cable above, and added to this a current competitive quote for the smaller 300mm^2 copper cable. The double circuit cost (per circuit length) is based on half the installation cost plus the cable cost.

As with Orion's extra heavy 66kV cable, the replacement cost is not subject to further terrain or location multipliers, but the cable has been considered in Orion's derivation of the traffic management allowance (refer to section 7.2).

Oil filled 66kV cable is assigned a total life of 70 years, consistent with the Handbook entry for PILC. Orion is actively maintaining and replacing the joints and expects the useful life to at least exceed this period. Segments of XLPE cable are assigned a total life of 45 years consistent with other Handbook entries.

8.1.2 33kV Cables

33kV Underground Heavy

The Handbook provides standard replacement costs for 33kV cables up to the equivalent of 240mm^2 Al (noted in Orion's valuation model as "medium" size). The *33kV UG Heavy* entry is provided as the modern equivalent for Orion's 33kV cable of sizes .3Cu, 300Al and 185Cu.

To establish the unit replacement cost, Orion has adjusted the Handbook entry for ≤ 240mm^2 Al cable by deducting the current cable cost for 185mm^2 Al cable, and adding back the current cost for 300mm^2 Al cable.

Consistent with the Handbook entries for medium size 33kV cable, Orion's heavy 33kV XLPE cable is valued using a 45 year total life, and heavy 33kV PILC is valued using a 70 year total life. As for 66kV cable, Orion's *oil filled* 33kV cable is valued using a 70 year total life.

8.1.3 11kV Cables

This section covers non-standard replacement costs for *subtransmission* cables. The following non-standard replacement costs are also used against Orion's 11kV distribution cables of appropriate sizes.

11kV Extra Heavy (single and double circuit)

The Handbook provides standard replacement costs for a range of 11kV cable sizes up to 300mm^2 Al. This entry, denoted *Extra Heavy*, is established as the modern equivalent for Orion's range of 11kV conductors that exceed this capacity (from .5Al to 630Cu).

To derive the replacement cost for extra heavy cable, Orion has considered the trenching/reinstatement and cable components separately.

- Orion has derived the trenching/reinstatement cost inherent in the Handbook entry for *heavy 11kV cable* by deducting the marginal additional cost of the cable (established by comparing the single circuit cost with the double circuit cost for this size cable). Orion considers that this would apply equally for the larger extra heavy cable.
- Orion bases the cable component of the cost on its current competitive price for purchasing 400Cu XLPE (as the metric equivalent of .5Cu, and Orion's standard size).

These components are added to provide the unit replacement costs for single circuit installation. Half the installation cost is added to the cable cost to establish the double circuit unit replacement cost. Orion acknowledges that this approach does not account for the cost of jointing and laying the cables, although analysis of the Handbook entries for smaller 11kV cables (in comparison to Orion's purchase price for these items), suggests that this allowance is nominal in the Handbook entries anyway.

As with other standard handbook asset entries, XLPE cables are valued using a 45 year total life and PILC cables are valued using a 70 year total life.

11kV Light (double circuit)

While *double circuit* with light conductor is not a common configuration, Orion uses the double circuit unit replacement cost (by circuit length) to represent the lower cost of shared trench installation (as per clause A.16, which describes instances where two cable are laid together).

As the Handbook does not provide a unit replacement cost for 11kV light double circuit, Orion has derived the trenching/reinstatement cost for medium cable (from the Handbook replacement cost entries for single and double circuit cable of this size). Half of this amount was then deducted from the Handbook replacement cost for light single circuit 11kV cable to establish the lower replacement cost for light double circuit 11kV cable (by circuit length).

As with other standard handbook asset entries, XLPE cables are valued using a 45 year total life and PILC cables are valued using a 70 year total life.

8.2 Other Subtransmission

8.2.1 Communications Lines and Cables

Communications Lines

All Orion's communications circuits are installed as cables. Therefore, Orion has not established a unit replacement cost for the standard handbook entry "Pilot/Communications Ccts O/H".

Communications Cables

Orion's communication cables are generally installed with other subtransmission cables and Orion has included only the marginal cost of their installation. The cable cost is based on current prices for 25 pair cable, and the installation cost, based on average conditions and including an allowance for jointing, was provided by Orion's main contractor who tenders for this type of work on a competitive basis.

Orion is not able to geographically extract detail from its GIS system in order to assign terrain and location multipliers. Instead, the average combined multiplier (by length) established for 11kV subtransmission cables (1.03) is applied in the derivation of this unit replacement cost.

8.2.2 GXP Check Metering

Orion has operational check metering installed at all Transpower grid exit points (GXP). In considering the value of these units, Orion has established that they vary significantly depending on the voltage and configuration of each GXP. Rather than establishing an average value to apply to all units, Orion has entered each of these assets in its valuation model with its own replacement cost. As a result there is no unit replacement cost noted in Appendix E. Instead, the relevant detail is provided here.

Orion has established the unit replacement costs based on the number of metering components at each installation which, in turn, are based on recent quotes and invoices for this type of work. The replacement costs range from $10,730 for small rural GXPs to $64,198 for large urban GXPs. The average is $29,205.

The total life is taken as 40 years based on the Handbook entry for *Other Items,* under the heading *Zone Substations*.

8.3 District and Network Substations

8.3.1 Zone Substation Land

Orion has 50 land title sites relating to district and network (zone) substations. Each title site has been entered in Orion's valuation model with its own replacement cost (hence, no uniform cost is provided in Appendix E).

With the exception of the Armagh district substation, all replacement costs are based on Councils' rateable valuations, indexed to reflect the movement in values between the various rateable valuation dates and 31 March 2004 (the effective date of this ODV). The indexing adjustments were provided in a registered valuer's report (dated 6 October 2004) based on a sample of properties in each council area. They are:

Council Area	Date of Rateable Valuation	Indexing factor
Christchurch City Council	1 September 2001	1.51
Banks Peninsula District Council	1 July 2003	1.80
Selwyn District Council	1 July 2003	1.25

A proportionate reduction has been applied to some sites to reflect land area that is not used for network purposes. Further, this land is subject to the optimisation considerations detailed in section 9.5.2. These 49 title sites are entered in Orion's valuation model with a total replacement cost of $5,498,809. The minimum is $1,500 for a small rural site and the maximum is $555,680 for a central city site.

The Armagh district substation spans several title sites. Orion's assessment is based on the land value component established in a registered valuer's report dated 12 May 2003 (effective 31 March 2003), proportionately reduced to reflect the area occupied by the substation. Orion acknowledges that there is upward pressure on this value over the year to 31 March 2004, but considers that this would not materially affect the total. The amount included in respect of this site is $476,625.

8.3.2 Site Development and Buildings

Orion has 67 buildings over 50 district substation sites, 197 network substation buildings, and 78 network substations on customers' premises.

District substation buildings and development

Orion has categorised the primary buildings at each of its district substations to reflect the capacity and configuration of the substation (which largely affect the size of the structure). This yielded five different *standard* structures, which Orion considers to represent the modern equivalent replacement of the existing buildings. These standard structures are assigned a replacement cost based on recent construction costs for Highfield, Killinchy and Te Pirita district substations, and a quantity surveyor's report on Ilam and Spreydon district substations, and a quantity surveyor's report on Roydvale network substation, which represents a basic block building.

The standard replacement costs include planning and design costs, the building (based on modern standard construction, including basic plumbing, power and drainage), and basic site development such as fencing and access. The standard structures are:

Standard Building	Examples	Replacement cost
11kV in urban area (housing ripple injection plant and/or providing switching of two or more 11kV primary feeders from GXPs)	Bishopdale Montreal	$287,000
66kV or 33kV with Outdoor Structure	Darfield Halswell	$290,677
Small 66kV or 33kV with Outdoor Structure	Annat Motukarara	$203,706
66kV or 33kV with Indoor Structure	Brighton McFaddens	$385,000
Basic Block Building	Papanui	$91,000

16 additional buildings at district substation sites (for example, buildings providing sound enclosures for power transformers) have been valued as basic block buildings. The additional building at Armagh district substation, housing what would otherwise be an outdoor 66kV structure, is valued at its construction cost adjusted for the movement in the CPI from the date of completion in 2002 to 31 March 2004 (noted in Appendix E as an *individually assessed structure*).

Network substations (Orion owned)

Orion's *building* network substations house switching equipment for Orion's 11kV subtransmission network. The value of these structures includes the building and site development (based on a quantity surveyor's report in respect of Roydvale network substation dated May 2004), plus sundry plant and associated installation costs (but excluding electricity distribution assets that are separately included in the valuation).

Network substations (On customers' premises)

These network substations are housed in buildings that are not owned by Orion. The replacement cost covers only the sundry plant and associated installation costs identified as a component of the replacement cost for Orion-owned network substations above.

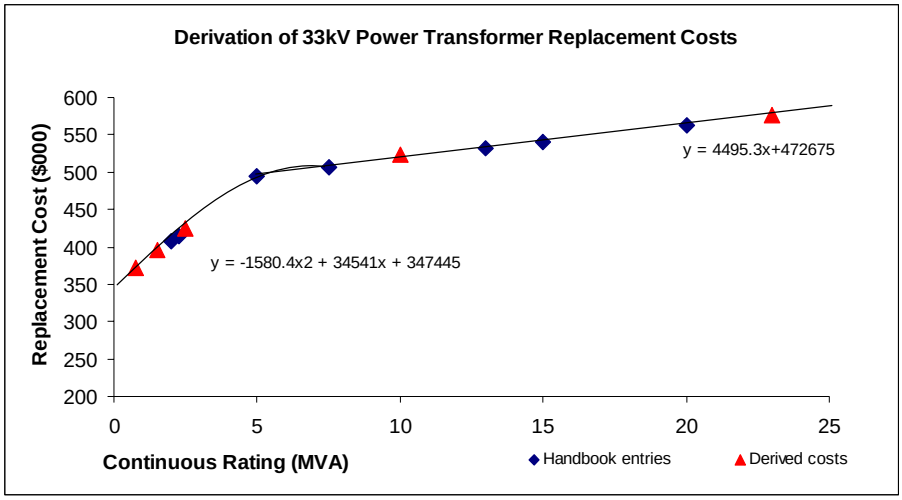
8.3.3 Power Transformers and Regulators

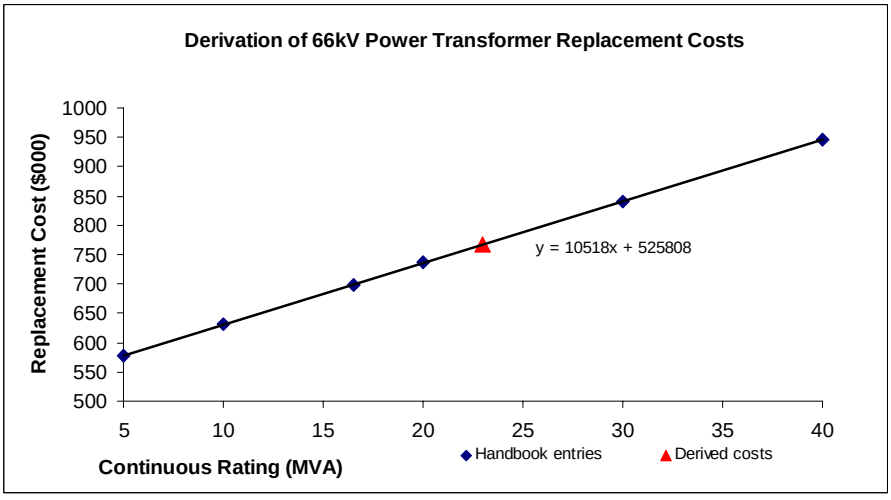
Orion has 25 66/11kV transformers, 32 33/11kV transformers, and 16 voltage regulators all of varying capacities.

66/11kV and 33/11kV Power Transformers

Replacement costs for a number of transformer sizes are provided in Transpower's section of the Handbook (Handbook table A.4) and Orion has relied on these figures where they match Orion's transformer sizes (note that Orion's power transformers all include an on-line tap changer).

Within the Handbook entries for these assets, Orion notes the strong correlation between capacity and replacement cost. Orion has used this relationship, interpolating and extrapolating, to establish unit replacement costs for Orion's transformer sizes that do not exactly match the sizes detailed in the handbook. The following graphs show the Handbook entries and Orion's derived replacement costs:





The total life of these transformers is detailed in Handbook table A.1, but is subject to a life extension as covered in section 6.3.

Voltage Regulators (20MVA)

Orion's network utilises three 20MVA voltage regulators and Orion has not been able to source a replacement cost for these items. Instead, the replacement cost for 4MVA regulators (detailed below) has been factored up to reflect the larger 20MVA size. Orion considers that these assets carry similar pricing characteristics as power transformers, and has based the factor on the relative costs from the 66kV graph above. That is,

$$\frac{10{,}518 \times 20\text{MVA} + 525{,}808\text{MVA}}{10{,}518 \times 4\text{MVA} + 525{,}808\text{MVA}} = 1.30$$

and, $172,261 x 1.30 = $223,939

Voltage Regulators (4MVA)

Orion has 13 smaller ground-mounted voltage regulators mostly with a nominal rating of 4MVA, with some smaller capacity units ranging in size from 0.55MVA to 1MVA. Based on availability, Orion considers that the 4MVA model is the modern equivalent for all these units.

The unit replacement cost for these items ($172,261) is based on quotes and invoices covering purchase and installation.

8.3.4 66kV and 33kV Switchgear

Orion's network includes a range of 66kV and 33kV switchgear which is not detailed in Handbook table A.1. The unit replacement costs detailed in Appendix E are based on current quotes from Orion's main contractor covering purchase and installation.

8.3.5 Protection and Controls

A range of protection and control relays are installed on Orion's network. In valuing the older components, Orion has identified the modern equivalent replacement as being the multi-functional unit providing the same capability. The multi-functional units identified are:

66kV Unit Protection (with intertrip)
Directional Overcurrent Relay (with Circuit breaker fail)
Transformer Diff Protection & Control (with intertrip)
Transformer Diff Protection & Control
11/33kV Feeder Protection (with OC & EF)
11/33kV Unit Protection (with OC)
11/33kV Unit Protection
11kV Protection (with OC & EF)
11kV Protection (with OC, EF, reclose & CB fail)
Bus Bar Protection Relay

The unit replacement costs detailed in Appendix E are based on current quotes from Orion's main contractor covering purchase and installation. The total lives of these assets are prescribed in the Handbook (40 years).

8.3.6 Outdoor Structures

Orion's outdoor structures at district substations are identified separately from other district substation assets. Orion has valued these items based on a standardised set of modern replacements: Incomer, Bus Section, Isolator Section, and Feeder, for 33kV and 66kV. The unit replacement costs detailed in Appendix E are based on current quotes from Orion's main contractor covering purchase and installation.

The total lives of these assets are detailed in the Handbook - based on whether the structures use concrete or wood pole construction (60 years and 45 years respectively). All Orion's structures are steel and Orion considers that the useful life will, at least, match the Handbook total life for concrete pole construction. On this basis, Orion has used the 60 year total life.

8.3.7 SCADA and Communications Equipment

Communications equipment at district substations consists of remote terminal units (RTUs) and pilot boxes.

In the past, all SCADA indications and control were implemented via hardwired connections between industry standard SCADA RTUs and the field devices. In recent years, the availability of Intelligent Electronic Devices (IEDs) with inbuilt SCADA capable communications has reduced the role of the traditional RTU to that of a data concentrator with most physical interfaces being located at the IEDs on the substation equipment itself. These devices are able to provide large amounts of information/indications at very low incremental cost simply requiring database configuration to provide the additional functionality.

Orion has valued all district substations' communications on this modern equivalent basis: protection, control and switching equipment including SCADA remote points, and an RTU acting as a data collector. Orion has identified six standard sizes of RTU, and two sizes of pilot box that would be required in the replacement of its district substations (on a modern equivalent basis).

The unit replacement costs for RTUs and pilot boxes detailed in Appendix E are based on invoices covering purchase and installation. As per the Handbook, the total life assigned to these assets is 15 years.

8.3.8 Ripple Injectors

Orion has recently shifted from injecting ripple signals at the 66kV level to injecting at the 11kV level, installing three 11kV injectors in 2002, 1 in 2003, and 23 in 2004. The three 66kV injectors were effectively retired in 2004, although a portion of them remains to act as a wave trap for Orion's lower voltage injection.

Orion has valued its 175Hz 11kV injectors based on the average installed cost in 2004. This value has been adjusted for the difference in plant cost to provide a basis for Orion's 317Hz 11kV injectors, and 317Hz 33kV injectors.

The cost of the 66kV equipment acting as a wave trap is based on the cost of the basic set of equipment (capacitors and inductors) that provides this functionality, and a reasonable estimate of their installation (provided by Orion's main contractor).

8.3.9 DC Supplies, Batteries and Inverters

The replacement cost for Orion's standard battery configurations (including charger and battery stand) are based on current price quotes for materials, and recent quotes and invoices for installation.

8.3.10 Other Items

Orion has identified a number of district substation components that are not included in the Handbook sections noted above. All these items have been added to Orion's valuation model against the Handbook entry "other items", and carry the Handbook prescribed total life of 40 years:

11kVA AT (15kVA)

Orion has 29 15kVA auxiliary transformers at district substations, providing the local low voltage supply. These items have similar pricing and installation characteristics as 11kV voltage transformers (see below) and the unit replacement cost is set to match that derived for the voltage transformers.

11kV Connecting Cables

Orion's GIS and cables database do not include details on connecting cabling within district substations. While the cost of terminating these cables is included with the equipment to which they connect, the actual installation cost in the district substation environment is significant. Orion has identified five standard connecting cables and has derived replacement costs based on average lengths employed, current price quotes for materials, and recent quotes and invoices for installation.

Voltage Transformers

Voltage transformers (66kV, 33kV and 11kV) are installed at each district substation to support operational metering requirements. Replacement costs are based on current price quotes for materials, and recent quotes and invoices for installation.

Surge Diverters and Neutral Earthing Resistors

Where appropriate, Orion provides surge diverters (including where necessary, neutral earthing resistors) at district substations. While the Handbook provides a replacement cost for 33kV surge arresters in the subtransmission section (presumably installed on overhead lines), installation of these items at district substations differs significantly, and is lower cost. Orion's derived replacement costs are based on current price quotes for materials, and recent quotes and invoices for installation.

8.4 11kV Distribution Conductors

Non-standard replacement costs for 11kV *distribution* cables are consistent with the entries noted for 11kV subtransmission cables in section 8.1.3 above. In relation to 11kV distribution lines, a non-standard entry is required for overhead underbuilt single phase (that is not required in the subtransmission section).

11kV Underbuilt Single Phase

The Handbook prescribes a replacement cost for 11kV single phase lines and for 11kV underbuilt lines, but does not cover the combination "11kV single phase underbuilt".

Orion has derived the replacement cost of 11kV underbuilt single phase line by deducting the difference between the Handbook costs for 11kV light and 11kV single phase from the Handbook cost for 11kV Underbuilt light.

The total life is taken from the Handbook entry for all other 11kV lines, 60 years for concrete pole, and 45 years for wood pole construction.

8.5 Distribution Switchgear

11kV Dropout Fuse (single phase)

The Handbook provides for dropout fuses in two-phase and three phase sets. While Orion considers that this split establishes an unnecessary level of detail, it also fails to provide for single phase dropout fuses (previously, Orion has valued all dropout fuses at one third of the three-phase replacement cost).

Orion has established the single phase replacement cost as half the two-phase replacement cost provided in the Handbook. The total life is set to the same period as that of the Handbook entry for two-phase dropout fuses.

11kV Single Phase Circuit Breaker (recloser)

The replacement cost for single-phase units is significantly less than the Handbook's standard entry for three-phase units. Orion's derived replacement cost is based on a current quote for materials and installation. The total life is set to the same period as that of the Handbook entry for reclosers.

11kV Surge Arresters

Orion's 11kV surge diverters are mainly installed on rural overhead 11kV distribution lines. Orion actively tests, maintains and replaces these units and the derived replacement cost (including earthing) is based on Orion's schedule of standard maintenance/replacement rates negotiated with Orion's main contractor. The total life is based on the Handbook entry for 33kV surge arresters.

11kV Magnefix Units

To address safety concerns, Orion uses magnefix switchgear (air insulated with resin case), rather than the oil filled ring main units commonly employed in other areas. On this basis, and with reference to Handbook clause 2.12(f), Orion considers that the modern equivalent replacement for these units is not the Handbook entry for ring main units. Orion has established individual replacement costs for each Magnefix configuration employed, based on current quoted prices and installation costs. It is worth noting that, while the cost of some units exceed the $16,000 provided for ring main units in the Handbook, the weighted average replacement cost for Orion's Magnefix units is $13,400.

The total life for Magnefix units is set to match the Handbook entry for ring main units.

11kV Switchgear Cabinet (¼ kiosk)

Orion has identified 88 situations where switchgear is installed separately to other equipment, requiring its own housing. To provide for this cost, Orion has established the replacement cost for a basic pad-mounted cabinet, based on current quotes and prices for time and materials. This approach resulted in a replacement cost of $3,622.

Orion notes that these installations are very similar to Orion's ½ kiosks at ground-mounted distribution substation sites. On a similar basis, Orion establishes the replacement cost of these kiosks as $7,286, considerably higher than the $4,000 prescribed in the Handbook.

To ensure consistency with the Handbook, Orion has factored down the replacement cost by the ratio $4,000 / $7,286, applying a replacement cost of $2,000 for switchgear cabinets. The total life for these cabinets is set to match the Handbook entry for kiosks (listed as Ground mounted (Covered)).

Communications

Orion has UHF remote units and auxiliary equipment associated with RTUs installed in conjunction with distribution switchgear. Orion has established the replacement cost for these items based on suppliers' current price schedules and recent invoices. The total life is set to the total life provided for other communications equipment in the Handbook.

8.6 Distribution Substations

8.6.1 Housing

The Handbook does not provide a replacement cost for distribution substations in the 50 to 100kVA range. On the basis of note (d) to Handbook table A.1, which allows intermediate distribution transformers to be valued at the next size up, 50 to 100kVA pole mountings are valued as 100kVA pole mountings.

8.6.2 MDI Metering

Orion has maximum demand metering installed with each ground-mounted distribution transformer. Information collected from these meters is used to assess transformer and network loading levels required for Orion's proactive management of these assets. Again, Orion has identified the two standard sizes installed on low voltage panels and has derived replacement costs based on current quotes for supply and installation.

8.7 Low Voltage Distribution

8.7.1 Light 4-wire Underbuilt Lines

The Handbook provides for light (≤50mm2 Al) and medium (clarified as >50mm2, ≤150mm2 Al by the Commerce Commission) size low voltage overhead lines. However, the entries for *underbuilt* low voltage lines do not specify a light size, starting at medium (defined as ≤150mm2 Al).

Consistent with the clarification provided for the definition of medium size lines, Orion assumes that the omission of the light underbuilt size is an error in the drafting of the Handbook and has established this category.

Orion derived the replacement cost for light underbuilt based on the Handbook replacement cost for light line size reduced by the ratio of the cost of medium underbuilt line to medium line.

8.7.2 Road Crossings and Back Section Lines

These assets differ from the standard assets in the Handbook in two respects:

- pole spacings (span lengths) are, on average, significantly shorter than normal low voltage line, and
- Orion does not own all the poles in each segment.

Orion has derived the component replacement cost inherent in the Handbook entries for standard low voltage lines based on its experience with this type of construction. Orion has then combined these components to reflect the higher cost of shorter span lengths and lower cost associated with the average proportion of poles that are not Orion-owned. The resulting replacement costs (detailed separately for urban and rural construction) are lower than, but consistent with, the other handbook entries for low voltage line.

The total life assigned to these lines is consistent with the Handbook total lives for other low voltage lines.

8.7.3 Service Cables

Orion owns significant lengths of service cables where these have been T-jointed to Orion's low voltage cable network (refer Appendix B4 to this report). The Handbook's standard replacement cost for low voltage cables is not appropriate in situations where this cable is identified as a 2-core (or neutral screen) conductor. To reflect the lower cost of smaller cable, Orion has derived a non-standard cable cost entry (referenced as LV UG Service Main (16mm^2 NS)).

The replacement cost has been derived by adjusting the Handbook standard replacement cost for medium size cable for the difference in cable cost, based on current pricing schedules. Trenching and installation costs are not adjusted.

The total life assigned to these cables is consistent with the Handbook total lives for other low voltage cables.

8.7.4 Streetlighting

Orion's network includes a significant quantity of streetlighting conductor that is either the 5th core in cable, the 5th wire on lines, or 2-core cable buried with other low voltage reticulation. Consistent with the Handbook requirements (as clarified to Orion by the Commerce Commission) these assets are optimised out in favour of individual low voltage connections for each streetlight.

In order to optimise, the assets must first be valued. Orion has established these non-standard unit replacement costs on a marginal cost approach, basing calculations on the costs of recent low voltage construction. The total life assigned to these assets is consistent with the Handbook total lives for low voltage cables and lines.

8.7.5 Link Pillars

Handbook table A.1 includes standard replacement costs for 2-way and 4-way link pillars. Orion has assessed the unit replacement cost for its 3-way link pillars as the mid-point between these two Handbook replacement costs. The total life is taken from the Handbook entries for 2 & 4-way units.

The modern equivalent replacement for Orion's more sophisticated link pillars (5-way and above) is considered to be the 4-way unit (refer to Appendix B6 to this report).

8.7.6 Service Connections

In situations where Orion supplies low voltage connections via a T-joined service cable, Orion does not provide a boundary box, and it would not be appropriate include the Handbook's standard allowance (which includes a boundary box). Instead, Orion has derived a non-standard entry representing a simple fuse installed within the customer's meter box.

The replacement cost is based on a quote provided by Orion's main contractor, and the total life is set to the same period as provided for other connection assets in the Handbook.

8.8 SCADA and Communications (Central Facilities)

SCADA Master Station

Orion employs a leading international provider on a competitive basis to supply and maintain its SCADA system. The provider has an intimate knowledge of Orion's SCADA system and its capability.

To establish the replacement cost for the system, Orion sought a hypothetical quote for its replacement from the provider. This information, and resulting cost, was then reviewed for reasonableness and accepted by Orion's technical adviser to this valuation.

UHF Masters and Repeaters

Total replacement costs are derived from current price schedules for individual components plus installation costs based on recent contracts.

8.9 Network Spares

With the exception of voltage regulators, the replacement costs for Orion's spares (identified as defined in section 5.3) are based on the most recent purchase of each item, essentially supporting the historic cost approach[1] on the basis that Orion rotates stocks as new items are purchased. Installation costs are not included.

The replacement cost for Orion's spare voltage regulators is derived as defined in section 8.3.3, but without the installation component. Unlike other spares where Orion has not established a total life (as the assets are not considered to age) Orion's voltage regulators have previously been in service and are depreciated based the 55 year life defined in the Handbook for installed regulators.

Many of Orion's spares represent individual components of standard assets detailed in the Handbook, and Orion's valuation model includes more than 1,300 entries covering more than 12,000 individual items. In summary:

Category	Number of items	Total Replacement Cost
66kV OH Spares	1,389	$22,696
66kV UG Spares	2,117	$806,965
33kV OH Spares	11	$8,629
33kV UG Spares	253	$85,780
11kV OH Spares	869	$9,074
11kV UG Spares	13	$2,801
Subtransmission Spares	6,497	$1,071,376
Distribution Transformer Spares	61	$263,622
Spare 11kV Regulator (4MVA)	2	$237,170
Spare 11kV Regulator (20MVA)	1	$154,160
Ripple Spares	342	$416,024
11kV Circuit Breaker Spares	83	$1,039,662
Distribution Switchgear Spares	11	$93,048
Distribution Spares	751	$70,087
Total		**$4,281,094**

[1] Regulation of Electricity Lines Businesses Handbook for Optimised Deprival Valuation of System Fixed Assets of Electricity Lines Businesses - Explanatory Notes, dated 22 October 2004, issued by the Commerce Commission.

9 Optimisation

Consideration of the utilisation of all of Orion's assets resulted in net reductions for optimisation of $50.3m on replacement cost (RC) and $27.3m on depreciated replacement cost (DRC).

This chapter explains the steps taken by Orion to optimise the RC and DRC of the system fixed assets according to the requirements in the Handbook. After considering the key issues of the Quality of Supply Criteria and undergrounding practices, the sections consider network assets at all levels taking into account the forecast loading. Finally, there is a section summarising the impacts of optimisation.

9.1 General

Orion has used the existing network as the starting point for its assets valuation as allowed by the valuation rules in the Handbook (clause 2.18). Orion has then systematically applied a series of optimisation tests to the whole network, as described in Appendix B of the Handbook, to identify any inappropriate configurations (ie overvalued compared with how Orion would configure the network today), any excess capacity and any over-engineering. Where necessary, Orion has notionally redesigned its network to provide an optimised network.

The sections that follow cover the optimisation of the various parts of Orion's network. Each section has a general description of the optimisation methodology applied by Orion, as required by clause 2.65(j) of the Handbook. In terms of the "five stages" of optimisation referred to in clause 2.22, Orion's approach is covered as follows:

(a) exclude stranded assets. They are not included in the initial asset quantities, so are therefore inherently excluded. Refer to section 9.5.9;

(b) optimise the configuration of the network. Refer to the sections within 9.4 which cover the configurations of supply points, subtransmission, substations, feeders and street lighting;

(c) optimise the capacity of elements in the network. Refer to the first 8 sections within 9.5, which cover the both the capacity and engineering optimisations for subtransmission, substations including circuit breakers, land & buildings, power & distribution transformers, primary & secondary 11kV cables & lines, voltage control devices, trench sharing, low voltage distribution and system control;

(d) optimise network engineering; Refer to (c);

(e) optimise stores and spares. Orion has reviewed its operating requirements. Refer to section 9.5.9.

Refer also to Orion's "Quality of Supply" (QoS) Criteria in Appendix J. This largely provides the test standard for the optimisation of Orion's system fixed assets in terms of Handbook clause 2.24(a). Quality is considered with respect to security, reliability, voltage regulation, losses and asset requirements.

The Handbook provides for a non-standard level of service exceeding that detailed in the Quality of Supply Criteria where this enhanced level is contracted with customers (clause 2.24(a)). Orion has long-established formal arrangements with some major customers for more than one connection at their site to improve their supply security. These are significant loads, typically 2MVA or more (Security Class B or greater), and the customers suffer high costs if their loads are interrupted. These arrangements, however, fall within Orion's QoS Criteria, and therefore no optimisation is avoided.

Orion has not avoided the use of any asset with a lower replacement cost in its optimised network where an analysis shows that the life cycle costs would be less, as allowed for in Handbook clause 2.19. Therefore, there is no need to provide a general description of the analysis and assumptions used, as required by Handbook clause 2.65(k).

9.2 Undergrounding Practices

A considerable portion of Orion's distribution network is reticulated underground. Most of the urban network that has been built since the mid-1960s is underground including all new subdivisions, all redevelopments of roading corridors and shopping centres and all replacements of dilapidated overhead reticulation that has reached the end of its useful life.

Orion justifies undergrounding reticulation largely on the basis of the Handbook rule *"local authority planning criteria prohibit the construction of new overhead circuits"* (Handbook clauses B.7(b)(i), B.9(b)(i), and B.12(a)(i)). The rules in the plans of the Territorial Local Authorities (TLA), do not permit the erection of utility structures and conductors in certain areas. This is a discretionary activity. These are generally built-up areas and areas of special conservation or environmental significance. Undergrounding is a permitted activity which requires no resource consent. The District Plans are prepared under the Resource Management Act 1991. The plans state the desirability of placing services underground in certain areas in the Council's policy statements. The Utilities section of each plan contains the Rules under which utilities can be installed. In particular, applicable to Orion (including their operative dates) are:

- Christchurch City Council City Plan, Volume 3, Part 9 General City Rules, 4 Utilities, clause 4.4 (from 8 May 1999);
- Selwyn District Council Proposed District Plan, Volume 1, Townships, 2 Land Use Rules for Living Zones, rule 22, Utilities: Cables, Lines, Antennae, Pipes, Drains and Structures (from 2 Dec 2000);
- Banks Peninsula District Council Proposed District Plan, Chapter 36 Utilities, rules, 1. Permitted Activities (from January 1997).

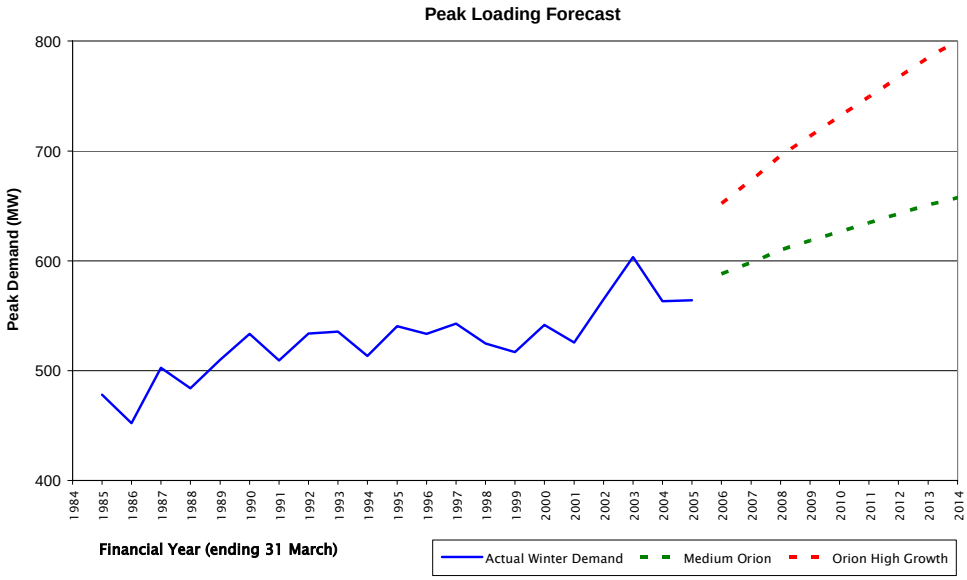
Orion has very little underground services outside the urban areas covered above, and has only installed underground reticulation (as an alternative to overhead):

- where required for safety reasons, as provided for in Handbook clauses B.7(b)(ii), B.9(b)(ii), and B.12(a)(ii)), such as conductors crossing a Transpower corridor; and
- where required by (and funded by) the consumer or TLA, as provided for in Handbook clauses B.7(b)(v), B.9(b)(v), and B.12(a)(v)), such as underground 11kV supplies across irrigated farm land.

The conclusion is that all underground reticulation within Orion's network is justified on the basis of the above criteria for justification, as quoted above, that are given in the Handbook. These requirements preclude the optimisation of underground cable assets to overhead line.

9.3 Loading Forecasts

For the purposes of meeting Orion's planning requirements, and also Transpower's upper South Island transmission planning, Orion produced a ten year load forecast during September 2004. The report develops forecasts based on the trend of peak loadings experienced over the last 20 years, Orion's estimate of the impact of Christchurch's clean air initiatives, and expected trend in load factor. The following graph and table illustrate the two main forecasts established in the report (high growth and medium growth):



Year ending 31 March	2005 Actual (MW)	2006 (MW)	2007 (MW)	2008 (MW)	2009 (MW)	2010 (MW)	2011 (MW)	2012 (MW)	2013 (MW)	2014 (MW)	2015 (MW)
High Growth	564.0	652.3	673.1	695.5	713.5	731.5	749.3	767.1	784.8	800.3	815.7
Medium Growth	564.0	588.2	598.4	609.9	618.2	626.4	634.6	642.8	650.8	657.3	663.8

Orion's medium forecast is considered the most likely scenario, and for planning purposes this has been adopted. All load forecasts in this ODV report also assume the medium forecast. Orion's peak demand for the year ending 31 March 2004 was 563.1MW. To produce a 15 year load forecast the medium growth scenario in the above table was extrapolated to the year ending 31 March 2019, reaching a load of 689.1MW. This results in the following 5, 10 and 15 year growth rates referenced in Handbook clause 2.30:

Five year load forecast:

1+ (618.2-563.1)/563.1 = 1.0978 = 1.96% per annum

Ten year load forecast:

1+ (657.3-563.1)/563.1 = 1.1673 = 1.67% per annum

Fifteen year load forecast:

1+ (689.1-563.1)/563.1 = 1.2237 = 1.49% per annum

The initially higher growth forecast is caused by the application of Environment Canterbury's Clean Air Plan which is encouraging older Christchurch homes to convert from fossil fuel burners to electrical heating.

Although load on Orion's network is not expected to grow evenly across all assets, the interconnected nature of the network allows load to be transferred between district substations and feeders and therefore the above growth rates have been applied evenly across the network.

The application of these forecasts against grid exit point loads, district substation loads and feeder loads (together with the 2004 loading levels) is shown in Appendix G to this report (pursuant to Handbook clause 2.27 and reporting requirement 2.65(l)).

In terms of Handbook clause 2.29 (and reporting requirement 2.65(m)), Orion has not included any separately identifiable new load or load increment exceeding 5% or 10MW in its forecasts. All load forecasts are based on Orion's projection of continuous load growth.

9.4 Network Configurations

The optimisation described in this section has been developed with reference to the *network configuration* considerations detailed in Handbook clauses B.2 to B.5. The resulting value impacts of each optimisation consideration are detailed in Appendix H to this report.

9.4.1 Supply Points (GXPs)

This section considers if, given Orion's Quality of Supply (QoS) Criteria, a lower network value could result if a GXP was eliminated and the load supplied from adjacent GXPs (refer Handbook clause B.2).

Orion has always taken into account existing Transpower assets when designing the distribution network. As such, where Transpower's assets, in conjunction with Orion's assets, can provide a quality of supply that meets Orion's QoS Criteria, Orion will not install additional assets which could be used to bypass the Transpower GXP. The only existing assets generally available to provide GXP bypass are those which are needed to meet Orion's QoS Criteria when including Transpower's existing assets.

The maps on the next page illustrate the geography of Orion's GXPs.

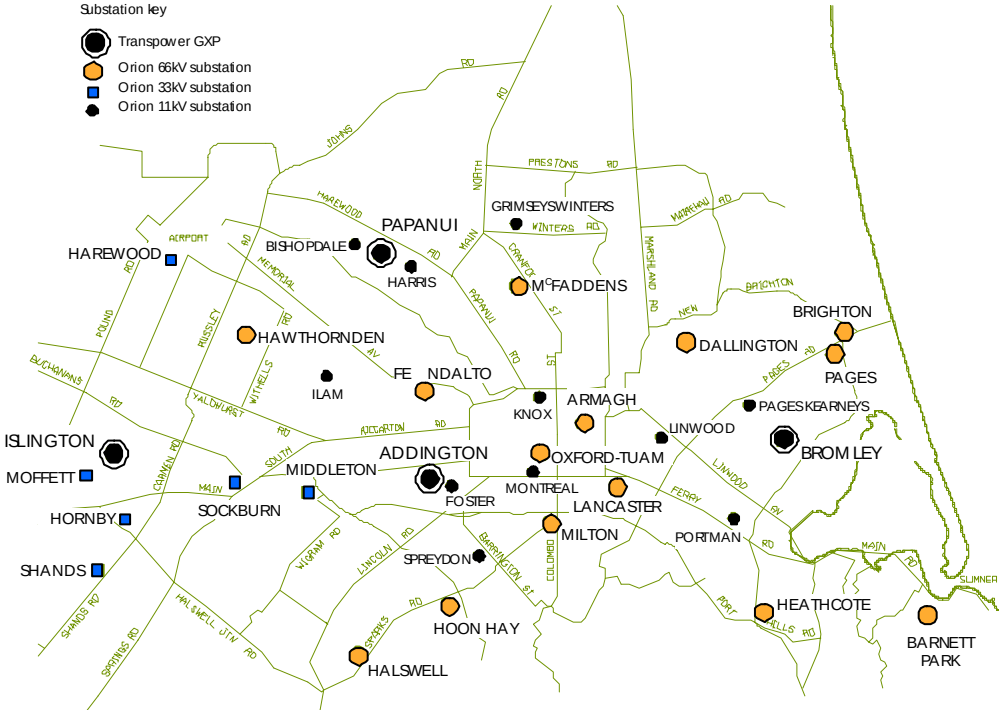
In all cases, to provide GXP bypass would require that Orion increase its network investment and thus its ODV. This consideration does not result in any optimisation.

Orion's current capability to bypass, by GXP, is as follows:

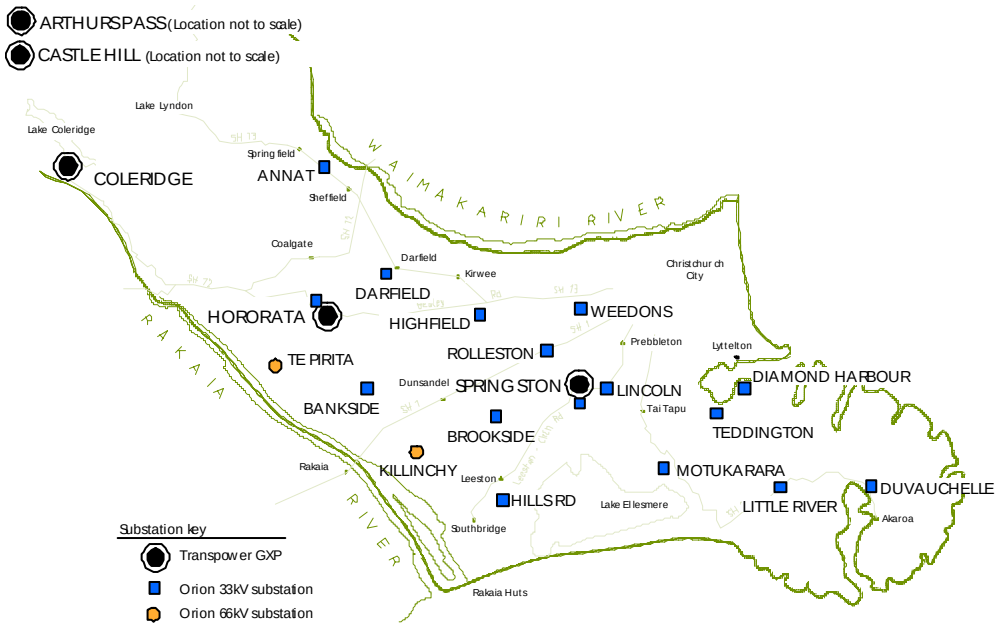
Grid Exit Point	Firm Capacity (MVA)	2004 Load (MW)	Notes	Orion's transfer capacity (MVA)	Nearest * alternative source
Islington 66kV	500	357	Supplies Papanui, Springston, Addington, Hororata, Coleridge, Castle Hill, Arthur's Pass (Partial)	20 at 66kV	Bromley 66kV (15.2km)
Islington 33kV	100	75		15 at 33kV	Springston 33kV (12.2km)
Addington 66kV	225	190	Supplies Addington 11kV	20 at 11kV	Papanui 66kV (5.3km) Bromley 66kV (8.0km)
Addington1 11kV	40	36		4 at 11kV	Addington 66kV Addington2 11kV
Addington2 11kV	60	30		20 at 11kV	Addington 66kV
Papanui 66kV	200	97	Supplies Papanui 11kV	15 at 11kV	Addington 66kV (5.3km)
Papanui 11kV	70	60		15 at 11kV	Papanui 66kV Addington 66kV (5.3km)
Bromley 66kV	134	161	Supplies Bromley 11kV	20 at 66kV	Islington 66kV (15.2km)
Bromley 11kV	60	56		20 at 11kV	Bromley 66kV
Springston 33kV	54	47		5 at 11kV & 15 at 33kV	Islington 33kV (12.2km) Hororata 33kV (39.3km)
Hororata 33kV	20	22		5 at 11kV	Springston 33 kV (39.3km)
Hororata 66kV	40	36		0	Islington 66kV (44.0km)
Coleridge 11kV	0.5	0.36		0	Castle Hill 11kV (23.4km)
Castle Hill 11kV	3.5	0.59		0	Coleridge 11kV (23.4km)
Arthur's Pass 11kV	3.5	0.32		0	Castle Hill 11kV (32.0km)

** Note that distances are provided "as the crow flies". Required circuit lengths would be longer.*

Orion's Urban Network - Location of GXPs



Orion's Rural Network - Location of GXPs



9.4.2 66kV and 33kV Subtransmission Circuits

This section considers whether the number of subtransmission circuits exceeds that which is required to meet Orion's QoS Criteria, and whether lower voltage circuits could notionally replace Orion's 66kV and 33kV (refer Handbook clause B.3).

Number of Circuits

Orion's QoS Criteria states that each district substation serving load above 10MVA shall have n-1 capability with no break in supply. Furthermore, for district substations with load below 10MVA, n-1 capability is required, but an interruption to supply is permitted whilst switching takes place to restore supply.

This level of security requires duplicated 66kV and 33kV subtransmission supplies to each of Orion's district substations. Some strategic sites (Lancaster, Armagh, Halswell and Heathcote) have additional subtransmission links (as opposed to feeders) and these are installed to provide transfer capability across the city during n-2 faults at Transpower's GXPs. The quantity of subtransmission links required is justified by the high utilisation of these assets during n-2 events. See Appendix G for subtransmission circuit loadings.

Subtransmission Voltage

The most cost effective subtransmission voltage is determined by a balance of parameters, such as the quantity of load, the load density, the distance of the load from Transpower's grid exit points, and network configuration. Due to the high load density experienced in Christchurch central city, it is cost effective to install fewer 66kV cables (at a greater per meter expense) than it is to install a larger number of 33kV cables (at a lower per meter expense). On the fringes of Christchurch city, load density is not as high and the use of 33kV cables and lines is more cost effective than installing long lengths of relatively lightly loaded 66kV cables.

In the rural network, there is a mixture of 33kV and 66kV lines, with 33kV being the most appropriate voltage for local (near to GXP) load and 66kV for remote loads (reduced voltage drop and losses).

Configuration Optimisation

A review of Orion's subtransmission configuration identified one instance where the network could be optimised. This optimisation occurs within the urban area on a double-circuit overhead line which runs from Heathcote, over a hilly region, to Barnett Park (a total of 3,982 metres). Constructed in 1971 using steel lattice towers with "wolf" conductor, each circuit can carry 525 amps at 66kV.

In this report, the depreciated replacement value of this arrangement totals $239,755.

Optimisation of this line has been considered for each of the following reasons:

- Orion currently operates one of the circuits at 11kV, with a capacity requirement of 490 amps (allowing for appropriate contingent loading and growth); and
- The other circuit is operated at 66kV but only requires a capacity of 14.7MVA (or 130 amps).

The obvious optimised construction is a single circuit steel tower 66kV line with a smaller ("hyena") conductor, and a single circuit "heavy" 11kV wooden pole line. The depreciated replacement value of this arrangement is $159,761 and $84,056 for the 66kV and 11kV lines respectively. As the total of these two values is greater than the value of the existing arrangement, this does not represent an optimised construction.

A lower value alternative can only be achieved by considering a smaller conductor size for the 66kV circuit (the 11kV circuit requires the full 525 amp capacity of the wolf conductor). This involves a steel tower double circuit construction, with a wolf conductor operating at 11kV and a hyena conductor operating at 66kV. The Transpower handbook provides unit replacement values for each construction allowing each circuit to be appropriately valued at half the double-circuit value. With this approach the 66kV hyena circuit is valued at $97,782 and the 11kV wolf circuit at $119,878. The total depreciated replacement value of $217,660 represents an optimisation of $22,096.

The optimisation result can be found under the heading of '66kV Line Capacity Utilisation in Appendix H.

9.4.3 District and Network Substations (Zone)

This section considers whether the *number* and *voltage* of district or network substations exceeds the level required to meet Orion's QoS Criteria allowing for future load growth (Handbook clause B.4(a)), and whether substation *configuration* exceeds Orion's requirements (Handbook clause B.4(b)).

District Substations

For district substations of loads greater than 10MVA, Orion's QoS Criteria require no interruption to supply for an n-1 event. The dual transformer configuration of most of Orion's district substations is a direct result of applying these criteria. There are a few sites (Harewood, Rolleston, Brookside and Duvauchelle) where the load is not above 10MVA, but two transformers are installed. In these cases, the extra transformer capacity is required to restore the load (as opposed to no break in supply) following an n-1 event at that substation, or at a neighbouring substation.

In terms of the quantity of district substations, the substation transformer loadings (see Appendix G) show that the utilisation of Orion's transformer capacity is high and that, with the exception of Barnett Park and Shands Road substations (see section 9.5.3), no optimisation is required on a capacity basis. The required quantity of district substations is largely determined by the quantity and location of load. Orion has not been able to identify any district substations which are either sufficiently underutilised, or inappropriately located, to the extent that their removal would result in a lower overall network value.

Section 9.4.2 shows that Orion's subtransmission voltages of 66kV and 33kV are, in all but one instance, appropriate for the characteristics found in Christchurch and Canterbury load. By default, the voltage level of our district substations is determined by the subtransmission voltage, that is, 66/11kV and 33/11kV and therefore no optimisation is required.

Network Substations

Orion's 11kV primary network includes 278 network substations. Each network substation comprises of at least three 11kV circuit breakers, and may also contain other 11kV switchgear. Network substations are 11kV, so no voltage optimisation is required.

Network substations provide facilities to connect primary cables to each other and to secondary cables. Primary network cables are normally operated in parallel. In order to facilitate this, each primary circuit is fitted with unit protection. Network substations also provide radial connection to secondary cables, and often incorporate a distribution substation.

Each 11kV network substation was considered for possible elimination on the basis that the 11kV network is built entirely using present technology and practices. The secondary cables that emanate from Orion's network substations previously had much smaller capacities (typically 109A) than those used today (180A or 230A). Consequently, the cables were configured in shorter runs, requiring more network substations. In assessing these, the main considerations were:

- Location of main loads and cable routes.
- Established subdivision of land.
- The load carried by the network substation and its proximity to another network centre or to the district substation or major switching station.
- Proximity of major customer connections.
- Number of primary cables terminating at the network centre. Generally, a network substation remained where there were more than two primary cables.
- Likely use of large capacity secondary cables.
- Opportunity for switching and back-up (eg from adjacent districts).

In total, 28 network substations are optimised and the results are entered in Orion's valuation model with the reference "Network Substation Replacement". In each case the optimisation involved removing the network substation equipment from the site. The site was then valued on the basis of any remaining equipment, such as a distribution substation. The total value of this optimisation is a reduction of $6,061,883 in replacement cost and a reduction of $1,889,462 in depreciated replacement cost. Refer to Appendix H for detail.

In terms of substation configuration, some network substations incorporate a split busbar design, providing flexibility with load shifting within Orion's meshed network, facilitating repair and maintenance work, and maintaining Orion's security standard detailed in the QoS. These split busbar arrangements are generally installed at key central network centres and near district substation boundaries. These configurations are necessary in order to meet Orion's supply security requirements. Therefore no optimisation is required.

In considering the configuration, Orion has identified 12 circuit breakers at district and network substations that are surplus to Orion's requirements during the next 15 years, and 1 circuit breaker at a district substation surplus to Orion's requirements during the next 5 years. These are optimised out under the heading "Excess Circuit Breakers" detailed in Appendix H. The value of this optimisation is a reduction of $360,000 in replacement cost and a reduction of $64,667 in depreciated replacement cost.

9.4.4 11kV Subtransmission

This section considers whether the *number* of 11kV feeder cables exceeds the required level to meet Orion's QoS Criteria (Handbook clause B.3). For example, Orion might be able to notionally replace three light size cables with two medium size cables.

Orion has identified points within its meshed 11kV subtransmission network that exceed the required level of security, and has individually considered the reduced number of circuits that might meet Orion's requirements. The analysis has identified four areas of optimisation with the result detailed in Appendix H under the heading "11kV Subtransmission Configuration". Where capacity optimisation (to a smaller size conductor) was also appropriate, this has been included in these optimisations.

In situations where this optimisation effectively removes a cable, Orion has also optimised any circuit breakers attached to that cable. The result is an optimised reduction in RC of $1,823,682, and a reduction in DRC of $1,165,705.

9.4.5 11kV Distribution

This section considers low capacity 11kV distribution lines, and whether 3-phase can be optimised to single phase (2 wire), or whether a single phase (2 wire) design could replace a SWER design (with an isolating transformer), as detailed in Handbook clause B.5.

Very low capacity or less than 3-phase 11kV lines

Orion has included 612.9km of single phase, 2 wire 11kV distribution line, and 7.5km of single phase, 2 wire 11kV *underbuilt* distribution line, as reported from Orion's GIS database. Refer to Appendix B13 for an explanation of some length estimations.

Handbook clause B.5 (a) states "*Three phase distribution spur lines in rural areas shall be optimised to single phase two wire lines where there are no existing three phase customers and it is possible to meet the ELB's quality of supply criteria with a two wire arrangement*". Such situations do not exist in Orion's network, to any material extent. The key reasons why such optimisation is not possible are:

- Most of Orion's core rural load (ie outside of towns) is irrigation pump motors. These all require 3-phase supplies;
- As connected customers on the fringes of Orion's network generally have to contribute towards the cost of extensions because Orion limits its investment in extensions, customers are motivated to pay the minimum amount and so a 1-phase line would be built, if possible;
- 3-phase spur lines are often required, particularly in rural situations, in order to provide sufficient voltage at the connection. Refer to section 4 in Orion's Quality of Supply Criteria (Appendix J).

Hence, no optimisation was appropriate.

Single wire earth return (SWER) circuits

Orion has 103.6km of SWER lines, configured in a number of separate systems on Banks Peninsula (as detailed in section 4.6.1 of Orion's Asset Management Plan 2005). They supply small 1-phase remote loads, typically with 5kVA or 7.5kVA transformers, in rugged locations. They are the appropriate configuration for these situations.

SWER is appropriate in rough terrain where clearances are difficult to achieve, and there are risks of multiple lines clashing together and the loading densities are very low. A single SWER line can traverse over gullies in big spans without clashing of the conductors during windy conditions. The geography and customer density must be considered when optimising networks that deliver electricity to customers in remote areas.

Handbook clause B.5 (b) states that SWER systems "*should be valued as if they were constructed using a light single phase two wire distribution circuit with the isolating transformer optimised out*". This is not an appropriate configuration for situations where SWER constructions are used. However, Orion has valued these 11kV SWER circuits on the prescribed basis as the entry in the Handbook table A.1 covers both – "*11kV single phase or SWER lines*". In addition, Orion has optimised out nine isolating transformers associated with these SWER systems (as listed under the heading "11kV SWER to Single Phase" in Appendix H). The SWER lines are valued using the prescribed unit replacement cost in Handbook table A.1, with location and terrain multipliers as appropriate. The subsequent optimisation of isolating transformers offsets this value, with a reduction of $38,600 in RC and $26,318 in DRC.

9.4.6 Streetlighting Circuits

Orion owns and maintains a significant lighting subnetwork for streetlighting and other outside lighting. The subnetwork connects to Orion's low voltage network at approximately 2,100 points, and supplies electricity to 38,176 lighting connections (supplying a total of 41,490 lights). Orion uses a ripple relay to switch the downstream lights at each of the points of connection to the low voltage network.

The lighting subnetwork includes a variety of circuit configurations as follows:

	Total Length (m)
Overhead	
On own	111,447
With low voltage (5th wire)	825,766
With high voltage (underbuilt)	52,407
Underground	
2-core & neutral screen on own	256,737
2-core & neutral screen with low voltage	362,479
5th core of low voltage reticulation	979,724
	2,588,560

Orion's current practice is to install street lighting reticulation as 5th core cabling for all new development and underground conversion projects. When the cost of (albeit normally customer-owned) switching devices are included, Orion considers that this configuration is the most cost effective way to provide the required level of control (meeting the switching requirement of the main customer, as detailed in the QoS Criteria).

The streetlighting subnetwork provides an electricity distribution service, core to Orion's business, and is integrated with Orion's electrical network. It is operated as a monopoly activity with prices that are subject to the Commerce Commission's price path threshold. However, Handbook clause A.25 specifically excludes a significant portion of Orion's streetlighting assets from its ODV. It states that *"circuits or other field equipment used exclusively for the control of street lights, or the supply of electricity to street lights in areas where LV reticulation is available, shall not be included in the valuation"*. The Commerce Commission has confirmed to Orion that these assets should be excluded via optimisation.

On this basis, Orion has optimised out all streetlighting 5th circuit and circuits buried with other low voltage, notionally replacing the circuits with individual connections to the low voltage network. Ripple control relays are also optimised out and the customer would be responsible for the provision of switching functionality in this hypothetical situation. Orion has estimated that this portion of its subnetwork feeds 15,562 overhead lighting connections and 16,378 underground lighting connections, and this quantity is notionally added with the same weighted average proportion of remaining life as the circuits they notionally replace (per Handbook clause 2.57).

Optimising out the circuits and ripple relays removes $9,867,148 in depreciated value. The notional low voltage connections replacing the circuit offset this amount by $2,978,812, providing a net optimisation reduction of $6,888,336. Appendix H includes details of this optimisation under the heading "Direct Connection of Streetlighting".

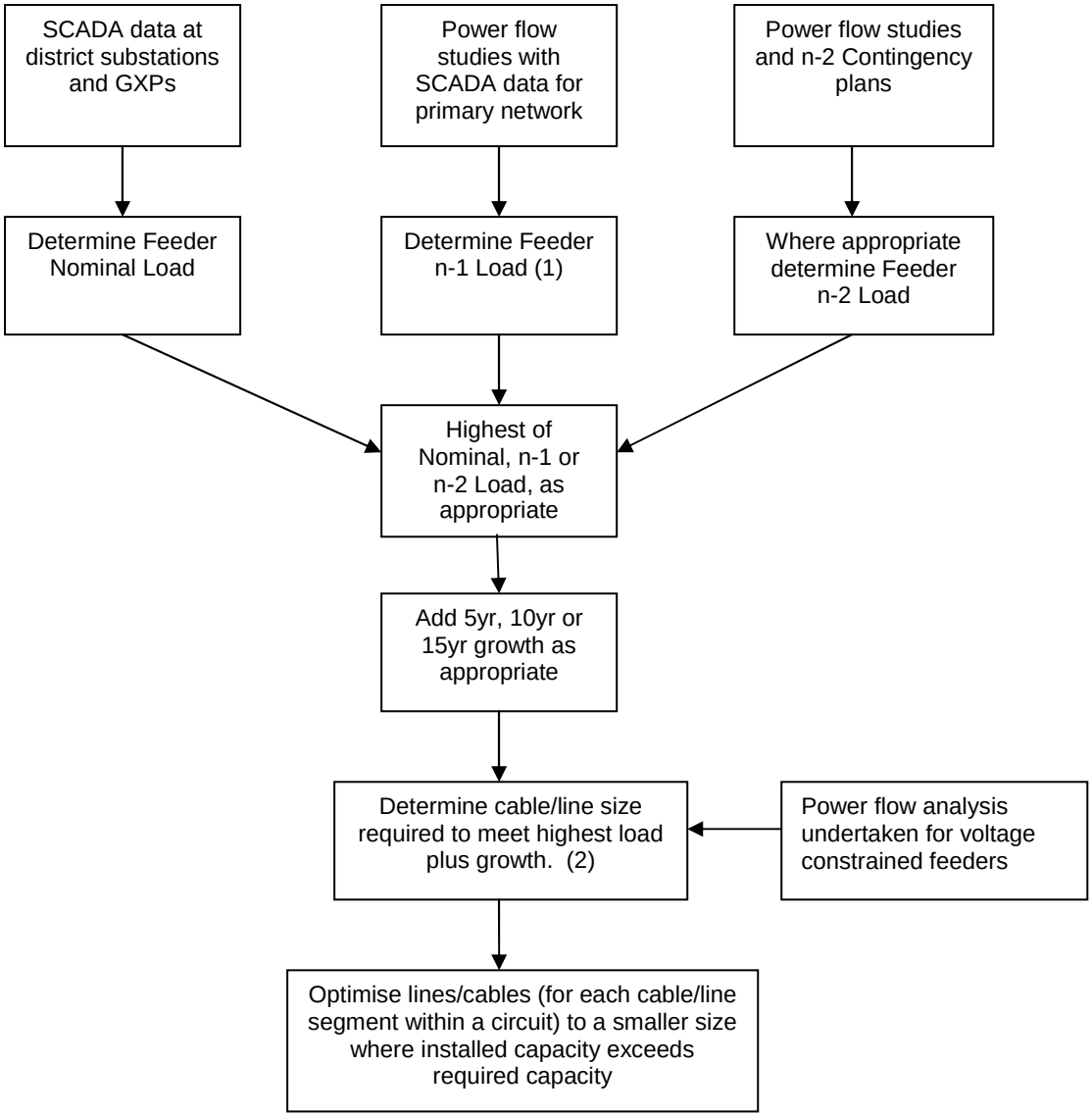
9.5 Network Capacity and Engineering

The optimisation described in this section has been developed with reference to the *network capacity and engineering* considerations detailed in Handbook clauses B.7 to B.13. The resulting value impacts of each optimisation consideration are detailed in Appendix H to this report.

9.5.1 High Voltage Subtransmission and Distribution

This section considers whether the *capacity* of 66kV, 33kV and 11kV subtransmission feeder and primary links cables and whether the capacity of 11kV distribution cables exceed the capability required to meet Orion's QoS Criteria (Handbook clause B.7(a) and B.9(a)).

The following flowchart describes the process for determining whether optimisation is required for each of Orion's 66kV, 33kV and 11kV feeders.



Notes

(1) n-1 loads for the secondary network were determined by assuming that Orion's secondary network is normally meshed with three feeds into one area and therefore an n-1 event will require the remaining two feeds to carry 150% of their nominal load.

(2) As many 11kV cables are laid in shared trenches and there are higher than normal ground thermal resistivities, the manufacturers' specified ratings for each cable type were de-rated to 85% and 95% of their standard ratings for primary and secondary cables respectively. De-rating factors were not applied to 66kV and 33kV subtransmission cables.

A full table of loads on Orion's 66kV, 33kV and 11kV subtransmission and distribution network feeders is available in Appendix G of this report. Because Orion does not have SCADA loading information on its 11kV primary links, the level (percentage of value basis) of optimisation applied to the 11kV primary feeders (by Handbook standard size) has been equally applied to the 11kV primary link network.

Appendix I details Orion's assessment of cable and line ratings used in this optimisation review. Note that the current ratings are listed prior to the addition of the de-rating factor noted in (2) above (where applicable).

The table below summarises the optimisation results for subtransmission capacity optimisation. A more detailed list of results is available in Appendix H of this report.

Optimisation Reference	Depreciated Optimisation
11kV Cable Capacity Optimisation	$6,652,701
11kV Cable Capacity Optimisation - primary links	$603,772
11kV Cable Capacity Optimisation (includes impact of shared trenching optimisation)	$1,077,458
11kV Line Capacity Optimisation - thermal	$170,727
11kV Line Capacity Optimisation - voltage drop	$244,021
Total	**$8,748,679**

Orion could not identify any optimisation requirement for the 66kV and 33kV subtransmission network.

9.5.2 Land and Buildings

Orion's network includes 1,811 land title sites and 331 buildings.

District Substation Land

Only land used or intended for use for network distribution purposes has been included in this valuation. Land occupied by corporate or domestic buildings, including Orion's Packe Street site, is excluded.
Orion has then individually considered the area of each district substation site, identifying unutilised land (Handbook clause B.8(b)) after allowing for:

- access to buildings and cables,
- clearance access for overhead lines,
- health and safety issues,
- storage requirements,
- parking for work related purposes,
- minimum distances from boundaries, and
- the 15 year planning period detailed in Handbook clause 2.30.

In terms of materiality, Orion has only optimised the land value in situations where the unutilised land exceeds 10% of the land area. This analysis identified a total of 11,753m^2 (or 12%) of unutilised land which has been optimised out based on the value of by area in proportion to the total area. The optimisation reduction in RC and DRC is $448,976 as shown under the heading "District Substation Land Area Optimisation" in Appendix H.

Network and Distribution Substation Land

Orion has 1,766 parcels of land associated with network and distribution substations and it is not practical to individually analyse each site. The vast majority of sites are only a few square metres and carry a nominal value; Orion considers that these sites will not include any unutilised land. Orion has identified the larger sites (those with a rateable valuation in excess of $12,000) and has individually considered them for optimisation. The engineering requirements for network and distribution substations differ from those of district substations above. Orion has identified spare land (to the nearest 5%) as any area not occupied by the substation, allowing for access, but assuming any replacement substation would be located on the road front of any site.

This analysis identified the unutilised percentage of each site by land area and the replacement cost of these sites is optimally reduced by this percentage. Of 87 sites considered, 10 sites were found to have an average of 59% unutilised land. The optimisation reduction in RC and DRC is $562,249 as shown under the heading "Network/Distribution Substation Land Optimisation" in Appendix H.

Within this set of 1,766 parcels of land, Orion has also identified 64 sites that are not currently used by the network, and have not specifically been identified as being required in the planning period (15 years for network substations, or 5 years for distribution substations). Orion considers this land as "investment" land, and has optimised it out of the ODV. The optimisation reduction in RC and DRC is $1,081,450 as shown under the heading "Network Land Exclusion" in Appendix H.

Network substation land is also affected by the optimisation of network substations considered in 9.4.3 above.

Unlike other optimised assets, land that is optimised out of Orion's ODV is considered to retain its value, and is instead regarded as "investment" land, and is included in Orion's financials alongside corporate and residential properties.

Buildings

Orion has valued buildings based on the replacement cost of the modern equivalent replacement, - buildings with simple standard modern construction of low cost design:

- District substation buildings are categorised by size and assigned uniform costs, according to size, as non-standard assets (refer section 8.3.2),
- network substation buildings are assigned the replacement cost (as a non-standard asset) of a basic block building (refer section 8.3.2), and
- distribution substation buildings are valued as if they are basic masonry kiosks (using the standard value in Handbook table A.1).

This *modern equivalent* approach effectively values the optimised construction of buildings, as required by Handbook clause B.8(b), which requires Orion to "*Optimise indoor substations to outdoor where land is available and where this will result in a more cost-effective design unless there are clear technical reasons or local authority requirements that prevent this*". Both of these apply, as explained in Orion's Quality of Supply Criteria (Appendix J, section 6.4), and so it would not be possible to further optimise indoor District and Network substations to outdoor. The categorised values derived for district substation buildings and network substation buildings are based on recent projects which Orion considers reflect the most cost-efficient standard of engineering, as required by Handbook clause B.8(c) B.8(d).

9.5.3 District Substation Transformer Capacity

This section considers whether the *capacity* of district substation transformers exceeds the level required to meet Orion's QoS Criteria. (Handbook clause B.8(a)).

Orion's network contains both dual and single transformer district substations:

- in the case of dual transformer substations, the worst case contingent load (n-1) that either of the transformers has to meet is simply the normal substation load, and
- in the case of single transformer sites, the worst case contingent load is determined by calculating the amount of contingent load that the transformer would need to support for failures of neighbouring single transformer sites (or dual sites where n-2 load applies), or 11kV feeder failures from neighbouring dual transformer sites.

On this basis, the worst case contingent loads have been determined, and then 10 years of growth has been applied to give the results as listed in Appendix G of this report.

The resultant 10 year contingent load was compared against each transformer's capacity to determine any level of surplus capacity. Consequently, the following two sites required transformer optimisation:

Site	Description	Depreciated Optimisation
Barnett Park	40MVA down to 23MVA	$73,013
Shands	2 x 23MVA down to 2 x 20MVA	$16,184
Total		**$89,198**

A more detailed table of this result can be found in Appendix H of this report.

9.5.4 Voltage Control Devices

Zone Substation Tap Changers

All Orion district substations are equipped with tap changers, either integral with the transformer, or as separate voltage regulators.

Tap changers are required at all district substations for three reasons:

(a) In the urban area, where two or more transformers are located in a zone substation, tap changers are required to provide voltage control on loss of a single transformer. At full load the change in voltage on loss of a transformer would result in customer supply voltages deviating outside statutory requirements.

(b) Subtransmission system voltages in both the urban and rural areas are controlled to maximise capacity and reliability, rather than for the purpose of maintaining distribution voltages. Consequently, system voltages may vary over quite a wide range, depending on system load and plant availability.

For all Orion's single transformer substations that are not located at a GXP, the voltage drop in the subtransmission system and district substation transformer under normal load conditions is such that, without tap changers, customer supply voltages would deviate outside statutory requirements.

Even where Orion building substations are located at a GXP, line drop compensation is applied on the GXP supply transformers to maximise subtransmission capacity to remote distribution substations. Thus, at high load periods, customer supply voltages would deviate outside statutory requirements if tap changers were not installed.

Line drop compensation is applied at most district substation to maximise utilisation of the 11kV and 400V distribution system. Removing voltage control capability would require additional investment in the distribution system. Orion considers that the cost of this additional investment would exceed the savings in removing voltage control equipment.

Inline Voltage Regulators

Orion has installed a number of inline 11kV voltage regulators in locations where distribution voltages may vary to the extent that delivery voltages deviate outside statutory voltage limits, either during maximum system loading or during n-1 contingencies. All existing voltage regulators are required to meet Orion's declared QoS Criteria. Installation of equipment to allow removal of this voltage regulation equipment would increase the ODV of Orion's network.

9.5.5 Distribution Transformers

Orion's distribution transformers all have voltage taps that are set manually (off-load). The tapping range is typically +2.5% to –7.5% in 5x2.5% steps. These are required in all cases to ensure that Orion can meet its voltage standard at consumer connections, given the expected 11kV input voltage range for a particular transformer's location. Refer to Orion's Quality of Supply Criteria (Appendix J, section 4).

Clause B.11 of the Handbook requires excess distribution transformer capacity to be optimised out so that the "*capacity utilisation ratio for the network is at a level judged to be efficient for the ELB, given its load and supply characteristics, but in any case not less than 30%*". Orion achieved 36% for year ending 31 March 2004. Furthermore, Orion achieves very high distribution transformer utilisations in its urban area and appropriate utilisations in its rural area, considering the much lower loading densities. Therefore, there is no need for Orion to optimise any distribution transformer capacity and no need to report on any separate network segments with non-coincident peak loads for distribution transformer capacity optimisation, as required by Handbook clause 2.65(q).

9.5.6 Cables Sharing Trenches

66kV and 33kV Cables

The segments of Orion's subtransmission network of 66kV and 33kV cables have been individually considered and valued as sharing a trench (double circuit) where appropriate. The result is 88.2% of 66kV cable by circuit length is in a shared trench and all 33kV cable is installed on its own. Generally, the level of security required in the subtransmission network requires physical separation of conductors. Orion considers that a new entrant replacing the network would aim to provide a greater level of physical separation than exists in Orion's network. On this basis, no further optimisation is appropriate.

11kV Cables

11kV cables can be installed with other 11kV cables either in a shared trench or as a double circuit arrangement. For maximum supply security, Orion's engineering practice is not to install 11kV cables with higher voltage cables. In situations where 11kV cables are installed with low voltage cables, the 11kV cable is considered the primary conductor and is allocated the full cost of installation, whereas the low voltage conductor is assigned only the marginal cost of installation.

Orion has estimated the proportion of its subtransmission and distribution 11kV cables that are installed in a shared trenching arrangement (as detailed in Appendix B9 to this report) and valued its cable on this basis. The analysis required for the estimate also identified a further proportion of cables installed on their own, but in close proximity to other cables, and *able to share a trench* (generally cables on the same side of a road or street). As detailed in Appendix B9, 5.7% of 11kV subtransmission and 6.8% of 11kV distribution cables are able to share a trench. Orion has optimised random segments, in these proportions, to the lower cost of double circuit installation. The randomised selection approach allows the optimisation to be spread across segments with different ages, different sizes and five different combinations of valuation multipliers. It also allows the result of subsequent optimisation considerations (for example, capacity optimisation to smaller size cables) to apply to the appropriately reduced value of assets.

The net result of optimisation is detailed under the headings "11kV Cable Shared Trenching" in Appendix H to this report, summarised as follows:

- The first section covers cable segments that are only affected by this shared trenching optimisation with a reduction in RC of $3,714,860, and a corresponding reduction in DRC of $2,257,095.
- The second section, headed "11kV Cable Shared Trenching ...and... 11kV Cable Capacity Optimisation", covers cable segments that are affected by both shared trenching and capacity optimisation (detailed in 9.5.1 above). Noting the interaction between the two optimisations, Orion's valuation model only provides the net effect of both considerations: a reduction in RC of $1,762,789, and a reduction in DRC of $1,077,458.

Low voltage cables

Low voltage cables can be installed with 11kV cables, or share a trench with other low voltage cables. Orion has estimated the *optimal* proportion of its low voltage cable network that utilises shared trenching as 28% based on detailed analysis of recent new subdivisions (as detailed in Appendix B8 to this report).

Based on the history of Orion's construction methods, this optimal proportion of shared trenching is applied to all cables installed from 1987 onwards. Prior to 1987, all cables are valued on the basis of being installed on their own (as installation was mainly undertaken with chain diggers), and this gives rise to an optimisation consideration as detailed in Handbook clause B.9(c).

The optimisation has been applied against randomly selected segments until the correct optimal proportion was achieved (28%). The randomised selection approach allows the optimisation to be spread across segments with different ages, different sizes and five different combinations of valuation multipliers.

The net result of optimisation is detailed under the heading "LV Cable Shared Trenching" in Appendix H to this report. The reduction in RC is $8,883,626, with a corresponding reduction in DRC of $3,749,423.

9.5.7 Low Voltage Distribution

Orion's Quality of Supply Criteria (Appendix J, section 6.7) explains Orion's LV distribution asset requirements, mainly in relation to security and reliability. Orion is also obliged, as stated in the QoS Criteria (Appendix J, section 1) to provide delivery services in accordance with 'Good Industry Practice'.

Accordingly, Orion provides some LV interconnection facilities via link boxes to provide some alternative delivery routes. Their implementation is included in Orion's design standards. Isolation and/or fusing are also used at the output of distribution transformers and at each connection, with suitable discrimination. These are essential for the isolation of faults, either on an LV feeder or within a connected customer's installation. Orion considers these arrangements for interconnection and fusing are features of Good Industry Practice and are sensibly employed on extensive urban networks for the reasons given above. Overall, these requirements also determine the sizes used by Orion for cables and lines.

Clause B.12 (a) of the Handbook considers the issue of whether LV underground cables are justified. Section 9.2 of this report provides this justification.

Clause B.12 (b) of the Handbook considers the issue of LV underground distribution trenching. Section 9.5.6 has covered this issue and explained Orion's optimisation for this reason.

Clause B.12 (c) of the Handbook considers the issue of "*whether the configuration and engineering of the low voltage distribution network exceeds the standard required to meet the ELB's quality of supply criteria*". Recent projects are to be used as a benchmark for this test. Accordingly, Orion has considered the LV network configuration and engineering for recent projects compared with the established network and concluded that there is not any material or radical difference to warrant any notional reconfiguration.

Therefore, overall, there has not been any further optimisation for LV Distribution.

9.5.8 System Control

Orion's SCADA (Supervisory Control & Data Acquisition) master station implements industry standard distribution SCADA functionality including a load management application for automatic control of network load by use of the ripple control system.

The master station retrieves field data (digital, analogue and counters) and provides remote control of field devices such as circuit breakers, tap changers, generators and the ripple control system. It provides an interface for the control centre operators via alarms, event logging and the presentation of real time data.

Orion's SCADA design standard requires the retrieval of feeder circuit breaker status including, as a minimum, the following indications - open/closed, in/out of service, local/remote control, closed in circuit earth position, and load current. For zone substation transformers, the status of all transformer protection is returned including tap changer position. Other miscellaneous status points returned are status of the local battery and substation security. Remote control is implemented on feeder and transformer circuit breakers and transformer tap changers.

Until recently all SCADA indications and control were implemented via hardwired connections between industry standard SCADA RTUs and the field devices. From a cost point of view, apart from a fixed cost for provision of the basic RTU, costs increased approximately linearly with the addition of each additional I/O point.

Recent availability of Intelligent Electronic Devices (IEDs) with inbuilt SCADA capable communications has meant that in recent substations, the traditional SCADA RTU has been reduced to the role of a data concentrator with all physical I/O being located in the IEDs on the substation equipment itself. These devices are able to provide large amounts of information/indications at very low incremental cost simply requiring database configuration to provide the additional functionality.

These facilities are needed for Orion to meet its supply security standard, its voltage regulation and its reliability performance targets. No functionality can be optimised out, but the cost of Modern Equivalent Assets (MEA) has been used for valuation.

Orion's ripple control system is justified economically on the basis of the value of deferring investment in capacity that would otherwise be required during peak loading. This is documented in the Quality of Supply Criteria, section 6.10. The further functions of outside lighting control and revenue meter switching provide further incremental benefits at low cost. These are all used daily. There is no case for optimising out any of the assets involved. The injection plants are located at District Substations.

9.5.9 Stores, Spares and Stranded Assets

Stores and Spares

While Handbook clauses 2.6 and 2.7 specifically provide for the inclusion of an appropriate quantity of stores and spares, clause 2.43 effectively limits this to stores and spares required to meet Orion's disclosed QoS Criteria. On this basis, Orion has identified items held as emergency spares within its stock of spares, and has only included these in this valuation. No further optimisation is required.

Stranded Assets

Stranded assets are assets that were previously required, are still in place, but are no longer used. Orion has valued only assets that were in service at 31 March 2004. Hence, the values of any stranded assets are excluded from Orion's valuation.

Some assets that have previously been in service are retained as (and valued as) spares, although these items are not considered "stranded assets" as they have not remained in place (for example, voltage regulators).

9.6 Optimisation Summary

As detailed in this section, Orion has applied all optimisation considerations detailed in clauses 2.18 through 2.44 and Appendix B of the Handbook. In addition to these major considerations, Orion has applied a small amount of optimisation in relation to removal of all its sub-circuit maximum demand meters, and removal of duplication in battery equipment at district substations. In summary:

Optimisation Reference	Optimisation ($)	Depreciated Optimisation ($)
66kV Line Capacity Utilisation	$56,523	$22,096
11kV Cable Capacity Optimisation	$10,848,991	$6,652,701
11kV Cable Capacity Optimisation - primary links	$905,952	$603,772
11kV Cable Shared Trenching	$3,714,860	$2,257,095
11kV Cable Shared Trenching ...and... 11kV Cable Capacity Optimisation	$1,762,789	$1,077,458
11kV Line Capacity Optimisation - thermal	$334,277	$170,727
11kV Line Capacity Optimisation - voltage drop	$423,766	$244,021
11kV SWER to Single Phase	$38,600	$26,318
11kV Subtransmission Configuration	$1,823,682	$1,165,705
Power Transformer Capacity	$205,782	$89,198
District Sub Standardised Battery Arrangement	$23,740	$10,362
District Substation Land Area Optimisation	$448,976	$448,976
Network Land Exclusion	$1,081,450	$1,081,450
Network/Distribution Substation Land Optimisation	$562,249	$562,249
Network Substation Replacement	$6,061,003	$1,889,462
Excess Circuit Breakers	$360,000	$64,667
Distribution Sub Circuit MDIs	$1,108,874	$288,138
LV Cable Shared Trenching	$8,883,626	$3,749,423
Direct Connection of Streetlighting	$11,634,649	$6,888,336
	$50,279,789	$27,292,154

10 Economic Value

10.1 Potentially Uneconomic Assets

Pursuant to clause 2.59 of the Handbook, Orion has used the EV analysis for its recalibrated and certified ODV as at 31 March 2001 as a guide to whether a comprehensive EV test is required. This analysis identified Orion's potentially uneconomic assets per the method prescribed in the previous ODV Handbook (4th edition, issued by MED, October 2000). The process considered network segments with low densities of consumers (≤3 ICPs per km) or installed transformer capacities (<20kVA per ICP). Results in 2001 were:

Assessment of 11kV segments		Feeders	Spurs	Total
Number identified from prescribed density criteria.		7	82	89
Number remaining after elimination of segments that were clearly economic, using conservatively high ODRCs of 11kV lines.		4	28	32
Number after application of EV test	*Economic*	2	10	12
	Uneconomic	2	18	20

These segments are located in the remote rural parts of Orion's network. There would have generally been some growth in volumes of electricity delivered. In most instances, there has not been any significant development. Where Orion has invested in more assets, this would be to provide additional capacity for new irrigation loads, improving the economic position of the segment. Therefore, the 32 potentially uneconomic segments identified previously provide a suitable set of potentially uneconomic assets to consider for the 2004 ODV.

Pursuant to Handbook clause 2.65(r), using the basis described above, Orion has reviewed its system fixed assets base and identified assets that are potentially uneconomic.

10.2 Immaterial Economic Adjustment

The EV adjustment in the recalibrated and certified ODV at 31 March 2001 was $1.798m, which was 0.41% of the ODRC of $437.3m.

Orion has rerun the EV test analysis, with suitable updating of some data. The result is a calculated EV adjustment of $3.235m, which is 0.56% of the ODRC of $580m. The key aspects of the previous and updated EV adjustment calculations are as follows:

Parameter	Date of ODV		
	31 Mar 2001 (recalibrated)	31 Mar 2004	
ODV	435,510		k$
EV Adjustment	1,798	3,235	k$
ODRC	437,308	580,220	k$
EV adjustment/ODRC	0.41%	0.56%	
Profit maximising line tariff [1]	30.0	30.0	c/kWh
Average transmission cost	1.20	1.13	c/kWh
WACC	7.6%	7.6%	
Feeders & spurs:			
Number economic	12	7	
Number uneconomic	20	25	
Total number segments potentially uneconomic	32	32	
RC of 11kV lines [2]	8,182	10,228	k$
ODRC of assets in segments	6,376	7,595	k$
Annual volume delivered [3]	3,019	3,261	MWh
Total useful life of assets [4]	45	52	years

Notes:

1. Maximum profit maximising tariff prescribed in previous Handbook. This represents the expected cost, per unit, of electricity generated by a diesel generator, less 5c/kWh for the energy component.
2. Assumed 25% increase from 2001 to 2004.
3. Assumed 8% increase from 2001 to 2004.
4. Updated recognition of mix of concrete (48% with 60yr life) and wood (52% with 45yr life) pole 11kV lines.
5. The average tax depreciation expense rate is corrected from assuming an asset life of 45 years in the 2001 calculation to 25 years in the 2004 calculation.

Pursuant to Handbook clause 2.65(r) and as provided for in Handbook clause 2.61, Orion has not undertaken a comprehensive EV test on any of its network assets (ie reworked and updated data in detail) because it is satisfied that a comprehensive EV analysis of potentially uneconomic assets would not result in an ODV of its system fixed assets that is materially less than the ODRC of its system fixed assets. Orion has estimated the EV adjustment at 0.56% of ODRC. The basis for our conclusion is as described above.

Appendix A
Valuation Asset Base

This appendix provides a schedule of all assets in Orion's valuation model. It is been developed in the form of Handbook table A.1, listing all standard assets detailed in the Handbook, plus non-standard assets added by Orion. Pursuant to the reporting requirements in Handbook clause 2.65(a) and 2.65(b), the schedule includes quantity, replacement cost (RC), depreciated replacement cost (DRC), optimised replacement cost (ORC), optimised depreciated replacement cost (ODRC), and optimised depreciated value (ODV) for each asset type. For completeness, the schedule also includes optimised quantities.

In terms of Handbook clause 2.63, Orion has determined that a comprehensive economic value (EV) test is not required (refer to section 10.2). On this basis, Orion's ODV is equivalent to its ODRC, as detailed in the schedule.

Note:

- Some assets show higher optimised quantities and values than their pre-optimisation levels. This is an expected result of optimisation and occurs in two ways. Firstly, when an asset is optimised to a smaller size, the quantity of the smaller size asset will *increase* by the same amount that the quantity of the larger size asset decreases. Similarly, when an asset is notionally replaced with an item of lower cost, the quantity of the lower cost item will increase.
- Orion has excluded some *classes* of standard assets from the schedule where there are none of the items installed in the network. For example, Orion does not have any 22kV assets and these entries are excluded. Individual standard asset entries (within an asset class) with nil quantities are not excluded.
- As detailed in the Handbook, quantities are not shown for stores and spares, although they are largely disaggregated into asset classes, and shown as separate line items.

Schedule of Modern Equivalent Assets (Quantities and Values)

Asset	(Handbook entry)	Quantity	Replacement Cost	Depreciated Replacement Cost	Optimised Quantity	Optimised Replacement Cost	Optimised Depreciated Replacement Cost - Optimised Deprival Value
Subtransmission							
66kV Subtransmission Lines							
66kV OH Heavy (Dcst Wolf)		59,428 m	$4,691,819	$745,634	55,446 m	$4,385,156	$625,757
66kV OH Heavy (Dcst Hyena)		0 m	$0	$0	3,982 m	$250,139	$97,782
66kV OH Medium (Single circuit wooden pole)		37,734 m	$3,187,768	$3,010,670	37,734 m	$3,187,768	$3,010,670
66kV Subtransmission Lines Subtotal		97,162 m	$7,879,587	$3,756,304	97,162 m	$7,823,064	$3,734,209
66kV OH Spares			$22,696	$22,696		$22,696	$22,696
66kV Subtransmission Cables							
66kV UG Extra Heavy		7,278 m	$10,243,130	$9,521,316	7,278 m	$10,243,130	$9,521,316
66kV UG Heavy		75 m	$74,652	$70,505	75 m	$74,652	$70,505
66kV UG Heavy Dcct		55,210 m	$40,114,678	$23,166,254	55,210 m	$40,114,678	$23,166,254
66kV Subtransmission Cables Subtotal		62,563 m	$50,432,460	$32,758,075	62,563 m	$50,432,460	$32,758,075
66kV UG Spares			$806,965	$806,965		$806,965	$806,965
33kV Subtransmission Lines							
33kV OH Heavy	*(33 kV Lines - Heavy (≥150mm2, ≤300mm2 Al))*	8,749 m	$822,356	$269,716	8,749 m	$822,356	$269,716
33kV OH Light	*(33 kV Lines - Light (<150mm2 Al))*	312,810 m	$14,928,467	$7,911,874	312,810 m	$14,928,467	$7,911,874
33kV OH Heavy Dcct	*(33 kV Lines - Dcct Heavy (≥150mm2, ≤300mm2 Al))*	0 m	$0	$0	0 m	$0	$0
33kV OH Light Dcct	*(33 kV Lines - Dcct Light (<150mm2 Al))*	0 m	$0	$0	0 m	$0	$0
33kV Subtransmission Lines Subtotal		321,559 m	$15,750,823	$8,181,590	321,559 m	$15,750,823	$8,181,590
33kV OH Spares			$8,629	$8,629		$8,629	$8,629
33kV Subtransmission Cables							
33kV UG Heavy		21,625 m	$4,272,099	$3,221,848	21,625 m	$4,272,099	$3,221,848
33kV UG Medium	*(33 kV Cables (≤240mm2 Al))*	344 m	$60,200	$40,030	344 m	$60,200	$40,030
33kV UG Medium Dcct	*(33 kV Cables Dcct (≤240mm2 Al))*	0 m	$0	$0	0 m	$0	$0
33kV Subtransmission Cables Subtotal		21,969 m	$4,332,299	$3,261,878	21,969 m	$4,332,299	$3,261,878
33kV UG Spares			$85,780	$85,780		$85,780	$85,780

Asset (Handbook entry)	Quantity	Replacement Cost	Depreciated Replacement Cost	Optimised Quantity	Optimised Replacement Cost	Optimised Depreciated Replacement Cost - Optimised Deprival Value
33kV Subtransmission						
33kV Isolation (33 kV Isolation)	24 No.	$216,000	$79,843	24 No.	$216,000	$79,843
33kV Surge Arresters (3ph) (33 kV Surge Arresters (3ph))	8 No.	$64,000	$49,371	8 No.	$64,000	$49,371
33kV Subtransmission Subtotal	32 No.	$280,000	$129,214	32 No.	$280,000	$129,214
11kV Subtransmission Lines						
11kV OH Heavy (SubT) (11kV OH Lines - Heavy (≥150mm2, ≤240mm2 Al))	38,010 m	$1,602,744	$900,608	9,063 m	$356,146	$278,670
11kV OH Medium (SubT) (11kV OH Lines - Medium (>50mm2, <150mm2 Al))	27,531 m	$1,128,651	$546,682	24,864 m	$1,011,045	$524,824
11kV OH Light (SubT) (11kV OH Lines - Light (≤50mm2 Al))	158 m	$6,161	$2,549	31,741 m	$1,115,272	$523,099
11kV OH Single Phase (SubT) (11kV OH Lines - Single Phase or SWER)	213 m	$5,868	$4,768	213 m	$5,868	$4,768
11kV OH Heavy Dcct (SubT) (11kV OH Lines - Heavy Dcct (≥150mm2, ≤240mm2 Al))	0 m	$0	$0	0 m	$0	$0
11kV OH Medium Dcct (SubT) (11kV OH Lines - Medium Dcct (>50mm2, <150mm2 Al))	0 m	$0	$0	0 m	$0	$0
11kV OH Light Dcct (SubT) (11kV OH Lines - Light Dcct (≤50mm2 Al))	0 m	$0	$0	0 m	$0	$0
11kV Subtransmission Lines Subtotal	65,912 m	$2,743,424	$1,454,606	65,881 m	$2,488,330	$1,331,360
11kV OH Spares		$9,074	$9,074		$9,074	$9,074
11kV Subtransmission Cables						
11kV UG Extra Heavy SubT	17,499 m	$3,800,371	$2,068,539	5,733 m	$878,942	$488,371
11kV UG Heavy SubT (11kV UG Cables - Heavy (>240mm2, ≤300mm2 Al))	67,367 m	$9,089,935	$5,428,273	38,650 m	$4,556,496	$2,601,518
11kV UG Medium SubT (11kV UG Cables - Medium (>50mm2, ≤240mm2 Al))	12,449 m	$1,728,885	$657,177	20,094 m	$2,485,525	$1,227,711
11kV UG Light SubT (11kV UG Cables - Light (≤50mm2 Al))	0 m	$0	$0	2,424 m	$204,667	$102,809
11kV UG Extra Heavy Dcct SubT	111,097 m	$18,829,844	$9,832,601	83,940 m	$14,257,372	$7,214,382
11kV UG Heavy Dcct SubT (11kV UG Cables - Heavy Dcct (>240mm2, ≤300mm2 Al))	358,255 m	$33,027,556	$19,578,036	311,252 m	$28,735,956	$16,996,762
11kV UG Medium Dcct SubT (11kV UG Cables - Medium Dcct (>50mm2, ≤240mm2 Al))	56,488 m	$5,013,897	$1,926,291	134,940 m	$11,022,752	$5,342,157
11kV UG Light Dcct SubT	0 m	$0	$0	14,268 m	$764,429	$476,048
11kV Subtransmission Cables Subtotal	623,155 m	$71,490,487	$39,490,916	611,302 m	$62,906,139	$34,449,759
11kV UG Spares		$2,801	$2,801		$2,801	$2,801
Communications						
Comms OH (Pilot/Communications Cct O/H)	0 m	$0	$0	0 m	$0	$0
Comms UG (Pilot/Communications Cct U/G)	1,031,266 m	$15,695,869	$5,676,390	1,031,266 m	$15,695,869	$5,676,390
Communications Subtotal	1,031,266 m	$15,695,869	$5,676,390	1,031,266 m	$15,695,869	$5,676,390
GXP Check Metering	9 No.	$262,844	$204,069	9 No.	$262,844	$204,069
Subtransmission Subtotal		$169,803,738	$95,848,987		$160,907,772	$90,662,489

Asset (Handbook entry)	Quantity	Replacement Cost	Depreciated Replacement Cost	Optimised Quantity	Optimised Replacement Cost	Optimised Depreciated Replacement Cost - Optimised Deprival Value
Zone Substations (District & Network)						
Zone Substation Land (Land)	50 No.	$6,795,024	$6,795,024	50 No.	$6,129,423	$6,129,423
Site Development and Buildings						
Network Sub-Orion Owned (Site Development and Buildings)	197 No.	$20,008,896	$5,206,376	173 No.	$17,571,264	$4,808,229
Network Sub-On Customer's Premises (Site Development and Buildings)	78 No.	$824,304	$294,636	76 No.	$803,168	$291,360
District Sub-11kV Urban (Site Development and Buildings)	11 No.	$3,157,000	$1,285,760	11 No.	$3,157,000	$1,285,760
District Sub-66or33kV wth Outdoor Struct (Site Development and Buildings)	24 No.	$6,976,248	$3,697,411	24 No.	$6,976,248	$3,697,411
District Sub-Sml 66or33kV wth Outdoor Struct (Site Development and Buildings)	3 No.	$611,118	$332,041	3 No.	$611,118	$332,041
District Sub-66kV or 33kV Indoor (Site Development and Buildings)	11 No.	$4,235,000	$1,401,400	11 No.	$4,235,000	$1,401,400
District Sub-Block Building (Site Development and Buildings)	17 No.	$1,547,000	$705,250	17 No.	$1,547,000	$705,250
District Sub-Individually Assessed Structure (Site Development and Buildings)	1 No.	$943,866	$896,673	1 No.	$943,866	$896,673
Site Development and Buildings Subtotal	342 No.	$38,303,432	$13,819,546	316 No.	$35,844,664	$13,418,124
Transformers						
66/11kV 20/40MVA (Transformers)	23 No.	$21,770,190	$11,855,288	22 No.	$20,823,660	$11,468,789
66/11kV 11.5/23 MVA (Transformers)	0 No.	$0	$0	1 No.	$767,722	$313,486
66/11kV 7.5/10MVA (Transformers)	2 No.	$1,261,980	$1,209,398	2 No.	$1,261,980	$1,209,398
33/11kV 11.5/23MVA (Transformers)	6 No.	$3,456,402	$2,141,049	4 No.	$2,304,268	$1,449,769
33/11kV 10/20MVA (Transformers)	4 No.	$2,250,320	$1,312,687	6 No.	$3,375,480	$1,987,783
33/11kV 7.5/10MVA (Transformers)	1 No.	$523,374	$484,121	1 No.	$523,374	$484,121
33/11kV 7.5MVA (Transformers)	15 No.	$7,595,850	$3,295,755	15 No.	$7,595,850	$3,295,755
33/11kV 2.5MVA (Transformers)	4 No.	$1,695,680	$897,297	4 No.	$1,695,680	$897,297
33/11kV 1.5MVA (Transformers)	1 No.	$395,701	$36,273	1 No.	$395,701	$36,273
33/11kV 0.75MVA (Transformers)	1 No.	$372,462	$294,866	1 No.	$372,462	$294,866
11kV Regulator (20MVA) (Voltage Regulator)	3 No.	$602,038	$136,827	3 No.	$602,038	$136,827
11kV Regulator (4MVA) (Voltage Regulator)	13 No.	$2,132,041	$1,435,962	13 No.	$2,132,041	$1,435,962
Transformers Subtotal	73 No.	$42,056,038	$23,099,522	73 No.	$41,850,256	$23,010,324

Asset (Handbook entry)	Quantity	Replacement Cost	Depreciated Replacement Cost	Optimised Quantity	Optimised Replacement Cost	Optimised Depreciated Replacement Cost - Optimised Deprival Value
66kV Circuit Breaker	28 No.	$1,894,732	$1,169,922	28 No.	$1,894,732	$1,169,922
66kV A B Isolator	36 No.	$499,932	$251,702	36 No.	$499,932	$251,702
66kV A B Isolator with E/Sw	22 No.	$363,924	$176,586	22 No.	$363,924	$176,586
33kV Indoor Switchgear Cubicle (33kV Indoor Switchgear Cubicle)	0 No.	$0	$0	0 No.	$0	$0
33kV Bus Section/Coupler Indoor Switchgear (33kV Bus Section/Coupler Indoor Switchgear)	0 No.	$0	$0	0 No.	$0	$0
33kV Circuit Breaker (33kV Outdoor Circuit Breakers)	44 No.	$1,980,000	$636,188	44 No.	$1,980,000	$636,188
33kV A B Isolator	149 No.	$772,267	$196,501	149 No.	$772,267	$196,501
11kV Circuit Breaker (District & Network Sub) (11kV Indoor Switchgear Cubicle)	1,527 No.	$45,810,000	$12,140,666	1,422 No.	$42,660,000	$11,445,667
11kV Circuit Breaker Sealed (District & Network Sub) (11kV Indoor Switchgear Cubicle)	394 No.	$11,820,000	$10,759,090	386 No.	$11,580,000	$10,543,636
11kV Outdoor Circuit Breaker (District & Network Sub) (11kV Outdoor Circuit Breaker)	0 No.	$0	$0	0 No.	$0	$0
11kV Circuit Breaker Spares		$1,039,662	$1,039,662		$1,039,662	$1,039,662
Incoming Outdoor Switchgear (Incoming Outdoor Switchgear)	0 No.	$0	$0	0 No.	$0	$0
Transformer Outdoor Switchgear (Transformer Outdoor Switchgear)	0 No.	$0	$0	0 No.	$0	$0
Feeder Outdoor Switchgear (Feeder Outdoor Switchgear)	0 No.	$0	$0	0 No.	$0	$0
Bus Section/Coupler Outdoor Switchgear (Bus Section/Coupler Outdoor Switchgear)	0 No.	$0	$0	0 No.	$0	$0
Incoming Circuit Protection & Controls						
66kV Unit Protection (with intertrip)	36 No.	$1,672,812	$814,334	36 No.	$1,672,812	$814,334
Directional Overcurrent Relay (with CB fail)	25 No.	$217,750	$149,050	25 No.	$217,750	$149,050
Incoming Circuit Protection & Controls Subtotal	61 No.	$1,890,562	$963,384	61 No.	$1,890,562	$963,384
Transformer Protection and Controls						
Transformer Diff Protection & Control (+intertrip)	15 No.	$1,329,060	$477,354	15 No.	$1,329,060	$477,354
Transformer Diff Protection & Control	43 No.	$2,414,235	$1,621,889	43 No.	$2,414,235	$1,621,889
Transformer Protection and Controls Subtotal	58 No.	$3,743,295	$2,099,243	58 No.	$3,743,295	$2,099,243
Feeder Protection and Controls						
11/33kV Feeder Protection (with OC & EF)	12 No.	$218,352	$115,545	12 No.	$218,352	$115,545
11/33kV Unit Protection (with OC)	348 No.	$3,612,240	$1,375,350	348 No.	$3,612,240	$1,375,350
11/33kV Unit Protection	720 No.	$3,780,000	$1,594,098	720 No.	$3,780,000	$1,594,098
11kV Protection (with OC & EF)	697 No.	$4,450,345	$1,790,036	697 No.	$4,450,345	$1,790,036
11kV Protection (with OC, EF, reclose & CB fail)	83 No.	$876,065	$567,991	83 No.	$876,065	$567,991
Feeder Protection and Controls Subtotal	1,860 No.	$12,937,002	$5,443,019	1,860 No.	$12,937,002	$5,443,019

Asset (Handbook entry)	Quantity	Replacement Cost	Depreciated Replacement Cost	Optimised Quantity	Optimised Replacement Cost	Optimised Depreciated Replacement Cost - Optimised Deprival Value
Bus Section/Coupler Protection and Controls						
Bus Bar Protection Relay	30 No.	$940,350	$490,157	30 No.	$940,350	$490,157
Bus Section/Coupler Protection and Controls Subtotal	30 No.	$940,350	$490,157	30 No.	$940,350	$490,157
Outdoor Structure						
Structure 66kV - Incomer (Outdoor Structure)	15 No.	$587,745	$374,524	15 No.	$587,745	$374,524
Structure 66kV - Bus Section (Outdoor Structure)	13 No.	$728,312	$475,737	13 No.	$728,312	$475,737
Structure 66kV - Isolator Section (Outdoor Structure)	5 No.	$193,350	$146,624	5 No.	$193,350	$146,624
Structure 66kV - Feeder (Outdoor Structure)	12 No.	$684,456	$533,305	12 No.	$684,456	$533,305
Structure 33kV - Incomer (Outdoor Structure)	14 No.	$504,238	$256,921	14 No.	$504,238	$256,921
Structure 33kV - Bus Section (Outdoor Structure)	36 No.	$1,799,928	$829,134	36 No.	$1,799,928	$829,134
Structure 33kV - Isolator Section (Outdoor Structure)	6 No.	$213,264	$120,257	6 No.	$213,264	$120,257
Structure 33kV - Feeder (Outdoor Structure)	38 No.	$2,070,012	$1,080,401	38 No.	$2,070,012	$1,080,401
Outdoor Structure Subtotal	139 No.	$6,781,305	$3,816,903	139 No.	$6,781,305	$3,816,903
SCADA and Communications Equipment						
RTU (large urban District Sub) (SCADA and Communications Equipment)	5 No.	$440,110	$225,923	5 No.	$440,110	$225,923
RTU (medium urban District Sub) (SCADA and Communications Equipment)	15 No.	$1,051,725	$385,633	15 No.	$1,051,725	$385,633
RTU (small urban District Sub) (SCADA and Communications Equipment)	18 No.	$692,316	$248,721	18 No.	$692,316	$248,721
RTU (small rural District Sub) (SCADA and Communications Equipment)	17 No.	$762,569	$466,513	17 No.	$762,569	$466,513
RTU (medium Network Sub) (SCADA and Communications Equipment)	3 No.	$53,391	$35,001	3 No.	$53,391	$35,001
RTU (small Network Sub) (SCADA and Communications Equipment)	43 No.	$574,351	$467,940	42 No.	$560,994	$457,700
Pilot Box 140 way (SCADA and Communications Equipment)	2 No.	$10,506	$8,405	2 No.	$10,506	$8,405
Pilot Box 280 way (SCADA and Communications Equipment)	27 No.	$283,662	$80,196	27 No.	$283,662	$80,196
SCADA and Communications Equipment Subtotal	130 No.	$3,868,630	$1,918,331	129 No.	$3,855,273	$1,908,091
Ripple Injection Plant						
Ripple Injection Plant (11kV, 175Hz) (Ripple Injection Plant)	24 No.	$4,259,376	$4,090,776	24 No.	$4,259,376	$4,090,776
Ripple Injection Plant (11kV, 317Hz) (Ripple Injection Plant)	3 No.	$444,336	$433,228	3 No.	$444,336	$433,228
Ripple Injection Plant (33kV, 317 Hz) (Ripple Injection Plant)	5 No.	$1,576,000	$275,800	5 No.	$1,576,000	$275,800
Ripple Wave Trap (66kV 175Hz) (Ripple Injection Plant)	3 No.	$180,000	$40,500	3 No.	$180,000	$40,500
Ripple Injection Plant Subtotal	35 No.	$6,459,712	$4,840,303	35 No.	$6,459,712	$4,840,303
Ripple Spares		$416,024	$416,024		$416,024	$416,024

Asset (Handbook entry)	Quantity	Replacement Cost	Depreciated Replacement Cost	Optimised Quantity	Optimised Replacement Cost	Optimised Depreciated Replacement Cost - Optimised Deprival Value
DC supplies, batteries and inverters						
Battery (50/100AH), Charger (110V) & Stand (DC supplies, batteries and inverters)	34 No.	$318,920	$129,913	31 No.	$290,780	$118,892
Battery (50/100AH), Charger (50V) & Stand (DC supplies, batteries and inverters)	18 No.	$79,200	$19,910	19 No.	$83,600	$20,570
DC supplies, batteries and inverters Subtotal	52 No.	$398,120	$149,823	50 No.	$374,380	$139,462
Other Items						
11kV AT (15kVA) (Other Items)	29 No.	$202,681	$49,098	29 No.	$202,681	$49,098
11kV Incomer Cable 40MVA (Other Items)	24 No.	$1,101,360	$409,568	24 No.	$1,101,360	$409,568
11kV Incomer Cable 20MVA (Other Items)	10 No.	$253,090	$44,291	10 No.	$253,090	$44,291
11kV Incomer Cable 10MVA (Other Items)	18 No.	$233,748	$103,239	18 No.	$233,748	$103,239
11kV Bus coupler cable 20MVA (Other Items)	28 No.	$270,480	$78,246	28 No.	$270,480	$78,246
11kV Bus coupler cable 10MVA (Other Items)	5 No.	$23,585	$7,252	5 No.	$23,585	$7,252
66kV VT (3ph) (Other Items)	5 No.	$69,185	$35,803	5 No.	$69,185	$35,803
66kV Surge Diverter (3ph) (Other Items)	9 No.	$42,813	$30,742	9 No.	$42,813	$30,742
33kV VT (3ph) (Other Items)	3 No.	$59,367	$7,668	3 No.	$59,367	$7,668
33kV Surge Diverter (3ph) (Other Items)	5 No.	$12,565	$7,508	5 No.	$12,565	$7,508
11kV VT (3ph) (Other Items)	73 No.	$510,197	$184,772	73 No.	$510,197	$184,772
11kV Neutral Earthing Resistor (Other Items)	5 No.	$142,220	$83,554	5 No.	$142,220	$83,554
Other Items Subtotal	214 No.	$2,921,291	$1,041,741	214 No.	$2,921,291	$1,041,741
Subtransmission Spares		$1,071,376	$1,071,376		$1,071,376	$1,071,376
Zone Substations	5,244 No.	$192,762,678	$92,334,713	5,102 No.	$186,005,430	$90,247,436

Asset (Handbook entry)	Quantity	Replacement Cost	Depreciated Replacement Cost	Optimised Quantity	Optimised Replacement Cost	Optimised Depreciated Replacement Cost - Optimised Deprival Value
Distribution Lines & Cables						
11kV Lines						
11kV OH Heavy (Distn) (11kV OH Lines - Heavy (≥150mm2, ≤240mm2 Al))	3,040 m	$115,050	$52,975	496 m	$15,366	$8,733
11kV OH Medium (Distn) (11kV OH Lines - Medium (>50mm2, <150mm2 Al))	1,038,807 m	$30,921,671	$16,707,721	910,317 m	$27,078,886	$14,498,503
11kV OH Light (Distn) (11kV OH Lines - Light (≤50mm2 Al))	1,153,889 m	$30,926,326	$19,146,201	1,284,659 m	$34,427,520	$21,144,830
11kV OH Single Phase (Distn) (11kV OH Lines - Single Phase or SWER)	612,919 m	$15,291,355	$8,731,856	612,919 m	$15,291,355	$8,731,856
11kV OH SWER (Distn) (11kV OH Lines - Single Phase or SWER)	103,661 m	$2,984,487	$1,895,052	103,661 m	$2,984,487	$1,895,052
11kV OH Heavy Underbuilt (Distn) (11kV OH Lines - Heavy Underbuilt (≥150mm2, ≤ 240mm2 Al))	47 m	$701	$423	47 m	$701	$423
11kV OH Medium Underbuilt (Distn) (11kV OH Lines - Medium Underbuilt (>50mm2, <150mm2 Al))	205,546 m	$3,024,753	$1,864,973	178,322 m	$2,593,033	$1,608,277
11kV OH Light Underbuilt (Distn) (11kV OH Lines - Light Underbuilt (≤50mm2 Al))	15,002 m	$182,493	$124,529	42,225 m	$552,540	$344,554
11kV OH Single Phase Underbuilt (Distn)	7,513 m	$60,657	$39,483	7,513 m	$60,657	$39,483
Traffic Mgmt (OH Level 1) (Traffic Mgmt OH Level 1 (clause A.19))	121,676 m	$97,341	$46,346	121,676 m	$97,341	$46,346
Traffic Mgmt (OH Level 2) (Traffic Mgmt OH Level 2 (clause A.19))	34,435 m	$51,652	$24,593	34,435 m	$51,652	$24,593
11kV Lines Subtotal	3,296,534 m	$83,656,487	$48,634,151	3,296,271 m	$83,153,538	$48,342,648
11kV Cables						
11kV UG Extra Heavy Distn	633 m	$127,643	$74,310	12 m	$2,340	$685
11kV UG Heavy Distn (11kV UG Cables - Heavy (>240mm2, ≤300mm2 Al))	19,258 m	$2,931,037	$2,287,474	2,330 m	$417,261	$313,074
11kV UG Medium Distn (11kV UG Cables - Medium (>50mm2, ≤240mm2 Al))	408,942 m	$49,463,473	$33,703,516	272,030 m	$31,982,677	$22,656,268
11kV UG Light Distn (11kV UG Cables - Light (≤50mm2 Al))	259,856 m	$22,935,962	$12,918,326	322,390 m	$29,811,051	$17,567,160
11kV UG Extra Heavy Dcct Distn	905 m	$189,974	$89,503	0 m	$0	$0
11kV UG Heavy Dcct Distn (11kV UG Cables - Heavy Dcct (>240mm2, ≤300mm2 Al))	15,443 m	$1,543,778	$1,203,645	3,478 m	$377,949	$280,901
11kV UG Medium Dcct Distn (11kV UG Cables - Medium Dcct (>50mm2, ≤240mm2 Al))	387,489 m	$32,366,882	$22,206,240	335,483 m	$27,615,100	$19,401,577
11kV UG Light Dcct Distn	249,697 m	$14,107,551	$8,013,307	404,969 m	$23,347,997	$13,780,173
Traffic Mgmt (UG Level 1) (Traffic Mgmt UG Level 1 (clause A.19))	428,497 m	$2,570,982	$1,560,284	428,497 m	$2,570,982	$1,560,284
Traffic Mgmt (UG Level 2) (Traffic Mgmt UG Level 2 (clause A.19))	344,068 m	$5,161,016	$3,132,131	344,068 m	$5,161,016	$3,132,131
Traffic Mgmt (UG Level 2-in road) (Traffic Mgmt UG Level 2 in Carriageway (clause A.19))	47,620 m	$1,904,813	$1,155,998	47,620 m	$1,904,813	$1,155,998
11kV Cables Subtotal	2,162,408 m	$133,303,110	$86,344,735	2,160,877 m	$123,191,185	$79,848,252
Distribution Lines & Cables Subtotal	5,458,941 m	$216,959,597	$134,978,886	5,457,147 m	$206,344,723	$128,190,900

Asset (Handbook entry)	Quantity	Replacement Cost	Depreciated Replacement Cost	Optimised Quantity	Optimised Replacement Cost	Optimised Depreciated Replacement Cost - Optimised Deprival Value
Distribution Switchgear						
11kV Disconnector (3ph) (11kV Disconnector 3ph (Excl Pole))	1,004 No.	$3,514,000	$1,076,100	1,004 No.	$3,514,000	$1,076,100
11kV Disconnector (2ph) (11kV Disconnector 2ph (Excl Pole))	0 No.	$0	$0	0 No.	$0	$0
11kV Load Break Switch (11kV Load Break Switch (Excl Pole))	0 No.	$0	$0	0 No.	$0	$0
11kV Dropout Fuse (3ph set) (11kV Dropout Fuse 3ph (Excl Pole))	6,184 No.	$15,460,000	$9,179,464	6,184 No.	$15,460,000	$9,179,464
11kV Dropout Fuse (2ph set) (11kV Dropout Fuse 2ph (Excl Pole))	1,546 No.	$3,092,000	$2,162,200	1,546 No.	$3,092,000	$2,162,200
11kV Dropout Fuse (1ph)	94 No.	$94,000	$78,029	94 No.	$94,000	$78,029
11kV Sectionaliser (11kV Sectionaliser (Excl Pole))	7 No.	$126,000	$64,575	7 No.	$126,000	$64,575
11kV Circuit Breaker / Recloser (Pole-Mounted) (11kV Recloser (Excl Pole))	48 No.	$1,296,000	$1,041,525	48 No.	$1,296,000	$1,041,525
11kV Circuit Breaker (Distn Substation) (11kV Indoor Switchgear Cubicle)	53 No.	$1,590,000	$522,667	49 No.	$1,470,000	$498,667
11kV Circuit Breaker Sealed (Distn Sub) (11kV Indoor Switchgear Cubicle)	13 No.	$390,000	$342,818	13 No.	$390,000	$342,818
11kV Single Phase Breaker	8 No.	$121,112	$108,622	8 No.	$121,112	$108,622
11kV Surge Arresters (3ph)	492 No.	$871,332	$728,893	492 No.	$871,332	$728,893
Ring Main Unit - 3 Way (Ring Main Unit - 3 Way)	0 No.	$0	$0	0 No.	$0	$0
11kV Magnefix Type UT	159 No.	$1,493,487	$482,213	159 No.	$1,493,487	$482,213
11kV Magnefix Type 1K2T	26 No.	$405,990	$333,771	26 No.	$405,990	$333,771
11kV Magnefix Type 1K3T	1 No.	$21,230	$18,842	1 No.	$21,230	$18,842
11kV Magnefix Type 2K1T	974 No.	$13,294,126	$3,948,144	968 No.	$13,212,232	$3,932,239
11kV Magnefix Type 2K2T	47 No.	$903,246	$421,595	47 No.	$903,246	$421,595
11kV Magnefix Type 2K3T	1 No.	$28,517	$14,615	1 No.	$28,517	$14,615
11kV Magnefix Type 2KB2K	256 No.	$4,133,376	$3,662,316	256 No.	$4,133,376	$3,629,217
11kV Magnefix Type 2KBK	536 No.	$6,890,816	$3,286,636	532 No.	$6,839,392	$3,262,210
11kV Magnefix Type 3K	337 No.	$4,201,042	$3,512,452	358 No.	$4,462,828	$3,629,319
11kV Magnefix Type 3K1T	338 No.	$6,467,968	$2,575,466	334 No.	$6,391,424	$2,552,982
11kV Magnefix Type 3K2T	2 No.	$46,290	$39,347	2 No.	$46,290	$39,347
11kV Magnefix Type 3KX	1 No.	$15,997	$4,999	1 No.	$15,997	$4,999
11kV Magnefix Type 4K	1 No.	$16,545	$5,170	1 No.	$16,545	$5,170
11kV Magnefix Type 4K1T	15 No.	$354,180	$166,760	15 No.	$354,180	$166,760
11kV Magnefix Type 5K	6 No.	$123,732	$118,061	6 No.	$123,732	$118,061
11kV Magnefix Type KB2K	20 No.	$266,120	$233,853	20 No.	$266,120	$233,853
11kV Magnefix Type KB2KBK	181 No.	$2,924,236	$1,548,351	178 No.	$2,875,768	$1,523,511
11kV Magnefix Type KBX	456 No.	$3,595,560	$2,734,321	456 No.	$3,595,560	$2,734,321
11kV Magnefix Type KTB	39 No.	$366,327	$317,836	39 No.	$366,327	$317,836

Asset (Handbook entry)	Quantity	Replacement Cost	Depreciated Replacement Cost	Optimised Quantity	Optimised Replacement Cost	Optimised Depreciated Replacement Cost - Optimised Deprival Value
11kV Switchgear Cabinet (1/4 Kiosk)	88 No.	$176,000	$138,978	88 No.	$176,000	$138,978
11kV Oil Switch (Not Fused) (Extra Oil Switch)	36 No.	$216,000	$63,450	36 No.	$216,000	$63,450
11kV Oil Switch (Fused) (Extra Fuse Switch)	157 No.	$1,256,000	$138,200	148 No.	$1,184,000	$132,400
UHF Remote Unit	64 No.	$250,048	$179,722	64 No.	$250,048	$179,722
RTU Aux Equip (Pole mount on LCB)	48 No.	$326,928	$252,461	48 No.	$326,928	$252,461
Distribution Switchgear Spares		$93,048	$93,048		$93,048	$93,048
Distribution Switch	13,238 No.	$74,421,253	$39,595,499	13,229 No.	$74,232,709	$39,561,811
Distribution Transformers						
11/0.4 kV Single/Two Phase Units (pole and ground mounted)						
1ph Pole Mount ≤ 15 kVA (Up to and including 15 kVA)	1,516 No.	$3,941,600	$1,747,430	1,516 No.	$3,941,600	$1,747,430
1ph Pole Mount 30 kVA (30 kVA)	41 No.	$135,300	$113,777	41 No.	$135,300	$113,777
1ph Pole Mount 50 kVA (50 kVA)	0 No.	$0	$0	0 No.	$0	$0
1ph Pole Mount 75 kVA (75 kVA)	0 No.	$0	$0	0 No.	$0	$0
1ph Pole Mount 100 kVA (100 kVA)	1 No.	$7,000	$2,878	1 No.	$7,000	$2,878
1ph Pad Mount ≤ 15 kVA (Up to and including 15 kVA)	12 No.	$31,200	$20,445	12 No.	$31,200	$20,445
1ph Pad Mount 30 kVA (30 kVA)	6 No.	$19,800	$14,760	4 No.	$13,200	$12,660
1ph Pad Mount 50 kVA (50 kVA)	3 No.	$12,000	$6,218	0 No.	$0	$0
1ph Pad Mount 75 kVA (75 kVA)	4 No.	$20,000	$18,000	0 No.	$0	$0
11/0.4 kV Single/Two Phase Units (pole and ground mounted) Subtotal	1,583 No.	$4,166,900	$1,923,508	1,574 No.	$4,128,300	$1,897,190
11/0.4 kV Three Phase Units (pole mounted, bushing terminations)						
3ph Pole Mount ≤ 30 kVA (Up to and including 30 kVA)	2,429 No.	$12,145,000	$6,431,720	2,429 No.	$12,145,000	$6,431,720
3ph Pole Mount 50 kVA (50 kVA)	1,032 No.	$7,224,000	$3,943,411	1,032 No.	$7,224,000	$3,943,411
3ph Pole Mount 100 kVA (100 kVA)	660 No.	$5,940,000	$3,692,200	660 No.	$5,940,000	$3,692,200
3ph Pole Mount 200 kVA (200 kVA)	247 No.	$3,211,000	$1,543,245	247 No.	$3,211,000	$1,543,245
3ph Pole Mount 300 kVA (300 kVA)	8 No.	$128,000	$36,089	8 No.	$128,000	$36,089
3ph Pole Mount 500 kVA (500 kVA)	0 No.	$0	$0	0 No.	$0	$0
11/0.4 kV Three Phase Units (pole mounted, bushing terminations) Subtotal	4,376 No.	$28,648,000	$15,646,665	4,376 No.	$28,648,000	$15,646,665

Asset (Handbook entry)	Quantity	Replacement Cost	Depreciated Replacement Cost	Optimised Quantity	Optimised Replacement Cost	Optimised Depreciated Replacement Cost - Optimised Deprival Value
11/0.4 kV Three Phase Units (ground mounted, cable entry)						
3ph Pad Mount 100 kVA (100 kVA)	72 No.	$648,000	$408,764	72 No.	$648,000	$408,764
3ph Pad Mount 200 kVA (200 kVA)	1,298 No.	$18,172,000	$8,841,763	1,298 No.	$18,172,000	$8,841,763
3ph Pad Mount 300 kVA (300 kVA)	1,446 No.	$23,136,000	$12,282,327	1,446 No.	$23,136,000	$12,282,327
3ph Pad Mount 500 kVA (500 kVA)	606 No.	$13,332,000	$8,669,800	606 No.	$13,332,000	$8,669,800
3ph Pad Mount 750 kVA (750 kVA)	246 No.	$6,395,997	$3,424,672	246 No.	$6,395,997	$3,424,672
3ph Pad Mount 1000 kVA (1000 kVA)	119 No.	$3,450,996	$1,957,236	119 No.	$3,450,996	$1,957,236
3ph Pad Mount 1250 kVA (1250 kVA)	1 No.	$40,000	$36,727	1 No.	$40,000	$36,727
3ph Pad Mount 1500 kVA (1500 kVA)	3 No.	$138,000	$85,727	3 No.	$138,000	$85,727
11/0.4 kV Three Phase Units (ground mounted, cable entry) Subtotal	3,791 No.	$65,312,993	$35,707,017	3,791 No.	$65,312,993	$35,707,017
Distributon Transformer Spares		$263,622	$263,622		$263,622	$263,622
Distribution Transformers Subtotal	9,750 No.	$98,391,515	$53,540,813	9,741 No.	$98,352,915	$53,514,495
Distribution Substation						
Distn Sub - Land	1,761 No.	$21,402,458	$21,402,458	1,761 No.	$19,141,050	$19,141,050
Housing						
Distn Sub - Pole Mount (≤50 kVA) (Pole Mount (50 kVA or less))	4,955 No.	$4,955,000	$2,184,834	4,955 No.	$4,955,000	$2,184,834
Distn Sub - Pole Mount (>50 kVA, <100 kVA)	88 No.	$176,000	$112,800	88 No.	$176,000	$112,800
Distn Sub - Pole Mount (≥100 kVA) (Pole Mount (100 kVA or more))	862 No.	$1,724,000	$803,666	862 No.	$1,724,000	$803,666
Distn Sub - Pad Mount (Orion full kiosk) (Ground Mount (Covered))	2,528 No.	$10,112,000	$5,605,091	2,552 No.	$10,208,000	$5,621,491
Distn Sub - Pad Mount (Orion 1/2 kiosk) (Ground Mount (Covered))	429 No.	$1,716,000	$1,359,236	431 No.	$1,724,000	$1,359,756
Distn Sub - Pad Mount (masonary/block kiosk) (Kiosk (Masonry or block enclosure))	0 No.	$0	$0	0 No.	$0	$0
Distn Sub - Building (Orion owned) (Kiosk (Masonry or block enclosure))	67 No.	$737,000	$220,400	67 No.	$737,000	$220,400
Distn Sub - Building (Customer owned) (On Customer's Premises with Feedout)	202 No.	$404,000	$219,091	202 No.	$404,000	$219,091
Housing Subtotal	9,131 No.	$19,824,000	$10,505,118	9,157 No.	$19,928,000	$10,522,038
Metering						
Distn Sub - LV MDI Metering (800A)	3,740 No.	$4,824,600	$1,844,684	2,919 No.	$3,765,510	$1,578,638
Distn Sub - LV MDI Metering (1500A)	447 No.	$794,766	$302,416	419 No.	$744,982	$280,324
Metering Subtotal	4,187 No.	$5,619,366	$2,147,100	3,338 No.	$4,510,492	$1,858,962
Distribution Spares		$70,087	$70,087		$70,087	$70,087
Distribution Substation Subtotal	15,079 No.	$46,915,911	$34,124,764	14,256 No.	$43,649,629	$31,592,137

Asset (Handbook entry)	Quantity	Replacement Cost	Depreciated Replacement Cost	Optimised Quantity	Optimised Replacement Cost	Optimised Depreciated Replacement Cost - Optimised Deprival Value
Low Voltage						
LV Lines						
LV OH Heavy 4 wire (Overhead Heavy 4 wire (>150mm2 Al))	45,414 m	$2,043,634	$699,913	45,414 m	$2,043,634	$699,913
LV OH Medium 4 wire (Overhead Medium 4 wire (>50mm2, ≤150mm2 Al))	640,499 m	$26,900,938	$15,620,013	640,499 m	$26,900,938	$15,620,013
LV OH Light 4 wire (Overhead Light 4 wire (≤50mm2 Al))	26,225 m	$996,550	$422,985	26,225 m	$996,550	$422,985
LV OH Medium 2 wire (Overhead Medium 2 wire (>50mm2, ≤150mm2 Al))	36,685 m	$1,320,662	$540,019	36,685 m	$1,320,662	$540,019
LV OH Light 2 wire (Overhead Light 2 wire (≤50mm2 Al))	1,631 m	$48,924	$19,678	1,631 m	$48,924	$19,678
LV OH Heavy 4 wire Underbuilt (Overhead Heavy Underbuilt 4 wire (>150mm2))	2,353 m	$56,482	$14,327	2,353 m	$56,482	$14,327
LV OH Medium 4 wire Underbuilt (Overhead Medium Underbuilt 4 wire (>50mm2, ≤150mm2 Al))	207,476 m	$4,356,995	$2,110,652	207,476 m	$4,356,995	$2,110,652
LV OH Light 4 wire Underbuilt	20,858 m	$396,297	$149,316	20,858 m	$396,297	$149,316
LV OH Medium 2 wire Underbuilt (Overhead Medium Underbuilt 2 wire (>50mm2, ≤150mm2 Al))	46,936 m	$797,919	$432,688	46,936 m	$797,919	$432,688
LV OH Light 2 wire Underbuilt (Overhead Light Underbuilt 2 wire (≤50mm2))	951 m	$13,319	$7,226	951 m	$13,319	$7,226
LV OH Urban Road Crossings & Back Sections	262,085 m	$10,404,775	$4,319,784	262,085 m	$10,404,775	$4,319,784
LV OH Rural Road Crossings & Back Sections	406,270 m	$13,248,465	$5,500,437	406,270 m	$13,248,465	$5,500,437
LV OH Lighting (on own) (Overhead Light 2 wire (≤50mm2 Al))	111,447 m	$3,343,421	$1,372,207	111,447 m	$3,343,421	$1,372,207
LV OH Lighting (with LV)	825,766 m	$2,667,224	$1,080,116	0 m	$0	$0
LV OH Lighting (with HV) (Overhead Light Underbuilt 2 wire (≤50mm2))	52,407 m	$733,693	$342,330	52,407 m	$733,693	$342,330
LV Lines Subtotal	2,687,003 m	$67,329,298	$32,631,688	1,861,237 m	$64,662,074	$31,551,573
LV Cables						
LV UG Heavy (Underground Heavy (>240mm2))	158,143 m	$15,422,700	$9,632,869	132,563 m	$12,721,443	$8,367,420
LV UG Medium (Underground Medium (≤240mm2))	1,313,817 m	$99,849,512	$58,503,234	1,107,976 m	$84,235,537	$52,026,426
LV UG Service Main (16mm2 NS)	314,087 m	$14,133,932	$6,192,990	314,087 m	$14,133,932	$6,192,990
LV UG Heavy Shared Trench (Underground Heavy Shared Trench (>240mm2))	23,838 m	$1,163,327	$947,438	49,418 m	$2,664,025	$1,650,466
LV UG Medium Shared Trench (Underground Medium Shared Trench (≤240mm2))	225,489 m	$8,664,603	$7,099,947	431,330 m	$16,595,512	$10,389,754
LV UG Lighting 2 Core (on own) (Underground Streetlighting Circuit (own trench))	256,737 m	$10,499,399	$6,694,183	256,737 m	$10,499,399	$6,694,183
LV UG Lighting 2 Core (with LV)	362,479 m	$5,525,544	$3,474,295	0 m	$0	$0
LV UG Lighting 2 Core (with HV) (Underground Streetlighting Circuit (HV cable trench))	0 m	$0	$0	0 m	$0	$0
LV UG Lighting 5th Core (with LV)	979,724 m	$8,422,481	$5,119,054	0 m	$0	$0
LV Cables Subtotal	3,634,316 m	$163,681,499	$97,664,010	2,292,112 m	$140,849,848	$85,321,239

Asset (Handbook entry)	Quantity	Replacement Cost	Depreciated Replacement Cost	Optimised Quantity	Optimised Replacement Cost	Optimised Depreciated Replacement Cost - Optimised Deprival Value
Link Pillars						
LV 2 Way Linkbox / Multibox (2 Way Link Pillar)	2,888 No.	$5,776,000	$3,507,133	2,888 No.	$5,776,000	$3,507,133
LV 3 Way Linkbox / Multibox	1,139 No.	$3,417,000	$2,077,067	1,139 No.	$3,417,000	$2,077,067
LV 4 Way Linkbox / Multibox (4 Way Link Pillar)	809 No.	$3,236,000	$1,968,311	809 No.	$3,236,000	$1,968,311
Link Pillars Subtotal	4,836 No.	$12,429,000	$7,552,511	4,836 No.	$12,429,000	$7,552,511
Low Voltage Subtotal		$243,439,797	$137,848,210		$217,940,922	$124,425,323
Customer Service Connections						
LV Connection OH 1ph (LV Overhead - 1 ph)	67,355 No.	$4,714,850	$1,489,441	83,917 No.	$5,874,190	$1,966,058
LV Connection OH 3ph (LV Overhead - 3 ph)	9,058 No.	$1,630,440	$577,652	9,058 No.	$1,630,440	$577,652
LV Connection UG 1ph (fuse only)	22,540 No.	$2,051,140	$890,172	22,540 No.	$2,051,140	$890,172
LV Connection UG 3ph (fuse only)	1,932 No.	$314,916	$142,218	1,932 No.	$314,916	$142,218
LV Connection UG 1ph (shared bndry box) (LV Underground - 1 ph shared pillar)	46,737 No.	$11,684,250	$7,166,764	63,115 No.	$15,778,750	$9,668,958
LV Connection UG 1ph (dedicated bndry box) (LV Underground - 1 ph own pillar)	4,620 No.	$2,310,000	$1,417,661	4,620 No.	$2,310,000	$1,417,661
LV Connection UG 3ph (shared bndry box) (LV Underground - 3 ph shared pillar)	21,056 No.	$8,422,400	$4,969,329	21,056 No.	$8,422,400	$4,969,329
LV Connection UG 3ph (dedicated bndry box) (LV Underground - 3 ph own pillar)	2,081 No.	$1,664,800	$982,062	2,081 No.	$1,664,800	$982,062
LV Lighting Control Relay	2,070 No.	$273,240	$193,684	0 No.	$0	$0
Customer Service Connections Subtotal	177,449 No.	$33,066,036	$17,828,982	208,319 No.	$38,046,636	$20,614,110
Other System Fixed Assets						
SCADA & Comms (central facilities)						
SCADA Master Station	1 Lot	$2,977,427	$1,290,218	1 Lot	$2,977,427	$1,290,218
UHF Masters	7 No.	$154,000	$61,600	7 No.	$154,000	$61,600
UHF Repeaters	7 No.	$192,500	$63,500	7 No.	$192,500	$63,500
SCADA & Comms (central facilities) Subtotal		$3,323,927	$1,415,318		$3,323,927	$1,415,318
Other System Fixed Assets Subtotal		$3,323,927	$1,415,318		$3,323,927	$1,415,318
Schedule Total		$1,079,084,452	$607,516,171		$1,028,804,664	$580,224,018

Appendix B
Estimated Quantities and Ages

This appendix provides the methodology that Orion has used in deriving the estimates of quantity and/or age for the assets scheduled in sections 5.2 and 6.2 of this report. This detail provides Orion's approach under clause 2.9, and is reported pursuant to clause 2.65(d), of the Handbook.

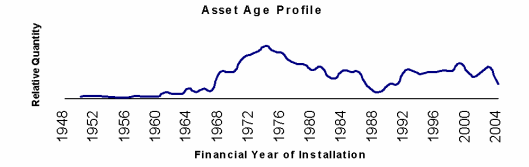
B1 Low voltage rural underbuilt lines

Orion's GIS system does not record detail of underbuilt low voltage line in the rural area. This line is typically constructed under 11kV distribution lines, providing low voltage reticulation from a pole mounted distribution transformer to a small group of connections.

Orion's estimate of total quantity and age profile is consistent with the previous (2001) valuation, as Orion considers that a more accurate basis is not available at this time.

In summary, the quantity (length) is based on the number of pole mounted three phase distribution transformers multiplied by the assessed average length. In Orion's 2001 valuation, the number of pole mounted three phase transformers was 2,532, and analysis of a representative sample indicated an average length of 40 metres. On this basis, the total length of 101,280 metres is added (this quantity is further subject to Orion's estimate of the proportion of 2-wire and 4-wire lines detailed below).

Orion has valued all low voltage rural underbuilt lines as medium size line, using the standard replacement cost in Handbook table A.1. The age of this line is profiled based on the age profile of Orion's 11kV rural lines, which has an average age of 21.6 years, as follows:



B2 Low voltage overhead road crossings and back section lines

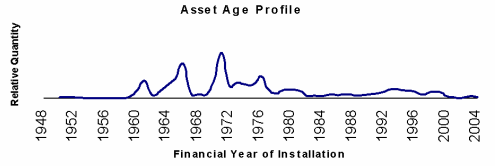
Orion's GIS system does not record the majority of low voltage *spur* lines crossing roads, supplying back sections, and supplying rural properties which might be some distance from the main low voltage line.

Those segments that are recorded in the GIS have been identified and removed from the valuation data to ensure that they are not valued twice. Orion has then established the quantity of all road crossing and back section lines as an estimate based on Orion's partially completed "poles survey".

The poles survey has identified 10,966 urban and 5,532 rural conductor carrying poles that are not part of the main line. Orion's project manager for the survey has estimated the rural count of poles represents half the rural network (as the survey is not yet complete) and, on this basis, the rural count is doubled.

The average road crossing plus back section span length for urban lines has been established as 23.9m based on a representative sample of 178 spans (including 54 road crossings). The corresponding span length for rural lines is based on the survey results, averaging 36.72 metres.

The urban and rural count of poles is multiplied by the urban and rural span estimates to establish the total lengths of 262,087m and 406,270m respectively. The age of this line is profiled based on the age of all other low voltage line, with an average age of 28.9 years, as follows:



Note that Orion does not own all the poles in line segments supplying back sections and rural properties, and this has been allowed for as a reduction in the unit replacement cost. The proportion of 2-wire vs 4-wire construction is also allowed for in this derivation of the unit replacement cost (see section 8.7.2).

B3 Low voltage urban lines upgrade

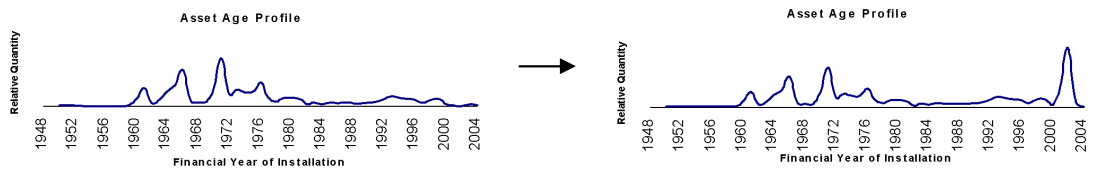
Orion's urban low voltage overhead network in Christchurch has recently been significantly upgraded with the roll-out of Telstra's communications network on Orion's poles. While the upgrade to a higher carrying capacity does not affect the standard unit replacement cost as prescribed in the Handbook, the upgrade included a significant number of pole replacements. With the vast scale of the project, Orion's GIS has not yet been updated to reflect the younger age of replaced assets and it is necessary to apply an estimate to reflect this value enhancement.

Orion's manager for this project has supplied detailed records of the quantity of poles replaced, and the dates on which work was carried out. The quantity of poles is multiplied by Orion's average urban span length (40m) to establish the line length affected:

Financial Year (ending 31/3)	Poles Replaced	Estimated Line Length (m)
2001	996	39,840
2002	3,187	127,480
2003	151	6,040
	4,334	173,360

The adjustment is applied by including a "deduction" against older asset quantities, with a corresponding "addition" of *like* assets in 2001, 2002 and 2003. Recognising that 90% of Orion's low voltage line is of the standard Handbook size "medium", this estimate is simplified by applying an age adjustment for this category only. The derivation also assumes that the majority of poles replaced (rather than reinforced) would have been older poles with installation dates ranging from 1948 through to 1982, and the quantity deduction is applied in proportion to annual quantities installed over this period.

The net effect is a reduction in the average age of low voltage line from 29.1 years to 23.2 years. This can be seen as a shift in the age profile graphs. The left hand graph represents the age profile of low voltage line prior to the application of this adjustment; the right hand graph is the age profile after the adjustment (excluding estimated quantities for road crossings, back section lines, and rural underbuilt lines):



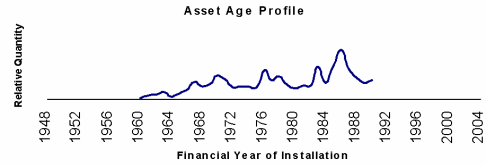
B4 T-Jointed underground service mains

Orion owns and maintains low voltage underground service mains where they are T-jointed to Orion's underground network. Christchurch MED built these from approximately 1960 through to 1990 and Orion's ownership of these cable lengths is shown in Orion's Network Code, section 7.2.2.2 where the Network Connection point (NCP), the point of ownership change, is at the meter board.

Details of these service mains are currently only available in *dumb* drawings, which have not yet been migrated to Orion's GIS system. As the drawings do not provide a practical basis for establishing total lengths or ages, it is necessary to derive and apply estimates.

The total number of T-Jointed service cables is available from the GIS as a simple count of this type of connection - 850 in Christchurch's CBD area, and 18,051 in the suburban area. The average length of service mains in the CBD area is assumed to be a nominal 5m. The length in the suburban area has been based on Orion's analysis of the drawings for 82 properties in 4 different network areas, averaging 17.4m. Multiplying the counts by the estimated lengths provides the estimated total quantities of 4250m and 314,087m for CBD and suburban respectively. In this estimate, Orion has maintained the split between CBD and suburban installations to reflect their substantially different average length, and also to value the suburban installations using lower cost 2-core cable.

The age profile for both CBD and suburban T-Jointed service mains is taken from the age profile for Orion's other low voltage cabling for the period 1960 to 1990, as follows:



Consistent with the estimate for unknown low voltage cable construction established below, Orion assumes that all T-jointed service mains installed prior to 1965 were of PILC construction, and those installed during or after 1965 were XLPE.

Note that some T-Jointed service cables supply more than one connection, so the count of T-jointed service cables is fewer than the count of T-jointed connections applied in the estimate for low voltage connections below.

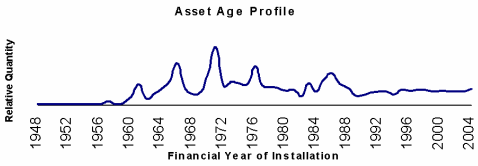
B5 Low Voltage Connections

In this valuation, quantities and number of phases of low voltage connections are primarily based on information from Orion's "Connections" database, and the distinction between overhead, underground and T-jointed connections is sourced from Orion's GIS. The following describes the exceptions to this approach, and where additional details have been referenced from the Electricity Commission's Registry database:

Situation	Quantity Applied to
Assumed overhead as rural	8
Assumed overhead based on majority from same transformer	10
Assumed underground based on majority from same transformer	158
Conservatively assumed (guessed) as overhead	572
Excluded as high voltage connection	88
Excluded as not Commissioned (not status 001 or 002) in Registry.	3,190
Overhead based on Connections DB (not specified in GIS)	37
Underground based on Connections DB (not specified in GIS)	40
2 phase assessed as 3 phase	5530
Registry metering cat 0 or 1, assumed 1 phase	653
Registry metering cat 2, 3 or 4, assumed 3 phase	81

The age of connections is recorded in the Connections database as "date first energised". However, this level of detail has only reliably been collected since 1989 and only 45,094 connections carry a useable date. The balance of connections are profiled in age according to the profile for low voltage cable (for underground connections), and low voltage line (for overhead connections), up to 1989.

The resulting age profile is a combination of actual ages and ages profiled according to two different bases, with an average age of 24.5 years:



Shared and Dedicated Boundary Boxes

For underground connections (other than T-jointed underground connections), the Handbook prescribes a separate value depending on whether each connection requires a dedicated boundary box or shares a boundary box. Orion's asset databases do not record this level of detail and it is necessary to estimate the proportions of each.

To provide a basis for this split, Orion has analysed plans covering 11 underground conversion projects (representing replacement of an asset in developed infrastructure), and 5 new subdivisions (where Orion installs the minimum number of boundary boxes to serve the required number and location of properties). In total 709 connections were considered.

Orion has approximately 65,000 underground connections supplied by boundary boxes and the connections database indicates that approximately 45,000 of these have been commissioned since 1989. Orion expects that approximately 70% of underground connections have been added through the development of new subdivisions, and 30% have been added through underground conversion projects. Accordingly, the results of the analysis have been combined with a 70% weighting in favour of the proportions provided by the analysis of new subdivisions. The results for shared vs dedicated boundary boxes are summarised as follows:

	Number of connections considered	Proportion sharing a boundary box	Proportion with a dedicated boundary box
Underground conversions	401	84%	16%
New subdivisions	308	94%	6%
Combined (weighted 70% in favour of new subdivisions)		**91%**	**9%**

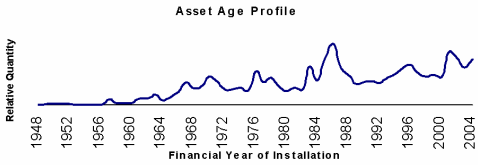
B6 Low voltage link boxes

Orion has not yet loaded low voltage link boxes to its asset management database, WASP. However, the GIS model of the electrical network provides a sound basis for the quantity and type of link boxes in service.

The Handbook prescribes unit replacement costs for 2 and 4 way link boxes and PB Associates indicate that sophisticated link pillar arrangements are unnecessary in an optimised network[2]. On this basis, Orion has derived a non-standard unit replacement cost for 3 way link boxes (refer to section 8.7.5) and mapped its range of link boxes to these standard modern equivalents as follows:

GIS Asset Description	Quantity	Valued as
Blank	11	LV 2 Way Linkbox / Multibox
2-way linkbox	1140	LV 2 Way Linkbox / Multibox
2.5-way linkbox	451	LV 2 Way Linkbox / Multibox
3.5-way linkbox	29	LV 3 Way Linkbox / Multibox
2-cct linkbox	1	LV 2 Way Linkbox / Multibox
3-way linkbox	623	LV 3 Way Linkbox / Multibox
4-way linkbox	799	LV 4 Way Linkbox / Multibox
5-way linkbox	5	LV 4 Way Linkbox / Multibox
6-way linkbox	6	LV 4 Way Linkbox / Multibox
2-way multibox	650	LV 2 Way Linkbox / Multibox
2.5-way multibox	636	LV 2 Way Linkbox / Multibox
3-way multibox	490	LV 3 Way Linkbox / Multibox
Unequipped Box	13	exclude - not in service

The asset set is then assigned an age profile consistent with Orion's low voltage cable (all sizes) with an average of 17.8 years, as follows:



[2] Parsons Brinckerhoff Associates report "Review of Optimised Deprival Valuation Handbook Replacement Costs of System Fixed Assets" dated 31 August 2004, section 3.7 (page 12).

B7 Separation between 4-wire and 2-wire low voltage lines

Orion's GIS system records low voltage line circuit details including date of installation, location and conductor type and size. However, it does not detail the situations where low voltage line has been constructed using 2 lines, rather than 3, 4 or 5. In order to meet the new separation between 2 and 4 wire lines, now required by the Handbook, Orion must estimate the proportions of each.

Orion has surveyed 25.7km of urban line and 133.4km of rural line to establish the proportions of each. The results of this survey show:

Situation		2 Wire	3,4 or 5 wire
Low voltage overhead reticulation (excluding service lines, road crossings and rural underbuilt)	Urban	0%	100%
	Rural	60%	40%
Low voltage overhead road crossings and back section lines (excluding service lines and final span of back section line)	Urban	33%	67 %
	Rural	41%	60%
Rural underbuilt low voltage lines	Rural	40%	60%

Application to low voltage overhead

The survey shows that while no urban line is 2-wire, 60% of Orion's rural line is 2 wire. Under previous valuations Orion has established that only 8.6% of its low voltage overhead line is in rural areas. Using this, the two proportions are combined to provide a 2-wire proportion of 5.2%.

Assuming that 2-wire construction is only applicable to the medium and light line sizes, Orion has randomly selected line segments from all medium and light segments and assigned them as 2-wire construction (rather than the default 4-wire construction) until a total of 5.2%, by length, was reached. The randomised approach ensures that an appropriate mix of medium and light, and an appropriate mix of segment ages are selected and valued at the lesser 2-wire replacement cost.

Application to overhead road crossings and back section lines

The urban and rural proportions of 2 wire construction have been incorporated in Orion's derivation of the unit replacement cost for this asset, rather than being applied to the quantities. Refer to section 8.6.1.

Application to rural underbuilt lines

The total length and age profile is established as an estimate above (see section headed "low voltage rural underbuilt lines"). This is simply split 40/60 between 2-wire and 4-wire as suggested by the survey results.

B8 Shared trenching installation of low voltage cable

Orion's GIS system is not yet able to include shared trenching details in the process of extracting data from the GIS database. The amount of shared trenching installation of low voltage cable (either with 11kV or with other low voltage cable) is based on an investigation of recent subdivision work in which 22% of low voltage cable is shared with 11kV cable, and a further 6% is shared with other low voltage cable. The investigation covered 19 new subdivisions in 2004, with a total of 749 new connections and 17.1km of cabling.

Previous valuations have assessed this optimised practice (at the similar total level of 30%) as applying since the financial year ending 31 March 1987. Prior to this, the majority of all low voltage cable was laid separately using chain diggers.

Consistent with previous valuations and the current analysis, 28% of low voltage cable (excluding the 318,337m of cable associated with T-jointed services noted in B4 above) installed from 1987 onwards has been valued as cable installed in a shared trench. This *devaluation* has been applied against randomly selected segments until the correct proportion was achieved. The randomised selection approach allows the devaluation to be spread across segments with different ages, different sizes and five different combinations of valuation multipliers.

Low voltage cable installed prior to 1987 is valued as cable in its own trench, but this value is then subject to optimisation as detailed in section 9.5.6.

B9 Shared trenching installation of 11kV cable

Orion's GIS system is not yet able to include shared trenching details in the process of extracting data from the GIS database. With the exception of 11kV primary feeders, which were individually considered and valued appropriately, the level of shared trench installation of primary and secondary 11kV is based on the results of a sample investigation.

The sample investigation focused on 5 representative areas of Orion's network totalling 10km^2. All 11kV cable segments in these areas were individually considered and noted as either sharing a trench (within 0.5m of another 11kV cable), able to share a trench (on the same side of the road as another 11kV cable), or installed on their own. Results were recorded separately for subtransmission and distribution cables:

Cable Situation	11kV Subtransmission		11kV Distribution	
	(km)	(%)	(km)	(%)
On own	7.22	12.8	36.34	44.5
Shares trench	45.84	81.5	39.73	48.7
Able to share trench	3.20	5.7	5.51	6.8
Total	**56.26**	**100.0**	**81.58**	**100.0**

All 11kV cable segments were initially entered in the valuation model as being installed on their own. Then, to represent the shared trenching, 81.5% of subtransmission segments (by length) and 48.7% of distribution segments (by length) were randomly selected and valued as sharing a trench. The randomised selection approach allows the devaluation to be spread across segments with different ages, different sizes and five different combinations of valuation multipliers. It also allows the result of subsequent optimisation considerations (for example, capacity optimisation to smaller size cables) to apply to the appropriately reduced value of assets.

The proportions identified as "able to share a trench" are incorporated in the optimisation consideration detailed in section 9.5.6.

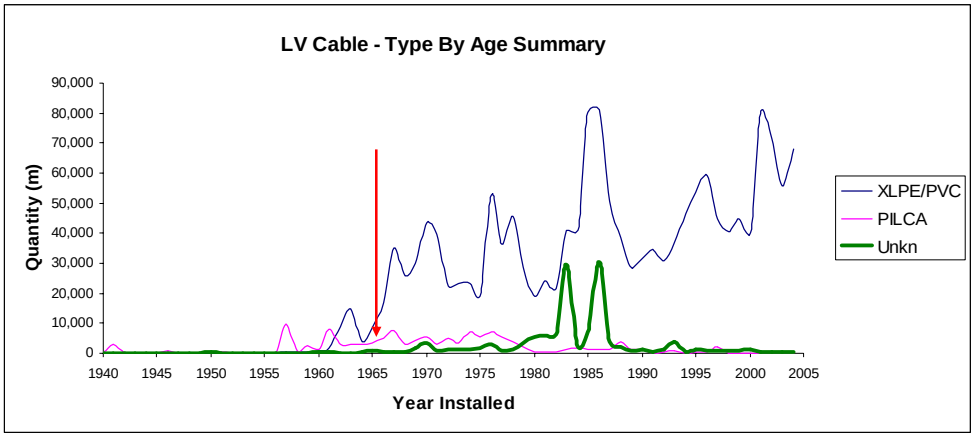
B10 Low voltage cable of unknown construction or unknown age

Orion's GIS system (and cables database) includes some low voltage cable segments noted as "unknown" construction or "unknown" age.

Only 461 metres of low voltage cable is of unknown age (0.03% of total) and this affects Orion's calculation of the depreciated value of these assets. Orion reasonably assumes that this is older cable and applies the year of installation as 1900.

132km of low voltage cable is of unknown construction (7.7% of total). Orion must estimate the size of these segments and, as the total life of cable is dependent on its construction, this also affects Orion's calculation of the depreciated value.

Graphing the quantities of *known* construction cable installed (by) year shows a gradual changeover from PILC type construction to XLPE. From the following graph, 1965 was conservatively accepted as the change-over (marked in red on the graph); unknown cable segments prior to this date (1,802m) are assumed to be PILC, segments after this date (130,097m) are assumed to be XLPE. The vast majority of cable of unknown construction was installed during 1980, so the result is not sensitive to the selection of a change-over date.



Conservatively, Orion values all low voltage cable of unknown construction as the smaller "medium" size cable. In any case, only 11.4% of Orion's low voltage cable of known construction is of the larger "heavy" size.

B11 Low voltage line of unknown size

204km of Orion's low voltage overhead line is of unknown size. On the basis that 90% of *known* size line is medium (with roughly equally proportions of heavy and light), and noting that there is only a very small variation in the unit replacement costs prescribed in the Handbook between heavy, medium and light, Orion values all low voltage overhead line of unknown size as medium size line.

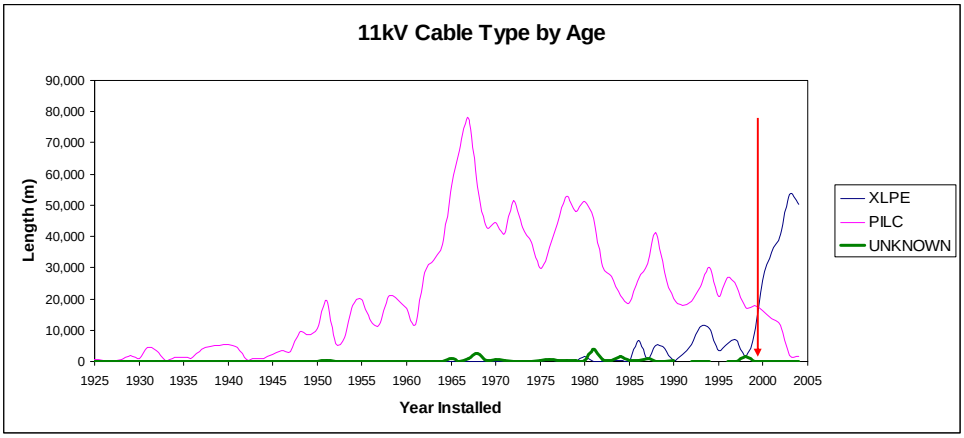
B12 11kV cable of unknown construction, unknown size or unknown age

Orion's GIS system (and cables database) includes some 11kV cable segments noted as "unknown" construction, "unknown" size, or "unknown" age.

Only 197 metres of 11kV cable is of unknown age (0.01% of total) and this affects Orion's calculation of the depreciated value of these assets. Orion reasonably assumes that this is older cable and applies the year of installation as 1900.

Of almost 2,000km of 11kV cable in Orion's network, less than 20km is of unknown construction. This affects the selection of an MEA as the Handbook specifies different useful lives for XLPE or PILC construction. The size of the cable is known so the uncertainty is limited to useful life.

Orion has decided to assume the cable construction based on the date the cable was installed. The following graph shows that prior to 1999, PILC was more commonly installed and all unknown cable prior to (but not including 1999) has been assumed to be of this construction (with the longer useful life). It is much less common for more recent segments' construction to be unknown (>= 1999 adds to less than 0.5km), but this has been assumed to be of XLPE construction.



Orion has very small quantities of 11kV cable for which the size is unknown. In respect of these cable segments, Orion has valued 227m of subtransmission cable as medium, and 3,721m of 11kV distribution cable as light.

B13 11kV line of unknown size or phasing

Unknown size
0.64% of Orion's 11kV overhead line (20km) is of unknown size. On the basis that the majority of *known* size line is light, and noting that there is only a very small variation in the unit replacement costs prescribed in the Handbook between heavy, medium and light, Orion values all 11kV overhead line of unknown size as light size line.

Unknown phasing
Orion's GIS identifies the phasing of 11kV overhead lines allowing Orion to establish the quantity of SWER and single phase (2-wire) lines. However, a significant quantity is listed as "unknown" phasing, as follows:

Size	Quantity (m)
Heavy	20,403
Medium	77,197
Light	475,609
	573,209

Conservatively, and considering that:

- Orion's information is likely to be less reliable in respect of lines on the fringes of its network, and
- heavy and medium size lines are likely to be of 3 phase construction,

Orion has assumed that all heavy and medium 11kV line of unknown construction phasing is 3 phase, but that all light 11kV line of unknown construction is single phase (2-wire).

B14 Proportion of concrete poles in streetlighting, low voltage, 11kV and 33kV line

The Handbook provides for the total life of overhead lines to be based on the weighted average of the lives of poles used in the construction of each line, wood poles providing a total life of 45 years and concrete providing 60 years.

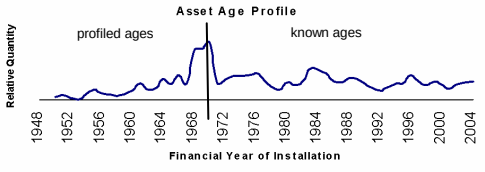
Orion's valuation of overhead lines is based on the attributes of each line segment: length, size and location. This information is sourced from Orion's GIS system.

Unfortunately the GIS does not include detail on the type of poles in each segment and it is necessary to apply an estimate. Orion's ongoing survey of all poles provides a sound basis for this estimate, as described in section 6.5.

B15 Pole mounted distribution substations

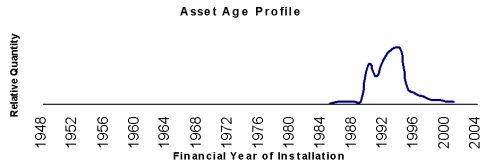
Data extracted from Orion's asset management system, WASP, shows a large group of pole distribution substation sites with unknown commissioning dates. There is a clear beginning to the recorded data in 1971.

To accommodate these assets in the valuation model Orion has applied an age profile. Sites with no date have been split into their respective sizes and profiled over the period 1950 - 1970 according to the 11kV line age profile over this same period. Orion considers that the 11kV line profile is a reasonable surrogate because substations are generally replaced when 11kV line is replaced. The resulting age profile is:



B16 Streetlighting relays

Orion owns 2,070 ripple relays installed within its network for the purpose of switching streetlighting circuits. In this valuation, the quantity and age profile of these assets is consistent with that applied in Orion's 2001 valuation and is based on historic records. More accurate information is not available at this time.

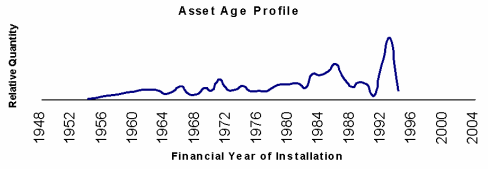


Note that these are "system fixed assets" as defined in the disclosure requirements, but are excluded from the ODV under Handbook clause 2.7(m). For consistency with advice received from the Commerce Commission in relation to other streetlighting assets, this exclusion is achieved through optimisation. Refer to section 9.4.6.

B17 Rewireable fuses

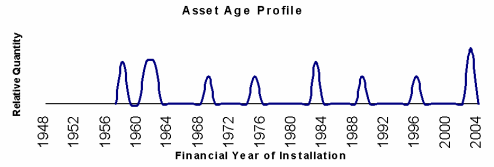
Orion is actively replacing rewireable fuses with drop-out fuses. While the quantity of rewireable fuses is known, the age profile is based on an historic profile (as used in the previous valuation), updated to reflect the removal of older assets. Further, these assets occur in 2 and 3 phase sets, each attributed a different standard replacement cost in the Handbook. Orion has split the total quantity between 2 and 3 phase sets in the same proportion as drop-out fuses are split.

The age profile for 2 and 3 phase sets of rewireable fuses (combined) is:



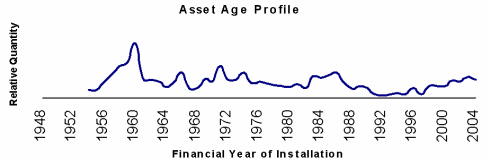
B18 33kV Isolation

Orion has 24 33kV line air break isolators (in addition to the air break isolators installed at district substations). These are individually recorded on Orion's asset management database, WASP, but older assets do not carry a date of installation. For these older assets the age profile is based on an historic profile (as used in the previous valuation) updated to reflect any removals.



B19 11kV Disconnectors

Orion has 1,004 11kV air break isolators in 3 phase sets (termed "disconnectors" in the Handbook). These are individually recorded on Orion's asset management database, WASP, but older assets do not carry a date of installation. For these older assets the age profile is based on an historic profile (as used in the previous valuation) updated to reflect any removals.

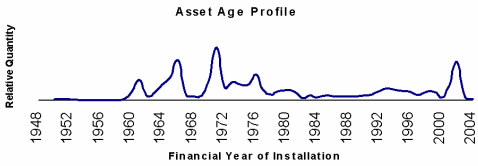
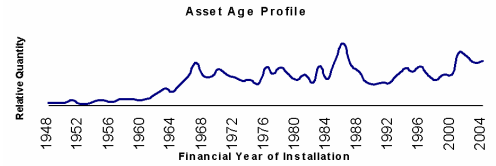


B20 Traffic management allowance for installation of lines and cables

Orion is not able to identify the *primary* cable or line to which the traffic management allowance may be added, as provided for in Handbook clause A.19. Instead, Orion has estimated the total value of the allowance based on road and street lengths (rather than cable and line lengths) to ensure that the allowance is not duplicated against multiple assets in the same location. For cable in level 2 roads, the average proportion buried in the carriageway is based on an analysis of sample areas.

The allowance is then included in Orion's valuation model as a pseudo asset, profiled according to the age profile of all assets giving rise to the allowance, and with its total life appropriately split between the different total lives of the assets giving rise to the allowance.

Details of the methodology used to derive this estimated quantity are included in section 7.2. The resulting quantities (lengths) and age profiles are:

Situation	Estimated length	Age profile
Traffic management for overhead lines in level 1 roads	121,676m	Based on lengths of low voltage line:- 
Traffic management for overhead lines in level 2 roads	34,435m	
Traffic management for underground cables in level 1 roads	428,497m	Based on combined lengths of all cable, except communications cable 
Traffic management for underground cables in level 2 roads	344,068m	
Traffic management for underground cables in the carriageway of level 2 roads	47,620m	

Appendix C
Valuation Multipliers and Allowances

This appendix provides schedules of valuation multipliers and allowances pursuant to the reporting requirement in Handbook clause 2.65(e).

The schedule details location and terrain multipliers, and traffic management allowances, together with the lengths of conductor to which these have been applied. It also provides the total ODRC for the assets to which the multipliers have been applied, and the total value of the traffic management allowance.

Valuation Multiplier & Allowance Report

Based on Valuation Model as at 31 March 2004 (extracted 24/11/2004 5:07 pm)

	Applied to (m)	Resulting ODRC ($)	Multiplier / Allowance
Location Multipliers			
Overhead Lines Remote Location			**1.25**
11kV Lines	*367,456*	*$7,269,898*	
Overhead Lines Urban Location			**1.56**
33kV Subtransmission Lines	*21,751*	*$557,694*	
11kV Subtransmission Lines	*47,543*	*$1,045,901*	
11kV Lines	*215,656*	*$4,238,907*	
Underground Cable CBD Location			**1.96**
11kV Subtransmission Cables	*26,541*	*$1,935,864*	
11kV Cables	*23,623*	*$1,948,618*	
LV Cables	*109,625*	*$3,741,996*	
Underground Cable High Vol Road (level 2) Location			**1.96**
33kV Subtransmission Cables	*295*	*$91,549*	
11kV Subtransmission Cables	*37,616*	*$3,487,940*	
11kV Cables	*90,938*	*$8,197,072*	
LV Cables	*357,798*	*$14,169,114*	
Terrain Multipliers			
Transpower Lines Hilly			**1.07**
66kV Subtransmission Lines	*23,531*	*$314,445*	
Transpower Lines Urban			**1.20**
66kV Subtransmission Lines	*35,897*	*$409,094*	
Overhead Lines Rugged Terrain			**1.30**
33kV Subtransmission Lines	*38,286*	*$1,463,596*	
11kV Lines	*337,414*	*$6,867,110*	
Underground Cable Rocky Terrain			**2.00**
11kV Subtransmission Cables	*5,918*	*$891,182*	
11kV Cables	*102,063*	*$10,176,832*	
LV Cables	*310,247*	*$12,551,856*	
Traffic Management Allowances			
Traffic Mgmt (OH Level 1)			**$0.80/m**
	121,676	*$46,346*	
Traffic Mgmt (OH Level 2)			**$1.50/m**
	34,435	*$24,593*	
Traffic Mgmt (UG Level 1)			**$6.00/m**
	428,497	*$1,560,284*	
Traffic Mgmt (UG Level 2)			**$15.00/m**
	344,068	*$3,132,131*	
Traffic Mgmt (UG Level 2-in road)			**$40.00/m**
	47,620	*$1,155,998*	

Appendix D
Replacement Costs and Total Lives (for all assets)

This appendix provides a schedule of all replacement costs and total lives used in Orion's valuation model. It is provided as a useful reference in addition to the report requirements specified in the Handbook.

Note:

- entries with no unit replacement cost represent assets that have varying costs, as identified in section 8,
- entries with no total life do not depreciate, and
- for cables and lines, all unit replacement costs represent circuit length, not route length (this is particularly noted in relation to *double circuit* entries).

Schedule of Modern Equivalent Assets (Quantities, Unit Replacement Costs and Total Lives)

Based on Handbook Table A.1 with additional non-standard assets

Asset	*(Handbook entry)*	*Total Optimised Quantity*	*Unit Replacement Cost & Source*	*Total Life (years) (TL1 & TL2) & Source*
Subtransmission				
66kV Subtransmission Lines				
66kV OH Heavy (Dcst Wolf)		55,446 m	$68.74 Orion	55 Orion
66kV OH Heavy (Dcst Hyena)		3,982 m	$56.07 Orion	55 Orion
66kV OH Medium (Single circuit wooden pole)		37,734 m	$84.48 Orion	45 Orion
66kV Subtransmission Cables				
66kV UG Extra Heavy		7,278 m	$1,407.41 Orion	45 Orion
66kV UG Heavy		75 m	$995.36 Orion	45 70 Orion
66kV UG Heavy Dcct		55,210 m	$726.58 Orion	45 70 Orion
33kV Subtransmission Lines				
33kV OH Heavy	*(33 kV Lines - Heavy (≥150mm2, ≤300mm2 Al))*	8,749 m	$61.00 Handbook	60 45 Handbook
33kV OH Light	*(33 kV Lines - Light (<150mm2 Al))*	312,810 m	$45.00 Handbook	60 45 Handbook
33kV Subtransmission Cables				
33kV UG Heavy		21,625 m	$195.00 Orion	45 70 Handbook
33kV UG Medium	*(33 kV Cables (≤240mm2 Al))*	344 m	$175.00 Handbook	45 70 Handbook
33kV Subtransmission				
33kV Isolation	*(33 kV Isolation)*	24 No.	$9,000.00 Handbook	35 Handbook
33kV Surge Arresters (3ph)	*(33 kV Surge Arresters (3ph))*	8 No.	$8,000.00 Handbook	35 Handbook
11kV Subtransmission Lines				
11kV OH Heavy (SubT)	*(11kV OH Lines - Heavy (≥150mm2, ≤240mm2 Al))*	9,063 m	$31.00 Handbook	60 45 Handbook
11kV OH Medium (SubT)	*(11kV OH Lines - Medium (>50mm2, <150mm2 Al))*	24,864 m	$28.00 Handbook	60 45 Handbook
11kV OH Light (SubT)	*(11kV OH Lines - Light (≤50mm2 Al))*	31,741 m	$25.00 Handbook	60 45 Handbook
11kV OH Single Phase (SubT)	*(11kV OH Lines - Single Phase or SWER)*	213 m	$21.00 Handbook	60 45 Handbook
11kV Subtransmission Cables				
11kV UG Extra Heavy SubT		5,733 m	$195.00 Orion	45 70 Handbook
11kV UG Heavy SubT	*(11kV UG Cables - Heavy (>240mm2, ≤300mm2 Al))*	38,650 m	$125.00 Handbook	45 70 Handbook
11kV UG Medium SubT	*(11kV UG Cables - Medium (>50mm2, ≤240mm2 Al))*	20,094 m	$103.00 Handbook	45 70 Handbook
11kV UG Light SubT	*(11kV UG Cables - Light (≤50mm2 Al))*	2,424 m	$81.00 Handbook	45 70 Handbook
11kV UG Extra Heavy Dcct SubT		83,940 m	$155.00 Orion	45 70 Handbook
11kV UG Heavy Dcct SubT	*(11kV UG Cables - Heavy Dcct (>240mm2, ≤300mm2 Al))*	311,252 m	$85.00 Handbook	45 70 Handbook
11kV UG Medium Dcct SubT	*(11kV UG Cables - Medium Dcct (>50mm2, ≤240mm2 Al))*	134,940 m	$70.00 Handbook	45 70 Handbook
11kV UG Light Dcct SubT		14,268 m	$49.50 Orion	45 70 Handbook
Communications				
Comms UG	*(Pilot/Communications Ccts U/G)*	1,031,266 m	$15.22 Orion	45 Handbook
GXP Check Metering		9 No.	Orion	40 Orion

Printed 24/11/2004 5:18:47 p.m. ***Schedule Page 1 of 6***

Asset	(Handbook entry)	Total Optimised Quantity	Unit Replacement Cost & Source	Total Life (years) (TL1 & TL2) & Source
Zone Substations (District & Network)				
Zone Substation Land	(Land)	50 No.	Orion	
Site Development and Buildings				
Network Sub-Orion Owned	(Site Development and Buildings)	173 No.	$101,568.00 Orion	50 Handbook
Network Sub-On Customer's Premises	(Site Development and Buildings)	76 No.	$10,568.00 Orion	50 Handbook
District Sub-11kV Urban	(Site Development and Buildings)	11 No.	$287,000.00 Orion	50 Handbook
District Sub-66or33kV wth Outdoor Struct	(Site Development and Buildings)	24 No.	$290,677.00 Orion	50 Handbook
District Sub-Sml 66or33kV wth Outdoor Struct	(Site Development and Buildings)	3 No.	$203,706.00 Orion	50 Handbook
District Sub-66kV or 33kV Indoor	(Site Development and Buildings)	11 No.	$385,000.00 Orion	50 Handbook
District Sub-Block Building	(Site Development and Buildings)	17 No.	$91,000.00 Orion	50 Handbook
District Sub-Individually Assessed Structure	(Site Development and Buildings)	1 No.	$943,866.00 Orion	50 Handbook
Transformers				
66/11kV 20/40MVA	(Transformers)	22 No.	$946,530.00 Orion	60 Extended
66/11kV 11.5/23 MVA	(Transformers)	1 No.	$767,722.00 Orion	60 Extended
66/11kV 7.5/10MVA	(Transformers)	2 No.	$630,990.00 Orion	60 Extended
33/11kV 11.5/23MVA	(Transformers)	4 No.	$576,067.00 Orion	60 Extended
33/11kV 10/20MVA	(Transformers)	6 No.	$562,580.00 Orion	60 Extended
33/11kV 7.5/10MVA	(Transformers)	1 No.	$523,374.00 Orion	60 Extended
33/11kV 7.5MVA	(Transformers)	15 No.	$506,390.00 Orion	60 Extended
33/11kV 2.5MVA	(Transformers)	4 No.	$423,920.00 Orion	60 Extended
33/11kV 1.5MVA	(Transformers)	1 No.	$395,701.00 Orion	60 Extended
33/11kV 0.75MVA	(Transformers)	1 No.	$372,462.00 Orion	60 Extended
11kV Regulator (20MVA)	(Voltage Regulator)	3 No.	$223,939.00 Orion	55 Handbook
11kV Regulator (4MVA)	(Voltage Regulator)	13 No.	$172,261.00 Orion	55 Handbook
66kV Circuit Breaker		28 No.	$67,669.00 Orion	45 Handbook
66kV A B Isolator		36 No.	$13,887.00 Orion	40 Handbook
66kV A B Isolator with E/Sw		22 No.	$16,542.00 Orion	40 Handbook
33kV Circuit Breaker	(33kV Outdoor Circuit Breakers)	44 No.	$45,000.00 Handbook	40 Handbook
33kV A B Isolator		149 No.	$5,183.00 Orion	40 Handbook
11kV Circuit Breaker (District & Network Sub)	(11kV Indoor Switchgear Cubicle)	1,422 No.	$30,000.00 Handbook	45 Handbook
11kV Circuit Breaker Sealed (District & Network Sub)	(11kV Indoor Switchgear Cubicle)	386 No.	$30,000.00 Handbook	55 Extended
Incoming Circuit Protection & Controls				
66kV Unit Protection (with intertrip)		36 No.	$46,467.00 Orion	40 Handbook
Directional Overcurrent Relay (with CB fail)		25 No.	$8,710.00 Orion	40 Handbook
Transformer Protection and Controls				
Transformer Diff Protection & Control (+intertrip)		15 No.	$88,604.00 Orion	40 Handbook
Transformer Diff Protection & Control		43 No.	$56,145.00 Orion	40 Handbook
Feeder Protection and Controls				
11/33kV Feeder Protection (with OC & EF)		12 No.	$18,196.00 Orion	40 Handbook
11/33kV Unit Protection (with OC)		348 No.	$10,380.00 Orion	40 Handbook
11/33kV Unit Protection		720 No.	$5,250.00 Orion	40 Handbook
11kV Protection (with OC & EF)		697 No.	$6,385.00 Orion	40 Handbook
11kV Protection (with OC, EF, reclose & CB fail)		83 No.	$10,555.00 Orion	40 Handbook
Bus Section/Coupler Protection and Controls				
Bus Bar Protection Relay		30 No.	$31,345.00 Orion	40 Handbook
Outdoor Structure				
Structure 66kV - Incomer	(Outdoor Structure)	15 No.	$39,183.00 Orion	60 45 Handbook
Structure 66kV - Bus Section	(Outdoor Structure)	13 No.	$56,024.00 Orion	60 45 Handbook
Structure 66kV - Isolator Section	(Outdoor Structure)	5 No.	$38,670.00 Orion	60 45 Handbook
Structure 66kV - Feeder	(Outdoor Structure)	12 No.	$57,038.00 Orion	60 45 Handbook
Structure 33kV - Incomer	(Outdoor Structure)	14 No.	$36,017.00 Orion	60 45 Handbook
Structure 33kV - Bus Section	(Outdoor Structure)	36 No.	$49,998.00 Orion	60 45 Handbook
Structure 33kV - Isolator Section	(Outdoor Structure)	6 No.	$35,544.00 Orion	60 45 Handbook
Structure 33kV - Feeder	(Outdoor Structure)	38 No.	$54,474.00 Orion	60 45 Handbook

Asset (Handbook entry)	Total Optimised Quantity	Unit Replacement Cost & Source	Total Life (years) (TL1 & TL2) & Source
SCADA and Communications Equipment			
RTU (large urban District Sub) (SCADA and Communications Equipment)	5 No.	$88,022.00 Orion	15 Handbook
RTU (medium urban District Sub) (SCADA and Communications Equipment)	15 No.	$70,115.00 Orion	15 Handbook
RTU (small urban District Sub) (SCADA and Communications Equipment)	18 No.	$38,462.00 Orion	15 Handbook
RTU (small rural District Sub) (SCADA and Communications Equipment)	17 No.	$44,857.00 Orion	15 Handbook
RTU (medium Network Sub) (SCADA and Communications Equipment)	3 No.	$17,797.00 Orion	15 Handbook
RTU (small Network Sub) (SCADA and Communications Equipment)	42 No.	$13,357.00 Orion	15 Handbook
Pilot Box 140 way (SCADA and Communications Equipment)	2 No.	$5,253.00 Orion	15 Handbook
Pilot Box 280 way (SCADA and Communications Equipment)	27 No.	$10,506.00 Orion	15 Handbook
Ripple Injection Plant			
Ripple Injection Plant (11kV, 175Hz) (Ripple Injection Plant)	24 No.	$177,474.00 Orion	20 Handbook
Ripple Injection Plant (11kV, 317Hz) (Ripple Injection Plant)	3 No.	$148,112.00 Orion	20 Handbook
Ripple Injection Plant (33kV, 317 Hz) (Ripple Injection Plant)	5 No.	$315,200.00 Orion	20 Handbook
Ripple Wave Trap (66kV 175Hz) (Ripple Injection Plant)	3 No.	$60,000.00 Orion	20 Handbook
DC supplies, batteries and inverters			
Battery (50/100AH), Charger (110V) & Stand (DC supplies, batteries and inverters)	31 No.	$9,380.00 Orion	20 Handbook
Battery (50/100AH), Charger (50V) & Stand (DC supplies, batteries and inverters)	19 No.	$4,400.00 Orion	20 Handbook
Other Items			
11kV AT (15kVA) (Other Items)	29 No.	$6,989.00 Orion	40 Handbook
11kV Incomer Cable 40MVA (Other Items)	24 No.	$45,890.00 Orion	40 Handbook
11kV Incomer Cable 20MVA (Other Items)	10 No.	$25,309.00 Orion	40 Handbook
11kV Incomer Cable 10MVA (Other Items)	18 No.	$12,986.00 Orion	40 Handbook
11kV Bus coupler cable 20MVA (Other Items)	28 No.	$9,660.00 Orion	40 Handbook
11kV Bus coupler cable 10MVA (Other Items)	5 No.	$4,717.00 Orion	40 Handbook
66kV VT (3ph) (Other Items)	5 No.	$13,837.00 Orion	40 Handbook
66kV Surge Diverter (3ph) (Other Items)	9 No.	$4,757.00 Orion	40 Handbook
33kV VT (3ph) (Other Items)	3 No.	$19,789.00 Orion	40 Handbook
33kV Surge Diverter (3ph) (Other Items)	5 No.	$2,513.00 Orion	40 Handbook
11kV VT (3ph) (Other Items)	73 No.	$6,989.00 Orion	40 Handbook
11kV Neutral Earthing Resistor (Other Items)	5 No.	$28,444.00 Orion	40 Handbook
Distribution Lines & Cables			
11kV Lines			
11kV OH Heavy (Distn) (11kV OH Lines - Heavy (≥150mm2, ≤240mm2 Al))	496 m	$31.00 Handbook	60 45 Handbook
11kV OH Medium (Distn) (11kV OH Lines - Medium (>50mm2, <150mm2 Al))	910,317 m	$28.00 Handbook	60 45 Handbook
11kV OH Light (Distn) (11kV OH Lines - Light (≤50mm2 Al))	1,284,659 m	$25.00 Handbook	60 45 Handbook
11kV OH Single Phase (Distn) (11kV OH Lines - Single Phase or SWER)	612,919 m	$21.00 Handbook	60 45 Handbook
11kV OH SWER (Distn) (11kV OH Lines - Single Phase or SWER)	103,661 m	$21.00 Handbook	60 45 Handbook
11kV OH Heavy Underbuilt (Distn) (11kV OH Lines - Heavy Underbuilt (≥150mm2, ≤ 240	47 m	$15.00 Handbook	60 45 Handbook
11kV OH Medium Underbuilt (Distn) (11kV OH Lines - Medium Underbuilt (>50mm2, <15	178,322 m	$14.00 Handbook	60 45 Handbook
11kV OH Light Underbuilt (Distn) (11kV OH Lines - Light Underbuilt (≤50mm2 Al))	42,225 m	$12.00 Handbook	60 45 Handbook
11kV OH Single Phase Underbuilt (Distn)	7,513 m	$8.00 Orion	60 45 Orion
Traffic Mgmt (OH Level 1) (Traffic Mgmt OH Level 1 (clause A.19))	121,676 m	$0.80 Handbook	60 45 Handbook
Traffic Mgmt (OH Level 2) (Traffic Mgmt OH Level 2 (clause A.19))	34,435 m	$1.50 Handbook	60 45 Handbook
11kV Cables			
11kV UG Extra Heavy Distn	12 m	$195.00 Orion	45 70 Handbook
11kV UG Heavy Distn (11kV UG Cables - Heavy (>240mm2, ≤300mm2 Al))	2,330 m	$125.00 Handbook	45 70 Handbook
11kV UG Medium Distn (11kV UG Cables - Medium (>50mm2, ≤240mm2 Al))	272,030 m	$103.00 Handbook	45 70 Handbook
11kV UG Light Distn (11kV UG Cables - Light (≤50mm2 Al))	322,390 m	$81.00 Handbook	45 70 Handbook
11kV UG Extra Heavy Dcct Distn	0 m	$155.00 Orion	45 70 Handbook
11kV UG Heavy Dcct Distn (11kV UG Cables - Heavy Dcct (>240mm2, ≤300mm2 Al))	3,478 m	$85.00 Handbook	45 70 Handbook
11kV UG Medium Dcct Distn (11kV UG Cables - Medium Dcct (>50mm2, ≤240mm2 Al))	335,483 m	$70.00 Handbook	45 70 Handbook
11kV UG Light Dcct Distn	404,969 m	$49.50 Orion	45 70 Handbook
Traffic Mgmt (UG Level 1) (Traffic Mgmt UG Level 1 (clause A.19))	428,497 m	$6.00 Handbook	45 70 Handbook
Traffic Mgmt (UG Level 2) (Traffic Mgmt UG Level 2 (clause A.19))	344,068 m	$15.00 Handbook	45 70 Handbook
Traffic Mgmt (UG Level 2-in road) (Traffic Mgmt UG Level 2 in Carriageway (clause A.19,	47,620 m	$40.00 Handbook	45 70 Handbook

Asset	(Handbook entry)	Total Optimised Quantity	Unit Replacement Cost & Source	Total Life (years) (TL1 & TL2) & Source
Distribution Switchgear				
11kV Disconnector (3ph)	*(11kV Disconnector 3ph (Excl Pole))*	1,004 No.	$3,500.00 Handbook	35 Handbook
11kV Dropout Fuse (3ph set)	*(11kV Dropout Fuse 3ph (Excl Pole))*	6,184 No.	$2,500.00 Handbook	35 Handbook
11kV Dropout Fuse (2ph set)	*(11kV Dropout Fuse 2ph (Excl Pole))*	1,546 No.	$2,000.00 Handbook	35 Handbook
11kV Dropout Fuse (1ph)		94 No.	$1,000.00 Orion	35 Handbook
11kV Sectionaliser	*(11kV Sectionaliser (Excl Pole))*	7 No.	$18,000.00 Handbook	40 Handbook
11kV Circuit Breaker / Recloser (Pole-Mounted)	*(11kV Recloser (Excl Pole))*	48 No.	$27,000.00 Handbook	40 Handbook
11kV Circuit Breaker (Distn Substation)	*(11kV Indoor Switchgear Cubicle)*	49 No.	$30,000.00 Handbook	45 Handbook
11kV Circuit Breaker Sealed (Distn Sub)	*(11kV Indoor Switchgear Cubicle)*	13 No.	$30,000.00 Handbook	55 Extended
11kV Single Phase Breaker		8 No.	$15,139.00 Orion	40 Orion
11kV Surge Arresters (3ph)		492 No.	$1,771.00 Orion	35 Handbook
11kV Magnefix Type UT		159 No.	$9,393.00 Orion	40 Handbook
11kV Magnefix Type 1K2T		26 No.	$15,615.00 Orion	40 Handbook
11kV Magnefix Type 1K3T		1 No.	$21,230.00 Orion	40 Handbook
11kV Magnefix Type 2K1T		968 No.	$13,649.00 Orion	40 Handbook
11kV Magnefix Type 2K2T		47 No.	$19,218.00 Orion	40 Handbook
11kV Magnefix Type 2K3T		1 No.	$28,517.00 Orion	40 Handbook
11kV Magnefix Type 2KB2K		256 No.	$16,146.00 Orion	40 Handbook
11kV Magnefix Type 2KBK		532 No.	$12,856.00 Orion	40 Handbook
11kV Magnefix Type 3K		358 No.	$12,466.00 Orion	40 Handbook
11kV Magnefix Type 3K1T		334 No.	$19,136.00 Orion	40 Handbook
11kV Magnefix Type 3K2T		2 No.	$23,145.00 Orion	40 Handbook
11kV Magnefix Type 3KX		1 No.	$15,997.00 Orion	40 Handbook
11kV Magnefix Type 4K		1 No.	$16,545.00 Orion	40 Handbook
11kV Magnefix Type 4K1T		15 No.	$23,612.00 Orion	40 Handbook
11kV Magnefix Type 5K		6 No.	$20,622.00 Orion	40 Handbook
11kV Magnefix Type KB2K		20 No.	$13,306.00 Orion	40 Handbook
11kV Magnefix Type KB2KBK		178 No.	$16,156.00 Orion	40 Handbook
11kV Magnefix Type KBX		456 No.	$7,885.00 Orion	40 Handbook
11kV Magnefix Type KTB		39 No.	$9,393.00 Orion	40 Handbook
11kV Switchgear Cabinet (1/4 Kiosk)		88 No.	$2,000.00 Orion	45 Orion
11kV Oil Switch (Not Fused)	*(Extra Oil Switch)*	36 No.	$6,000.00 Handbook	40 Handbook
11kV Oil Switch (Fused)	*(Extra Fuse Switch)*	148 No.	$8,000.00 Handbook	40 Handbook
UHF Remote Unit		64 No.	$3,907.00 Orion	15 Handbook
RTU Aux Equip (Pole mount on LCB)		48 No.	$6,811.00 Orion	15 Handbook
Distribution Transformers				
11/0.4 kV Single/Two Phase Units (pole and ground mounted)				
1ph Pole Mount ≤ 15 kVA	*(Up to and including 15 kVA)*	1,516 No.	$2,600.00 Handbook	45 Handbook
1ph Pole Mount 30 kVA	*(30 kVA)*	41 No.	$3,300.00 Handbook	45 Handbook
1ph Pole Mount 100 kVA	*(100 kVA)*	1 No.	$7,000.00 Handbook	45 Handbook
1ph Pad Mount ≤ 15 kVA	*(Up to and including 15 kVA)*	12 No.	$2,600.00 Handbook	55 Extended
1ph Pad Mount 30 kVA	*(30 kVA)*	4 No.	$3,300.00 Handbook	55 Extended
1ph Pad Mount 50 kVA	*(50 kVA)*	0 No.	$4,000.00 Handbook	55 Extended
1ph Pad Mount 75 kVA	*(75 kVA)*	0 No.	$5,000.00 Handbook	55 Extended
11/0.4 kV Three Phase Units (pole mounted, bushing terminations)				
3ph Pole Mount ≤ 30 kVA	*(Up to and including 30 kVA)*	2,429 No.	$5,000.00 Handbook	45 Handbook
3ph Pole Mount 50 kVA	*(50 kVA)*	1,032 No.	$7,000.00 Handbook	45 Handbook
3ph Pole Mount 100 kVA	*(100 kVA)*	660 No.	$9,000.00 Handbook	45 Handbook
3ph Pole Mount 200 kVA	*(200 kVA)*	247 No.	$13,000.00 Handbook	45 Handbook
3ph Pole Mount 300 kVA	*(300 kVA)*	8 No.	$16,000.00 Handbook	45 Handbook

Asset	(Handbook entry)	Total Optimised Quantity		Unit Replacement Cost & Source		Total Life (years) (TL1 & TL2) & Source		
11/0.4 kV Three Phase Units (ground mounted, cable entry)								
3ph Pad Mount 100 kVA	*(100 kVA)*	72	No.	$9,000.00	Handbook	55		Extended
3ph Pad Mount 200 kVA	*(200 kVA)*	1,298	No.	$14,000.00	Handbook	55		Extended
3ph Pad Mount 300 kVA	*(300 kVA)*	1,446	No.	$16,000.00	Handbook	55		Extended
3ph Pad Mount 500 kVA	*(500 kVA)*	606	No.	$22,000.00	Handbook	55		Extended
3ph Pad Mount 750 kVA	*(750 kVA)*	246	No.	$26,000.00	Handbook	55		Extended
3ph Pad Mount 1000 kVA	*(1000 kVA)*	119	No.	$29,000.00	Handbook	55		Extended
3ph Pad Mount 1250 kVA	*(1250 kVA)*	1	No.	$40,000.00	Handbook	55		Extended
3ph Pad Mount 1500 kVA	*(1500 kVA)*	3	No.	$46,000.00	Handbook	55		Extended
Distribution Substation								
Distn Sub - Land		1,761	No.		Orion			
Housing								
Distn Sub - Pole Mount (≤50 kVA)	*(Pole Mount (50 kVA or less))*	4,955	No.	$1,000.00	Handbook	45		Handbook
Distn Sub - Pole Mount (>50 kVA, <100 kVA)		88	No.	$2,000.00	Orion	45		Handbook
Distn Sub - Pole Mount (≥100 kVA)	*(Pole Mount (100 kVA or more))*	862	No.	$2,000.00	Handbook	45		Handbook
Distn Sub - Pad Mount (Orion full kiosk)	*(Ground Mount (Covered))*	2,552	No.	$4,000.00	Handbook	55		Extended
Distn Sub - Pad Mount (Orion 1/2 kiosk)	*(Ground Mount (Covered))*	431	No.	$4,000.00	Handbook	55		Extended
Distn Sub - Building (Orion owned)	*(Kiosk (Masonry or block enclosure))*	67	No.	$11,000.00	Handbook	55		Extended
Distn Sub - Building (Customer owned)	*(On Customer's Premises with Feedout)*	202	No.	$2,000.00	Handbook	55		Extended
Metering								
Distn Sub - LV MDI Metering (800A)		2,919	No.	$1,290.00	Orion	40		Orion
Distn Sub - LV MDI Metering (1500A)		419	No.	$1,778.00	Orion	40		Orion
Low Voltage								
LV Lines								
LV OH Heavy 4 wire	*(Overhead Heavy 4 wire (>150mm2 Al))*	45,414	m	$45.00	Handbook	60	45	Handbook
LV OH Medium 4 wire	*(Overhead Medium 4 wire (>50mm2, ≤150mm2 Al))*	640,499	m	$42.00	Handbook	60	45	Handbook
LV OH Light 4 wire	*(Overhead Light 4 wire (≤50mm2 Al))*	26,225	m	$38.00	Handbook	60	45	Handbook
LV OH Medium 2 wire	*(Overhead Medium 2 wire (>50mm2, ≤150mm2 Al))*	36,685	m	$36.00	Handbook	60	45	Handbook
LV OH Light 2 wire	*(Overhead Light 2 wire (≤50mm2 Al))*	1,631	m	$30.00	Handbook	60	45	Handbook
LV OH Heavy 4 wire Underbuilt	*(Overhead Heavy Underbuilt 4 wire (>150mm2))*	2,353	m	$24.00	Handbook	60	45	Handbook
LV OH Medium 4 wire Underbuilt	*(Overhead Medium Underbuilt 4 wire (>50mm2, ≤150m*	207,476	m	$21.00	Handbook	60	45	Handbook
LV OH Light 4 wire Underbuilt		20,858	m	$19.00	Orion	60	45	Handbook
LV OH Medium 2 wire Underbuilt	*(Overhead Medium Underbuilt 2 wire (>50mm2, ≤150m*	46,936	m	$17.00	Handbook	60	45	Handbook
LV OH Light 2 wire Underbuilt	*(Overhead Light Underbuilt 2 wire (≤50mm2))*	951	m	$14.00	Handbook	60	45	Handbook
LV OH Urban Road Crossings & Back Sections		262,085	m	$39.70	Orion	60	45	Handbook
LV OH Rural Road Crossings & Back Sections		406,270	m	$32.61	Orion	60	45	Handbook
LV OH Lighting (on own)	*(Overhead Light 2 wire (≤50mm2 Al))*	111,447	m	$30.00	Handbook	60	45	Handbook
LV OH Lighting (with LV)		0	m	$3.23	Orion	60	45	Handbook
LV OH Lighting (with HV)	*(Overhead Light Underbuilt 2 wire (≤50mm2))*	52,407	m	$14.00	Handbook	60	45	Handbook
LV Cables								
LV UG Heavy	*(Underground Heavy (>240mm2))*	132,563	m	$72.00	Handbook	45	70	Handbook
LV UG Medium	*(Underground Medium (≤240mm2))*	1,107,976	m	$63.00	Handbook	45	70	Handbook
LV UG Service Main (16mm2 NS)		314,087	m	$45.00	Orion	45	70	Handbook
LV UG Heavy Shared Trench	*(Underground Heavy Shared Trench (>240mm2))*	49,418	m	$40.00	Handbook	45	70	Handbook
LV UG Medium Shared Trench	*(Underground Medium Shared Trench (≤240mm2))*	431,330	m	$32.00	Handbook	45	70	Handbook
LV UG Lighting 2 Core (on own)	*(Underground Streetlighting Circuit (own trench))*	256,737	m	$30.00	Handbook	45	70	Handbook
LV UG Lighting 2 Core (with LV)		0	m	$12.00	Orion	45	70	Handbook
LV UG Lighting 5th Core (with LV)		0	m	$7.20	Orion	45	70	Handbook
Link Pillars								
LV 2 Way Linkbox / Multibox	*(2 Way Link Pillar)*	2,888	No.	$2,000.00	Handbook	45		Handbook
LV 3 Way Linkbox / Multibox		1,139	No.	$3,000.00	Orion	45		Handbook
LV 4 Way Linkbox / Multibox	*(4 Way Link Pillar)*	809	No.	$4,000.00	Handbook	45		Handbook

Asset	(Handbook entry)	Total Optimised Quantity		Unit Replacement Cost & Source		Total Life (years) (TL1 & TL2) & Source	
Customer Service Connections							
LV Connection OH 1ph	(LV Overhead - 1 ph)	83,917	No.	$70.00	Handbook	45	Handbook
LV Connection OH 3ph	(LV Overhead - 3 ph)	9,058	No.	$180.00	Handbook	45	Handbook
LV Connection UG 1ph (fuse only)		22,540	No.	$91.00	Orion	45	Handbook
LV Connection UG 3ph (fuse only)		1,932	No.	$163.00	Orion	45	Handbook
LV Connection UG 1ph (shared bndry box)	(LV Underground - 1 ph shared pillar)	63,115	No.	$250.00	Handbook	45	Handbook
LV Connection UG 1ph (dedicated bndry box)	(LV Underground - 1 ph own pillar)	4,620	No.	$500.00	Handbook	45	Handbook
LV Connection UG 3ph (shared bndry box)	(LV Underground - 3 ph shared pillar)	21,056	No.	$400.00	Handbook	45	Handbook
LV Connection UG 3ph (dedicated bndry box)	(LV Underground - 3 ph own pillar)	2,081	No.	$800.00	Handbook	45	Handbook
LV Lighting Control Relay		0	No.	$132.00	Orion	40	Orion
Other System Fixed Assets							
SCADA & Comms (central facilities)							
SCADA Master Station		1	Lot	$2,977,427.00	Orion	15	Handbook
UHF Masters		7	No.	$22,000.00	Orion	15	Handbook
UHF Repeaters		7	No.	$25,000.00	Orion	15	Handbook

Appendix E
Replacement Costs and Total Lives (for non-standard assets)

This appendix provides a schedule of the replacement costs and total lives established by Orion and used in the valuation (pursuant to the reporting requirement in clause 2.65(f) of the Handbook). It also provides detail of the replacement costs determined by Orion where standard assets are listed in Handbook table A.1 with no standard replacement cost (that is, entries marked "**"). The basis for determining these replacement costs and total lives is detailed in section 8.

Note:

- entries with no unit replacement cost represent assets that have varying costs, as identified in section 8,
- entries with no total life do not depreciate, and
- for cables and lines, all unit replacement costs represent circuit length, not route length (this is particularly noted in relation to *double circuit* entries).

Schedule of Modern Equivalent Assets (Quantities, Unit Replacement Costs and Total Lives)

Based on Handbook Table A.1 with additional non-standard assets

Asset	*(Handbook entry)*	*Total Optimised Quantity*	*Unit Replacement Cost & Source*	*Total Life (years) (TL1 & TL2) & Source*
Subtransmission				
66kV Subtransmission Lines				
66kV OH Heavy (Dcst Wolf)		55,446 m	$68.74 Orion	55 Orion
66kV OH Heavy (Dcst Hyena)		3,982 m	$56.07 Orion	55 Orion
66kV OH Medium (Single circuit wooden pole)		37,734 m	$84.48 Orion	45 Orion
66kV Subtransmission Cables				
66kV UG Extra Heavy		7,278 m	$1,407.41 Orion	45 Orion
66kV UG Heavy		75 m	$995.36 Orion	45 70 Orion
66kV UG Heavy Dcct		55,210 m	$726.58 Orion	45 70 Orion
33kV Subtransmission Cables				
33kV UG Heavy		21,625 m	$195.00 Orion	45 70 Handbook
11kV Subtransmission Cables				
11kV UG Extra Heavy SubT		5,733 m	$195.00 Orion	45 70 Handbook
11kV UG Extra Heavy Dcct SubT		83,940 m	$155.00 Orion	45 70 Handbook
11kV UG Light Dcct SubT		14,268 m	$49.50 Orion	45 70 Handbook
Communications				
Comms UG	*(Pilot/Communications Ccts U/G)*	1,031,266 m	$15.22 Orion	45 Handbook
GXP Check Metering		9 No.	Orion	40 Orion
Zone Substations (District & Network)				
Zone Substation Land	*(Land)*	50 No.	Orion	
Site Development and Buildings				
Network Sub-Orion Owned	*(Site Development and Buildings)*	173 No.	$101,568.00 Orion	50 Handbook
Network Sub-On Customer's Premises	*(Site Development and Buildings)*	76 No.	$10,568.00 Orion	50 Handbook
District Sub-11kV Urban	*(Site Development and Buildings)*	11 No.	$287,000.00 Orion	50 Handbook
District Sub-66or33kV wth Outdoor Struct	*(Site Development and Buildings)*	24 No.	$290,677.00 Orion	50 Handbook
District Sub-Sml 66or33kV wth Outdoor Struct	*(Site Development and Buildings)*	3 No.	$203,706.00 Orion	50 Handbook
District Sub-66kV or 33kV Indoor	*(Site Development and Buildings)*	11 No.	$385,000.00 Orion	50 Handbook
District Sub-Block Building	*(Site Development and Buildings)*	17 No.	$91,000.00 Orion	50 Handbook
District Sub-Individually Assessed Structure	*(Site Development and Buildings)*	1 No.	$943,866.00 Orion	50 Handbook

Asset	(Handbook entry)	Total Optimised Quantity	Unit Replacement Cost & Source	Total Life (years) (TL1 & TL2) & Source
Transformers				
66/11kV 20/40MVA	(Transformers)	22 No.	$946,530.00 Orion	60 Extended
66/11kV 11.5/23 MVA	(Transformers)	1 No.	$767,722.00 Orion	60 Extended
66/11kV 7.5/10MVA	(Transformers)	2 No.	$630,990.00 Orion	60 Extended
33/11kV 11.5/23MVA	(Transformers)	4 No.	$576,067.00 Orion	60 Extended
33/11kV 10/20MVA	(Transformers)	6 No.	$562,580.00 Orion	60 Extended
33/11kV 7.5/10MVA	(Transformers)	1 No.	$523,374.00 Orion	60 Extended
33/11kV 7.5MVA	(Transformers)	15 No.	$506,390.00 Orion	60 Extended
33/11kV 2.5MVA	(Transformers)	4 No.	$423,920.00 Orion	60 Extended
33/11kV 1.5MVA	(Transformers)	1 No.	$395,701.00 Orion	60 Extended
33/11kV 0.75MVA	(Transformers)	1 No.	$372,462.00 Orion	60 Extended
11kV Regulator (20MVA)	(Voltage Regulator)	3 No.	$223,939.00 Orion	55 Handbook
11kV Regulator (4MVA)	(Voltage Regulator)	13 No.	$172,261.00 Orion	55 Handbook
66kV Circuit Breaker		28 No.	$67,669.00 Orion	45 Handbook
66kV A B Isolator		36 No.	$13,887.00 Orion	40 Handbook
66kV A B Isolator with E/Sw		22 No.	$16,542.00 Orion	40 Handbook
33kV A B Isolator		149 No.	$5,183.00 Orion	40 Handbook
Incoming Circuit Protection & Controls				
66kV Unit Protection (with intertrip)		36 No.	$46,467.00 Orion	40 Handbook
Directional Overcurrent Relay (with CB fail)		25 No.	$8,710.00 Orion	40 Handbook
Transformer Protection and Controls				
Transformer Diff Protection & Control (+intertrip)		15 No.	$88,604.00 Orion	40 Handbook
Transformer Diff Protection & Control		43 No.	$56,145.00 Orion	40 Handbook
Feeder Protection and Controls				
11/33kV Feeder Protection (with OC & EF)		12 No.	$18,196.00 Orion	40 Handbook
11/33kV Unit Protection (with OC)		348 No.	$10,380.00 Orion	40 Handbook
11/33kV Unit Protection		720 No.	$5,250.00 Orion	40 Handbook
11kV Protection (with OC & EF)		697 No.	$6,385.00 Orion	40 Handbook
11kV Protection (with OC, EF, reclose & CB fail)		83 No.	$10,555.00 Orion	40 Handbook
Bus Section/Coupler Protection and Controls				
Bus Bar Protection Relay		30 No.	$31,345.00 Orion	40 Handbook
Outdoor Structure				
Structure 66kV - Incomer	(Outdoor Structure)	15 No.	$39,183.00 Orion	60 45 Handbook
Structure 66kV - Bus Section	(Outdoor Structure)	13 No.	$56,024.00 Orion	60 45 Handbook
Structure 66kV - Isolator Section	(Outdoor Structure)	5 No.	$38,670.00 Orion	60 45 Handbook
Structure 66kV - Feeder	(Outdoor Structure)	12 No.	$57,038.00 Orion	60 45 Handbook
Structure 33kV - Incomer	(Outdoor Structure)	14 No.	$36,017.00 Orion	60 45 Handbook
Structure 33kV - Bus Section	(Outdoor Structure)	36 No.	$49,998.00 Orion	60 45 Handbook
Structure 33kV - Isolator Section	(Outdoor Structure)	6 No.	$35,544.00 Orion	60 45 Handbook
Structure 33kV - Feeder	(Outdoor Structure)	38 No.	$54,474.00 Orion	60 45 Handbook
SCADA and Communications Equipment				
RTU (large urban District Sub)	(SCADA and Communications Equipment)	5 No.	$88,022.00 Orion	15 Handbook
RTU (medium urban District Sub)	(SCADA and Communications Equipment)	15 No.	$70,115.00 Orion	15 Handbook
RTU (small urban District Sub)	(SCADA and Communications Equipment)	18 No.	$38,462.00 Orion	15 Handbook
RTU (small rural District Sub)	(SCADA and Communications Equipment)	17 No.	$44,857.00 Orion	15 Handbook
RTU (medium Network Sub)	(SCADA and Communications Equipment)	3 No.	$17,797.00 Orion	15 Handbook
RTU (small Network Sub)	(SCADA and Communications Equipment)	42 No.	$13,357.00 Orion	15 Handbook
Pilot Box 140 way	(SCADA and Communications Equipment)	2 No.	$5,253.00 Orion	15 Handbook
Pilot Box 280 way	(SCADA and Communications Equipment)	27 No.	$10,506.00 Orion	15 Handbook
Ripple Injection Plant				
Ripple Injection Plant (11kV, 175Hz)	(Ripple Injection Plant)	24 No.	$177,474.00 Orion	20 Handbook
Ripple Injection Plant (11kV, 317Hz)	(Ripple Injection Plant)	3 No.	$148,112.00 Orion	20 Handbook
Ripple Injection Plant (33kV, 317 Hz)	(Ripple Injection Plant)	5 No.	$315,200.00 Orion	20 Handbook
Ripple Wave Trap (66kV 175Hz)	(Ripple Injection Plant)	3 No.	$60,000.00 Orion	20 Handbook
DC supplies, batteries and inverters				
Battery (50/100AH), Charger (110V) & Stand	(DC supplies, batteries and inverters)	31 No.	$9,380.00 Orion	20 Handbook
Battery (50/100AH), Charger (50V) & Stand	(DC supplies, batteries and inverters)	19 No.	$4,400.00 Orion	20 Handbook

Asset	(Handbook entry)	Total Optimised Quantity		Unit Replacement Cost & Source		Total Life (years) (TL1 & TL2) & Source		
Other Items								
11kV AT (15kVA)	(Other Items)	29	No.	$6,989.00	Orion	40		Handbook
11kV Incomer Cable 40MVA	(Other Items)	24	No.	$45,890.00	Orion	40		Handbook
11kV Incomer Cable 20MVA	(Other Items)	10	No.	$25,309.00	Orion	40		Handbook
11kV Incomer Cable 10MVA	(Other Items)	18	No.	$12,986.00	Orion	40		Handbook
11kV Bus coupler cable 20MVA	(Other Items)	28	No.	$9,660.00	Orion	40		Handbook
11kV Bus coupler cable 10MVA	(Other Items)	5	No.	$4,717.00	Orion	40		Handbook
66kV VT (3ph)	(Other Items)	5	No.	$13,837.00	Orion	40		Handbook
66kV Surge Diverter (3ph)	(Other Items)	9	No.	$4,757.00	Orion	40		Handbook
33kV VT (3ph)	(Other Items)	3	No.	$19,789.00	Orion	40		Handbook
33kV Surge Diverter (3ph)	(Other Items)	5	No.	$2,513.00	Orion	40		Handbook
11kV VT (3ph)	(Other Items)	73	No.	$6,989.00	Orion	40		Handbook
11kV Neutral Earthing Resistor	(Other Items)	5	No.	$28,444.00	Orion	40		Handbook
Distribution Lines & Cables								
11kV Lines								
11kV OH Single Phase Underbuilt (Distn)		7,513	m	$8.00	Orion	60	45	Orion
11kV Cables								
11kV UG Extra Heavy Distn		12	m	$195.00	Orion	45	70	Handbook
11kV UG Extra Heavy Dcct Distn		0	m	$155.00	Orion	45	70	Handbook
11kV UG Light Dcct Distn		404,969	m	$49.50	Orion	45	70	Handbook
Distribution Switchgear								
11kV Dropout Fuse (1ph)		94	No.	$1,000.00	Orion	35		Handbook
11kV Single Phase Breaker		8	No.	$15,139.00	Orion	40		Orion
11kV Surge Arresters (3ph)		492	No.	$1,771.00	Orion	35		Handbook
11kV Magnefix Type UT		159	No.	$9,393.00	Orion	40		Handbook
11kV Magnefix Type 1K2T		26	No.	$15,615.00	Orion	40		Handbook
11kV Magnefix Type 1K3T		1	No.	$21,230.00	Orion	40		Handbook
11kV Magnefix Type 2K1T		968	No.	$13,649.00	Orion	40		Handbook
11kV Magnefix Type 2K2T		47	No.	$19,218.00	Orion	40		Handbook
11kV Magnefix Type 2K3T		1	No.	$28,517.00	Orion	40		Handbook
11kV Magnefix Type 2KB2K		256	No.	$16,146.00	Orion	40		Handbook
11kV Magnefix Type 2KBK		532	No.	$12,856.00	Orion	40		Handbook
11kV Magnefix Type 3K		358	No.	$12,466.00	Orion	40		Handbook
11kV Magnefix Type 3K1T		334	No.	$19,136.00	Orion	40		Handbook
11kV Magnefix Type 3K2T		2	No.	$23,145.00	Orion	40		Handbook
11kV Magnefix Type 3KX		1	No.	$15,997.00	Orion	40		Handbook
11kV Magnefix Type 4K		1	No.	$16,545.00	Orion	40		Handbook
11kV Magnefix Type 4K1T		15	No.	$23,612.00	Orion	40		Handbook
11kV Magnefix Type 5K		6	No.	$20,622.00	Orion	40		Handbook
11kV Magnefix Type KB2K		20	No.	$13,306.00	Orion	40		Handbook
11kV Magnefix Type KB2KBK		178	No.	$16,156.00	Orion	40		Handbook
11kV Magnefix Type KBX		456	No.	$7,885.00	Orion	40		Handbook
11kV Magnefix Type KTB		39	No.	$9,393.00	Orion	40		Handbook
11kV Switchgear Cabinet (1/4 Kiosk)		88	No.	$2,000.00	Orion	45		Orion
UHF Remote Unit		64	No.	$3,907.00	Orion	15		Handbook
RTU Aux Equip (Pole mount on LCB)		48	No.	$6,811.00	Orion	15		Handbook
Distribution Substation								
Distn Sub - Land		1,761	No.		Orion			
Housing								
Distn Sub - Pole Mount (>50 kVA, <100 kVA)		88	No.	$2,000.00	Orion	45		Handbook
Metering								
Distn Sub - LV MDI Metering (800A)		2,919	No.	$1,290.00	Orion	40		Orion
Distn Sub - LV MDI Metering (1500A)		419	No.	$1,778.00	Orion	40		Orion

Asset	(Handbook entry)	Total Optimised Quantity	Unit Replacement Cost & Source	Total Life (years) (TL1 & TL2) & Source
Low Voltage				
LV Lines				
LV OH Light 4 wire Underbuilt		20,858 m	$19.00 Orion	60 45 Handbook
LV OH Urban Road Crossings & Back Sections		262,085 m	$39.70 Orion	60 45 Handbook
LV OH Rural Road Crossings & Back Sections		406,270 m	$32.61 Orion	60 45 Handbook
LV OH Lighting (with LV)		0 m	$3.23 Orion	60 45 Handbook
LV Cables				
LV UG Service Main (16mm2 NS)		314,087 m	$45.00 Orion	45 70 Handbook
LV UG Lighting 2 Core (with LV)		0 m	$12.00 Orion	45 70 Handbook
LV UG Lighting 5th Core (with LV)		0 m	$7.20 Orion	45 70 Handbook
Link Pillars				
LV 3 Way Linkbox / Multibox		1,139 No.	$3,000.00 Orion	45 Handbook
Customer Service Connections				
LV Connection UG 1ph (fuse only)		22,540 No.	$91.00 Orion	45 Handbook
LV Connection UG 3ph (fuse only)		1,932 No.	$163.00 Orion	45 Handbook
LV Lighting Control Relay		0 No.	$132.00 Orion	40 Orion
Other System Fixed Assets				
SCADA & Comms (central facilities)				
SCADA Master Station		1 Lot	$2,977,427.00 Orion	15 Handbook
UHF Masters		7 No.	$22,000.00 Orion	15 Handbook
UHF Repeaters		7 No.	$25,000.00 Orion	15 Handbook

Appendix F
Assets with Total Life Extensions

This appendix provides a schedule of the assets where Orion has applied an extension to the total life, as detailed in section 6.3 of this report (Handbook reporting requirement 2.65(g)). The life extensions are derived and applied in accordance with Handbook clauses A.34, A.35, and A.40 to A.43.

Schedule of Modern Equivalent Assets (Quantities, Values and Total Lives)

Based on Handbook Table A.1 with additional non-standard assets

Asset	*(Handbook entry)*	*Total Optimised Quantity*	*Total Optimised Depreciated Replacement Cost*	*Total Life (years) (TL1 & TL2) & Source*	
Zone Substations (District & Network)					
Transformers					
66/11kV 20/40MVA	*(Transformers)*	22 No.	$11,468,788	60	Extended
66/11kV 11.5/23 MVA	*(Transformers)*	1 No.	$313,486	60	Extended
66/11kV 7.5/10MVA	*(Transformers)*	2 No.	$1,209,398	60	Extended
33/11kV 11.5/23MVA	*(Transformers)*	4 No.	$1,449,769	60	Extended
33/11kV 10/20MVA	*(Transformers)*	6 No.	$1,987,783	60	Extended
33/11kV 7.5/10MVA	*(Transformers)*	1 No.	$484,121	60	Extended
33/11kV 7.5MVA	*(Transformers)*	15 No.	$3,295,755	60	Extended
33/11kV 2.5MVA	*(Transformers)*	4 No.	$897,297	60	Extended
33/11kV 1.5MVA	*(Transformers)*	1 No.	$36,273	60	Extended
33/11kV 0.75MVA	*(Transformers)*	1 No.	$294,866	60	Extended
11kV Circuit Breaker Sealed (District & Network Sub)	*(11kV Indoor Switchgear Cubicle)*	386 No.	$10,543,636	55	Extended
Distribution Switchgear					
11kV Circuit Breaker Sealed (Distn Sub)	*(11kV Indoor Switchgear Cubicle)*	13 No.	$342,818	55	Extended
Distribution Transformers					
11/0.4 kV Single/Two Phase Units (pole and ground mounted)					
1ph Pad Mount ≤ 15 kVA	*(Up to and including 15 kVA)*	12 No.	$20,445	55	Extended
1ph Pad Mount 30 kVA	*(30 kVA)*	4 No.	$12,660	55	Extended
11/0.4 kV Three Phase Units (ground mounted, cable entry)					
3ph Pad Mount 100 kVA	*(100 kVA)*	72 No.	$408,764	55	Extended
3ph Pad Mount 200 kVA	*(200 kVA)*	1,298 No.	$8,841,763	55	Extended
3ph Pad Mount 300 kVA	*(300 kVA)*	1,446 No.	$12,282,327	55	Extended
3ph Pad Mount 500 kVA	*(500 kVA)*	606 No.	$8,669,800	55	Extended
3ph Pad Mount 750 kVA	*(750 kVA)*	246 No.	$3,424,672	55	Extended
3ph Pad Mount 1000 kVA	*(1000 kVA)*	119 No.	$1,957,236	55	Extended
3ph Pad Mount 1250 kVA	*(1250 kVA)*	1 No.	$36,727	55	Extended
3ph Pad Mount 1500 kVA	*(1500 kVA)*	3 No.	$85,727	55	Extended
Distribution Substation					
Housing					
Distn Sub - Pad Mount (Orion full kiosk)	*(Ground Mount (Covered))*	2,552 No.	$5,621,491	55	Extended
Distn Sub - Pad Mount (Orion 1/2 kiosk)	*(Ground Mount (Covered))*	431 No.	$1,359,756	55	Extended
Distn Sub - Building (Orion owned)	*(Kiosk (Masonry or block enclosure))*	67 No.	$220,400	55	Extended
Distn Sub - Building (Customer owned)	*(On Customer's Premises with Feedout)*	202 No.	$219,091	55	Extended

Printed 24/11/2004 5:45:10 p.m. ***Schedule Page 1 of 1***

Appendix G
Loads and Load Forecasts

This appendix provides schedules of electrical loadings and loading forecasts consistent with the planning periods prescribed in Handbook clause 2.30. The schedules are provided in accordance with the reporting requirement detailed in clause 2.65(l) of the Handbook and the forecast loads detailed here are those that Orion used as a basis for its optimisation considerations.

Note that, unless detailed separately, contingent load requirements have been included in the 2004 load.

Network Loadings (GXPs, District Substations, 66kV and 33kV Subtransmission)

Grid Exit Point	*District Substation Name*	*2004 Load*	*Forecast Load*	*Units*
Grid Exit Points (15 year forecast)				
Addington	66kV	125,202	153,235	kW
	11kV	65,810	80,545	kW
	Total	189,596	232,047	kW
Arthurs Pass	Total	318	389	kW
Bromley	11kV	55,750	68,232	kW
	Total	160,986	197,031	kW
	66kV	109,084	133,508	kW
Castle Hill	Total	588	720	kW
Coleridge	Total	358	438	kW
Hororata	33kV	19,646	24,045	kW
	66kV	15,546	19,027	kW
	Total	34,694	42,462	kW
Islington	33kV	75,478	92,378	kW
	66kV	70,000	85,673	kW
	Total	151,496	185,416	kW
Papanui	11kV	59,722	73,094	kW
	66kV	41,192	50,415	kW
	Total	97,490	119,318	kW
Springston	Total	47,330	57,927	kW
District Substations (15 year forecast)				
Addington	Spreydon	885	1,083	A
	Armagh	1,961	2,401	A
	Oxford-Tuam	1,600	1,958	A
	Montreal	818	1,001	A
	Milton	1,869	2,288	A
	Knox	650	796	A
	Hoon Hay	1,572	1,924	A
	Foster St	925	1,132	A
	Fendalton	1,971	2,412	A
Bromley	Pages Kearneys	673	824	A
	Portman	815	997	A
	Linwood	936	1,145	A
	Lancaster	531	650	A
	Heathcote	1,301	1,592	A
	Dallington	1,532	1,875	A
	Brighton	1,459	1,786	A
	Barnett Park	642	785	A
Hororata	Darfield	327	400	A
	Hororata	259	317	A
	Bankside	450	551	A
	Killinchy	409	501	A

Grid Exit Point	District Substation Name	2004 Load	Forecast Load	Units
Hororata	Te Pirita	407	498	A
	Annat	59	72	A
Islington	Sockburn	852	1,042	A
	Halswell	252	309	A
	Middleton	1,090	1,334	A
	Moffett St	905	1,108	A
	Harewood	375	459	A
	Hornby	653	800	A
	Hawthornden	1,922	2,353	A
	Shands Rd	703	861	A
Papanui	Bishopdale	786	962	A
	Grimseys Winters	605	740	A
	Harris	744	911	A
	Mcfaddens	2,108	2,580	A
Springston	Springston	284	348	A
	Rolleston	400	490	A
	Lincoln	304	372	A
	Hills Rd	393	481	A
	Duvauchelle	277	339	A
	Diamond Harbour	75	92	A
	Brookside	446	545	A
	Motukarara	92	113	A
	Weedons	263	322	A

District Substation Transformers (10 year forecast)

Addington	Oxford Tuam	31	36	MVA
	Armagh	35	36	MVA
	Milton	36	40	MVA
	Fendalton	38	40	MVA
Bromley	Dallington	29	34	MVA
	Barnett Park	16	14	MVA
	Lancaster	17	34	MVA
	Brighton	29	33	MVA
Hororata	Annat	2	2	MVA
	Killinchy	12	14	MVA
	Bankside	16	19	MVA
	Te Pirita	12	14	MVA
	Hororata	8	9	MVA
Islington	Halswell	7	10	MVA
	Moffett St	17	20	MVA
	Middleton	21	22	MVA
	Harewood	7	8	MVA
	Shands Rd	13	18	MVA
	Heathcote	25	33	MVA
	Hornby	12	15	MVA
	Hawthornden	37	47	MVA
	Hoon Hay	30	35	MVA
	Sockburn	16	16	MVA
Papanui	Mcfaddens	32	38	MVA
Springston	Diamond Harbour	2	3	MVA
	Duvauchelle	5	6	MVA
	Darfield	8	10	MVA
	Highfield	9	10	MVA
	Rolleston	8	10	MVA
	Brookside	9	10	MVA
	Weedons	7	8	MVA
	Motukarara	4	4	MVA
	Hills Rd	11	12	MVA
	Lincoln	9	10	MVA
	Springston	9	11	MVA
	Little River	1	1	MVA
	Teddington	3	4	MVA

Grid Exit Point	District Substation Name	2004 Load	Forecast Load	Units
66kV Feeders (15 year forecast)				
Addington	Milton	312	364	A
	Fendalton	328	366	A
	Fendalton	328	366	A
	Oxford/Tuam	267	327	A
	Oxford/Tuam	267	327	A
	Armagh	302	334	A
	Armagh	302	334	A
	Milton	312	364	A
Bromley	Dallington	256	313	A
	Lancaster	178	248	A
	Heathcote to Barnett Park	137	132	A
	Heathcote	327	435	A
	Heathcote	348	461	A
	Brighton	251	307	A
	Lancaster to Armagh	178	218	A
	Dallington	256	313	A
	Brighton	251	307	A
Hororata	TePirita/Killinchy	211	258	A
Islington	Hawthornden	320	427	A
	Hawthornden	320	427	A
	Halswell to Heathcote Tie	477	583	A
	Halswell to Heathcote Tie	477	583	A
	Halswell to HoonHay	263	321	A
	Halswell to HoonHay	263	321	A
	Halswell	632	790	A
	Halswell	632	790	A
Papanui	Mc Faddens	283	346	A
	Mc Faddens	283	346	A
33kV Feeders (15 year forecast)				
Hororata	Hororata T1	131	160	A
	Annat	142	173	A
	Darfield	142	174	A
	Bankside	175	214	A
Islington	Harewood T1	125	153	A
	Moffett T1	300	367	A
	Shands	246	301	A
	Incomer T2	1,383	1,692	A
	Harewood T2	125	153	A
	Moffett T2	300	367	A
	Hornby T2	311	381	A
	Sockburn T1	273	334	A
	Hornby T1	313	383	A
	Middleton	380	465	A
	Sockburn T2	505	618	A
Springston	Lincoln	193	236	A
	Rolleston	340	416	A
	Weedons	340	416	A
	Springston 3544	178	218	A
	Little River	167	204	A
	Brookside	298	365	A
	Springston 3554	178	218	A
	Hills	298	365	A
	Incomer T1	670	819	A

Network Loadings (11kV Subtransmission and 11kV Distribution)

11kV Subtransmission (15 year forecast)

Substation Name	Circuit Breaker	2004 Load (A)	2004 Contingent Load (A)	Forecast Contingent Load (A)
Addington Transpower GXP	0003		327	400
	0004		366	448
	0005		366	448
	0006	202	290	355
	0007	25	467	571
	0008	160	290	355
	0009		366	448
	0010		468	573
	0011		327	400
	2642	270	350	428
	2662	148	327	400
	2682	116	320	392
	2722	150	327	400
	2742	214	366	448
	2762	0	467	571
	2782	290	350	428
	2802	155	327	400
	2822	231	350	428
	2842	210	354	433
Armagh Dist Sub	001A	255	472	578
	001A	255	472	578
	001B	224	426	521
	001B	224	426	521
	002A	242	434	531
	002A	242	434	531
	002B	259	478	585
	002B	259	478	585
	003A	0	218	267
	003B	150	250	306
	004A	167	265	324
	004B	165	304	372
	005A	115	246	301
	005B	191	292	357
	006A	125	242	296
	006B	80	145	177
	007A	179	182	223
	007B	90	141	173
	008B	51	141	173
	009A	315	469	574
	009A	315	469	574
	009B	262	431	527
	009B	262	431	527
	010A	291	436	534
	010A	291	436	534
	010B	316	476	582
	010B	316	476	582
	011A	170	244	299
	011B	139	304	372
	012A	166	188	230
	012B	0	231	283
	013A	0	175	214
	013B	67	188	230
	014A	96	166	203
	014B	71	253	310
Barnett Park Dist Sub	0002	174	228	279
	0003	71	140	171
	0003	71	140	171
	0004	97	286	350
	0005		474	580
	0008	114	309	378
	0009	130	219	268
	0010	89	219	268
	0011	69	140	171
	0011	69	140	171
Bishopdale Dist Sub	0002	172	327	400
	0003	284	445	545
	0004	99	181	221
	0005	82	181	221

11kV Subtransmission (15 year forecast)

Substation Name	Circuit Breaker	2004 Load (A)	2004 Contingent Load (A)	Forecast Contingent Load (A)
	0007	139	194	237
	0008	154	283	346
	0008	154	283	346
	0009	268	445	545
	0010	24	292	357
	0013	103	227	278
	0014	224	316	387
	0015	283	445	545
Brighton Dist Sub	0001	286	286	349
	0003	146	239	292
	0004	297	297	363
	0006	115	212	259
	0007	388	388	475
	0010	230	280	343
	0013	313	313	383
	0014	190	248	303
	0015	66	170	208
	0016	219	274	335
	0017	436	436	533
	0017	436	436	533
	0019	197	327	400
	0019	197	327	400
Bromley Transpower GXP	0001		196	240
	0002	220	346	423
	0003	220	384	470
	0004		152	186
	0005		338	414
	0006		338	414
	0007		338	414
	0008	224	357	437
	0009	132	212	259
	0010		167	204
	0011		304	372
	0012		304	372
	0013		304	372
	0014		304	372
	0015		195	239
	0016	180	307	376
	0017	170	346	423
	0018	292	473	579
Dallington Dist Sub	0001	142	262	321
	0002	270	391	478
	0002	270	391	478
	0003	101	203	248
	0004	112	240	294
	0005	149	273	334
	0008	96	198	242
	0009	150	297	363
	0010	111	240	294
	0011	178	293	359
	0012	246	375	459
	0012	246	375	459
	0016	201	339	414
	0016	201	339	414
	0019	30	549	672
	0021	224	298	365
	0024	245	428	523
	0024	245	428	523
	0025	168	278	340
Fendalton Dist Sub	0001	31	493	603
	0001	31	493	603
	0002	128	353	432
	0004	127	324	396
	0006	120	331	405
	0007	159	284	348
	0008	156	231	283
	0009	0	244	299
	0012	159	284	348

11kV Subtransmission (15 year forecast)

Substation Name	Circuit Breaker	2004 Load (A)	2004 Contingent Load (A)	Forecast Contingent Load (A)
Fendalton Dist Sub	0013	138	329	403
	0014	192	245	300
	0015	143	231	283
	0016	256	256	313
	0018	458	458	560
	0019	124	124	152
	0020	129	493	603
	0020	129	493	603
Foster St Dist Sub	0004	0	468	573
	0004	0	234	286
	0006	153	327	400
	0008	208	234	286
	0010	97	179	219
	0012	152	327	400
	0018	111	249	305
	0019	155	327	400
	0021	141	338	414
Grimseys Winters Dist Sub	0002	320	506	619
	0003	217	325	398
	0004	130	350	428
	0005	134	208	255
	0006	212	286	350
	0007	154	187	229
	0008	229	328	401
	0009	136	260	318
	0010	139	260	318
	0013	76	142	174
	0015	152	220	269
	0018	137	217	266
	0019	22	246	301
Halswell Dist Sub	0001	38	236	289
	0002	29	207	253
	0005	210	333	407
Harewood Dist Sub	0110	175	375	459
	0110	175	375	459
	0120	200	375	459
	0120	200	375	459
	0123	182	285	349
Harris Dist Sub	0001	168	240	294
	0002	190	293	359
	0003	316	372	455
	0005	84	165	202
	0007	216	334	409
	0008	150	260	318
	0009	376	376	460
	0010	14	184	225
	0011	155	199	244
	0015	375	378	463
	0016		256	313
	0017	202	313	383
Hawthornden Dist Sub	0002	285	502	614
	0002	285	502	614
	0004	201	340	416
	0005	254	336	411
	0008	228	288	352
	0009	212	284	348
	0010	212	324	396
	0012	273	460	562
	0012	273	460	562
	0015	250	275	337
	0016	321	509	623
	0016	321	509	623
	0021	192	315	385
	0023	225	269	329
	0024	293	452	553
	0024	293	452	553
	0025	118	292	357
Heathcote Dist Sub	0001	330	330	404
	0001	330	330	404
	0002	291	358	438
	0002	291	358	438

11kV Subtransmission (15 year forecast)

Substation Name	Circuit Breaker	2004 Load (A)	2004 Contingent Load (A)	Forecast Contingent Load (A)
	0003	299	299	365
	0005	314	474	580
	0008	245	319	390
	0009	102	179	219
	0011	31	138	169
	0012	269	293	358
	0012	269	293	358
	0015	179	287	351
	0015	179	287	351
	0016	260	339	415
	0016	260	339	415
	0017	45	45	55
	0018	258	293	359
	0023	27	330	404
	0024	250	312	381
	0024	250	312	381
	0031	305	305	373
	0031	305	305	373
	0032	199	309	378
	0032	199	309	378
	0033	252	309	378
	0033	252	309	378
	0033	252	330	404
Hoon Hay Dist Sub	0001		236	289
	0002	192	384	469
	0002	192	384	469
	0003	128	270	330
	0004	45	286	350
	0005	222	282	345
	0006	79	170	208
	0008	146	270	330
	0009	168	255	312
	0012	203	404	494
	0012	203	404	494
	0015	91	170	208
	0016	202	407	497
	0016	202	407	497
	0019	159	244	299
	0019	159	244	299
	0022	157	268	328
	0024	189	381	466
	0024	189	381	466
	0025	159	244	299
Hornby Dist Sub	0110	162	326	398
	0110	162	326	398
	0111	79	226	277
	0114	65	157	192
	0120	165	326	398
	0120	165	326	398
	0123	64	157	192
	0124	74	226	277
Hororata Dist Sub	0110	259	259	317
	0110	259	259	317
Killinchy Dist Sub	0110	409	409	501
	0110	409	409	501
Knox Dist Sub	0002	62	154	188
	0003	271	327	400
	0004	105	218	267
	0009	60	144	176
	0011	121	123	151
	0012	112	159	195
	0013	270	468	573
	0016		265	324
	0017	278	327	400
	0019	3	3	4
	0021	143	218	267
Lancaster Dist Sub	0001	17	148	181
	0003	152	284	348
	0004	347	347	424
	0004	347	347	424
	0005	152	231	283

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11kV Subtransmission (15 year forecast)

Substation Name	Circuit Breaker	2004 Load (A)	2004 Contingent Load (A)	Forecast Contingent Load (A)
Lancaster Dist Sub	0008	141	166	203
	0009	151	231	283
	0010	35	152	186
	0011	199	199	243
	0011	199	199	243
Linwood Dist Sub	00A2	162	261	319
	00A3	7	237	290
	00A4	236	304	372
	00A7	156	237	290
	00A8	118	232	284
	00A9	229	304	372
	00B2	7	7	9
	00B3	217	217	265
	00B4	221	304	372
	00B5	214	391	478
	00B7	182	391	478
	00B8	125	127	155
	00B9	225	304	372
Mcfaddens Dist Sub	0002	81	165	202
	0003	352	447	547
	0003	352	447	547
	0004	91	187	229
	0005	223	223	273
	0008	160	325	398
	0009	174	228	279
	0010	154	347	425
	0011	347	401	490
	0011	347	401	490
	0014	170	328	401
	0015	261	463	566
	0015	261	463	566
	0017	217	310	379
	0018	203	278	340
	0020	201	248	303
	0022	210	350	428
	0023	219	385	471
	0023	219	385	471
Middleton Dist Sub	0110	268	546	668
	0110	268	546	668
	0113	176	293	359
	0114	175	331	405
	0120	272	546	668
	0120	272	546	668
	0121	209	331	405
	0122	124	265	324
	0124	146	251	307
Milton Dist Sub	0003	252	475	581
	0003	252	475	581
	0004	155	199	244
	0006	213	329	403
	0007	200	314	384
	0009	182	219	268
	0011	175	222	272
	0013	326	460	563
	0013	326	460	563
	0014		253	310
	0016	87	168	206
	0017	337	475	581
	0017	337	475	581
	0018	138	152	186
	0019	216	216	264
	0020	233	286	350
	0021	160	242	296
	0023	149	205	251
	0024	209	243	297
	0025	228	228	278
	0027	313	460	563
	0027	313	460	563
Moffett St Dist Sub	0110	225	453	554
	0110	225	453	554
	0112	195	364	445

11kV Subtransmission (15 year forecast)

Substation Name	Circuit Breaker	2004 Load (A)	2004 Contingent Load (A)	Forecast Contingent Load (A)
	0114	220	380	465
	0120	405	453	554
	0120	405	453	554
Montreal Dist Sub	0001		167	204
	0003	245	309	378
	0004	278	350	428
	0005	134	221	270
	0007	74	339	415
	0008	249	262	321
	0010	297	350	428
	0012	117	117	143
	0014	162	260	318
	0015	298	350	428
	0016	145	216	264
	0017	180	282	345
Oxford-Tuam Dist Sub	0003	330	430	526
	0003	330	430	526
	0004	234	394	482
	0005	361	361	441
	0006	257	257	315
	0008	165	167	204
	0009	270	270	331
	0010	97	114	140
	0011	298	370	453
	0011	298	370	453
	0012		175	214
	0014	104	145	177
	0015	208	381	466
	0015	208	381	466
	0016	114	144	176
	0017	127	184	225
	0018	201	282	345
	0020	150	184	225
	0021	249	249	304
	0022	212	394	482
	0023	267	419	513
	0023	267	419	513
	0024	162	167	204
Pages Kearneys Dist Sub	0003	154	357	437
	0004	223	338	414
	0006	177	294	360
	0010	230	338	414
	0012	171	312	382
	0015	165	291	356
	0016	223	338	414
Papanui Transpower GXP	0001	139	357	437
	0002	272	442	541
	0003		236	289
	0003	86	236	289
	0004	272	442	541
	0005	197	255	312
	0006	289	506	619
	0007	177	272	333
	0008	313	369	452
	0009	314	445	545
	0010	308	372	455
	0011	315	445	545
	0012	376	376	460
	0013	315	445	545
	0014	378	378	463
Portman Dist Sub	0001	196	285	349
	0003	99	272	333
	0004	146	196	240
	0005	63	138	169
	0007		287	351
	0009	84	218	267
	0010	117	167	204
	0011		299	365
	0013	117	279	341
	0014	122	195	239
	0015	118	152	186

11kV Subtransmission (15 year forecast)

Substation Name	Circuit Breaker	2004 Load (A)	2004 Contingent Load (A)	Forecast Contingent Load (A)
Shands Rd Dist Sub	0110	172	352	430
	0110	172	352	430
	0111	138	277	339
	0120	180	352	430
	0120	180	352	430
	0121	139	277	339
Sockburn Dist Sub	0110	219	426	521
	0110	219	426	521
	0120	206	426	521
	0120	206	426	521
Spreydon Dist Sub	0001	16	150	184
	0002	95	224	274
	0003	249	366	448
	0004	0	253	310
	0005	168	305	373
	0007	241	278	340
	0008	99	267	327
	0009	229	366	448
	0010	30	45	55
	0015	253	366	448
	0016	229	311	381
Springston Dist Sub	0110	284	284	347
	0110	284	284	347
Te Pirita Dist Sub	0110	407	407	498
	0110	407	407	498
Teddington Dist Sub	0110	80	80	98
	0110		80	98

11kV Distribution (5 year forecast)

Substation Name	Circuit Breaker	2004 Load (A)	2004 Contingent Load (A)	Forecast Contingent Load (A)
Addington Orion Ripple Plant	0011	13	13	14
	0013	13	13	14
Alfred St	0031	30	30	33
	0033	25	25	27
Alport Pl	0014	30	30	33
	0015	47	64	71
Annat Dist Sub	0111	83	83	91
	0112	42	42	46
	0113	106	106	116
Armagh Dist Sub	004A	194	265	291
	005B	196	292	321
	007A	182	182	200
	008A	237	237	260
	012A	188	188	206
	013B	82	188	206
	014A	41	166	182
Armagh St Cwmc	0015	63	63	69
Armagh St Law Courts	0015	92	92	101
Arthurs Pass Transpower GXP	0622	35	35	38
Bankside Dist Sub	0111	162	162	178
	0112	154	154	169
	0113	226	226	248
	0114	136	141	155
Barnett Park Dist Sub	0002	228	228	250
	0004	37	286	314
	0006	55	55	60
	0008	126	309	339
	0009	121	219	240
	0010	100	219	240
	0012	35	35	38
Barrington St No.94	0012	87	87	96
	0015	28	28	31
	0016	13	13	14
	0035	71	71	78
	0036	35	35	38
Bayview Rd	0001	122	122	134
Beach Rd No.120	0033	129	129	142
	0034	69	69	76
	0035	111	111	122

11kV Distribution (5 year forecast)

Substation Name	Circuit Breaker	2004 Load (A)	2004 Contingent Load (A)	Forecast Contingent Load (A)
Beach Rd No.228	0014	48	48	53
	0015	104	104	114
	0018	201	201	221
Beresford St No.62	0034	35	35	38
	0035	52	52	57
Bexley Rd No.81	0035	58	58	64
	0037	43	43	47
	0038	11	11	12
Birmingham Dr No.46	0033	130	130	143
	0034	17	17	19
Bishopdale Dist Sub	0001	11	28	31
	0002	327	327	359
	0010	24	292	321
	0011	24	24	27
	0016	59	59	65
	0017	52	52	57
Bower Av No.179	0033	156	156	171
Braeburn Dr No.18	0035	162	162	178
	0037	50	50	55
Branston St No.76	0033	34	34	37
	0034	33	33	36
	0036	30	30	33
	0037	93	93	102
Breezes Rd N	0013	145	145	159
	0015	48	48	53
	0034	50	50	55
	0035	34	34	37
	0036	36	36	40
Brighton Dist Sub	0005	156	156	171
	0008	100	100	110
	0011	7	7	7
	0012	20	20	22
Brisbane St No.82	0002	18	18	20
Brisbane St S	0005	56	56	61
Brittan Tr No.4	0003	96	96	105
	0004	17	19	20
Brodie St No.98	0017	77	77	85
	0018	141	141	155
	0036	29	29	32
Bromley Transpower GXP	0008	185	357	392
	0009	212	212	233
	0016	204	307	337
	0017	326	346	380
	0018	473	473	519
Brookside Dist Sub	0111	67	67	74
	0112	162	162	178
	0113	58	58	64
	0121	155	155	170
	0122	256	256	281
	0123	218	218	239
Buchanans Rd No.115	0031	131	131	144
	0032	270	270	296
	0035	229	229	251
Byron St No.49	0002	47	47	52
Cashel St No.46	0033	112	112	123
	0034	40	40	44
Cashmere Rd No.34	0012	9	9	10
	0013	184	184	202
	0015	128	188	206
	0016	13	59	64
	0031	106	106	116
	0033	97	109	119
	0035	96	96	105
Cashmere View St	0017	71	71	78
Castle Hill Transpower GXP	0672	74	74	81
	0692	3	3	3
Chapel St	0017	60	60	66
	0018	42	42	46
	0032	32	32	35
	0033	155	155	170
Christs College	0004	82	82	90

11kV Distribution (5 year forecast)

Substation Name	Circuit Breaker	2004 Load (A)	2004 Contingent Load (A)	Forecast Contingent Load (A)
Club Ln A	0014	62	62	68
	0016	21	21	23
	0017	21	21	23
Clyde Rd No.146	0011	77	77	85
	0014	54	54	59
Coleridge Transpower GXP	1022	60	60	66
Colombo St No.163	0016	10	10	11
	0017	37	37	41
Colombo St No.551	0013	16	16	18
	0016	222	222	244
Colombo St Womens Hospital	0019	83	83	91
Colombo St Ww	0008	51	51	56
Curletts Rd No.59	0031	140	140	154
	0035	29	29	32
	0036	229	229	251
Curries Rd No.38	0032	137	137	150
	0037	91	91	100
Dallington Dist Sub	0001	178	262	288
	0009	139	297	326
	0013	242	242	266
	0018	57	57	63
	0019	53	549	603
Darfield Dist Sub	0111	205	205	225
	0112	128	128	141
	0113	117	117	128
	0114	278	278	305
	0115	221	221	243
Dee St No.67	0011	33	39	43
	0014	88	102	112
Devon St No.55	0024	112	112	123
Durham St No.191	0005	63	63	69
Duvauchelle Dist Sub	0111	223	223	245
	0121	38	38	42
	0122	46	46	50
	0123	177	177	194
	0124	98	98	108
	0125	13	13	14
Edmonton Rd No.16	0035	43	43	47
	0037	177	177	194
	0038	13	13	14
Factory Rd No.85	0035	82	82	90
	0037	13	13	14
Fendalton Dist Sub	0003	99	148	162
	0011	176	176	193
	0017	252	501	550
	0018	292	458	503
Ferry Rd No.221	0041	42	42	46
	0042	37	37	41
Ferry Rd No.331	0010	91	91	100
Fitzgerald Av Bus Depot	0015	72	72	79
Fitzgerald Av No.93	0012	61	61	67
	0014	32	32	35
Ford Rd	0011	52	52	57
	0014	11	11	12
	0015	53	53	58
	0016	13	13	14
Foster St Dist Sub	0007	149	166	182
	0009	40	40	44
	0011	7	7	8
	0014	103	103	113
	0015	77	77	85
	0017	27	56	62
	0020	240	240	263
Gamblins Rd	0003	150	150	165
	0004	58	58	64
	0005	47	47	52
Gasson St N	0009	87	87	96
Gasson St S	0015	23	23	25
Gatherer St	0032	29	438	481
	0033	65	73	81
Gloucester St No.56	0015	66	71	78

11kV Distribution (5 year forecast)

Substation Name	Circuit Breaker	2004 Load (A)	2004 Contingent Load (A)	Forecast Contingent Load (A)
Golf Links Rd S	0014	177	177	194
	0032	33	33	36
	0034	42	42	46
	0037	24	24	26
	0038	21	21	23
Grange St E	0012	89	89	98
Grants Rd No.44	0031	53	53	58
	0032	28	28	31
	0033	12	12	13
	0034	15	15	16
	0035	12	12	13
Grassmere St	0014	123	123	135
	0017	66	66	72
Grimseys Rd No.187	0011	25	25	27
	0017	144	144	158
	0020	185	185	203
Grimseys Winters Dist Sub	0011	157	157	172
	0013	47	142	156
	0014	24	24	26
	0020	157	157	172
Halswell Dist Sub	0001	62	236	259
	0002	61	207	227
	0004	54	289	317
	0005	333	333	366
	0006		0	0
Halswell Rd No.286	0035	79	79	87
	0036	119	119	131
Hampshire St Shops	0036	57	57	63
	0037	43	43	47
Harewood Dist Sub	0121	320	320	351
	0122	72	267	293
	0123	285	285	313
	0124	23	23	25
Harewood Rd No.412	0034	237	237	260
	0035	84	84	92
	0036	101	101	111
Harman St No.102	0031	71	71	78
	0033	54	54	59
Harris Dist Sub	0005	107	165	181
	0007	123	334	367
	0011	199	199	218
	0013	38	38	42
Hawthornden Dist Sub	0001	4	4	4
	0003	120	120	132
	0004	223	340	373
	0008	222	288	316
	0011	267	288	317
	0013	107	107	117
	0017	31	250	274
	0018	12	394	433
	0022	180	180	198
	0023	254	269	295
	0025	156	292	321
Hazeldean Rd No.198	0019	96	96	105
	0020	67	67	74
Heathcote Dist Sub	0003	279	299	328
	0006	84	84	92
	0010	61	61	67
	0017	26	45	50
	0018	293	293	322
	0019	175	175	192
	0025	7	7	7
Hereford St No.101	0003	55	55	60
Hereford St No.104	0012	240	240	263
	0014	17	17	19
Highfield Dist Sub	0111	70	70	77
	0112	60	174	191
	0113	223	223	245
	0114	107	107	117
Hills Rd Dist Sub	0111	193	193	212
	0112	278	278	305

11kV Distribution (5 year forecast)

Substation Name	Circuit Breaker	2004 Load (A)	2004 Contingent Load (A)	Forecast Contingent Load (A)
Hills Rd Dist Sub	0113	250	250	274
	0114	248	248	272
Hills Rd No.130	0013	90	90	99
	0014	44	44	48
	0015	35	35	38
Hoon Hay Dist Sub	0004	72	286	314
	0005	145	282	310
	0010	33	161	177
	0011	4	4	4
	0013	5	5	5
	0017	155	155	170
	0021	74	74	81
Hornby Dist Sub	0112	227	227	249
	0113	145	218	239
	0121	197	230	252
	0122	102	245	269
Hororata Dist Sub	0111	219	219	240
	0112	248	248	272
	0113	269	269	295
Idris Rd No.46	0014	47	47	52
	0015	23	23	25
	0033	50	50	55
	0034	25	25	27
	0035	44	44	48
Ilam Dist Sub	0006	50	50	55
	0011		0	0
	0013	197	197	216
Ilam Rd No.115	0018	26	26	29
Ilam Rd No.38	0011	81	81	89
	0015	47	102	112
Jeffreys Rd No.8	0016	161	161	177
	0017	56	56	61
	0020	17	17	19
Jervois St	0032	114	114	125
	0034	29	29	32
Kerrs Rd No.118	0034	39	39	43
	0035	26	26	29
Keyes Rd N	0014	11	11	12
	0015	66	66	72
	0034	29	29	32
	0035	36	36	40
Keyes Rd S	0034	52	52	57
Killinchy Dist Sub	0111	133	133	146
	0112	264	264	290
	0113	48	48	53
	0114	213	213	234
Kilmarnock St No.44	0034	87	87	96
	0037	71	71	78
Kilmore St Park Royal	0033	43	43	47
Kingsley St No.61	0004	17	17	19
Knox Dist Sub	0006	40	59	65
	0011	123	123	135
	0012	159	159	175
	0014	60	60	66
	0018	71	80	88
Lake Terrace Rd No.5	0016	110	110	121
	0018	50	50	55
	0038	90	90	99
	0039	236	236	259
Lancaster Dist Sub	0003	82	284	312
	0006	139	139	153
	0008	131	166	182
	0010	30	152	167
	0016		0	0
Lancewood Dr No.22	0032	60	60	66
	0033	130	130	143
Leeds St No.58	0031	17	17	19
	0034	5	5	5
Lichfield St No.79	0031	8	8	9
	0034	56	56	61
Lichfield St Tbc	0015	24	24	26

11kV Distribution (5 year forecast)

Substation Name	Circuit Breaker	2004 Load (A)	2004 Contingent Load (A)	Forecast Contingent Load (A)
Lichfield St W	0019	42	42	46
Lincoln Dist Sub	0121	378	378	415
	0122	242	242	266
	0123	399	399	438
	0124	142	142	156
Lincoln Rd No.235	0033	157	202	222
	0036	127	127	139
Linwood Av W	0014	76	76	83
	0031	29	29	32
	0032	44	44	48
	0033	43	43	47
	0034	23	23	25
Linwood Dist Sub	00B8	122	127	139
Little River Dist Sub	0111	37	37	41
	0112	82	82	90
Maces Rd No.120	0016	63	63	69
Mackenzie Av No.117	0012	115	115	126
Madras St No.156	0034	15	15	16
	0037		0	0
Main North Rd No.204	0035	59	59	65
	0036	185	185	203
	0037	57	61	67
Main North Rd No.433	0031	23	23	25
	0034	98	98	108
Main North Rd No.722	0032	146	146	160
	0036	193	193	212
	0037	82	82	90
Manchester St No.176	0020	95	95	104
Mandeville St No.70a	0031	45	45	49
	0034	46	46	50
Matsons Av	0014	55	55	60
	0015	52	52	57
Maunsell St E	0034	90	90	99
	0035	28	28	31
	0037	15	15	16
Mavin Rd S	0032	117	117	128
	0035	32	32	35
	0036	8	8	9
	0037	21	21	23
Maxwell St No.2	0018	131	147	161
Mcfaddens Dist Sub	0002	90	165	181
	0006	64	79	87
	0010	182	347	381
	0016	76	76	83
	0021	26	26	29
	0024	134	134	147
Merrin St No.51	0034	22	22	24
	0035	34	34	37
Middleton Dist Sub	0111	207	276	303
	0112	158	158	173
	0121	323	331	363
	0122	249	265	291
	0123	26	253	278
	0125	115	190	209
Milton Dist Sub	0002	116	144	158
	0005	28	28	31
	0010	139	139	153
	0016	153	168	184
	0018	152	152	167
	0026	21	21	23
Moffett St Dist Sub	0111	31	93	102
	0113	166	230	252
	0115	51	250	274
	0121	171	185	203
	0122	215	215	236
	0123	116	116	127
	0124	185	185	203
Montreal Dist Sub	0011	71	74	82
	0016	151	216	237
	0017	130	282	310
Montrose St	0031	74	74	81

11kV Distribution (5 year forecast)

Substation Name	Circuit Breaker	2004 Load (A)	2004 Contingent Load (A)	Forecast Contingent Load (A)
Montrose St	0034	40	40	44
Mooray Av No.23	0014	61	61	67
	0015	19	19	21
	0034	17	17	19
	0035	30	30	33
	0037	38	38	42
Moorhouse Av No.301	0032	32	32	35
Motukarara Dist Sub	0111	125	125	137
	0112	89	89	98
New Brighton Rd No.111	0013	34	34	37
	0014	35	35	38
	0015	23	23	25
	0034	14	14	15
	0036	53	53	58
North Pd No.75	0017	85	85	93
	0020	283	283	311
Office Rd E	0013	96	96	105
	0015	166	166	182
	0020	46	46	50
Office Rd W	0035	91	91	100
	0038	141	141	155
	0041	149	149	164
Oxford Tr No.160	0034	41	41	45
	0035	51	51	56
Oxford Tr No.228	0014	93	93	102
	0015	27	27	30
Oxford Tr Vacation Hotel	0012	15	15	16
	0013	21	21	23
Oxford-Tuam Dist Sub	0002	63	63	69
	0018	145	282	310
	0024	138	167	183
Pages Kearneys Dist Sub	0003	229	357	392
	0014	60	60	66
	0017	80	80	88
Palmers Rd No.193	0017	77	77	85
	0019	24	24	26
	0020	30	30	33
Papanui Transpower GXP	0001	163	357	392
Peterborough St No.100	0012	40	40	44
Philpotts Rd No.65	0036	47	47	52
	0037	58	58	64
Plymouth Ln	0034	36	36	40
Portman Dist Sub	0001	243	285	313
	0002	399	399	438
	0016	63	65	71
Press Ln	0011	47	47	52
	0012	96	96	105
Princess St No.39	0014	118	118	130
	0016	123	123	135
	0017	33	33	36
Print Pl No.17	0012	31	31	34
	0013	46	46	50
	0014	62	62	68
Queen Elizabeth Park	0011	35	35	38
	0012	10	10	11
Radbrook St No.14	0015	104	104	114
	0016	70	70	77
Radcliffe Rd No.25	0017	192	192	211
Raleigh St	0015	10	10	11
	0016	53	53	58
	0035	8	8	9
	0036	73	73	80
Randolph St S	0015	62	62	68
	0016	56	56	61
Reserve Bank	0006	31	31	34
Riccarton Rd No.188	0031		0	0
	0031	10	10	11
	0033	35	35	38
	0036	30	30	33
Riccarton Rd No.248	0032	18	18	20
	0036	30	30	33

11kV Distribution (5 year forecast)

Substation Name	Circuit Breaker	2004 Load (A)	2004 Contingent Load (A)	Forecast Contingent Load (A)
Rolleston Dist Sub	0111	209	209	229
	0112	67	95	104
	0113	424	424	465
	0121	175	223	244
	0122	138	252	277
	0123	193	193	212
Rowley Av No.11	0034	26	26	29
	0035	57	57	63
Roydvale Av No.173	0032	7	7	8
	0034	43	43	47
	0035	62	62	68
	0036	15	15	16
Sandyford St No.35	0032	18	31	34
Sawyers Arms Rd No.169	0011	126	126	138
	0012	88	88	97
Sawyers Arms Rd No.253	0032	107	107	117
	0033	65	65	71
	0035	8	8	9
Seddon St	0016	119	119	131
	0017	20	20	22
	0018	27	27	30
	0037	13	13	14
	0038	68	68	75
	0039	32	32	35
	0040	11	11	12
Shakespeare Rd No.6	0015	65	65	71
Shands Rd Dist Sub	0112	396	396	435
	0113	271	320	351
	0114	353	353	388
	0122	71	261	287
	0123	238	238	261
	0124	2	141	155
Simeon	0003	22	22	24
	0004	27	32	35
	0005	65	67	73
	0007	45	53	58
	0008	62	62	68
	0009	42	47	52
Sir William Pickering Dr No.11	0034	23	23	25
	0035	34	34	37
Sockburn Dist Sub	0111	227	227	249
	0112	52	52	57
	0113	48	81	89
	0121	107	129	142
	0122	209	209	229
	0123	208	208	228
	0124	228	285	313
	0127	170	170	187
	0128	375	375	412
	0129	76	150	165
Spreydon Dist Sub	0007	278	278	305
	0013	45	45	49
	0016	240	311	341
Springfield Rd No.56	0032	117	117	128
	0033	39	39	43
Springston Dist Sub	0111	156	156	171
	0112	198	198	217
	0113	289	289	317
	0114	159	159	175
	0115	67	92	101
St Albans Park	0032	108	108	119
St Albans St No.145	0035	190	190	209
St Johns St Ww	0031	33	33	36
	0032	44	44	48
	0033	107	107	117
	0034	72	72	79
	0035	65	65	71
Stanmore Rd No.119	0032	49	49	54
	0033	58	58	64
	0037	217	217	238
Straven Rd No.103	0032	46	46	50

Substation Name	Circuit Breaker	2004 Load (A)	2004 Contingent Load (A)	Forecast Contingent Load (A)
11kV Distribution (5 year forecast)				
Straven Rd No.103	0034	13	13	14
Tattersalls Ln National Bank	0013	10	10	11
Tattersalls Ln W Side	0014	92	92	101
Te Pirita Dist Sub	0112	153	153	168
	0113	197	197	216
	0114	170	170	187
	0115	133	133	146
Teddington Dist Sub	0111	191	191	210
	0112	41	41	45
Toorak Av N	0014	53	53	58
	0015	79	79	87
	0017	75	75	82
Totara St	0031	75	75	82
Town Hall Kitchen	0005	76	76	83
Trafalgar St	0015	72	72	79
	0017	69	69	76
University	0023		0	0
Vernon Tr N	0012	17	17	19
	0013	28	28	31
	0014	19	19	21
	0031	8	8	9
	0032	25	25	27
	0033	13	13	14
	0034	10	10	11
Victoria St No.62	0013	55	55	60
	0014	60	60	66
Waimairi Rd No.10	0015	73	73	80
	0016	97	97	106
Wainoni Rd No.98	0017	31	31	34
	0034	101	101	111
Wairakei Rd No.330	0038	51	51	56
Wairakei Rd No.585	0044	110	110	121
	0045	5	5	5
	0046	3	3	3
Wairakei Rd No.89	0013	187	187	205
	0015	111	111	122
Waltham Rd PdI	0003	45	45	49
Washington Way No.18	0014	93	93	102
Watts Rd No.41	0037	69	69	76
Weedons Dist Sub	0121	471	471	517
	0122	167	167	183
	0123	272	272	299
	0124	209	209	229
West Watson Av W	0014	119	119	131
	0015	28	28	31
Wilmer St No.10	0002	31	31	34
	0004	53	53	58
Wilsons Rd No.284	0002	90	90	99
Wilsons Rd No.338	0006	72	72	79
Woodard Tr No.2	0012	78	78	86
Woodham Rd No.271	0014	38	38	42
	0034	80	80	88
Worcester St No.60	0038	74	74	81
Worcester St W	0018	45	45	49
Wordsworth St No.125	0005	72	72	79
Wordsworth St No.49	0011	100	100	110
Wyndham St	0014	63	63	69
	0015	68	68	75

Appendix H
Valuation Optimisations

This appendix provides a schedule of optimisations applied in Orion's ODV. The schedule groups the optimisation considerations by reference, as detailed in section 9, and details the changes in quantities and changes in assets under each consideration. Finally, the schedule shows the change in replacement cost and depreciated replacement cost for the assets affected by optimisation.

Together with section 9, this schedule is provided pursuant to the reporting requirement detailed in Handbook clause 2.65(o).

Schedule of Optimisation

Optimised From		Optimised To		gives ..	Change in Replacement Cost (RC)			Change in Depreciated RC		
Quantity		Optimised Quantity	Optimised Assset		Optimised from	Optimised to	Reduction	Optimised from	Optimised to	Reduction
	Optimisation									
2,710	11kV UG Extra Heavy SubT	2,710	11kV UG Heavy SubT		$633,424	$406,041	($227,383)	$350,095	$224,420	($125,675)
3,922	11kV UG Extra Heavy SubT	3,922	11kV UG Medium SubT		$830,969	$438,922	($392,047)	$423,019	$223,441	($199,578)
25	11kV UG Extra Heavy SubT	25	11kV UG Light SubT		$4,875	$2,025	($2,850)	$2,960	$1,229	($1,730)
150	11kV UG Heavy SubT	0	11kV UG Heavy SubT		$18,750	$0	($18,750)	$18,542	$0	($18,542)
7,314	11kV UG Heavy SubT	7,314	11kV UG Medium SubT		$1,026,373	$845,731	($180,642)	$584,099	$481,297	($102,801)
1,886	11kV UG Heavy SubT	1,886	11kV UG Light SubT		$236,461	$153,227	($83,234)	$123,411	$79,971	($43,441)
513	11kV UG Medium SubT	513	11kV UG Light SubT		$62,836	$49,415	($13,421)	$27,478	$21,609	($5,869)
10,186	11kV UG Extra Heavy Dcct SubT	10,186	11kV UG Heavy Dcct SubT		$1,737,228	$952,673	($784,554)	$900,156	$493,634	($406,522)
13,127	11kV UG Extra Heavy Dcct SubT	13,127	11kV UG Medium Dcct SubT		$2,272,191	$1,026,151	($1,246,040)	$1,155,799	$521,974	($633,825)
439	11kV UG Extra Heavy Dcct SubT	439	11kV UG Light Dcct SubT		$68,045	$21,731	($46,315)	$40,250	$12,854	($27,396)
1,495	11kV UG Heavy Dcct SubT	0	11kV UG Heavy Dcct SubT		$127,483	$0	($127,483)	$104,992	$0	($104,992)
54,614	11kV UG Heavy Dcct SubT	54,614	11kV UG Medium Dcct SubT		$5,071,434	$4,176,475	($894,959)	$2,867,450	$2,361,430	($506,021)
11,437	11kV UG Heavy Dcct SubT	11,437	11kV UG Light Dcct SubT		$1,069,990	$623,112	($446,878)	$697,539	$406,214	($291,325)
1,843	11kV UG Medium Dcct SubT	1,843	11kV UG Light Dcct SubT		$129,003	$91,224	($37,779)	$49,753	$35,182	($14,571)
1	11kV Circuit Breaker (District & Network Sub)	0	11kV Circuit Breaker (District & Network Sub)		$30,000	$0	($30,000)	$15,667	$0	($15,667)
4	11kV Circuit Breaker Sealed (District & Network Sub)	0	11kV Circuit Breaker Sealed (District & Network Sub)		$120,000	$0	($120,000)	$108,545	$0	($108,545)
621	11kV UG Extra Heavy Distn	621	11kV UG Medium Distn		$125,303	$66,186	($59,117)	$73,625	$38,889	($34,736)
42	11kV UG Heavy Distn	0	11kV UG Heavy Distn		$10,290	$0	($10,290)	$9,482	$0	($9,482)
10,944	11kV UG Heavy Distn	10,944	11kV UG Medium Distn		$1,576,553	$1,299,079	($277,473)	$1,342,397	$1,106,135	($236,262)
2,858	11kV UG Heavy Distn	2,858	11kV UG Light Distn		$435,222	$282,024	($153,198)	$261,555	$169,487	($92,067)
530	11kV UG Medium Distn	0	11kV UG Medium Distn		$58,494	$0	($58,494)	$28,557	$0	($28,557)
94,035	11kV UG Medium Distn	94,035	11kV UG Light Distn		$12,132,777	$9,541,310	($2,591,467)	$7,723,297	$6,073,661	($1,649,636)
20	11kV UG Extra Heavy Dcct Distn	0	11kV UG Extra Heavy Dcct Distn		$5,924	$0	($5,924)	$1,396	$0	($1,396)
886	11kV UG Extra Heavy Dcct Distn	886	11kV UG Medium Dcct Distn		$184,050	$83,119	($100,931)	$88,106	$39,790	($48,316)
27	11kV UG Heavy Dcct Distn	0	11kV UG Heavy Dcct Distn		$2,295	$0	($2,295)	$2,246	$0	($2,246)
10,098	11kV UG Heavy Dcct Distn	10,098	11kV UG Medium Dcct Distn		$1,014,737	$835,666	($179,071)	$845,786	$696,529	($149,256)
2,527	11kV UG Heavy Dcct Distn	2,527	11kV UG Light Dcct Distn		$259,349	$151,033	($108,316)	$164,801	$95,972	($68,829)
745	11kV UG Medium Dcct Distn	0	11kV UG Medium Dcct Distn		$57,593	$0	($57,593)	$40,068	$0	($40,068)
101,233	11kV UG Medium Dcct Distn	101,233	11kV UG Light Dcct Distn		$8,829,906	$6,244,005	($2,585,901)	$5,745,060	$4,062,578	($1,682,482)
133	11kV UG Light Dcct Distn	0	11kV UG Light Dcct Distn		$6,584	$0	($6,584)	$2,869	$0	($2,869)
334,364		331,218			$38,138,139	$27,289,148	($10,848,991)	$23,798,997	$17,146,296	($6,652,701)

Optimised From		Optimised To		gives ..	Change in Replacement Cost (RC)			Change in Depreciated RC		
Quantity	Asset	Optimised Quantity	Optimised Assset		Optimised from	Optimised to	Reduction	Optimised from	Optimised to	Reduction
11kV Cable Capacity Optimisation - primary links										
0	11kV UG Extra Heavy SubT	0	11kV UG Extra Heavy SubT		$0	($258,647)	($258,647)	$0	($145,257)	($145,257)
0	11kV UG Heavy SubT	0	11kV UG Heavy SubT		$0	($628,555)	($628,555)	$0	($450,036)	($450,036)
0	11kV UG Medium SubT	0	11kV UG Medium SubT		$0	($18,750)	($18,750)	$0	($8,479)	($8,479)
0		0			$0	($905,952)	($905,952)	$0	($603,772)	($603,772)
11kV Cable Shared Trenching										
2,924	11kV UG Extra Heavy SubT	2,924	11kV UG Extra Heavy Dcct SubT		$668,585	$531,439	($137,146)	$371,180	$295,041	($76,139)
17,086	11kV UG Heavy SubT	17,086	11kV UG Heavy Dcct SubT		$2,392,474	$1,626,882	($765,592)	$1,462,214	$994,305	($467,908)
3,388	11kV UG Medium SubT	3,388	11kV UG Medium Dcct SubT		$515,437	$350,297	($165,140)	$135,372	$92,000	($43,371)
687	11kV UG Heavy Distn	687	11kV UG Heavy Dcct Distn		$162,577	$110,552	($52,025)	$132,483	$90,089	($42,395)
37,049	11kV UG Medium Distn	37,049	11kV UG Medium Dcct Distn		$4,520,819	$3,072,402	($1,448,418)	$3,143,902	$2,136,633	($1,007,270)
34,360	11kV UG Light Distn	34,360	11kV UG Light Dcct Distn		$2,948,245	$1,801,705	($1,146,540)	$1,594,315	$974,304	($620,011)
95,492		95,492			$11,208,137	$7,493,278	($3,714,860)	$6,839,465	$4,582,371	($2,257,095)
11kV Cable Shared Trenching ...and... 11kV Cable Capacity Optimisation										
1,428	11kV UG Extra Heavy SubT	1,428	11kV UG Heavy Dcct SubT		$302,336	$131,787	($170,548)	$161,180	$70,258	($90,922)
358	11kV UG Extra Heavy SubT	358	11kV UG Medium Dcct SubT		$69,713	$25,025	($44,688)	$36,982	$13,276	($23,707)
127	11kV UG Heavy SubT	0	11kV UG Heavy Dcct SubT		$15,875	$0	($15,875)	$15,699	$0	($15,699)
3,945	11kV UG Heavy SubT	3,945	11kV UG Medium Dcct SubT		$505,993	$283,356	($222,637)	$307,828	$172,384	($135,445)
459	11kV UG Heavy SubT	459	11kV UG Light Dcct SubT		$57,375	$22,721	($34,655)	$42,731	$16,922	($25,810)
90	11kV UG Medium SubT	90	11kV UG Light Dcct SubT		$11,742	$5,643	($6,099)	$10,147	$4,876	($5,271)
1,940	11kV UG Heavy Distn	1,940	11kV UG Medium Dcct Distn		$258,089	$144,530	($113,559)	$191,986	$107,512	($84,474)
457	11kV UG Heavy Distn	457	11kV UG Light Dcct Distn		$71,045	$28,134	($42,911)	$36,498	$14,453	($22,045)
35	11kV UG Medium Distn	0	11kV UG Medium Dcct Distn		$7,066	$0	($7,066)	$1,363	$0	($1,363)
16,827	11kV UG Medium Distn	16,827	11kV UG Light Dcct Distn		$2,126,905	$1,022,153	($1,104,751)	$1,295,154	$622,428	($672,725)
25,665		25,503			$3,426,137	$1,663,348	($1,762,789)	$2,099,567	$1,022,109	($1,077,458)

Optimised From		Optimised To		gives ..	Change in Replacement Cost (RC)			Change in Depreciated RC		
Quantity	Asset	Optimised Quantity	Optimised Assset		Optimised from	Optimised to	Reduction	Optimised from	Optimised to	Reduction
11kV Line Capacity Optimisation - thermal										
13,093	11kV OH Heavy (SubT)	13,093	11kV OH Medium (SubT)		$550,677	$497,385	($53,291)	$284,192	$256,689	($27,502)
15,854	11kV OH Heavy (SubT)	15,854	11kV OH Light (SubT)		$695,922	$561,227	($134,695)	$337,746	$272,376	($65,370)
31	11kV OH Medium (SubT)	0	11kV OH Medium (SubT)		$1,362	$0	($1,362)	$592	$0	($592)
15,729	11kV OH Medium (SubT)	15,729	11kV OH Light (SubT)		$613,630	$547,884	($65,746)	$277,955	$248,174	($29,781)
237	11kV OH Heavy (Distn)	237	11kV OH Medium (Distn)		$10,989	$9,926	($1,063)	$4,395	$3,970	($425)
2,307	11kV OH Heavy (Distn)	2,307	11kV OH Light (Distn)		$88,695	$71,528	($17,167)	$39,847	$32,135	($7,712)
141	11kV OH Medium (Distn)	0	11kV OH Medium (Distn)		$6,174	$0	($6,174)	$5,760	$0	($5,760)
11,942	11kV OH Medium (Distn)	11,942	11kV OH Light (Distn)		$466,989	$416,955	($50,035)	$272,130	$242,974	($29,157)
122	11kV OH Light (Distn)	0	11kV OH Light (Distn)		$4,742	$0	($4,742)	$4,424	$0	($4,424)
1	11kV OH Medium Underbuilt (Distn)	1	11kV OH Light Underbuilt (Distn)		$23	$19	($3)	$22	$19	($3)
59,457		59,163			$2,439,202	$2,104,925	($334,277)	$1,227,063	$1,056,336	($170,727)
11kV Line Capacity Optimisation - voltage drop										
116,643	11kV OH Medium (Distn)	116,643	11kV OH Light (Distn)		$3,379,548	$3,017,454	($362,094)	$1,935,298	$1,727,944	($207,353)
27,222	11kV OH Medium Underbuilt (Distn)	27,222	11kV OH Light Underbuilt (Distn)		$431,698	$370,027	($61,671)	$256,674	$220,007	($36,668)
143,865		143,865			$3,811,247	$3,387,481	($423,766)	$2,191,972	$1,947,951	($244,021)
11kV Subtransmission Configuration										
400	11kV UG Extra Heavy SubT	400	11kV UG Medium SubT		$152,880	$80,752	($72,128)	$89,495	$47,272	($42,223)
461	11kV UG Heavy SubT	0	11kV UG Heavy SubT		$57,625	$0	($57,625)	$46,615	$0	($46,615)
629	11kV UG Extra Heavy Dcct SubT	0	11kV UG Extra Heavy Dcct SubT		$143,025	$0	($143,025)	$81,974	$0	($81,974)
193	11kV UG Extra Heavy Dcct SubT	193	11kV UG Heavy Dcct SubT		$29,915	$16,405	($13,510)	$7,054	$3,868	($3,186)
5,506	11kV UG Extra Heavy Dcct SubT	5,506	11kV UG Medium Dcct SubT		$853,507	$385,455	($468,052)	$728,026	$328,786	($399,240)
8,406	11kV UG Heavy Dcct SubT	0	11kV UG Heavy Dcct SubT		$785,910	$0	($785,910)	$474,682	$0	($474,682)
493	11kV UG Heavy Dcct SubT	493	11kV UG Medium Dcct SubT		$56,022	$46,136	($9,886)	$25,598	$21,081	($4,517)
550	11kV UG Medium Dcct SubT	550	11kV UG Heavy Dcct SubT		$75,345	$91,491	$16,145	$22,171	$26,922	$4,751
585	11kV UG Medium Dcct SubT	0	11kV UG Medium Dcct SubT		$79,691	$0	($79,691)	$23,140	$0	($23,140)
6	11kV Circuit Breaker (District & Network Sub)	0	11kV Circuit Breaker (District & Network Sub)		$180,000	$0	($180,000)	$67,333	$0	($67,333)
1	11kV Circuit Breaker Sealed (District & Network Sub)	0	11kV Circuit Breaker Sealed (District & Network Sub)		$30,000	$0	($30,000)	$27,545	$0	($27,545)
17,230		7,142			$2,443,920	$620,239	($1,823,682)	$1,593,634	$427,929	($1,165,705)
11kV SWER to Single Phase										
2	1ph Pad Mount 30 kVA	0	1ph Pad Mount 30 kVA		$6,600	$0	($6,600)	$2,100	$0	($2,100)
3	1ph Pad Mount 50 kVA	0	1ph Pad Mount 50 kVA		$12,000	$0	($12,000)	$6,218	$0	($6,218)
4	1ph Pad Mount 75 kVA	0	1ph Pad Mount 75 kVA		$20,000	$0	($20,000)	$18,000	$0	($18,000)
9		0			$38,600	$0	($38,600)	$26,318	$0	($26,318)

Optimised From		Optimised To		gives ..	Change in Replacement Cost (RC)			Change in Depreciated RC		
Quantity	Asset	Optimised Quantity	Optimised Assset		Optimised from	Optimised to	Reduction	Optimised from	Optimised to	Reduction
66kV Line Capacity Utilisation										
3,982	66kV OH Heavy (Dcst Wolf)	3,982	66kV OH Heavy (Dcst Hyena)		$306,663	$250,139	($56,523)	$119,877	$97,782	($22,096)
3,982		3,982			$306,663	$250,139	($56,523)	$119,877	$97,782	($22,096)
Direct Connection of Streetlighting										
825,766	LV OH Lighting (with LV)	0	LV OH Lighting (with LV)		$2,667,224	$0	($2,667,224)	$1,080,116	$0	($1,080,116)
362,479	LV UG Lighting 2 Core (with LV)	0	LV UG Lighting 2 Core (with LV)		$5,525,544	$0	($5,525,544)	$3,474,295	$0	($3,474,295)
979,724	LV UG Lighting 5th Core (with LV)	0	LV UG Lighting 5th Core (with LV)		$8,422,481	$0	($8,422,481)	$5,119,054	$0	($5,119,054)
0	LV Connection OH 1ph	16,562	LV Connection OH 1ph		$0	$1,159,340	$1,159,340	$0	$476,618	$476,618
0	LV Connection UG 1ph (shared bndry box)	16,378	LV Connection UG 1ph (shared bndry box)		$0	$4,094,500	$4,094,500	$0	$2,502,194	$2,502,194
2,070	LV Lighting Control Relay	0	LV Lighting Control Relay		$273,240	$0	($273,240)	$193,684	$0	($193,684)
2,170,040		32,940			$16,888,489	$5,253,840	($11,634,649)	$9,867,148	$2,978,812	($6,888,336)
Distribution Sub Circuit MDIs										
821	Distn Sub - LV MDI Metering (800A)	0	Distn Sub - LV MDI Metering (800A)		$1,059,090	$0	($1,059,090)	$266,046	$0	($266,046)
28	Distn Sub - LV MDI Metering (1500A)	0	Distn Sub - LV MDI Metering (1500A)		$49,784	$0	($49,784)	$22,092	$0	($22,092)
849		0			$1,108,874	$0	($1,108,874)	$288,138	$0	($288,138)
District Sub Standardised Battery Arrangement										
1	Battery (50/100AH), Charger (110V) & Stand	0	Battery (50/100AH), Charger (110V) & Stand		$9,380	$0	($9,380)	$8,208	$0	($8,208)
2	Battery (50/100AH), Charger (110V) & Stand	2	Battery (50/100AH), Charger (50V) & Stand		$18,760	$8,800	($9,960)	$2,814	$1,320	($1,494)
1	Battery (50/100AH), Charger (50V) & Stand	0	Battery (50/100AH), Charger (50V) & Stand		$4,400	$0	($4,400)	$660	$0	($660)
4		2			$32,540	$8,800	($23,740)	$11,682	$1,320	($10,362)
District Substation Land Area Optimisation										
10	Zone Substation Land	10	Zone Substation Land		$1,569,460	$1,120,484	($448,976)	$1,569,460	$1,120,484	($448,976)
10		10			$1,569,460	$1,120,484	($448,976)	$1,569,460	$1,120,484	($448,976)
Excess Circuit Breakers										
11	11kV Circuit Breaker (District & Network Sub)	0	11kV Circuit Breaker (District & Network Sub)		$330,000	$0	($330,000)	$51,667	$0	($51,667)
1	11kV Circuit Breaker (Distn Substation)	0	11kV Circuit Breaker (Distn Substation)		$30,000	$0	($30,000)	$13,000	$0	($13,000)
12		0			$360,000	$0	($360,000)	$64,667	$0	($64,667)
LV Cable Shared Trenching										
25,581	LV UG Heavy	25,581	LV UG Heavy Shared Trench		$2,701,257	$1,500,698	($1,200,558)	$1,265,450	$703,028	($562,422)
205,841	LV UG Medium	205,841	LV UG Medium Shared Trench		$15,613,976	$7,930,908	($7,683,067)	$6,476,807	$3,289,807	($3,187,001)
231,422		231,422			$18,315,232	$9,431,606	($8,883,626)	$7,742,257	$3,992,834	($3,749,423)
Network Land Exclusion										
64	Distn Sub - Land	64	Distn Sub - Land		$1,081,450	$0	($1,081,450)	$1,081,450	$0	($1,081,450)
64		64			$1,081,450	$0	($1,081,450)	$1,081,450	$0	($1,081,450)

Optimised From		Optimised To		gives ..	Change in Replacement Cost (RC)			Change in Depreciated RC		
Quantity	Asset	Optimised Quantity	Optimised Assset		Optimised from	Optimised to	Reduction	Optimised from	Optimised to	Reduction
Network Substation Replacement										
1	Zone Substation Land	1	Zone Substation Land		$27,180	$6,855	($20,325)	$27,180	$6,855	($20,325)
22	Network Sub-Orion Owned	22	Distn Sub - Pad Mount (Orion full kiosk)		$2,234,496	$88,000	($2,146,496)	$384,943	$15,160	($369,783)
2	Network Sub-Orion Owned	2	Distn Sub - Pad Mount (Orion 1/2 kiosk)		$203,136	$8,000	($195,136)	$13,204	$520	($12,684)
2	Network Sub-On Customer's Premises	2	Distn Sub - Pad Mount (Orion full kiosk)		$21,136	$8,000	($13,136)	$3,276	$1,240	($2,036)
83	11kV Circuit Breaker (District & Network Sub)	0	11kV Circuit Breaker (District & Network Sub)		$2,490,000	$0	($2,490,000)	$537,000	$0	($537,000)
1	11kV Circuit Breaker (District & Network Sub)	1	11kV Magnefix Type 2K1T		$30,000	$13,649	($16,351)	$9,667	$4,398	($5,269)
3	11kV Circuit Breaker (District & Network Sub)	3	11kV Magnefix Type 3K		$90,000	$37,398	($52,602)	$13,667	$5,679	($7,988)
2	11kV Circuit Breaker Sealed (District & Network Sub)	0	11kV Circuit Breaker Sealed (District & Network Sub)		$60,000	$0	($60,000)	$52,909	$0	($52,909)
1	11kV Circuit Breaker Sealed (District & Network Sub)	1	11kV Magnefix Type 3K		$30,000	$12,466	($17,534)	$26,455	$10,993	($15,462)
1	RTU (small Network Sub)	0	RTU (small Network Sub)		$13,357	$0	($13,357)	$10,240	$0	($10,240)
3	11kV Circuit Breaker (Distn Substation)	0	11kV Circuit Breaker (Distn Substation)		$90,000	$0	($90,000)	$11,000	$0	($11,000)
1	11kV Magnefix Type 2K1T	0	11kV Magnefix Type 2K1T		$13,649	$0	($13,649)	$1,536	$0	($1,536)
1	11kV Magnefix Type 2K1T	1	11kV Magnefix Type 2KB2K		$13,649	$16,146	$2,497	$2,218	$2,624	$406
4	11kV Magnefix Type 2K1T	4	11kV Magnefix Type 3K		$54,596	$49,864	($4,732)	$15,014	$13,713	($1,301)
1	11kV Magnefix Type 2K1T	1	11kV Magnefix Type 3K1T		$13,649	$19,136	$5,487	$1,536	$2,153	$617
3	11kV Magnefix Type 2KB2K	3	11kV Magnefix Type 3K		$48,438	$37,398	($11,040)	$42,585	$32,879	($9,706)
4	11kV Magnefix Type 2KBK	4	11kV Magnefix Type 3K		$51,424	$49,864	($1,560)	$24,426	$23,685	($741)
2	11kV Magnefix Type 3K1T	2	11kV Magnefix Type 2KB2K		$38,272	$32,292	($5,980)	$8,133	$6,862	($1,271)
3	11kV Magnefix Type 3K1T	3	11kV Magnefix Type 3K		$57,408	$37,398	($20,010)	$16,505	$10,752	($5,753)
3	11kV Magnefix Type KB2KBK	3	11kV Magnefix Type 3K		$48,468	$37,398	($11,070)	$24,840	$19,166	($5,673)
9	11kV Oil Switch (Fused)	0	11kV Oil Switch (Fused)		$72,000	$0	($72,000)	$5,800	$0	($5,800)
19	Distn Sub - Land	19	Distn Sub - Land		$944,254	$130,245	($814,009)	$944,254	$130,245	($814,009)
171		72			$6,645,112	$584,109	($6,061,003)	$2,176,386	$286,924	($1,889,462)
Network/Distribution Substation Land Optimisation										
2	Zone Substation Land	2	Zone Substation Land		$268,025	$71,725	($196,300)	$268,025	$71,725	($196,300)
8	Distn Sub - Land	8	Distn Sub - Land		$573,800	$207,852	($365,949)	$573,800	$207,852	($365,949)
10		10			$841,825	$279,577	($562,249)	$841,825	$279,577	($562,249)
Power Transformer Capacity										
1	66/11kV 20/40MVA	1	66/11kV 11.5/23 MVA		$946,530	$767,722	($178,808)	$386,500	$313,486	($73,013)
2	33/11kV 11.5/23MVA	2	33/11kV 10/20MVA		$1,152,134	$1,125,160	($26,974)	$691,280	$675,096	($16,184)
3		3			$2,098,664	$1,892,882	($205,782)	$1,077,780	$988,582	($89,198)
Schedule Total					**$110,753,692**	**$60,473,904**	**($50,279,788)**	**$62,617,687**	**$35,325,534**	**($27,292,153)**

Appendix I
Cable and Line Ratings

This appendix details Orion's allocation of conductors to the standard size categories prescribed in the Handbook.

Note:

- In assessing the size of each cable and line, Orion has ranked conductors by current carrying capacity (in amps) and determined their valuation size category by comparing these with the current carrying capacity of the Handbook boundary conductor sizes (specified in cross sectional area of aluminium). These *raw* capacities take no account of the de-rating factors applied for Orion's 11kV cable network as detailed in sections 10.5.1 and 10.5.2.
- Low voltage line is subject to an estimated split between 2-wire and 4-wire construction as detailed in section 5.2 and Appendix B7.

66kV Cable Ratings

GIS Cable Size	*GIS Cable Construction*	*Approx Installed Length (m)*	*Capacity (A)*	*Comment*	*ODV Valuation Size*	*Valuation Construction*
> 300 mm2 Cu - Extra Heavy						
1600Cu	XLPE	7,278	1400		Extra Heavy	XLPE
≤ 300 mm2 Cu - Heavy						
300Cu	XLPE	75	460		Heavy	XLPE
300Al	PCCAS	23,452	365		Heavy	PCCAS
.45Al	PCCAS	31,717	350		Heavy	PCCAS
.25Cu	PCCAS	42	335		Heavy	PCCAS

33kV Cable Ratings

GIS Cable Size	*GIS Cable Construction*	*Approx Installed Length (m)*	*Capacity (A)*	*Comment*	*ODV Valuation Size*	*Valuation Construction*
> 240 mm2 Al - Heavy						
.3Cu	PCCAS	1,852	370		Heavy	Oil
.3Cu	PILCA	358	370		Heavy	PILC
300Al	PILCA	1,834	365		Heavy	PILC
300Al	XLPE	13,023	365		Heavy	XLPE
185Cu	PCCAS	1,566	355		Heavy	Oil
185Cu	PILCA	2,992	355		Heavy	PILC
≤ 240 mm2 Al - Medium						
.3Al	PILCA	344	285		Medium	PILC

11kV Cable Ratings

GIS Cable Size	GIS Cable Construction	Approx Installed Length (m)	Capacity (A)	Comment	ODV Valuation Size	Valuation Construction
> 300 mm2 Al - Extra Heavy						
630Cu	PILCA	35	650	Estimated capacity	Extra Heavy	PILC
630Cu	XLPE	96	650	Estimated capacity	Extra Heavy	XLPE
.6Cu	PILCA	320	520		Extra Heavy	PILC
400Cu	PILCA	3,353	520		Extra Heavy	PILC
400Cu	PILCA HDPE	132	520	Orion standard size	Extra Heavy	PILC
.5Cu	PILCA	50,307	475		Extra Heavy	PILC
.5Cu	PILCA HDPE	60	475		Extra Heavy	PILC
300Cu	PILCA	1,489	460		Extra Heavy	PILC
300Cu	PILCA HDPE	94	460		Extra Heavy	PILC
300Cu	Unknown	244	460	Assumed construction	Extra Heavy	PILC
240Cu	PILCA	86	400		Extra Heavy	PILC
240Cu	PILCA	187	400		Extra Heavy	PILC
400Al	PILCA	13	400		Extra Heavy	PILC
400Al	PILCA HDPE	773	400		Extra Heavy	PILC
400Al	XLPE	4,190	400		Extra Heavy	XLPE
.3Cu	PILCA	4,386	370		Extra Heavy	PILC
.5Al	PILCA	64,456	370		Extra Heavy	PILC
> 240 mm2 Al and ≤ 300 mm2 Al - Heavy						
300Al	PCCAS	2,754	365		Heavy	PILC
300Al	PILCA	142,884	365		Heavy	PILC
300Al	PILCA HDPE	13,186	365		Heavy	PILC
300Al	Unknown	5	365	Assumed construction	Heavy	PILC
300Al	XLPE	52,156	365	Orion standard size	Heavy	XLPE
185Cu	PILCA	9,662	355		Heavy	PILC
185Cu	PILCA HDPE	300	355		Heavy	PILC
185Cu	Unknown	22	355	Assumed construction	Heavy	PILC
185Cu	XLPE	438	355		Heavy	XLPE
.25Cu	PILCA	237,434	335		Heavy	PILC
.4Al	PILCA	1,483	335		Heavy	PILC
> 50 mm2 Al and ≤ 240 mm2 Al - Medium						
240Al	PILCA	1,193	325		Medium	PILC
240Al	XLPE	12,673	325	Orion standard size	Medium	XLPE
150Cu	PILCA	4,899	320		Medium	PILC
.2Cu	PILCA	66,057	290		Medium	PILC
.3Al	PILCA	6,579	285		Medium	PILC
.3Al	Unknown	2,004	285	Assumed construction	Medium	PILC
180Al	PILCA	143	280		Medium	PILC
185Al	PILCA	17,585	280		Medium	PILC
185Al	PILCA HDPE	11,765	280		Medium	PILC
185Al	Unknown	1,154	280	Assumed construction	Medium	PILC
185Al	XLPE	51,011	280	Orion standard size	Medium	XLPE
185AL	XLPE	12	280		Medium	XLPE
.15Cu	PILCA	34,340	245		Medium	PILC
150Al	PILCA	49,500	245		Medium	PILC
95Cu	PILCA	3,080	245		Medium	PILC
150Al	PILCA HDPE	6,198	245		Medium	PILC
.15Cu	Unknown	62	245	Assumed construction	Medium	PILC
150Al	Unknown	2,630	245	Assumed construction	Medium	PILC
95Cu	Unknown	7	245	Assumed construction	Medium	PILC
150Al	XLPE	2,339	245		Medium	XLPE
70Cu	PILCA	2,916	205		Medium	PILC
70Cu	Unknown	142	205	Assumed construction	Medium	PILC
70Cu	XLPE	724	205		Medium	XLPE
.1Cu	PILCA	3,462	200		Medium	PILC
.1Cu	Unknown	468	200	Assumed construction	Medium	PILC
.15Al	PILCA	98,227	190		Medium	PILC
95Al	PILCA	310,897	190		Medium	PILC
unknown (subl	PILCA	147	?	Assumed size	Medium	PILC
95Al	PILCA HDPE	21,393	190		Medium	PILC
.15Al	Unknown	392	190	Assumed construction	Medium	PILC
95Al	Unknown	2,448	190	Assumed construction	Medium	PILC
unknown (subl	Unknown	80	?	Assumed size and construction	Medium	PILC
.15Al	XLPE	114	190		Medium	XLPE
95Al	XLPE	46,024	190	Orion standard size	Medium	XLPE
70Al	PILCA	11,171	160		Medium	PILC
70Al	PILCA HDPE	205	160		Medium	PILC
70Al	Unknown	3,252	160	Assumed construction	Medium	PILC
70Al	XLPE	26,782	160		Medium	XLPE
.06Cu	PILCA	48,932	150		Medium	PILC
.1Al	PILCA	6,077	150		Medium	PILC
.06Cu	Unknown	367	150	Assumed construction	Medium	PILC
.1Al	Unknown	1,514	150	Assumed construction	Medium	PILC
35Cu	PILCA	2,576	140		Medium	PILC
35Cu	Unknown	7	140	Assumed construction	Medium	PILC
35Cu	XLPE	698	140		Medium	XLPE
.05Cu	PILCA	3,040	125		Medium	PILC

LV Cable Ratings

GIS Cable Size	GIS Cable Construction	Approx Installed Length (m)	Capacity (A)	Comment	ODV Valuation Size	Valuation Construction
> 240 mm2 Al - Heavy						
500XN 3p1	Copper XLPE	7	750		Heavy	XLPE/PVC
4 x 400X 1c	Copper XLPE	35	715		Heavy	XLPE/PVC
300XN 3p1	Copper XLPE	1,202	590		Heavy	XLPE/PVC
300T 5c	Copper PILCA	26	550		Heavy	PILC
.4T 4c	Copper PILCA	530	510		Heavy	PILC
.4T 5c	Copper PILCA	3,553	510		Heavy	PILC
.3X 5c	Copper XLPE	1,528	460		Heavy	XLPE/PVC
185XN 3p	Copper XLPE	1,161	460		Heavy	XLPE/PVC
185XN 3p1	Copper XLPE	70,316	460		Heavy	XLPE/PVC
300AX 4c	Aluminium XLPE	10,488	460		Heavy	XLPE/PVC
300AX 5c	Aluminium XLPE	20,455	460		Heavy	XLPE/PVC
300AXN 3p1	Aluminium XLPE	43,210	460		Heavy	XLPE/PVC
4 x 150X 1c	Copper XLPE	15	430		Heavy	XLPE/PVC
.3T 4c	Copper PILCA	2,723	425		Heavy	PILC
.3T 5c	Copper PILCA	46,309	425		Heavy	PILC
≤ 240 mm2 Al - Medium						
240AX 4c	Aluminium XLPE	20,499	410		Medium	XLPE/PVC
150XN 3p1	Copper XLPE	201	405		Medium	XLPE/PVC
185PN 3p1	Copper PVC	4,552	390		Medium	XLPE/PVC
185T 4c	Copper PILCA	3,206	390		Medium	PILC
185T 5c	Copper PILCA	9,079	390		Medium	PILC
4 x 120X 1c	Copper XLPE	477	385		Medium	XLPE/PVC
120XN 3p	Copper XLPE	9,261	360		Medium	XLPE/PVC
120XN 3p1	Copper XLPE	116,049	360		Medium	XLPE/PVC
.3AX 4c	Aluminium XLPE	329	350		Medium	XLPE/PVC
.3AX 5c	Aluminium XLPE	6,096	350		Medium	XLPE/PVC
185AX 4c	Aluminium XLPE	61,949	350		Medium	XLPE/PVC
185AX 5c	Aluminium XLPE	15,617	350		Medium	XLPE/PVC
185AXN 3p	Aluminium XLPE	1,465	350		Medium	XLPE/PVC
185AXN 3p1	Aluminium XLPE	112,990	350		Medium	XLPE/PVC
120T 4c	Copper PILCA	218	335		Medium	PILC
185AW 4c	Aluminium PILCA	3,031	330		Medium	PILC
95XN 3p1	Copper XLPE	678	315		Medium	XLPE/PVC
120PN 3p1	Copper PVC	786	310		Medium	XLPE/PVC
150AXN 3p1	Aluminium XLPE	21	310		Medium	XLPE/PVC
185APN 3p1	Aluminium PVC	110	300		Medium	XLPE/PVC
4 x 120AX 1c	Aluminium XLPE	9	300		Medium	XLPE/PVC
.15T 4c	Copper PILCA	4,669	290		Medium	PILC
.15T 5c	Copper PILCA	5,380	290		Medium	PILC
150AW 4c	Aluminium PILCA	200	290		Medium	PILC
95T 4c	Copper PILCA	132	290		Medium	PILC
4 x 70X 1c	Copper XLPE	52	285		Medium	XLPE/PVC
120AX 4c	Aluminium XLPE	19,846	275		Medium	XLPE/PVC
120AXCN 3p1	Aluminium XLPE	57,381	275		Medium	XLPE/PVC
120AXN 3p	Aluminium XLPE	5,478	275		Medium	XLPE/PVC
120AXN 3p1	Aluminium XLPE	96,305	275		Medium	XLPE/PVC
.15PN 3p	Copper PVC	532	270		Medium	XLPE/PVC
4 x .1P 1c	Copper PVC	599	270		Medium	XLPE/PVC
95PN 3p1	Copper PVC	3,090	270		Medium	XLPE/PVC
4x19/.083	Copper PVC	175	270	Expected *Size* to include p for PVC - PVC assumed	Medium	XLPE/PVC
70XN 3p	Copper XLPE	6,576	265		Medium	XLPE/PVC
70XN 3p1	Copper XLPE	241,375	265		Medium	XLPE/PVC
.2AW 4c	Aluminium PILCA	460	255		Medium	PILC
4 x 95AX 1c	Aluminium XLPE	12,043	255		Medium	XLPE/PVC
.15AX 5c	Aluminium XLPE	227	240		Medium	XLPE/PVC
.1T 4c	Copper PILCA	12,955	240		Medium	PILC
.1T 5c	Copper PILCA	8,707	240		Medium	PILC
70T 4c	Copper PILCA	554	240		Medium	PILC
95AX 4c	Aluminium XLPE	16,776	240		Medium	XLPE/PVC
95AX 5c	Aluminium XLPE	3,224	240		Medium	XLPE/PVC
95AXN 3p	Aluminium XLPE	25,529	240		Medium	XLPE/PVC
95AXN 3p1	Aluminium XLPE	2,781	240		Medium	XLPE/PVC
.15AW 4c	Aluminium PILCA	3,076	225		Medium	PILC
.1PN 3p	Copper PVC	26,155	225		Medium	XLPE/PVC
.1PN 3p1	Copper PVC	307,656	225		Medium	XLPE/PVC
70PN 3p	Copper PVC	1,318	225		Medium	XLPE/PVC
70PN 3p1	Copper PVC	84,371	225		Medium	XLPE/PVC
95AW 4c	Aluminium PILCA	1,980	225		Medium	PILC
95AWCN 3p	Aluminium PILCA	6,091	225		Medium	PILC
4 x 70AX 1c	Aluminium XLPE	421	220		Medium	XLPE/PVC
95APN 3p	Aluminium PVC	32,798	205		Medium	XLPE/PVC
95APN 3p1	Aluminium PVC	1,852	205		Medium	XLPE/PVC
70AX 4c	Aluminium XLPE	1,052	200		Medium	XLPE/PVC
35XN 1p	Copper XLPE	2,581	190		Medium	XLPE/PVC
.1AW 4c	Aluminium PILCA	9,274	185		Medium	PILC
4 x 35P 1c	Copper PVC	3,155	185	Expected *Size* to include p for PVC - PVC assumed	Medium	XLPE/PVC
70AW 4c	Aluminium PILCA	274	185		Medium	PILC

GIS Cable Size	GIS Cable Construction	Approx Installed Length (m)	Capacity (A)	Comment	ODV Valuation Size	Valuation Construction
4x19/.064	Copper PVC	23,517	185		Medium	XLPE/PVC
35XN 3p	Copper XLPE	33,370	180		Medium	XLPE/PVC
35XN 3p1	Copper XLPE	36,655	180		Medium	XLPE/PVC
.06T 4c	Copper PILCA	1,214	165		Medium	PILC
25XN 1p	Copper XLPE	144	165		Medium	XLPE/PVC
35T 4c	Copper PILCA	158	165		Medium	PILC
35T 5c	Copper PILCA	3	165		Medium	PILC
.06PN 3p	Copper PVC	17,527	155		Medium	XLPE/PVC
.06PN 3p1	Copper PVC	1,580	155		Medium	XLPE/PVC
35PN 3p	Copper PVC	6,339	155		Medium	XLPE/PVC
35PN 3p1	Copper PVC	2,947	155		Medium	XLPE/PVC
4 x 95AP 1c	Aluminium PVC	5,546	154	Estimated based on 3c equivalent	Medium	XLPE/PVC
25PN 1p	Copper PVC	541	150		Medium	XLPE/PVC
25XN 3p	Copper XLPE	47,933	150		Medium	XLPE/PVC
.04T 4c	Copper PILCA	3,138	135		Medium	PILC
25T 4c	Copper PILCA	17	135		Medium	PILC
4 x 70AP 1c	Aluminium PVC	1,037	132	Estimated based on 3c equivalent	Medium	XLPE/PVC
.04PN 3p	Copper PVC	4,423	130		Medium	XLPE/PVC
25PN 3p	Copper PVC	5,446	130		Medium	XLPE/PVC
16XN 1p	Copper XLPE	1,346	125		Medium	XLPE/PVC
16PN 1p	Copper PVC	1,322	115		Medium	XLPE/PVC
16XN 3p	Copper XLPE	524	115		Medium	XLPE/PVC
7/.064PN 1p	Copper PVC	132	115		Medium	XLPE/PVC
.0225PN 2p	Copper PVC	49	98		Medium	XLPE/PVC
.0225PN 3p	Copper PVC	609	98		Medium	XLPE/PVC
16PN 3p	Copper PVC	825	98		Medium	XLPE/PVC
.0145T 2c	Copper PILCA	53	70	Estimated based on smallest listed size (16mm2)	Medium	PILC
.0145T 3c	Copper PILCA	11	70	Estimated based on smallest listed size (16mm2)	Medium	PILC
4PN 1p	Copper PVC	318	53		Medium	XLPE/PVC
Unknown	Aluminium XLPE	48	?	Assumed size	Medium	XLPE/PVC
Unknown	Copper PILCA	45	?	Assumed size	Medium	PILC
Unknown	Copper XLPE	246	?	Assumed size	Medium	XLPE/PVC
Unknown	Unknown (installed ≤ 1964)	1,802	?	Assumed size and construction	Medium	PILC
Unknown	Unknown (installed > 1964)	130,097	?	Assumed size and construction	Medium	XLPE/PVC

66kV Line Ratings

GIS Line Size	Approx Installed Length (m)	Capacity (A)	Comment	ODV Valuation Size
> 150 mm2 Al - Heavy				
37/.102	51,464	525		Heavy
37/.108AL	7,964	525		Heavy
≤ 150 mm2 Al - Medium				
DOG	37,808	297		Medium

33kV Line Ratings

GIS Line Size	Approx Installed Length (m)	Capacity (A)	Comment	ODV Valuation Size
≥ 150 mm2 Al and ≤ 300 mm2 Al - Heavy				
JAGUAR	4,956	507		Heavy
19/.101	3,793	421		Heavy
< 150 mm2 Al - Light				
19/.080	54,095	324		Light
DOG	239,167	297		Light
19/.064	14,080	229		Light
SPARROW	5,255	139		Light
Unknown	213	?	Assumed light	Light

11kV Line Ratings

GIS Line Size	Approx Installed Length (m)	Capacity (A)	Comment	ODV Valuation Size
≥ 150 mm2 Al and ≤ 240 mm2 Al - Heavy				
JAGUAR	0	507	Orion standard size	Heavy
19/.183AL	1,028	500	Technically larger than *Heavy*, but only short length.	Heavy
19/.152AL	31,773	500		Heavy
37/.108AL	421	500		Heavy
MATA	1,512	500		Heavy
19/.101	6,362	443		Heavy
> 50 mm2 Al and < 150 mm2 Al - Medium				
19/2.34	11,603	350		Medium
19/.083	5,661	350		Medium
19/14	20,118	350		Medium
19/.080	42,100	324		Medium
7/.136	19,380	300		Medium
DOG	697,824	297	Orion standard size	Medium
19/.064	111,317	280		Medium
19/1.63 (XLPE)	2,195	280		Medium
19/16	8,054	280		Medium
HAKE	9,092	228		Medium
MINK	311,223	213	Orion standard size	Medium
RAVEN	29,488	213		Medium
7/.104	380	200		Medium
GARNET (PVC)	3,449	180		Medium
≤ 50 mm2 Al - Light				
7/14	17,765	150		Light
7/.080	24,967	150		Light
7/14 (PVC)	414	150		Light
SPARROW	33,050	150		Light
7/.064	294,534	110		Light
7/16	19,989	100		Light
FLOUNDER	188,562	100	Orion standard size	Light
SQUIRREL	449,697	100	Orion standard size	Light
SWAN	48,782	100		Light
THRUSH	46,819	99		Light
HERRING	10,977	80		Light
MAGPIE	1,207	80		Light
1/8	500	20		Light
1/8 STEEL	3,186	20		Light
7/16 STEEL	12,384	20		Light
STEEL	8,996	20		Light
Unknown	7,220	?	Assumed light	Light
Single phase (2-wire) - Any Size				
DOG	47	297		SWER/1Ph
MINK	2,275	213		SWER/1Ph
RAVEN	511	213		SWER/1Ph
7/14	17,614	150		SWER/1Ph
7/.080	3,858	150		SWER/1Ph
7/.083	254	150		SWER/1Ph
7/14 (PVC)	734	150		SWER/1Ph
SPARROW	3,857	150		SWER/1Ph
7/.064	56,411	110		SWER/1Ph
7/16 (PVC)	793	100		SWER/1Ph
7/14AL (PVC)	830	100		SWER/1Ph
7/16	23,101	100		SWER/1Ph
FLOUNDER	213,940	100		SWER/1Ph
SQUIRREL	233,899	100		SWER/1Ph
SWAN	8,132	100		SWER/1Ph
THRUSH	4,158	99		SWER/1Ph
7/.044 (PVC)	692	80		SWER/1Ph
HERRING	5,668	80		SWER/1Ph
MAGPIE	421	80		SWER/1Ph
1/8 STEEL	3,843	20		SWER/1Ph
7/16 STEEL	8,777	20		SWER/1Ph
STEEL	17,909	20		SWER/1Ph
Unknown	12,924	?		SWER/1Ph
SWER (single wire) - Any Size				
7/14 STEEL	1,956	150		SWER/1Ph
7/.064	24	110		SWER/1Ph
FLOUNDER	91,954	100		SWER/1Ph
SQUIRREL	369	100		SWER/1Ph
1/8 STEEL	8,100	20		SWER/1Ph
STEEL	754	20		SWER/1Ph
Unknown	504	?		SWER/1Ph

LV Line Ratings

GIS Line Size	Approx Installed Length (m)	Capacity (A)	Comment	ODV Valuation Size
> 150 mm2 Al - Heavy				
37/14	30,458	465		Heavy
37/14 (130)	14,162	465		Heavy
37/14 (130) + N 19/14 (65)	388	465		Heavy
37/14 + N 19/14	4,230	465		Heavy
> 50 and ≤ 150 mm2 Al - Medium				
WEKE-19	92,125	330		Medium
WEKE-19 (75)	24,310	330		Medium
19/14	321,214	300		Medium
19/14 (65)	104,896	300		Medium
19/14 (65) + N 19/16 (40)	915	300		Medium
19/14 + N 19/16	4,335	300		Medium
19/16	102,376	213		Medium
19/16 (40)	17,915	213		Medium
19/16 (40) + N 7/14 (25)	448	213		Medium
19/16 + N 7/14	1,254	213		Medium
1p 19/16	394	213		Medium
Unknown	203,648	?	Assumed medium	Medium
≤ 50 mm2 Al - Light				
RANGO	1,426	180		Light
WEKE-7	778	165		Light
WEKE-7 (75)	83	165		Light
7/14	36,360	150		Light
7/14 (25)	2,148	150		Light
1p 7/14	2,159	150		Light
1p 7/14 (25)	135	150		Light
2p 7/14	1,395	150		Light
2p 7/14 (25)	63	150		Light
1p 7/16	168	110		Light
2p 7/16	135	110		Light
7/16	6,384	102		Light
7/16 (15)	906	102		Light
No. 10 CU	28	80		Light

Appendix J
Quality of Supply Criteria

Quality of Supply Criteria

Updated November 2004

Table of Contents

1 Introduction

This document presents Orion's "Quality of Supply" criteria that it uses for designing and building its electricity network. Strictly speaking, 'delivery' is more appropriate than 'supply' because Orion only delivers electricity. Electricity generators and retailers are responsible for the supply of electricity. However, except for the frequency in the AC electricity supplied, Orion's delivery service determines the quality of supply that occurs at the consumer's connection. This includes the influence of the transmission system because Orion contracts with Transpower for the transmission service.

This document has been prepared in response to the requirement given in clauses 2.31 to 2.34 of the Handbook. Clause 2.32 requires Orion to "*disclose in its valuation report the quality of supply criteria that it currently uses as a basis for network design*". Handbook clause 2.33 expands on the relevant quality of supply criteria which has largely determined the arrangement of this document which covers security, reliability, voltage regulation, losses and asset requirements.

Sections 2 to 4 explain the standards used by Orion as criteria for the quality of supply. Section 5 explains the context of losses and how Orion considers these when designing and building its network. Section 6 explains the key aspects of the assets needed by Orion to achieve its quality of supply criteria.

Orion also has contractual obligations via agreements with electricity retailers and major customers to:

- provide delivery services in accordance with good industry practice, and
- use reasonable endeavours to provide continuous delivery.

"Good industry practice" means the exercise of that degree of skill, diligence, prudence and foresight which would reasonably and ordinarily be expected from a skilled and experienced distributor engaged in the same type of undertaking under the same or similar circumstances in New Zealand at the time.

These contractual obligations further determine how Orion designs, builds and operates its network.

2 Security

Security of supply is the ability of the network to meet the demand for electricity in certain circumstances when electrical equipment ceases to continue functioning. The more secure an electricity network, the greater its ability to continue to perform or the quicker it can recover from a fault or a series of faults.

Note that security of supply differs from reliability. Reliability is a measure of how the network performs and is measured in terms of such measures as the number of times supply to consumers is interrupted per annum. Reliability is covered in the next section.

Orion's Security Standard is summarised on the following page which is taken directly from section 2.3.7 of Orion's Asset Management Plan 2005 (AMP) published in June 2004.

These security criteria determine how much spare capacity Orion must have available in its network assets in order to meet the various contingencies.

It is common to express security of supply in terms of being able to cope with an 'n', 'n-1' or 'n-2' contingency. This terminology indicates that 0, 1 or 2 plant outages can occur and there is sufficient alternative back-up capacity available to supply the load.

Distribution network supply security standard

CLASS. D Loads up to 200MW i.e. CBD or major sector of city.

1. Immediately restore 100%.
2. Immediately restore 50% and the rest within 1 hour.
3. Immediately restore 50% and the rest in the time taken to complete repairs.

CLASS. C2 Loads 10 to 60MW i.e. Special industrial/commercial load, CBD and Transpower GXPs.

1. Immediately restore 100%.
2. Within ½ hour restore 95% and the rest in the time taken to complete repairs.
3. Within 2 hours restore 95% and the rest in the time taken to complete repairs.

CLASS. C1 Loads 10 to 60MW i.e. Primary urban network including district and network substations.

1. Immediately restore 100%.
2. Within 2 hours restore 95% and the rest in the time taken to complete repairs.
3. Within 2 hours restore 95% and the rest in the time taken to complete repairs.

CLASS. B Loads 2 to 10MW i.e. Major O/H lines, single transformer district subs and large urban radial feeders.

1. Within 1½ hours restore 50%, within 3 hours restore 95%, and the rest in the time taken to complete repairs.

2 & 3. Restore 100% in the time taken to complete repairs.

CLASS. A3 Loads 1 to 2MW i.e. Urban secondary feeder

1. Within 1 hour restore 50%, within 2 hours restore 95%, and the rest in the time taken to complete repairs.

2 & 3. Restore 100% in the time taken to complete repairs.

CLASS. A2 Loads 1 to 2MW i.e. Rural feeder

1. Within 2 hours restore 50%, within 6 hours restore 95%, and the rest in the time taken to complete repairs.

2 & 3. Restore 100% in the time taken to complete repairs.

CLASS. A1 Loads 0 to 1MW i.e Remote rural feeder & very small Transpower GXP.

1, 2 & 3. Restore 100% in the time taken to complete repairs or switching.

KEY. 1. Time allowed to restore supply after one interruption (n-1 event/contingency).

2. Time allowed to restore supply if a second interruption occurs in same area (n-2 event/contingency).

3. Time allowed to restore supply after single busbar fault.

3 Reliability

Orion has disclosed its reliability performance targets in section 2.3.3 of its AMP 2005. A summary of the targets follows:

Target number of interruptions of delivery to connections		
Network owner	**Classifications of interruptions**	**5-year average, 2005-2009 (# per year)**
Orion	Planned shutdowns	385
	Unplanned cuts	555

Target number of faults per 100 circuit-km (Orion network)	
Line or cable voltage	**5-year average, 2005-2009 (# per year)**
66kV	2
33kV	4
11kV	12
All	11

Target reliability indices – Orion network only 5 year average 2005-2009				
Location	**Type of interruption**	**SAIDI**	**SAIFI**	**CAIDI**
Whole area	Planned shutdowns	8	0.08	105
	Unplanned cuts	55	0.67	54
	Total	63	0.76	83

Where:

SAIDI is the duration of supply interruptions per connected customer – minutes per year

SAIFI is the number of supply interruptions per connected customer – times per year

CAIDI is the duration of supply interruptions per customer interrupted – minutes per year

Orion's overall reliability performance aligns with these targets. There are 'good' and 'bad' performance years caused mainly by the weather, but the five yearly average results are achieved. While Orion is always seeking ways to cost-effectively improve its reliability performance, this alignment of results with targets indicates that Orion's existing assets are appropriate.

Orion does not have reliability performance targets for different areas within its network, as suggested in Handbook clause 2.33(b). The above target values have been determined from the Commerce Commission's regulatory thresholds on reliability performance that have been in place since 1 April 2004. The security standard determines the requirements for capacity and redundancy in the different areas of Orion's network.

As detailed in Schedule F of its Delivery Services Agreement with retailers, Orion contractually commits to the following performance:

Reliability Performance Commitment, per connection	Urban	Rural
Target time to restore electricity delivery following a fault.	1.5h	3.0h
Duration after which financial penalty applies if electricity delivery is not restored following notification of a fault to Orion.	3.0h	6.0h

4 Voltage regulation

Orion's standard for voltage regulation is to comply with regulation 54 of the Electricity Regulations 1997.

This standard is:

- 230 volts ± 6% (i.e. 216 volts to 245 volts) for standard low voltage;
- within ± 5% of the nominal supply voltage at voltages exceeding 250 volts, unless otherwise agreed with the customer.

Orion delivers to connections at nominal voltages of 230, 400 and 11,000 volts. The voltage standard applies at the 'network connection point', generally at a boundary box for underground supply or at the pole fuse for overhead supply.

To achieve these standards, Orion designs for the voltage at the input to 11kV feeders at full load to be 3% above nominal, and for the far end voltage to be not less than 6% below nominal.

With regard to electrical disturbances, Orion will use reasonable endeavours to ensure that flicker, voltage sags, voltage surges, spikes and electrical noise, harmonics, inter-harmonics and other disturbances are controlled within the network to avoid disturbance to customers' equipment. Refer to section 5.3.5 of Orion's Network Code for details of applicable standards.

Orion's operational performance measure that arises from these standards is to have no more than 70 complaints (<4 per 10,000 consumers) per year of inadequate voltage which prove to be valid (AMP 2005, section 2.3.1).

5 Losses

5.1 Overall Policy

Orion does not have an overall standard or target level regarding electrical losses. However, electrical losses are specifically considered when purchasing transformers and in overhead line design. Orion considers that this is part of its responsibility in adhering to Good Industry Practice.

5.2 Occurrence of Losses

Electrical losses are derived from the difference between volumes entering Orion's network at the Grid Exit Points (GXP) and the energy volumes leaving Orion's network, as measured at the customer connections. The energy loss ratio is the volume of energy losses divided by the input energy volume, expressed as a percentage. For the recent five financial years (ending 31/3), the loss ratio for Orion's overall network, as disclosed, has been 4.9%.

There is considerable uncertainty in these values because:

- errors in metering occur at the GXPs (approx. $\pm$ 0.5%);
- errors in metering occur at the connections (approx. $\pm$ 2.5%);
- timing of meter reading is precise at the GXPs (meters are read every half hour) but is imprecise at the customers' meters (read every 1 or 2 months);
- loss volume is a small difference between two large numbers that have uncertainties – approximately 150 in 3,000 $\pm$30 ($\pm$1%);
- metering data is subject to gaps and distortions from the application of incorrect multipliers and to omissions and errors in capturing metering information.

Consequently, Orion's overall network loss ratio has to be considered as 5 $\pm$ 1%. There will be significant deviations from this value in some parts of the network such as urban vs rural.

Orion's assessment of the contributions to the loss ratio is as follows:

	Urban	**Rural**
Subtransmission lines and cables	0.5%	1.0%
District (power) transformers	0.5%	0.5%
11kV lines and cables	1.5%	3.5%
Subtotal subtransmission + 11kV	**2.5%**	**5.0%**
Distribution transformers	1.2%	1.2%
230/400V lines and cables	1.3%	0.3%
Subtotal Low Voltage (LV)	**2.5%**	**1.5%**
Totals	**5.0%**	**6.5%**

5.3 Transformer Purchase

Orion's equipment specification "Distribution Transformers 200 to 1000 kVA" (NW 74.23.05) includes a No-Load Load Loss multiplier and a Load Loss multiplier that are used for the capitalisation of loss costs when comparing offers of distribution transformers for purchase.

Orion's equipment specifications for power transformers (eg NW 74.23.07 "Transformer 66/11kV, 7.5/10MVA") also have these loss multipliers that are used in the evaluation of tenders.

For more detailed assessments in specific circumstances, Orion also uses the Guide "Purchase & Operating Costs of Transformers", published by the Electricity Engineers Association of New Zealand.

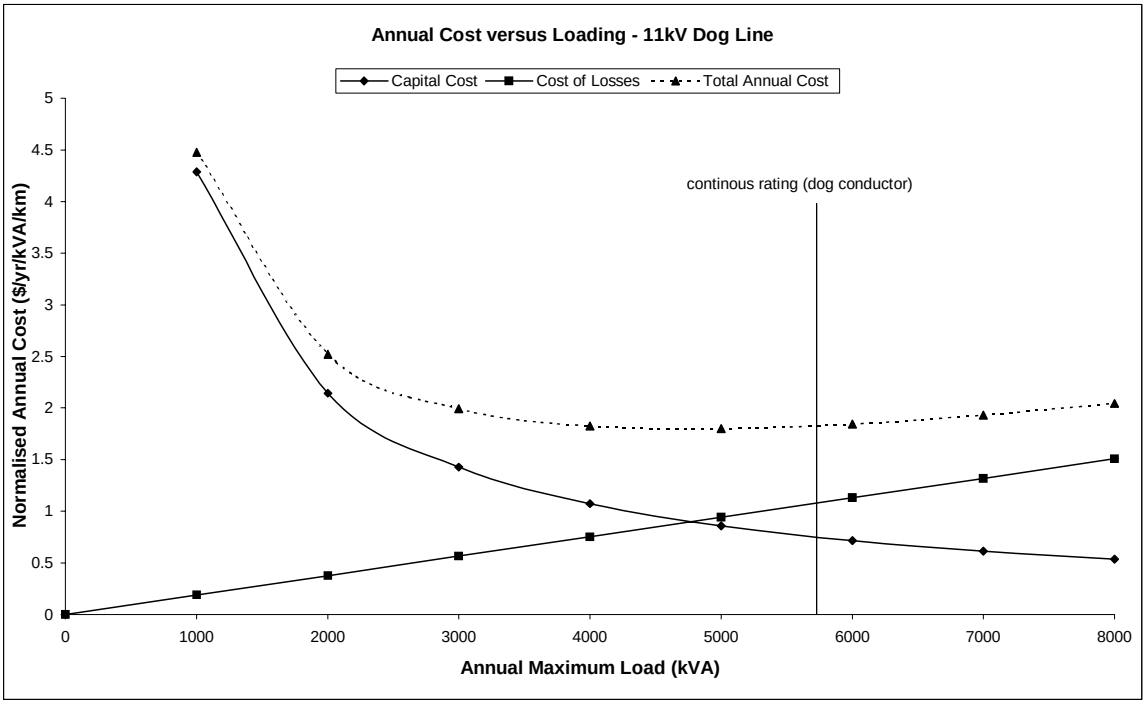
These approaches ensure that proper consideration is given to the trade-offs between the costs of transformer manufacture and the future costs of energy losses. It is more expensive to manufacture a transformer with lower losses because more expensive, higher quality materials have to be used. The future cost of energy purchase has been assumed to be in the range of 4¢ to 6¢/kWh at the GXP.

5.4 Selection of Conductor Size

Most of the electrical losses in Orion's network occur in lines and cables – the conductors. The loss is calculated from the expression I^2R where I is the current and R is the resistance of the conductor. The connected load determines the current and the conductor's size and material determines the conductor resistance. The larger the conductor size, the lower the resistance and hence the losses will be the lower. However, larger conductors cost more and hence, again, there is a trade-off between the costs of capital and losses.

5.4.1 Overhead Lines

There are economic optimum operating conditions for overhead lines used for delivering electricity to the reasonably substantial loads that typically occur on the fringes of cities or towns. "Kelvin's Law" of economics applies which states that the minimum annual operating cost occurs when the annual cost of losses equals the annual capital cost. This optimum operation typically occurs when the maximum load is 75 to 85% of the conductor's rating. The characteristic is illustrated in the following diagram for the 11kV 'Dog' conductor that Orion commonly uses in the higher-density loading areas.



Orion endeavours to design and operate its overhead lines in its higher-density loading areas for use within the optimum range. However, it should be noted that the total annual cost does not vary much over the wider range of 65 to 100% of rating.

The conductor size needed for the longer overhead lines in rural areas is principally determined by the limits on voltage drop. Hence, conductors with excess capacity are used as these have lower resistance resulting in reduced voltage drop along the line. The economic optimum is not achieved and lines typically operate with annual maximum loads of 5 to 40% of rating. Consequently, losses are lower than the economic optimum.

5.4.2 Underground Cables

For a given rating, cables cost more and have lower resistance per unit length. For example:

Conductor	Rating (amps)	Installed cost ($/km)	Resistance (ohms/km)
Dog overhead line	300	$30,800	0.273
185mm^{2}Al cable	280	$90,000	0.164

Consequently, with much higher capital costs and much lower resistance, an economic cross-over is never achieved. Hence, wherever cables are used, losses are extremely low. The high capital cost of cables is required to meet the community needs for reticulation to be underground.

5.5 Selection of Voltage

For the same power or energy volume delivered, losses are lower when conductors are operated at higher voltage. Capital costs are also higher for higher voltage equipment. A continuous range of voltage is not practical. Orion uses discreet voltages of 66kV, 33kV, 11kV and 230/400V.

When extending the network, Orion models the development and considers all future costs, including the cost of losses. In a rural area, for example, Orion's network may be extended at 11kV, 33kV or 66kV to supply future loading, such as large irrigation plants.

For developments at the connection level, Orion also considers alternatives for the voltage of supply and whether or not to extend the Low or High Voltage reticulation. Consideration of losses may be included in the decision making although other factors tend to dominate such as future access to plant, shared use of land and the particular preferences of customers.

5.6 Other Sources of Losses

Other sources of losses are:

- internal usage by Orion;
- unmetered supplies;
- theft.

All of Orion's major facilities, such as the main building, are metered as separate connections and Orion purchases this electricity from an electricity retailer. There are, however, many supplies in substations and kiosks that are used for lighting, heating, and miscellaneous other services. The annual volume of energy involved is estimated at 3.4GWh, which appears as a loss.

Unmetered supplies may also contribute towards "losses". For substantial volumes, such as for supply to street and traffic lights, the volumes are estimated and included with retail sales. Other miscellaneous outlets, such as those at parks, contribute towards losses but the volumes are insignificant.

Theft of electricity is a reasonably significant contributor towards losses. Volumes involved are, of course, unknown. Electricity retailers are responsible for the integrity of metering at connections and for reading meters and it is in their interest to minimise theft.

5.7 Conclusion on Losses

This section has covered the key aspects of electricity losses on Orion's network. Overall, they do not have much impact on the design and operation of Orion's network because other factors tend to dominate. Significant points made are:

- there is considerable uncertainty in determining electrical losses;
- losses occur mostly in lines and cables (3.3%) and in transformers (1.7%);
- there is always a trade-off between capital and loss costs resulting in optimisation of losses, not minimisation;
- Orion gives specific consideration to losses when purchasing transformers;
- Orion considers loss optimisation when designing and operating overhead lines in areas with high loading density. Elsewhere, other factors determine the selection of conductor size;
- for any major network development, Orion considers the cost of losses;
- there are some other minor contributors towards losses – internal use, unmetered supplies and theft – which have little impact on Orion's overall network losses.

6 Asset requirements

6.1 System Configuration

Orion receives 3-phase electricity for delivery from Transpower at voltages of 66kV, 33kV and 11kV. Orion delivers electricity to customers' connections at 230V (1-phase), 400V (3-phase) and 11kV (3-phase, to a small number of about 80 major customer connections). In between, Orion configures a subtransmission and distribution network to meet the quality of supply criteria given in sections 2 to 5 of this document.

As the **supply security** criteria are load-dependent, Orion has to configure its network and provide extra assets or extra capacity in its assets to cope with contingencies (ie provide contingency assets) on the basis of maximum loadings.

To cope with a single contingency, referred to as 'n-1', and be able to restore 100% of load immediately, there must always be an alternative delivery path available that can supply the maximum load. Orion therefore requires a duplication of all major 66kV and 33kV circuits in the urban area. In the rural area, there is some duplication of the 33kV circuits and some new 66kV subtransmission but some of the subtransmission is configured as single radial circuits and so Orion has to rely on back-up from the meshed 11kV network to cope with a failure, at some rural district substations such as Annat, Bankside and Hills Road.

In the CBD area where loads are security class D, the configuration must enable delivery to be quickly restored following a double contingency, referred to as 'n-2'. Therefore, there must always be sufficient capacity available in the subtransmission, district substations and 11kV network to always be able to switch in two alternative delivery paths of sufficient capacity to supply the maximum load.

The **supply security** criteria apply principally to loadings on 11kV feeders, district substations, subtransmission network and at GXPs. They do not apply to individual connections except in the case of a few major customer connections with maximum loadings in the 1 to 10MW range. As discussed above, the network from the 11kV feeder level and above must be configured to ensure that the security criteria are met.

The **voltage regulation** criteria apply with respect to the voltage delivered at the connections. In the urban area where distances are short and cables with Low Voltage drop are used, the voltage regulation criteria are readily met. However, in the rural area with long distances and overhead lines that have significant voltage drop, the limits on voltage regulation determine the configuration. This generally results in multiple subtransmission (33kV) and distribution (11kV) circuits to ensure that there is sufficient voltage at the connections. Voltage regulators and on-line tapchangers are also used to assist with voltage control. The voltage regulation criteria also influences the distribution transformer size as there must be sufficient voltage at the load at start-up. Motors have higher starting currents than running currents. Furthermore, motor loads require reactive power. The resulting lower power factors, principally on the rural network, have a considerable influence on the configuration of overhead lines in the rural area because they have to deliver the reactive current, as well as the active current.

Reliability performance measurement is also made with respect to the connections. There is a noticeable impact on the performance indices when significant numbers of connections have their delivery interrupted for a planned shutdown or a power cut. The network is consequently configured with proportionally less contingency assets as the network fans out from the GXPs to the customer connections. This is entirely compatible with the security requirement for more contingent capacity at higher loadings.

To meet the **voltage** performance criteria, the network is configured with voltage taps on transformers (on-line adjustment at district substations and off-line at distribution transformers). Lines and cables of appropriate capacity are then configured to ensure that the voltage criteria are met at the customer connections.

Losses criteria do not have much influence on configuration. Apart from being considered specifically with transformer purchase and high voltage line design with high density loading, losses are a natural consequence of loading patterns, given a network configuration.

Overall, in building its assets, Orion must comply with many legislated statutory requirements. The main legislation is listed in section 4.2.2 of Orion's Asset Management Plan 2005.

6.2 GXPs

Orion takes supply from nine Transpower GXPs. Descriptions of these are given in section 3.4 of the Asset Management Plan 2005, which also explains how they comply with Orion's Security Standard.

Where GXP maximum loadings are 10 - 60MW (security class C2) or above 60MW (class D), Orion must have sufficient capacity in its subtransmission network to:

- immediately restore 100% of load following the first fault (n-1) for both classes C2 and D;
- within ½ an hour, restore 95% of the load and the rest in the time taken to complete repairs (n-2) for class C2;
- immediately restore 50% of load and the rest within one hour for class D.

These criteria apply to all except the 3 remote GXPs.

Further, following such contingencies, the voltage at the connections, as explained in Section 4, must be within $\pm$6% of standard Low Voltage.

6.3 Transmission/subtransmission Lines and Cables

Orion has subtransmission at 66kV, 33kV and 11kV. Details of the lines and cables are given in Sections 3.5 to 3.7, 4.4, 4.5, and 4.8 to 4.10 of the Asset Management Plan 2005.

The subtransmission circuits carry maximum loads above 2MW, ranging across security classes B, C1, C2 and D.

Hence, Orion must have subtransmission lines and cables that will meet the corresponding security performance requirements given in section 2.

Further, for any contingencies, the resulting voltage must be within the limits given in section 4.

To achieve these standards, the standard sizes of cables and lines used by Orion and their ratings are as follows:

Voltage	Conductor	Thermal Rating		Valuation handbook classification
Cables:				
66kV	300Al	365A	40MVA	Not stated
66kV	1600 CuXLPE	1400A	160MVA	Not stated
33kV	300Al	365A	20MVA	Above range
11kV	300Al	310A[1]	6MVA	Heavy
11kV	185Al	238A[1]	4.5MVA	Medium
11kV	95Al	162A[1]	3.1MVA	Medium
LV	300Al	460	320kVA	Heavy
LV	120Al	275	200kVA	Medium
LV	95Al	225	150kVA	Medium
Lines:				
66kV	Wolf	525A	60MVA	Not stated
66kV	Dog	300A	34MVA	Not stated
33kV	Jaguar	500A	30MVA	Heavy
33kV	Dog	300A	17MVA	Light
11kV	Dog	300A	6MVA	Medium
LV	19/14	300A	210kVA	Medium

[1] 85% of standard rating to allow for congestion of cables in shared trenches and poor thermal conductivity of soil in Christchurch.

6.4 District and Network Substations

Orion's network includes district (zone) substations supplied at primary subtransmission voltages of 66kV, 33kV and 11kV. Details of these substations are given in section 4.3.1 of the Asset Management Plan 2005. The 11kV subtransmission extends via primary circuits to network substations and details of these are given in Section 4.3.2 of the Asset Management Plan 2005.

To meet the supply security criteria given in Section 4, Orion needs secure facilities that are available continuously. Buildings must:

- protect equipment from intruders, animals, vandals and entry by any other unauthorised people;
- protect the public from injury;
- enable appropriate access for vehicles, cranes and other construction equipment;
- be acceptable to the community;
- provide adequate ventilation for equipment and people;
- enable safe and practical entry for lines and cables;
- be able to withstand earthquakes expected in Canterbury (zone B);
- have fire protection and oil retention equipment;
- Meet all statutory requirements, as stated in section 6.1.

Switchgear in substations must:

- be able to clear faults up to the maximum possible level without failing;
- be safe to operate;
- have adequate capacity to supply the load.

The design and appearance of Orion's substation buildings must be functional, but suitable for their community environment. They must meet the requirements of the current building codes and the Resource Management Act. The Christchurch City Plan Section 8, stipulates that "utility buildings must be provided in a manner which takes account of potential adverse effects, particularly effects on public health and significant visual effects …….. having regard to the character of the local environment".

6.5 District Substation Transformers

Orion has 66kV/11kV and 33kV/11kV power transformers at District (Zone) substations. Details of these transformers are given in Section 4.15 of the Asset Management Plan 2005.

To meet the security requirements and allow for the contingency of a transformer failing, Orion needs a single transformer where the rating is less than 10MVA and dual transformers where the rating is greater.

All but the smallest power transformers of less than 2MVA rating require on-line tapchangers to regulate the output voltage in order to meet Orion's voltage criteria. This is the only part of the network where the voltage is dynamically adjusted. Each tapchanger needs a controller and the operation of the tapchanger and its controller has to be reported back to the central control centre via SCADA to monitor this important function. Distribution transformers have adjustable taps, but these are fixed and can only be changed off-line.

6.6 High Voltage Distribution

6.6.1 Subtransmission (11kV) lines and cables

Orion has a subtransmission network of primary 11kV cables and a few 11kV lines that deliver electricity, in bulk, to network substations. They are configured mostly in closed rings whereby a failure in one part of the ring does not interrupt supply to any network substation. This arrangement ensures that Orion can meet its security standard and its reliability targets. Unit protection is employed for each primary circuit, which isolates the circuit at both ends under a fault contingency. This arrangement compliments Orion's minimal 66kV subtransmission network, which does not have many interconnecting circuits between district substations.

6.6.2 Distribution (11kV) lines and cables

The installation of overhead versus underground lines is controlled predominantly by zoning and planning rules associated with the relevant territorial authority's District Plan. The configuration and design of these are included in Orion's Design Standards.

Details of distribution lines and cables within the network are included in sections 4.5 and 4.9 respectively of the Asset Management Plan. The policy for undergrounding of existing overhead lines is given in Section 3.9 of the Asset Management Plan 2005. The 11kV lines and cables have capacities and configurations to ensure that Orion's security and voltage regulation standards are met.

6.6.3 Regulators

The use of regulators within Orion's network is required to ensure that its quality of supply standards are maintained. Predominantly, regulators within the Orion system are used to increase the voltage in constrained areas of Low Voltage, either as a result of load growth remote from existing district substations or to meet network system security requirements.

Orion operates regulators at the system voltage of 11kV.

6.6.4 High Voltage Switches

The use of HV switches is required to ensure minimum protection for equipment and personnel safety. They are also used to ensure Orion meets its disclosed Quality of Supply Criteria and in addition, attempt to meet restoration times given in the Delivery Services Agreement with the Electricity Retailer. This identifies target restoration times of 1½ hours in the Urban Area and three hours in the rural area.

Switches are also required to switch loads in both pre-fault and post fault network configurations. Therefore network configuration and geographic topology have an influence on the positioning of the equipment.

Air break isolators (ABI) and switches are also used to isolate overhead consumer spurs that feed ground-mounted transformers of capacity greater than 500kVA via an 11kV cable. This is required as drop-out fuses are not capable of interrupting inductive and capacitive loads safely in all conditions.

6.6.4.1 Circuit Breakers

Orion operates circuit breakers at system voltages of 66kV, 33kV and 11kV to protect sub-transmission and distribution equipment and to meet disclosed reliability and security criteria. The circuit breakers are located at district and network substations. Details of the circuit breakers are given in Sections 4.13 and 4.14 of the Asset Management Plan 2005.

6.6.4.2 Recloser / Sectionalisers / Automated Air Break Switches

Orion operates reclosers and sectionalisers to minimise the effect of faults on overhead circuits to consumers, and therefore meeting disclosed reliability criteria. Details of reclosers and sectionalisers are given in Section 4.14 of the Asset Management Plan 2005.

Orion reviews feeder performance on a yearly basis. Under- performing (or rogue) circuits are reviewed for trending information. Feeder circuits are analysed and modelled to determine if reclosers will improve reliability performance of the circuits.

6.6.4.3 Enclosed Switchgear (Air Insulated Units)/ Air Break Isolators

Orion installs air insulated unit switchgear in the form of Magnefix units (fully enclosed in cast resin) and enclosed oil switches (both fused and non-fused) in its 11kV secondary cables network. These provide light-load switching and isolation of circuits for maintenance work. The Magnefix units have a fault level rating of 14.4kA or 270MVA, which determines the higher impedance level needed in the district transformers. Where Orion has 11kV district substations supplied directly from 11kV GXPs, resistors have been fitted in the neutral of Transpower's power transformer to limit the fault level. Thus, Orion's Magnefix units are now able to be used anywhere in its network to provide the switching capability for Orion to meet its security and reliability standards.

Orion installs air break isolators in its 11kV overhead network. These provide off-load switching capability and enable Orion to meet its security and reliability standards.

Details about the management of enclosed switchgear are included in Section 4.14 of the Asset Management Plan 2005. Details about the installation of the switches are also included in Orion's Design Standards.

6.6.5 Low Capacity or SWER Lines

For descriptions of low capacity 11kV (nominal) lines, refer to Section 4.6.1 of the Asset Management Plan 2005.

Extensions to the network (not including reinforcement projects) are built to meet the customer's / developer's / electricity consumer's requirements. Each extension is reviewed to establish if the development is economically viable based on projected loadings and revenue. Low capacity extensions to the 11kV network are generally not economically viable. Most recently, no substantial low capacity (in particular SWER) network extensions have been undertaken. Any non-economic extensions would only be undertaken with a specific connection agreement with the electricity consumer.

6.7 Low Voltage Distribution

The Low Voltage network has been designed to meet regulatory requirements for safety and Orion's disclosed reliability and security requirements. The configuration and design of the networks are included in Orion's Design Standards.

Details of 400V distribution lines and cables within the network are included in Sections 4.7 and 4.11 respectively of the Asset Management Plan 2005. The policy for undergrounding of existing overhead lines is given in Section 3.9 of the Asset Management Plan 2005. Refer also to section 9.2 of Orion's Valuation Report.

The LV configuration includes many links that can open or close ties to provide for alternative supply routes to consumer connections from a distribution substation or a neighbouring distribution substation. These are used during planned interruptions when work is undertaken on the LV network, such as for transformer changes, or following unplanned interruptions to restore supply. Each radial feeder must be capable of supplying or being supplied from the feeder adjacent to it in the event of component failure or other requirements. This arrangement assists Orion to meet its prescribed regulatory reliability measures in that, if there is a fault on an 11kV feeder, supply can be quickly restored to LV connections via switching the LV network. The arrangement is also used to enable Orion to meet its contractual commitment on restoration of electricity delivery following a fault (refer to section 3 of this document) and the expectations of connected customers who expect minimal duration supply interruptions during LV maintenance or if faults occur on a distribution transformer or within the LV network.

Orion's LV cables are 89% medium (predominantly 0.1Cu or 95mm^{2}Al equivalent and 70mm^{2}Cu or 120mm^{2}Al equivalent) and 11% heavy (predominantly 185mm^2 Cu or 300mm^{2}Al equivalent). There is less diversity of loading on LV feeders, particularly at night-load switching times, which requires the use of heavier cables to maintain the regulation voltage. Orion's relatively small use of 300mm^{2}Al is principally in commercial areas to provide adequate switching capability and voltage regulation for high density loading.

Distribution transformers are the interface between the 11kV High Voltage distribution network and the 230V/400V Low Voltage network. For Orion to meet the voltage regulation criteria in its QoS, the distribution transformers must all be fitted with off-load tapchangers because the range of 11kV voltage can vary considerably depending on where the transformer is connected to the 11kV feeder. A tapping range to accommodate an input voltage variation of +2.5% to –7.5% in 5 x 2.5% steps is generally sufficient.

6.8 Lighting

The Christchurch City Council and the other district councils provide all of the overhead street light fittings within Orion's overhead reticulation and the lighting standards with street light fittings within Orion's underground reticulation. The network connection point (ie point of ownership change) is at the connection to the line on the overhead and at the base of the lighting standard on the underground. There are also some private outside lights (driveways etc) with similar supply and ownership arrangements.

The lighting subnetwork has been engineered via co-operative arrangements, principally between the CCC and Orion (and its predecessors). The CCC requires its streetlights to be switched reliably, simultaneously and consistently, in blocks. Consequently, Orion uses ripple control signals to switch receiver-relays to control the lights. To minimise overall costs, Orion has a 5th circuit with its LV (a 5th cable core or a 5th overhead wire) where LV is reticulated. In these situations, and where there is a separate circuit out to lights where there is no LV, Orion owns a ripple receiver-relay that switches the lighting circuit, in bulk. Consequently, the lighting customer does not have to provide a separate receiver-relay per lighting connection. There are also a few photo-cell operated lights, principally in rural areas where there is only minimal LV reticulation.

6.9 System Control

The functionality that Orion needs in its SCADA (Supervisory Control and Data Acquisition) system to assist in meeting its QoS criteria includes:

for system security and voltage regulation,

- monitoring of substation and feeder loadings;
- real-time load management;

for reliability performance,

- reporting on the operating status of plant (eg circuit breakers) and any alarm conditions;
- providing a real-time operating diagram for system controllers, so that they can work safely with switching operators on the network;
- provision of remote control of some plant (eg circuit breakers) to enable rapid operation.

Details of the SCADA system are given in Section 4.21 of the Asset Management Plan 2005.

6.10 Load (ripple) Control System

Details of the management of the ripple injection system are included in Sections 3.10.3 and 4.20 of the Asset Management Plan 2005.

The ripple control system is principally justified via the economics of its value in terms of the savings it provides in investment in Orion's network assets. There is also a further economic benefit in deferring investment in Transpower's transmission assets. The economic calculation with respect to Orion's costs is as follows:

6.11 Equipment Spares

Orion must have a minimum of one spare for every type of plant item that cannot readily be obtained from other local sources.

Benefits:

Average load shed during on-line load control	75,000kW
Average load shifted into night period	50,000kW
Total Average Deferred Real Load	125,000kW
Power Factor of Network at peak loading	0.982
Average Deferred (Shed) Apparent Load	127,291kVA
Cost to provide capacity during peak loading	$93/kVA/yr
Hence, annual value of avoided cost	$11,838,086/yr

Costs:

Using data from Orion's 2001 ODV:

a) Replacement Cost of Injection Plants		$3,285,266	
For life (years), n =	20		
Pre-tax return Rate, i =	12%		
Capital Recovery Factor, CRF is		13.4%	
Hence, annual capital cost of injection plants is			$439,827/yr
b) Replacement Cost of Ripple Receiver Relays (owned by retailers)			
140,000 @	$110ea	$15,400,000	
For life (years), n =	40		
Pre-tax return Rate, i =	12%		
Capital Recovery Factor, CRF is		12.1%	
Hence, annual capital cost of ripple receiver relays is			$1,868,076/yr
c) Annual operation and maintenance:			
Proportion of replacement cost		2.1%	
Hence, annual operating and maintenance cost is			$392,391/yr
Sum of annual costs			$2,700,294/yr

Costs/Benefits:

Net present value of annual benefit	$9,137,792/yr
Ratio of annual benefits to costs (ie #years for payoff)	4.4

To cope with significant contingencies, such as storms and earthquakes, Orion must have multiple spares. Orion determines the quantity via risk analysis, taking account of the reliability performance criteria and the likely incidence of contingencies and plant failure rates.

Details of the management of equipment spares are included in section 2.4.5, of the Asset Management Plan 2005.

Appendix K
Directors' Certification and Auditor's Opinion

The following certification of this ODV report by Orion's Directors is provided pursuant to Disclosure Requirement 31(5), as prescribed in Form 6 of the Disclosure Requirements.

The following page contains the audit opinion that Orion sought from PricewaterhouseCoopers in relation to this ODV, pursuant to Disclosure Requirement 30(4), as prescribed in Form 3 of the Disclosure Requirements.

Certification of Valuation Report of Disclosing Entities

We, Linda Susan Constable and Peter Rae, directors of Orion New Zealand Limited certify that, having made all reasonable enquiry, to the best of our knowledge-

(a) the attached valuation report of Orion New Zealand Limited, prepared for the purposes of requirement 19 of the Commerce Commission's Electricity Information Disclosure Requirements 2004 complies with those Requirements; and

(b) the replacement cost of the line business system fixed assets of Orion New Zealand Limited is $1,079,084,452; and

(c) the depreciated replacement cost of the line business system fixed assets of Orion New Zealand Limited is $607,516,171; and

(d) the optimised depreciated replacement cost of the line business system fixed assets of Orion New Zealand Limited is $580,224,018; and

(e) the optimised deprival valuation of the line business system fixed assets of Orion New Zealand Limited is $580,224,018; and

(f) the values in paragraphs (b) through to (e) have been prepared in accordance with the ODV Handbook (as defined in the Electricity Information Disclosure Requirements 2004). These valuations are as at 31 March 2004.

7 December 2004

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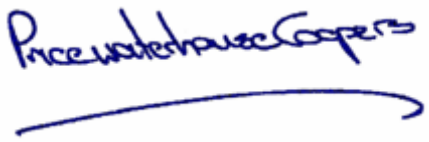
CERTIFICATION BY AUDITOR IN RELATION TO VALUATION

We have examined the valuation report of Orion New Zealand Limited and dated 7 December 2004, which report contains valuations of system fixed assets as at 31 March 2004.

In our opinion, having made all reasonable enquiry, to the best of our knowledge, the valuations contained in the report, including the total valuation of system fixed assets of $ 580,224,018, have been made in accordance with the ODV Handbook (as defined in the Commerce Commission's Electricity Information Disclosure Requirements 2004).



PricewaterhouseCoopers
Chartered Accountants
Auckland
7 December 2004