

LANGEBERG MUNICIPALITY



ELECTRICITY MASTERPLAN

Bonnievale Area of Supply

P302015-ELE-MPL-004-B

SEPTEMBER 2022

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1 EXECUTIVE SUMMARY

An electricity master plan report is a long-term planning document that investigates the current infrastructure and status of the electrical network, which forms the basis for future planning and network upgrade recommendations. Information on the changes to existing 11 kV networks were obtained from Langeberg Municipality.

This report deals with the electrical infrastructure in the Bonnievale supply area of Langeberg Municipality. The current notified maximum demand is 11.5MVA with recent maximum demand peaking at 10.6MVA. The load growth is forecasted at 2.7% per year based on historical average with some minor developments planned indicating that the NMD might be exceeded by 2026.

The impact of the load growth and new developments on the existing infrastructure was determined and recommendations were made on how to make sure that the electricity supply for the whole area remains reliable and of an acceptable quality.

No major capital projects are currently proposed, several smaller upgrades are recommended.

Service delivery, demand side management initiatives, assessment of asset condition and economic development and alternative sources of energy are also discussed.

The projects completed to date have been updated as applicable.

P302015-ELE-MPL-004-B

REV	DESCRIPTION	ORIG	REVIEW	iXengineers APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for approval	 W. Steyn	 W. Snyman	N/A	2022-06-27		
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LIST OF ABBREVIATIONS

ACSR	Aluminium Conductor Steel Reinforced
ADMD	After Diversity Maximum Demand
IDP	Integrated Development Plan
LED	Local Economic Development
LV	Low Voltage
kVA	kilovolt Ampere: Apparent Power
kW	kilowatt: Real Power
kWh	kilowatt hour
MFMA	Municipal finance management act
MV	Medium Voltage
MVA	Megavolt Ampere: Apparent Power
MW	Megawatt
NDP	National Development Plan
NMD	Notified Maximum Demand
NRS	National Rationalised Specifications
N/C	Normally Closed
N/O	Normally Open
PILC	Paper Insulated Lead Covered
PV	Photovoltaic
SALGA	South African Local Government Association
SANS	South African National Standards
SDBIP	Service Delivery Budget Implementation Plan
SDF	Spatial Development Framework
SS	Substation
SSEG	Small Scale Embedded Generation
SWH	Solar Water Heater
TID	Token Identifier
XLPE	Cross-linked Polyethylene

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2 INTRODUCTION

iX Engineers (Pty) Ltd was appointed to compile a new master plan which includes updates to the previous master plan on the electricity infrastructure in the Langeberg Municipal area.

The contents of this report will cover the Bonnievale area of supply. The other supply areas will be covered in separate reports.

This master plan report must be read in conjunction with the drawings and other information available in the Appendices.

3 EXISTING INFRASTRUCTURE

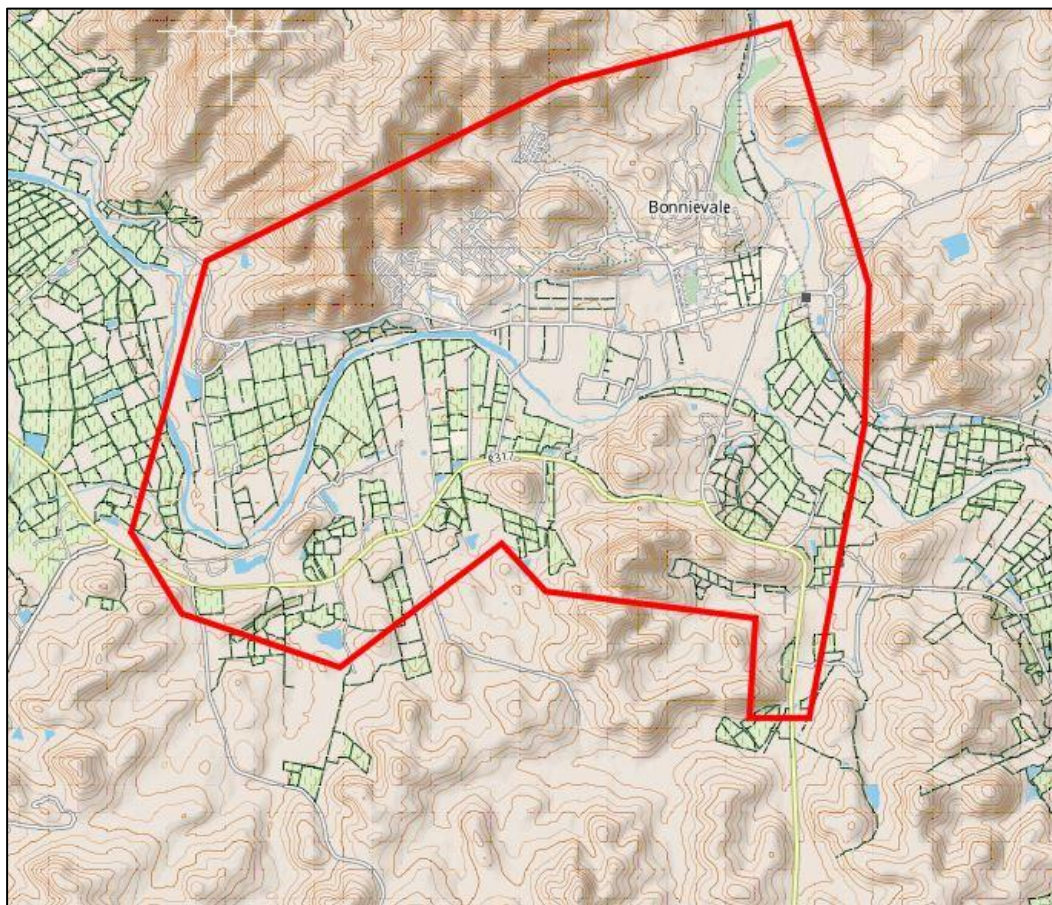


Figure 1: Bonnievale Distribution Area

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3.1 BULK SUPPLY

Bonnievale is currently supplied in bulk from the Eskom 66/11kV substation. There is currently only one 20 MVA 66/11kV transformer in the Eskom Substation.

Bonnievale area is on the Megaflex tariff.

Supply Conductor	Supply Conductor Capacity (MVA)	Supply Voltage (kV)	Maximum Demand (MVA)	Notified Maximum Demand (MVA)
2 x 2 x 150mm ² PILC Cu	23.24 (11.62 per feeder)	11	10.6*	11.5

*Maximum demand figure from February 2020.

Historical maximum demand and notified maximum figures for Bonnievale are shown in the chart below:

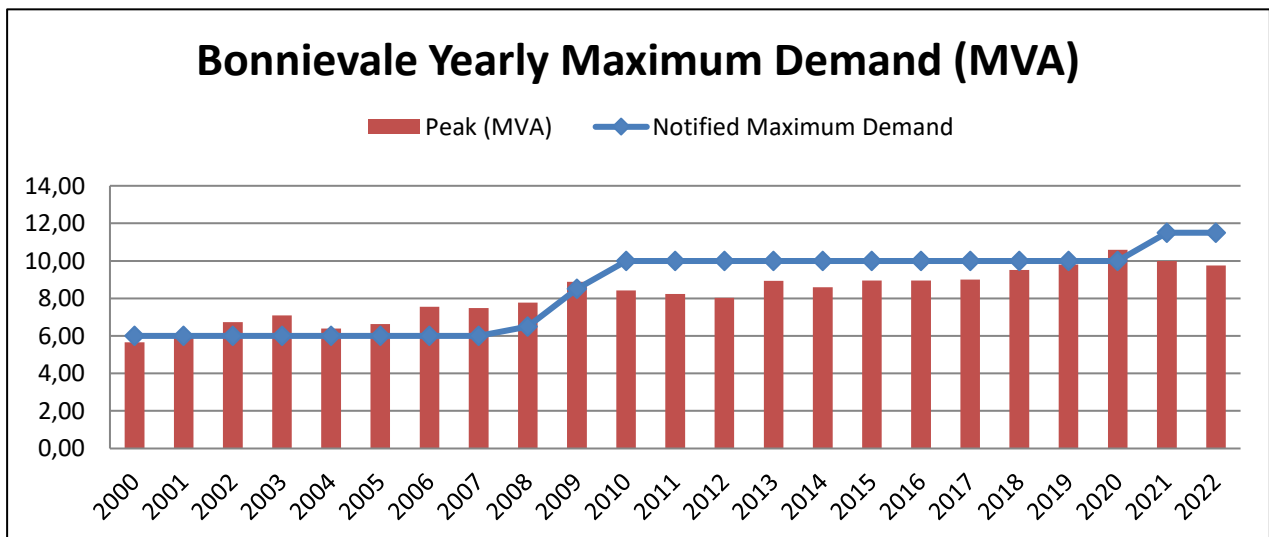


Figure 2: Bonnievale Yearly Maximum Demand Figures

Bonnievale has shown steady growth over the past few years. The NMD was increased to 11.5 MVA in 2021.

The monthly maximum demand figures are included below indicating that Ashton area of supply reaches its peak during the month of February / March each year.

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The average NMD for the area over the past 12 months was 8.72 MVA indicating a fairly steady demand throughout the year.

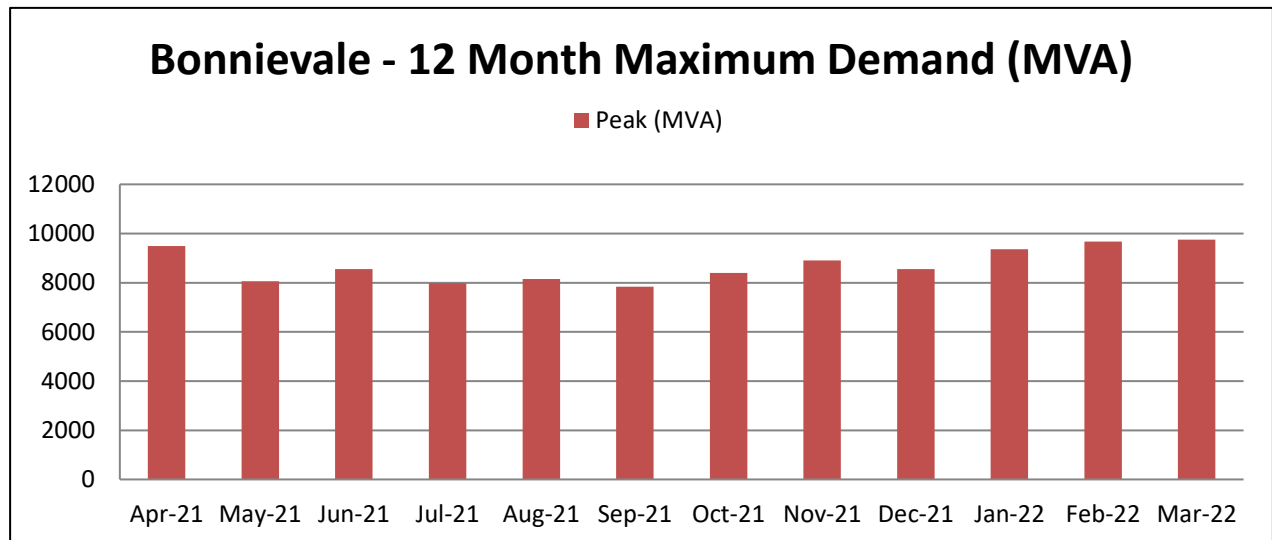


Figure 3: Bonnievale Monthly Maximum Demand Figures

3.2 11kV INFRASTRUCTURE

The Bonnievale supply is taken at 11kV from the Eskom Substation. There are two incomers that feed the Bonnievale 11kV main switching station. These incomers consist of overhead lines up to the main switching station whereafter 2 x 150mm² x 3 core underground cables per feeder are taken into the switching station building.

The bus section in the switching station is operated normally open.

There are four feeders from the main switching station that feed the network. The town area has established ring networks but there are cases where feeders are on spurs. These should be investigated to create ring networks. The outlying areas of town are fed on spur feeders.

The town area majorly consists of overhead lines with short underground cable sections that feed miniature substations and transformers from the overhead line.

The 11kV overhead line types used in Bonnievale area are majorly of the ACSR type.

The 11kV electrical distribution network layout for Bonnievale is included in Appendix 1 and the single line diagram is included in Appendix 2.

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The simplified 11kV single line diagram for the Bonnievale area is included in Appendix 3.

3.3 ASSET CONDITION ASSESSMENT

The information of existing assets was obtained from the municipal asset register.

The asset condition assessments for the various equipment are included in Appendix 4.

The expected useful life for the different asset types are indicated below as published in the Municipal Finance Management Act Guidelines.

Asset Type	Expected Useful Life (Years)
MV Transformer	45
MV Cables and Lines	45
MV Substation and Switchgear	45
LV Network	50
Consumer Meters	15

Table 1: MFMA – Local Government Capital Asset Management Guideline

3.3.1 SWITCHGEAR

The 11kV switchgear in the main switching station was replaced in 2020.

3.3.2 MINIATURE SUBSTATIONS

The miniature substations are all still within their expected useful life with the oldest miniature substation only due for replacement in 2029.

3.3.3 TRANSFORMERS

The assessment indicates that 54 transformers are over their expected useful life as and will need to be replaced urgently. When replacing these transformers, allowance should be made for installation of surge arrestors as some pole mounted transformers do not have surge arresters installed and are thus vulnerable to damage due to lightning strikes on the overhead line.

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3.3.4 CONSUMER METERS

Langeberg Municipality is on a continued meter replacement programme. In the financial year 2020/21, 385 meters were replaced with prepaid meters for the entire Langeberg municipal area.

All STS prepayment meters will be affected by the Token Identifier (TID) rollover happening on 24 November 2024. Any tokens generated after this date will be rejected by the meter as being old tokens. The current TID base date that is used to generate tokens is 1993.

To overcome this issue, all STS prepayment meters will require a key change token to be entered into the meter and be accepted by the meter. After the key change has been accepted, the new tokens will be calculated from a 2014 base date and will have a lifespan up to 2045.

4 ASSESMENT OF EFFICIENCY LEVELS AND SERVICE DELIVERY

4.1 OPERATIONS

The effectiveness of operations was assessed in accordance with the requirements of the Integrated Development Plan (IDP). Basic service delivery objectives were set at restoring 95% of municipal interruptions within 4 hours and 98% within 24 hours after complaints have been received according to NRS 047 Electricity Supply – Quality of Service and Reporting Guidelines. From the below chart it is evident that both objectives have been surpassed.

For Bonnievale area all restorations were done within 7.5 hours.

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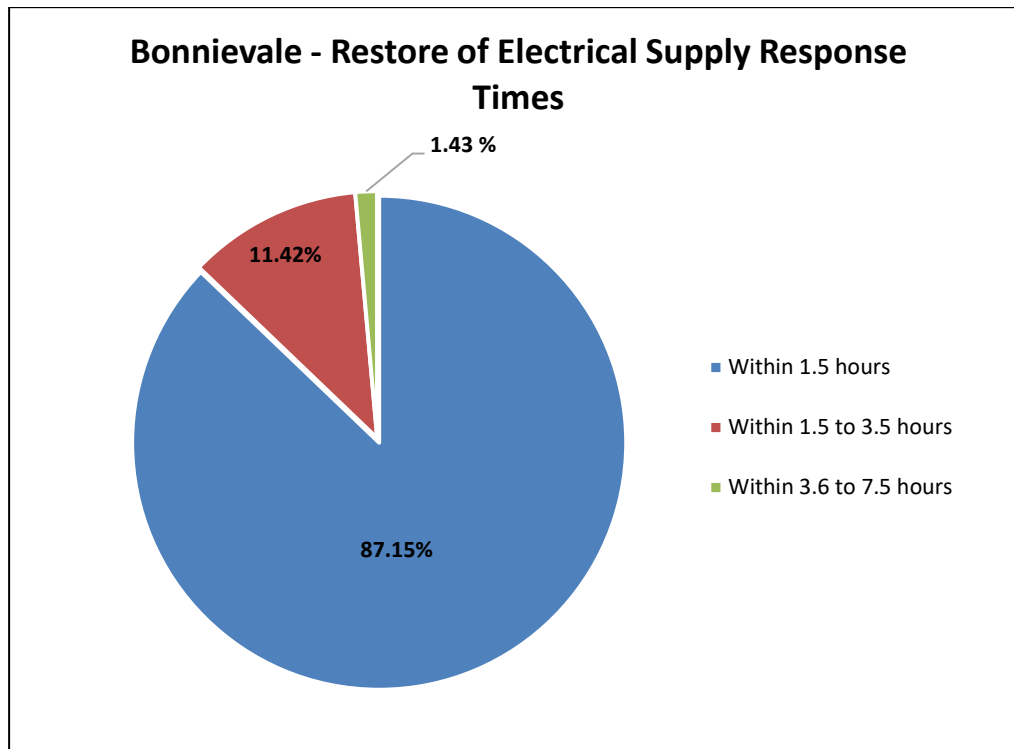


Figure 4: Electricity Supply Restore Response Times (Jan 20 – Sep 21)

The IDP also sets out an objective to provide quotations for new electricity connections (within 10 days) where existing network is being used, and within 30 days where extensions must be done.

The chart below indicates the response time success percentages per category. Deviations are indicated as 4% which is within the recommended target percentage success rate (at least 90% as stated in NRS 047) for providing quotations timeously.

The figures are for the whole of the Langeberg Municipal area.

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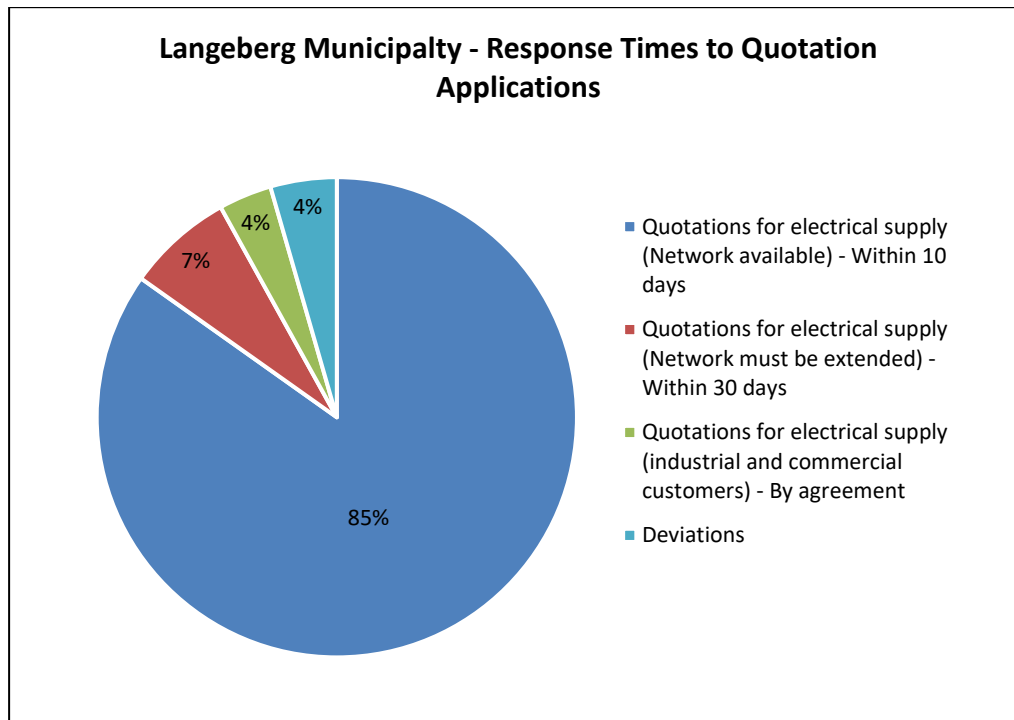


Figure 5: Quotation Application Response Times (Jun 20 – Jul 21)

4.2 LEVELS OF SERVICE

The possibility to restrict residential consumers by lowering the 60A rating of circuit breakers was also considered in this report.

According to the SDBIP figures, there are 17,804 (30 June 2021) formal residential properties connected to the municipal network which are billed.

To replace these circuit breakers will require substantial resources from the municipality to implement. If implemented, the lowered rating could cause nuisance tripping due to established consumer load profiles.

An option that could be considered is to implement the setting of meters, where applicable, to a certain amperage to trip and reset after a certain period and evaluate the response from consumers.

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4.3 DEMAND SIDE MANAGEMENT

The following are forms of demand side management initiatives that can be implemented / expanded on to further reduce the demand of the municipality:

- Set limits on meters,
- Installation of high efficiency motors,
- Installation of variable speed drives, where feasible to reduce,
- Installation of power factor correction equipment where low power factor measurements are experienced to reduce reactive energy supply from municipal network,
- Solar water heater installations / retrofit,
- SSEG installations with backup battery systems to reduce the reliance on the municipal network during peak periods,
- Replacement of street light lamps with LED.

5 ENERGY LOSSES

5.1 BACKGROUND OBJECTIVE METHODOLOGY

The transfer of electricity from generation to the end-users involves losses in energy volumes (electrical or technical losses) that reduce the amount of electricity volumes available for sale to end-customers. In addition, other energy losses may also occur due to non-metered usage related to electricity theft (non-technical).

Energy loss is an intrinsic risk in the electricity business and utilities globally have the challenge to address this issue.

Technical losses include resistive losses of the primary feeders, the distribution transformer losses (resistive losses in windings and the core losses), resistive losses in the secondary network, resistive losses in service cables and losses in and due to kWh meter accuracy. Losses are inherent to the distribution of electricity and cannot be eliminated.

The calculation of technical losses can be done using various approaches with different degrees of accuracy. Technical losses in distribution systems are directly related to consumers' load curves, which vary due to seasonality and / or changes in load over the year. For the management of technical losses, a balance between absolute calculation accuracy and the effort must prevail. Acceptable approaches to calculate

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technical losses of an electricity distribution network can be divided into two groups. These are the full accuracy methods and methods of representative load profiles.

5.2 BONNIEVALE TECHNICAL LOSSES

An investigation was done to determine the level of technical losses in the Bonnievale networks. The total losses were calculated by using the representative load profiles as the sum of all loads and no load losses. The table below summarises the contribution of each element in the network to the total technical loss, refer to Appendix 5 for the technical losses calculation.:

Network Element	% loss contribution
Transformers No Load Losses	1.29
Transformers Partial Load Losses	1.48
MV Network Losses	1.60
LV Network Losses	2.22
Total losses	6.58

The estimated technical loss factor for Bonnievale is therefore 1.0658. The Bonnievale network can be classified as a mixed load between urban (residential and small holdings) and rural. Using this classification and comparing the above calculated load factor to the NRS 080 table 1(a) and 1(b) guideline indicates the calculated value is within the guideline values.

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6 PREVIOUS COMPLETED PROJECTS

The following capital projects were executed since 2017:

Project Description		Year	Reference numbers	Budget spent (VAT excluded)
1.	Replacement of Prepaid Meters	Continuous		
2.	Replacement of 11kV Switchgear in Bonnievale Main Switching Station	2020	T55/2018	R 4,283,750.00
3.	Uitsig Electrification	2020/2021		R 1,486,960.00
Total				R 5,770,710.00

7 ASSESSMENT OF ECONOMIC DEVELOPMENT

The Local Economic Development Strategy must form an integral part of the assessment, latest version available is dated May 2018.

The LED strategy is aligned with the national and provincial planning framework.

The following are requirements set out in the National Development Plan (NDP) relating to electricity needs and supported by the LED strategy of Langeberg Municipality:

Objective (NDP)	Action proposed	Langeberg Municipality Status	Objective achieved / Action required
Economic Infrastructure	90% of people with access to the electricity grid by 2030	LED strategy confirmed that 94% of households used electricity as energy source for lighting. (2017)	Objective Achieved, continuously monitor new developments and provide electricity supply as required.
	Move to less carbon-intensive electricity production (renewable energy), including solar water heating	Refer to section on Alternative Sources of Energy in the masterplan for description. SSEG grid connection allowed.	Continuous development, Langeberg Municipality to be included in future SWH programmes.
	Establish a national, regional and municipal fibre-optic network to	N/A	Fibre-optic ducts could be installed, at relatively low cost, with new or

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	provide the base for broad band access and attract private investment		replacement of existing cables on strategic routes to reduce double excavations.
Environmental Sustainability and Resilience	Municipal regulations to stimulate renewable energy	Guidelines currently in place for SSEG connection to grid	Objective achieved
	All new buildings to meet the energy-efficiency criteria set out in South African National Standard 204	Energy efficiency conditions included in Langeberg Municipality: Land Use Planning By Law Clause 66 (2) (h)	Land use Planning Bylaw dated 2015 includes "energy efficiency" as a condition of approval. Reference to SANS 204 "Energy efficiency in buildings" to be included.
Inclusive Rural Economy	Improved infrastructure and service delivery to activate rural economies	Installation of networks as required.	Continuous implementation.
Social Protection	Design and implement mechanisms to assist the unemployed to access the labour market	Contract Participation Goals (CPG) and Extended Public Works Programme (EPWP) requirements to be included in tender conditions	Continuous implementation and reporting in projects.

8 ALTERNATIVE SOURCES OF ENERGY

8.1 CURRENT SSEG INSTALLATIONS

There are currently 49 SSEG installations exporting into the Langeberg Municipal network. Below is a trend indicating the growth of SSEG installations.

Bonnievale area of supply has three SSEG installation with a total of 55 kW installed capacity. The total installed capacity of SSEG's in Langeberg Municipal area is 1,863.28kW.

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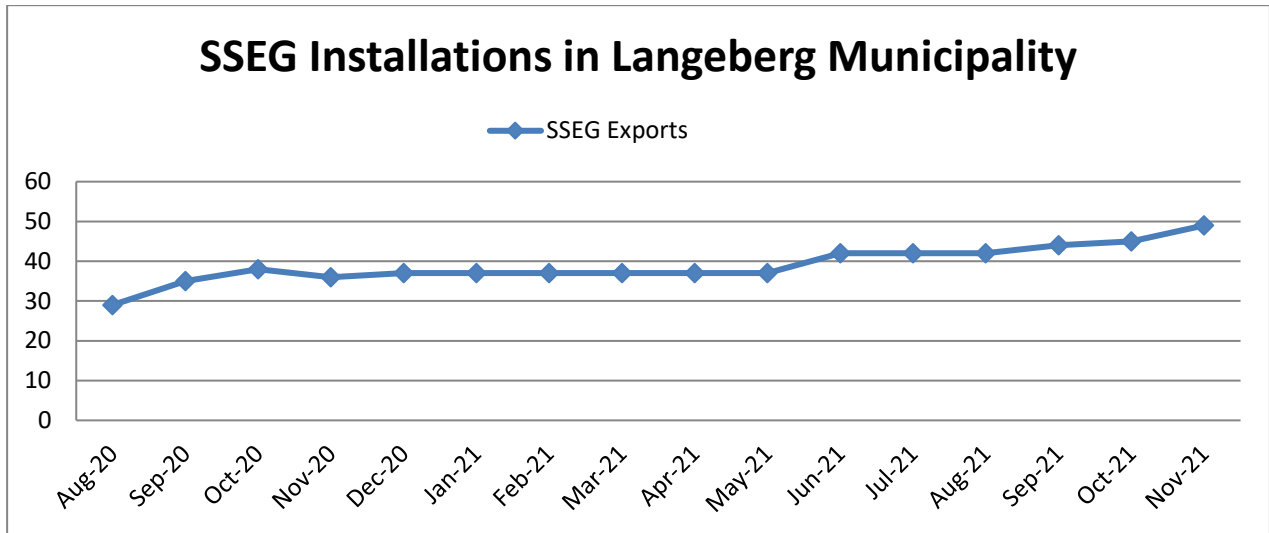


Figure 6: SSEG Installations

8.2 SSEG IMPACT ON MUNICIPAL REVENUE

A business case study on the impact of SSEG installations on municipal revenue was done and included in Appendix 6. Residential, Small Business, Medium Business and Large Business installations were considered.

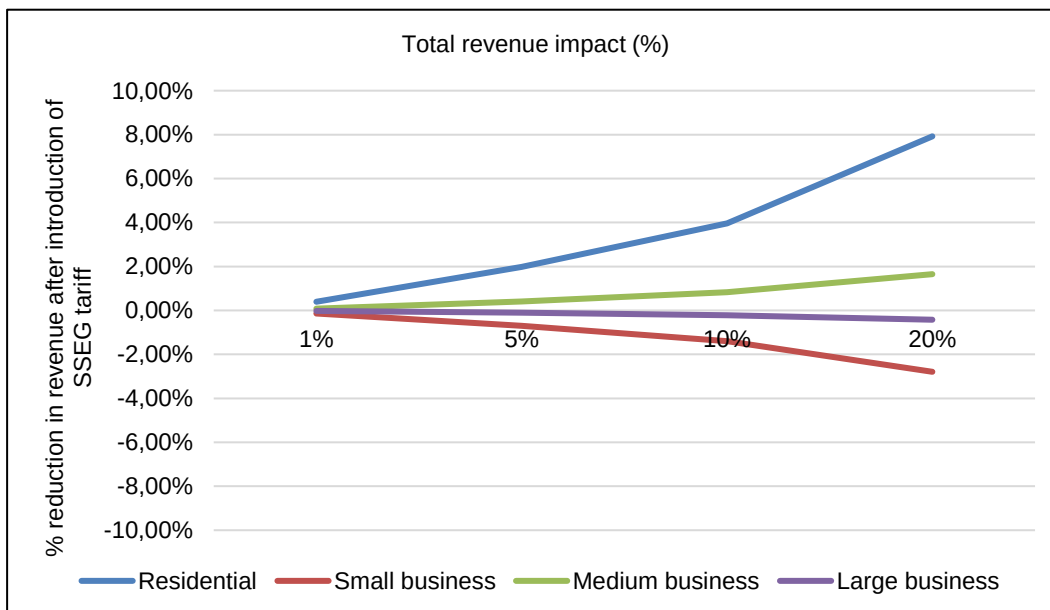


Figure 7: Revenue Impact of SSEG Installations

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8.3 ALTERNATIVE ENERGY SUPPLY FOR MUNICIPAL BUILDINGS

An high level investigation into the possibility of supplying municipal buildings with alternative energy supply was undertaken. The Robertson municipal offices in Kerk Street was taken as an example study area for a solar PV system installation and report included in the Robertson area of supply masterplan report.

8.4 ALTERNATIVE ENERGY SUPPLY OPTIONS FOR MUNICIPAL FEED IN POINTS

A high-level investigation into the possibility of implementing a 2MWp (DC) solar PV plant at the Bonnievale Main substation has been undertaken. The area directly adjacent of the substation was used as a hypothetical area that could be utilised for the plant. An area of approximate 1.9 Ha would be required and the estimated annual production would be around 3.5GWh, refer to Appendix 7 for the simulation report.

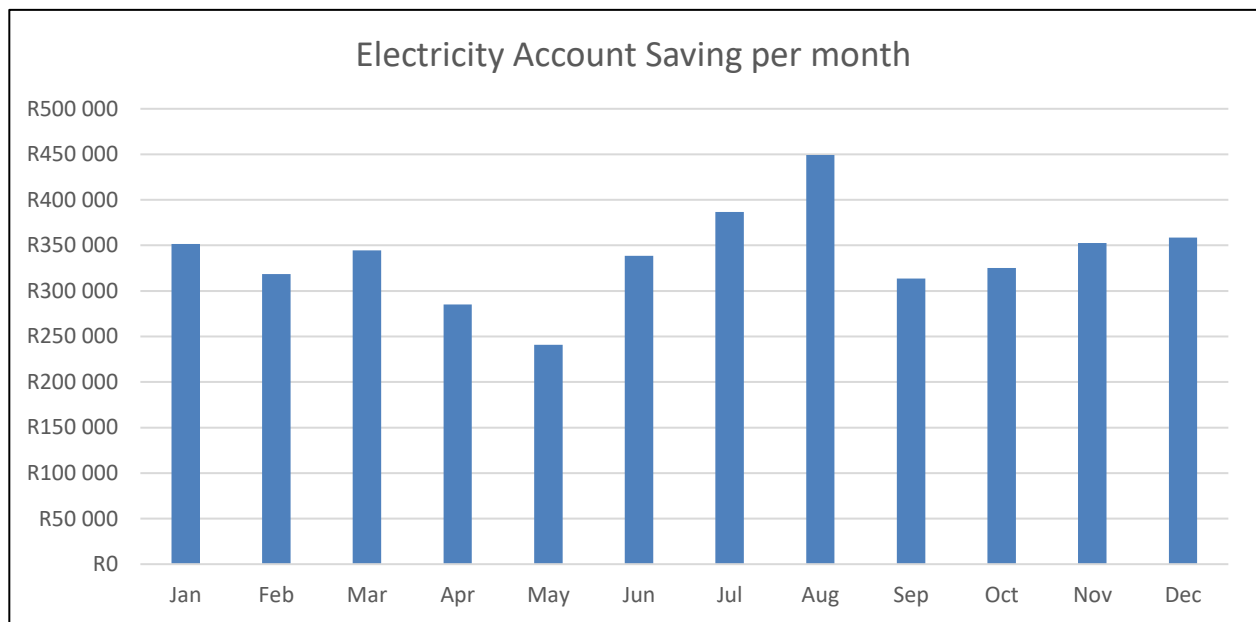
Below is a high-level cost estimate of both the capital and operation costs:

Capital Costs	
Solar PV Plant	Total
- Solar PV	24,000,000
-Perimeter Fence (electrified)	2,203,962
- CCTV	1,000,000
- Sundries	500,000
- Contingencies	2,770,396
Sub-total 1:	30,474,358
Grid Connection	
- Cable works	375,000
- Substation works	1,000,000
- Contingencies	137,500
Sub-total 2:	1,512,500
Professional Fees and Costs	
- Professional Fees	2,878,817
- Professional Costs	287,882
Sub-total 3:	3,166,699
Total (Sub-total 1+2+3)	35,153,557
Operational Costs per Annum	700,000

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By applying the hourly production figures for a typical year to the applicable Eskom tariff (Megaflex 2022) and assuming no energy will be exported to the Eskom grid, the estimated monthly electricity account savings for the first year would be R4.07million. The chart below indicates the estimated saving per month:



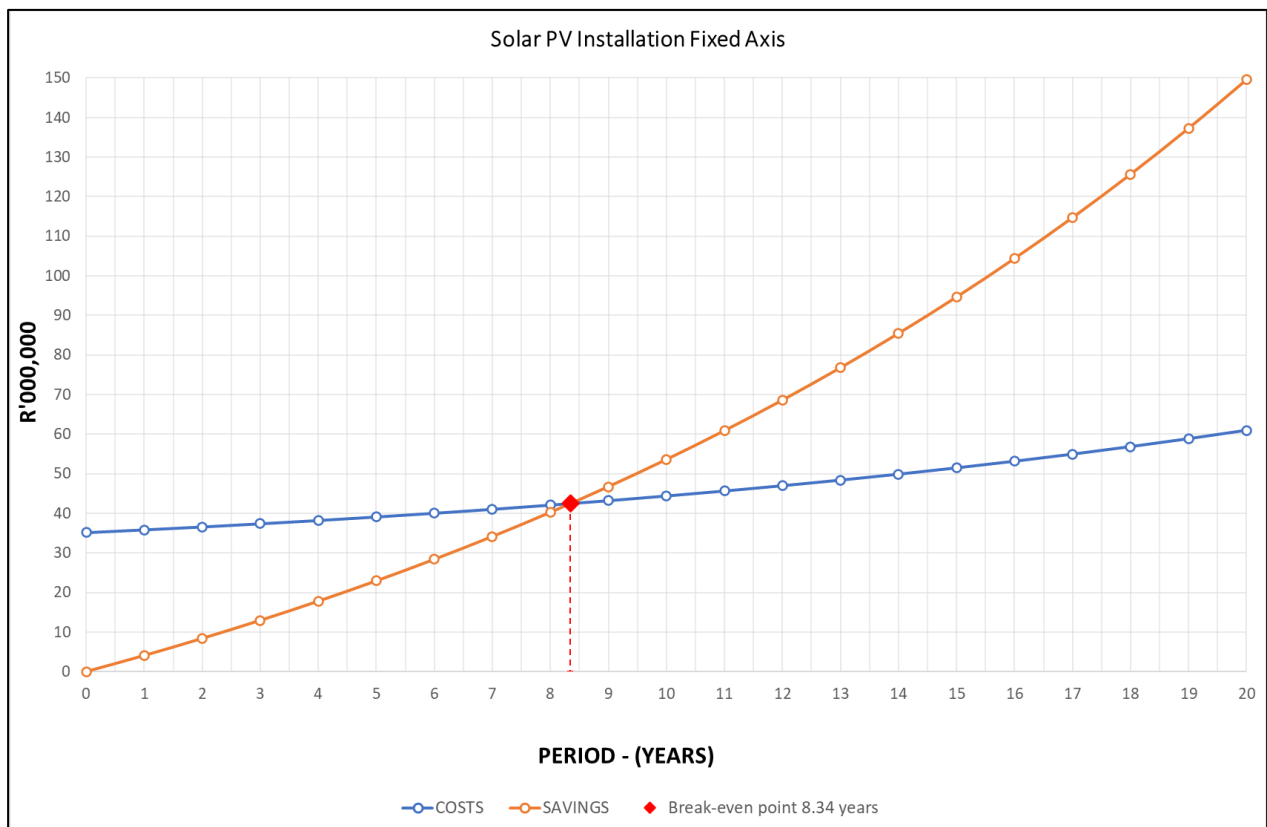
From the above a simple payback has been calculated without accounting for the costs of capital or the time cost of money. An annually compounded inflation rate of 6% has been assumed for both the O&M costs as well as tariff increases. The calculation indicates a break-even point of 8.345 years:

Solar PV - Fixed Axis					
PERIOD	Costs (R 'million)		Savings (R 'million)		NET Cashflow (R 'million)
	OPEX	Cum total	Annual	Cum total	
0		35.15		0	35.154
1	0.700	35.85	4.065	4.065	31.789
2	0.742	36.60	4.309	8.374	28.222
3	0.787	37.38	4.567	12.941	24.441
4	0.834	38.22	4.842	17.783	20.433
5	0.884	39.10	5.132	22.915	16.184
6	0.937	40.04	5.440	28.355	11.681
7	0.993	41.03	5.766	34.121	6.908
8	1.053	42.08	6.112	40.234	1.848
9	1.116	43.20	6.479	46.713	-3.515
10	1.183	44.38	6.868	53.581	-9.200
11	1.254	45.63	7.280	60.860	-15.227
12	1.329	46.96	7.717	68.577	-21.615
13	1.409	48.37	8.180	76.757	-28.386
14	1.493	49.86	8.670	85.427	-35.563
15	1.583	51.45	9.191	94.618	-43.171

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16	1.678	53.12	9.742	104.360	-51.236
17	1.778	54.90	10.327	114.687	-59.784
18	1.885	56.79	10.946	125.633	-68.845
19	1.998	58.79	11.603	137.236	-78.450
20	2.118	60.90	12.299	149.535	-88.632



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9 FUTURE DEVELOPMENTS / LOAD GROWTH FORECAST

9.1 HISTORIC LOAD GROWTH TREND

Historic maximum demand figures for the Bonnievale network:

- Year 2000 : 5.66 MVA
- Year 2005 : 6.64 MVA
- Year 2010 : 8.43 MVA
- Year 2015 : 8.95 MVA
- Year 2020 : 10.60 MVA

The historic maximum demand figures are based on the statistical metering data obtained from the Eskom Bulk Supply Point, as received from Langeberg Municipality.

Analysis of this data reveals a historical growth of 2.7% year on year average.

Using the historical figures, a graph was compiled to forecast future growth and included below:

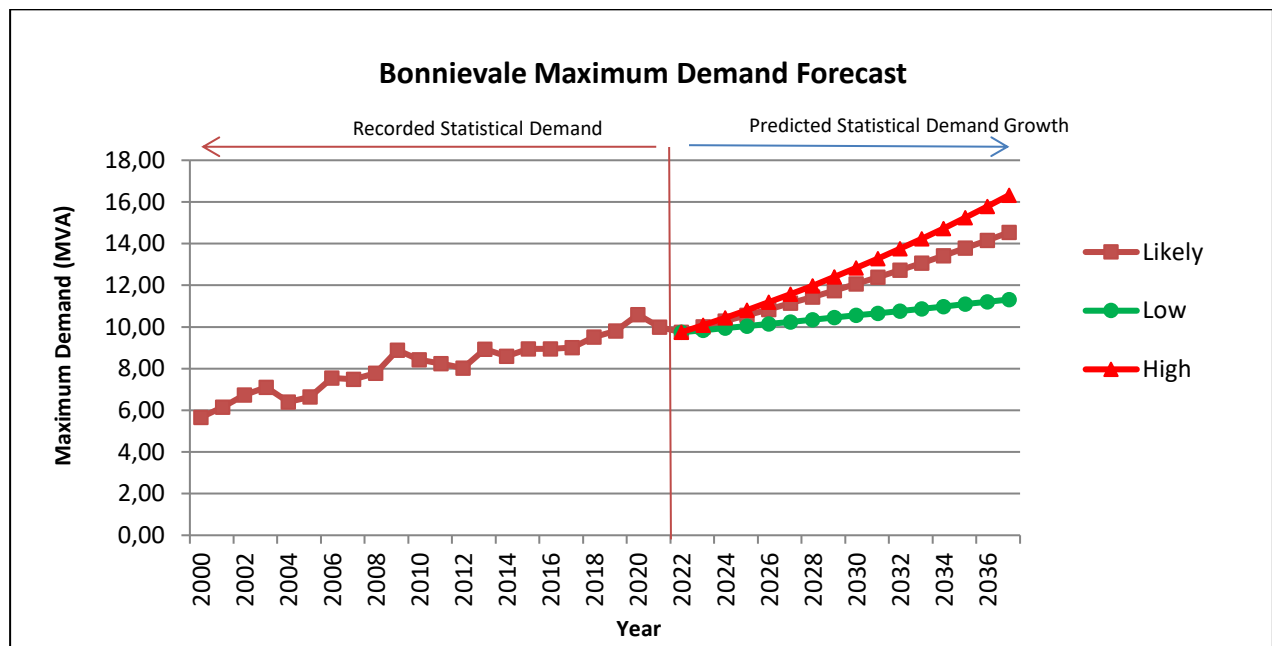


Figure 8: Bonnievale Maximum Demand Forecast based on historic growth

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Predicted maximum demand figures for low, likely and high demand predictions are as follows:

These predictions exclude any future bulk loads.

Growth Prediction	Current	2027 (5-Year)	2032 (10-Year)
Low (1%)	9.75 MVA	10.24 MVA	10.77 MVA
Likely (2.7%)		11.14 MVA	12.73 MVA
High (3.5%)		11.58 MVA	13.75 MVA

9.2 PROPOSED DEVELOPMENTS

The proposed future developments as indicated on the layout in Appendix 8 and detailed forecast in Appendix 9 is a combination of information received from the Langeberg Municipality's Spatial Development Framework, current electricity supply applications submitted and correspondence with large power users.

A summary of the forecast is included on the next page.

The Bonnievale area has several housing developments planned with approximately 2400 names on the housing waiting list as described in the SDF report. The implementation timeframe of these developments are not specified.

Only loads of significant size are demonstrated separately, the remaining form part of the "Other Load Growth". Load growth factor of 2.7% was included.

Applying the above load growth forecast, it can be seen that the current NMD of 11.5 MVA will be reached by 2026.

ADMD loads for the above table were calculated as per NRS 034-1 guidelines for classification of domestic consumers. The bulk loads indicated are indications obtained from the developer.

The following classifications were used, as detailed in NRS 034-1:

- Township area – 2.37 kVA / erf
- Urban Residential 1 – 3.59 kVA / erf
- Urban Residential 2 – 4.72 kVA / erf

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Summary of Load Growth Forecast:

Layout / Reference Number	Possible Developments	Area (Ha)	Number of erven	Total Load	Growth	Coinc. Factor	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
	Developments as per detailed Appendix																
	Other Current Loads			13,924	2.7%	0.7	13,924	14,300	14,686	15,083	15,490	15,908	16,338	16,779	17,232	17,697	18,175
	Total undiversified						13,924	14,650	15,456	16,316	16,987	17,906	18,756	19,879	20,922	22,053	23,725
	Total diversified (kVA)						9,747	10,255	10,819	11,421	11,891	12,534	13,129	13,916	14,645	15,437	16,608
	Total diversified (MVA)						9.75	10.26	10.82	11.42	11.89	12.53	13.13	13.92	14.65	15.44	16.61
	Notified Maximum Demand						11.50	11.50	11.50	11.50	11.50	11.50	11.50	11.50	11.50	11.50	11.50

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10 LOAD FLOW ANALYSIS

10.1 METHODOLOGY

The simulation software used to perform the load flow analysis is ReticMaster® Electrical Network Software for Distribution Systems.

The existing information was obtained from single line diagrams as well as technical input from the Langeberg Municipality for the following areas:

- Bonnievale

The load flow simulations were performed on the network to provide insight into the Bonnievale MV Network as it currently appears, and how it will perform with the addition of the known 5 and 10 year loads as well as the 2.7% per annum increase for average load growth.

The following load flow simulations were performed:

- Simulation 1: Current Maximum Demand;
- Simulation 2: 5 Year Maximum Demand;
- Simulation 3: 10 Year Maximum Demand;
- Simulation 4: Various Contingencies.

10.2 RESULTS OF LOAD FLOW ANALYSIS

The Bonnievale network represents a diversified maximum demand of 9.747 MVA (measured in March 2022).

The Bonnievale Network has a total installed capacity of 23.045MVA. Therefore, the Bonnievale network appears relatively lightly loaded, with a demand factor of approximately 0.42 ($9.747 / 23.045$).

The total connected load per individual transformer was entered into the simulation software and a scaling factor was introduced to all loads to bring the maximum demand on the network in line with load growth

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predictions to evaluate the effects on the network. This scenario was then simulated as the current status of the network and forms the basis for the future forecasting.

A coincidental factor of 0.7 was used as all the loads do not peak simultaneously.

The 5- and 10-year simulations were then prepared using scaling factors to coincide with the growth predictions and any known 5- and 10-year loads were added separately.

The following reports were then prepared for each scenario, where applicable and discussed:

- Prospective fault current study,
- Voltage level study (The NRS 034-1 stipulate that a voltage drop in the order of up to 3% to be acceptable in MV distributor cables),
- Conductor thermal capacity study.

10.2.1 CURRENT MAXIMUM DEMAND LOAD FLOW

Simulation 1 was based on the normal network configuration and operating conditions. The N/O and N/C points reflect the actual network status. There is one 20MVA 66/11kV transformer which supplies the Bonnievale MV network.

The simulation was performed applying a scaling factor of 0.595 to all the loads, which returned a maximum demand of 9.80 MVA compared to the actual maximum demand of 9.747 MVA. A difference of 53kVA, which is an acceptable difference.

Refer to Appendix 10 for the current maximum demand load flow analysis.

10.2.1.1 PROSPECTIVE FAULT CURRENT STUDY

The prospective short circuit fault current study was performed, and results included in Appendix 11. The study was only performed once as adding additional loads to the system will not affect the values. The equipment ratings exceed the prospective fault current values and no issues were identified.

10.2.1.2 VOLTAGE LEVEL STUDY

Refer to Appendix 12.

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The Nordale feeder currently exceeds the voltage drop limits with the highest percentage at NUWE UITBREIDING (4.79%). The other feeders are all within limits.

10.2.1.3 CONDUCTOR THERMAL CAPACITY STUDY

Refer to Appendix 13. All feeders are well within their thermal capacity limits, percentage loading indicated below:

Main Switching Station Feeders	Thermal Loading
NORDALE	52.3%
HOOFDORP	43.4%
ANGORA	28.8%
KAAS FABRIEK	23.8%

The Incomer 1 is currently loaded at 73.35%. It should be noted that the information on the type of conductor is not available and it was assumed to be Wolf.

The remainder of the feeders operate within their thermal limits.

10.2.2 5-YEAR MAXIMUM DEMAND LOAD FLOW

Simulation 2 was performed applying a scaling factor of 0.68 to all the loads, which returned a maximum demand of 11.22 MVA compared to the predicted maximum demand of 11.14 MVA. This was done prior to the adding of any known future loads

The following loads were added:

Description – 5 Year	kVA
Parmalat	$1,000 \times 0.7 = 700\text{kVA}$
Abatoir	$100 \times 0.7 = 70\text{kVA}$
Mooivalley Suiwel	$250 \times 0.7 = 175\text{kVA}$
Gateway Development	$208 \times 0.7 = 146\text{kVA}$
Residential (3)	$119 \times 0.7 = 83\text{kVA}$

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Total	$1,677 \times 0.7 = 1,174\text{kVA}$

The housing projects were included in the additional bulk loads although their exact dates of implementation are not known, this will give an indication of what upgrades are required should they be implemented.

Refer to Appendix 14 for the 5-year maximum demand load flow analysis.

10.2.2.1 VOLTAGE LEVEL STUDY

Refer to Appendix 15.

The Nordale and Hoofdorp feeders exceed the guideline limits, the highest percentage voltage drop is indicated below:

Feeder	Load	Percentage
NORDALE (From Main Switching Station)	GATEWAY DEVELOPMENT	6.06%
HOOFDORP (From Main Switching Station)	MOOI UITSIG	3.57%

10.2.2.2 CONDUCTOR THERMAL CAPACITY STUDY

Refer to Appendix 16. All feeders are well within their thermal capacity limits, percentage loading indicated below:

Main Switching Station Feeders	Thermal Loading
NORDALE	66.1%
HOOFDORP	49.9%
ANGORA	39.9%
KAAS FABRIEK	32.4%

The remainder of the feeders operate within their thermal limits.

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10.2.3 10-YEAR MAXIMUM DEMAND LOAD FLOW

Simulation 3 was performed applying a scaling factor of 0.77 to all the loads, which returned a maximum demand of 12.75 MVA compared to the predicted maximum demand of 12.73 MVA. This was done prior to the adding of any known future loads

The following loads were added, where existing 5 year loads were already present, these were adjusted to total indicated below:

Description – 10 Year	kVA
Mooivalley Suiwel	$500 \times 0.7 = 350\text{kVA}$
Mixed Income Residential (6)	$1,318 \times 0.7 = 923\text{kVA}$
Mixed Income Residential (8)	$894 \times 0.7 = 626\text{kVA}$
Industrial	$500 \times 0.7 = 350\text{kVA}$
Total	$3,212 \times 0.7 = 2,249\text{kVA}$

Refer to Appendix 17 for the 10-year maximum demand load flow analysis.

10.2.3.1 VOLTAGE LEVEL STUDY

Refer to Appendix 18.

The Nordale, Hoofdorp and Angora feeders exceed the guideline limits, the highest percentage voltage drop is indicated below:

Feeder	Load	Percentage
Nordale (From Main Switching Station)	GATEWAY DEVELOPMENT	8.39%
Hoofdorp (From Main Switching Station)	MOOI UITSIG	5.21%
Angora (From Main Switching Station)	MELK STALLE	3.27%

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10.2.3.2 CONDUCTOR THERMAL CAPACITY STUDY

Refer to Appendix 19. All feeders are well within their thermal capacity limits, percentage loading indicated below:

Main Switching Station Feeders	Thermal Loading
NORDALE	91.8%
HOOFDORP	70.4%
ANGORA	43.6%
KAAS FABRIEK	35.5%

The remainder of the feeders operate within their thermal limits.

10.2.4 VARIOUS CONTINGENCIES

The purpose of Simulation 4 is to determine the effect various contingencies (switching requirements) will have on the Bonnievale MV Network, with respect to existing N/O and N/C points, in order to assess network viability in the event of network faults occurring.

The results of the simulation are contained in the table below.

#	Critical Supply Scenarios	Action Required	Effect on Network
1	Fault on Feeder: Hoof Dorp	1] Close N/O point: RMU (N202)	A] Angora feeder from 28.8% to 71.2% thermal capacity
			B] Nordale Feeder remains at 52.3% thermal capacity
			C] Kaas Fabriek Feeder from 23.8% to 25.5% thermal capacity
2	Fault on Feeder: Angora	1] Close N/O point: RMU (N202)	A] Hoof Dorp Feeder from 43.4% to 65.2% thermal capacity
			B] Nordale Feeder remains at 52.3% thermal capacity
			C] Kaas Fabriek Feeder from 23.8% to 34.2% thermal capacity
3	Fault on Feeder: Nordale	1] Close N/O point: RMU towards Waterwerke	A] Hoof Dorp Feeder from 43.4% to 97.8% thermal capacity

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#	Critical Supply Scenarios	Action Required	Effect on Network
4	Fault on Feeder: Kaas Fabriek	No action required	B] Angora Feeder remains at 28.8% thermal capacity
			C] Kaas Fabriek Feeder remains at 23.8% thermal capacity
			A] Hoof Dorp Feeder remains at 43.4% thermal capacity
			B] Angora Feeder from 28.8% to 46.2% thermal capacity
			C] Nordale Feeder remains at 52.3% thermal capacity

Table 2: Critical Supply Scenarios for the Bonnievale MV Network

The Bonnievale MV Network has sufficient capacity to accommodate the critical supply scenarios as simulated above.

11 RECOMMENDED CAPITAL UPGRADES

Refer to Appendix 20 for list of recommended upgrades.

The capital projects are included as per the municipal plan for upgrading of the networks.

Masterplan recommendations were also included and indicated separately.

12 CONCLUSIONS

The following conclusions can be made for the Bonnievale area of supply:

- The current maximum demand of 10,6MVA is within the notified maximum demand of 11,5MVA;
- The Bonnievale network is relatively lightly loaded, with a demand factor of 0.42. Total installed capacity of 23.045MVA
- The current network operates within conductor thermal limits with the voltage drop exceeding guidelines on the Nordale feeder,
- The switchgear and miniature substation equipment are still within their expected useful life but several transformers have exceeded their expected useful life,
- The network has sufficient capacity to accommodate the critical supply scenarios,
- The volt-drop across the network exceeds limits recommended by NRS 034-1 guidelines for the 5- and 10-year forecast on some feeders.

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- The feeders are within their thermal capacity limit for the 5- and 10-year forecast. There are short sections of feeders that operate slightly above normal operating condition which are acceptable. No major feeder upgrades are required due to thermal limits,

13 RECOMMENDATIONS

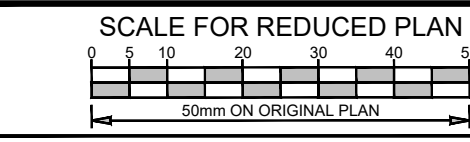
The following recommendations are made:

- Upgrading and replacement of network infrastructure as per the recommended capital project and masterplan upgrades,
- Regular updating of asset register,
- Information shortcomings were identified on existing layouts and schematics. Field studies to be conducted and all drawings to be updated,
- All infrastructure to be recorded on a GIS (geographic information system) and be updated regularly as projects are completed to keep an up to date database,
- An in-depth field study to determine the installation date of the different equipment types in the network to provide an accurate database of expected useful life remaining and phased replacement plan,
- Replacement of equipment that have exceeded their expected useful life as per asset condition assessment,
- Meter logging of municipal buildings electricity supply for implementation into study report for alternative energy supply e.g solar PV system,
- Installation of maximum demand meters on feeders in main switching station.

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ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 1 – BONNIEVALE 11KV ELECTRICAL DISTRIBUTION NETWORK LAYOUT



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PROJECT

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BONNIEVALL
TRICAL DISTRIB

NETWORK

NETWORK

DRAWING DESCRIPTION

DRAWING DESCRIPTION

EXISTING 11kV

MEDIUM VOLTAGE

LAYOUT

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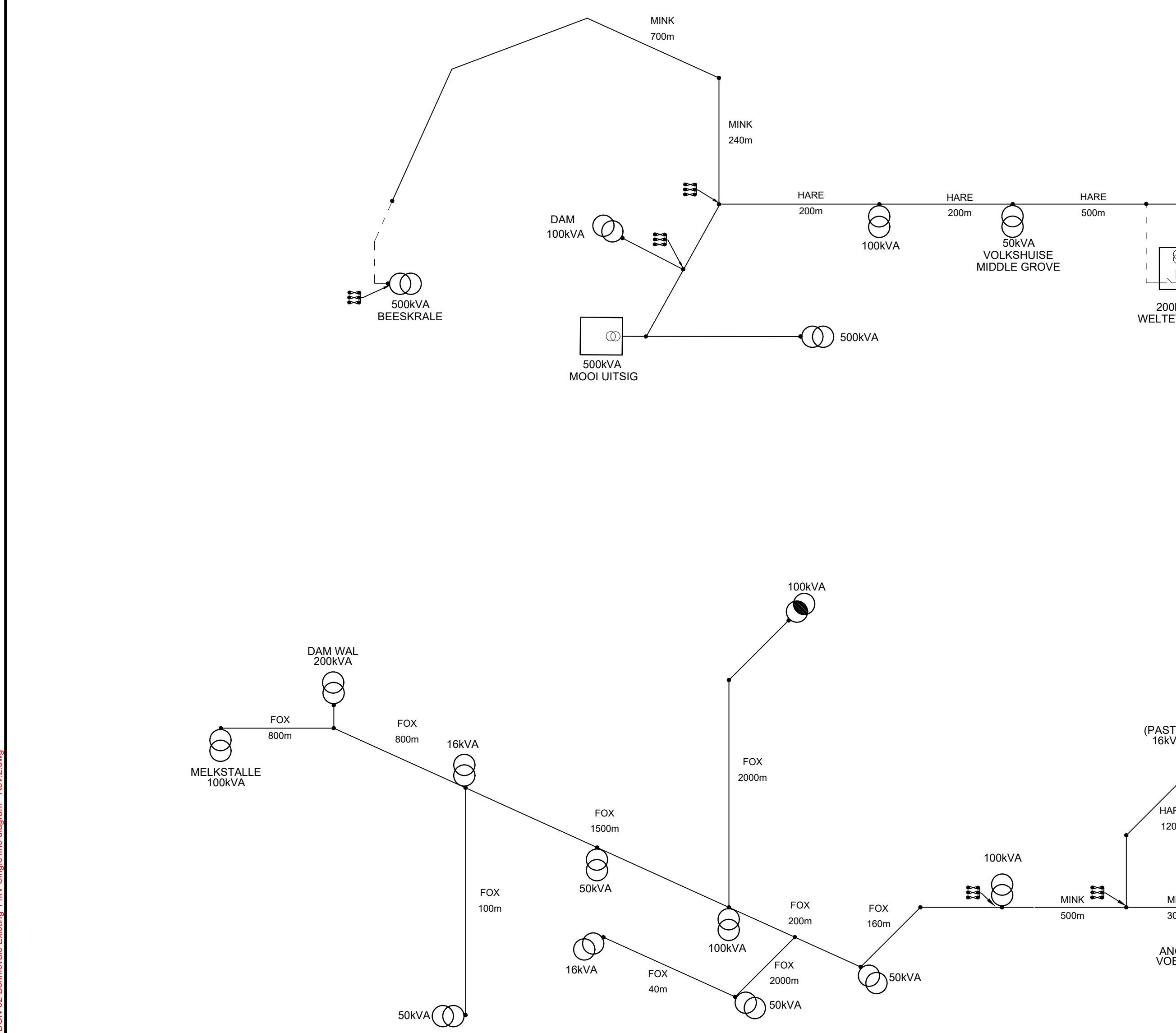
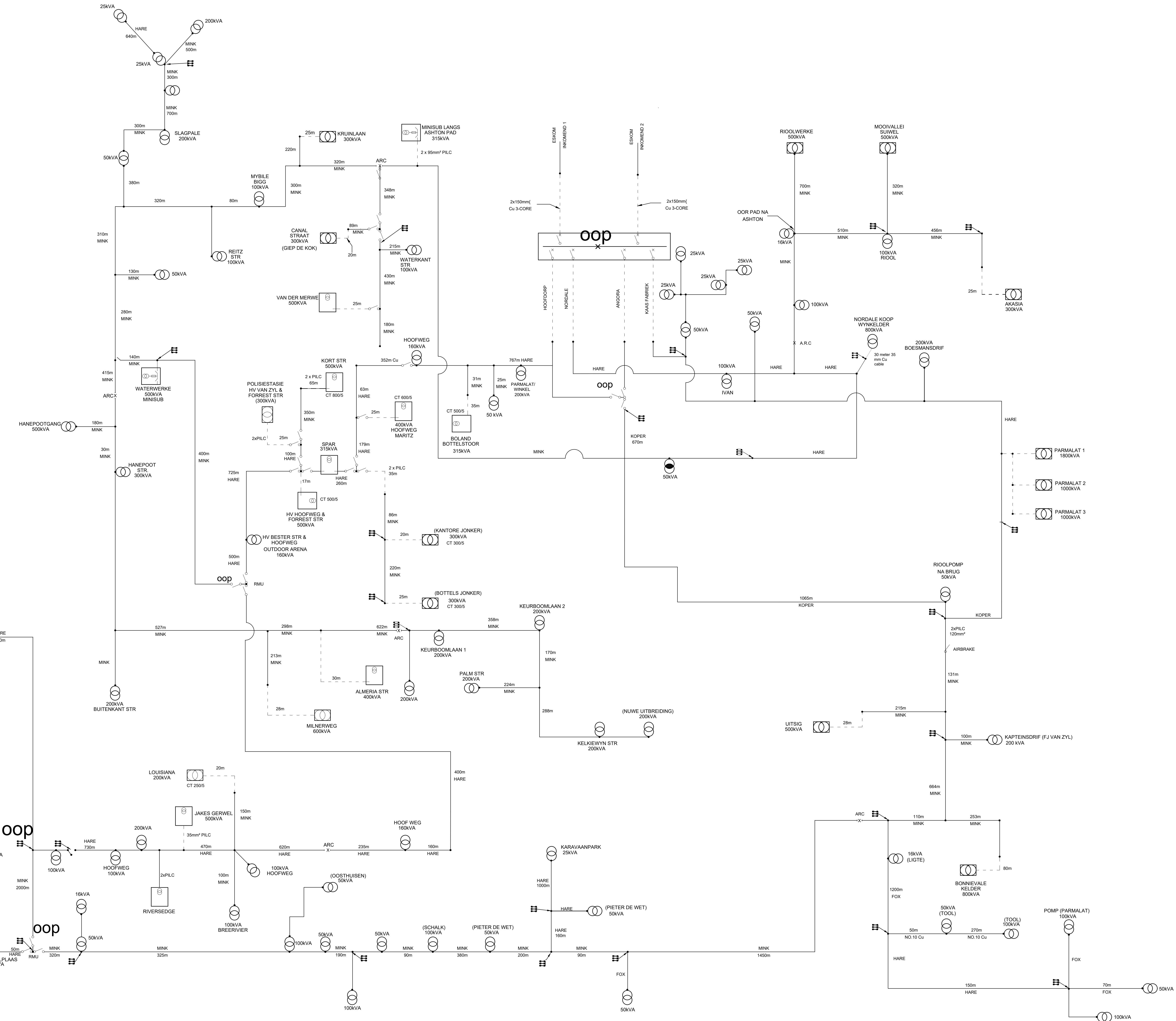
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ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 2 – BONNIEVALE 11KV SINGLE LINE DIAGRAM

VERKLARING	
BESKRYWING	SIMBOOL
MINIATUURSUBSTASIE MET RING-SKEISKAKELAAR	
DOORHOOFSE HS LYN	
ONDERGRONDSE HS KABEL	
PAALGEMONTETDE TRANSFORMATOR	
UITVALSEKERINGS	
RINGSKEISKAKELAAR	
STROOMBREKER	
MINIATUURSUBSTASIE SONDER RING-SKEISKAKELAAR	
GRONDSTAANDE TRANSFORMATOR	
SEKERINGSKAKELAAR	
A.R.C.	x



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PROJECT		DRAWING DESCRIPTION	
BONNIEVALE ELECTRICAL DISTRIBUTION NETWORK		EXISTING 11KV SINGLE LINE DIAGRAM	

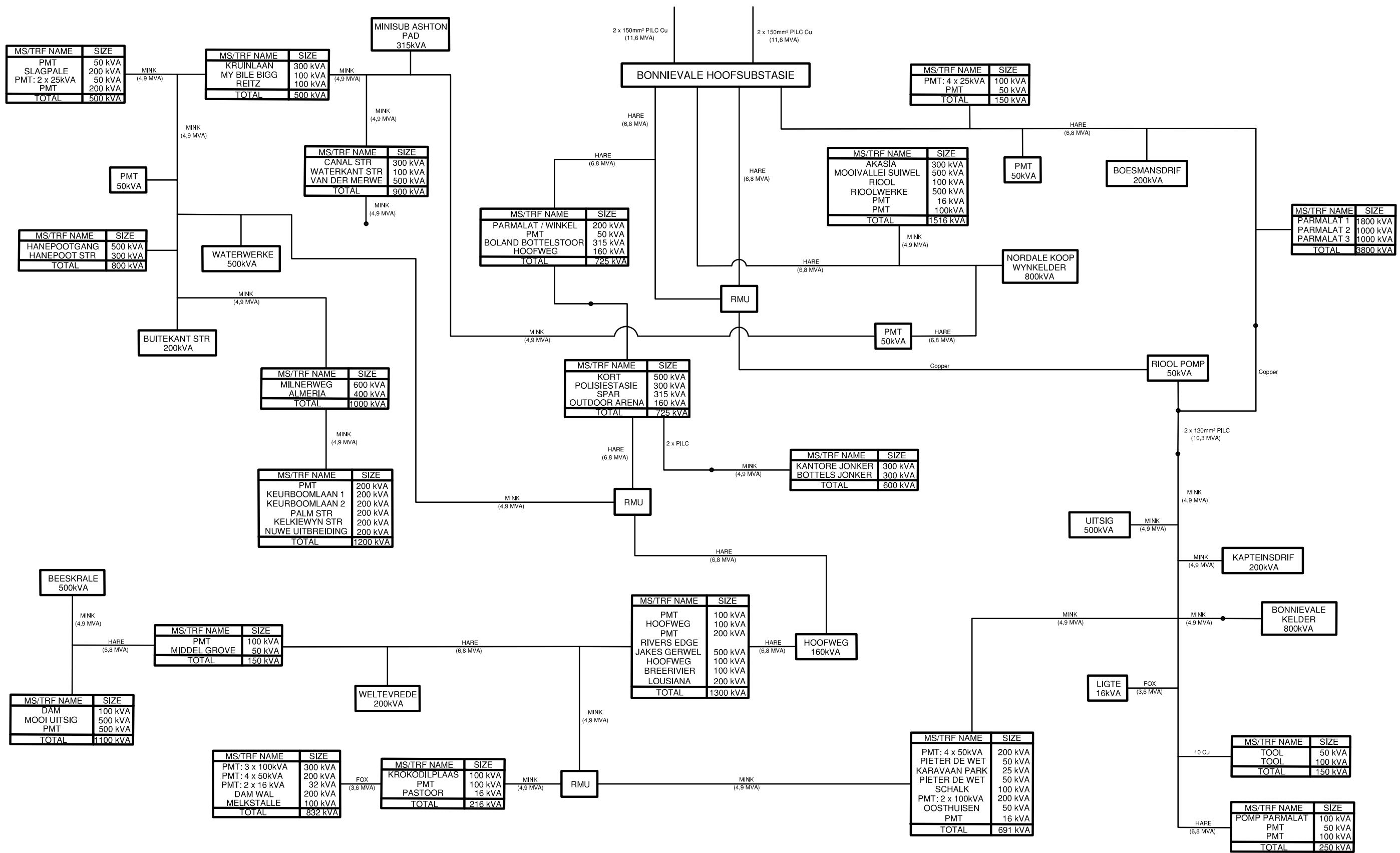
SCALE FOR REDUCED PLAN		
DATE	SCALE	ORIGINAL SIZE
JUNE 2022	NTS	A0
DRAWING NUMBER		REV
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ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 3 – SIMPLIFIED 11KV SINGLE LINE DIAGRAM

SIMPLIFIED 11kV NETWORK IN BONNIEVALE



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ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 4 – ASSET CONDITION ASSESSMENT

Bonnievale 11kV Switchgear Asset Condition

Area (Suburb)	Asset Location	Name	Function	Installation Date	Replacement Date	Replacement Cost
Bonnievale	Bonnievale SS	MVSG DORP	FEEDER	1967	2012	400,000.00
Bonnievale	Bonnievale SS	ANGORA	FEEDER	1967	2012	400,000.00
Bonnievale	Bonnievale SS	MVSG INCOMER NO 1	INCOMER	1967	2012	400,000.00
Bonnievale	Bonnievale SS	MVSG BUSBAR COUPLER	FEEDER	1967	2012	450,000.00
Bonnievale	Bonnievale SS	MVSG INCOMER NO 2	INCOMER	1976	2021	400,000.00
Bonnievale	Bonnievale SS	MVSG NORDALE MOOIUITSIG	FEEDER	1976	2021	400,000.00
Bonnievale	Bonnievale SS	MVSG KAAS FABRIEK	FEEDER	1976	2021	400,000.00
						2,850,000.00

Bonnievale Miniature Substation Asset Condition

Area (Suburb)	Name	Rating	Installation Date	Replacement Date	Replacement Cost
Bonnievale	MS VAN DE MERWE	500	1984	2029	575,000.00
Bonnievale	MS OU SPAAR	400	1989	2034	575,000.00
Bonnievale	MS JONKHEER WYNKELDER	500	1991	2036	575,000.00
Bonnievale	MS BOLAND BOTTELSTOOR	315	1992	2037	525,000.00
Bonnievale	MS RIVER'S EDGE	200	2004	2049	450,000.00
Bonnievale	MS SPAR	315	2009	2054	525,000.00
Bonnievale	MS WATERWERKE	500			575,000.00
Bonnievale	Waterkantstr. Sub	500	2007	2052	575,000.00
Bonnievale	Almeria Laan	400	1991	2036	575,000.00
Bonnievale	MS Bonnie Park	500	1993	2038	575,000.00
Bonnievale	Lekkerbek	500	2001	2046	575,000.00
Bonnievale		315	2019	2064	525,000.00
					6,625,000.00

Bonnievale Transformer Asset Condition

Area (Suburb)	Name	Type of Transformer	Rating	Installation Date	Replacement Date	Replacement Cost
Bonnievale	PTRF JAN HOPPES	POLE MOUNTED	25	1959	2004	40,000.00
Bonnievale	PTRF SONSKYN	POLE MOUNTED	100	1960	2005	75,000.00
Bonnievale	PTRF SCHALK WENSEL 3	POLE MOUNTED	50	1960	2005	55,000.00
Bonnievale	PTRF 1 WOLVENDRIFT CLAASSEN	POLE MOUNTED	50	1960	2005	55,000.00
Bonnievale	PTRF SWELLENSHARON	POLE MOUNTED	50	1961	2006	55,000.00
Bonnievale	PTRF OOSTHYSEN	POLE MOUNTED	50	1962	2007	55,000.00
Bonnievale	PTRF SKOOL	POLE MOUNTED	10	1963	2008	20,000.00
Bonnievale	PTRF 2 WOLVENDRIFT D ZEEMAN Jnr	POLE MOUNTED	15	1963	2008	20,000.00
Bonnievale	PTRF 1 GROENLAND	POLE MOUNTED	50	1963	2008	55,000.00
Bonnievale	PTRF MIDDELFARM	POLE MOUNTED	50	1963	2008	55,000.00
Bonnievale	PTRF VAN LOOVEN PUMP 2	POLE MOUNTED	75	1964	2009	75,000.00
Bonnievale	PTRF 1 WOLVENDRIFT CLAASSEN	POLE MOUNTED	15	1966	2011	20,000.00
Bonnievale	PTRF SCHALK WENSEL 1	POLE MOUNTED	50	1967	2012	55,000.00
Bonnievale	PTRF PIET DE WET 2	POLE MOUNTED	50	1967	2012	55,000.00
Bonnievale	PTRF SKERPIONKOP 1	POLE MOUNTED	25			40,000.00
Bonnievale	PTRF MOOIUITSIG POMP	POLE MOUNTED	150	1967	2012	130,000.00
Bonnievale	PTRF BUSHMAN PUMP	POLE MOUNTED	15	1967	2012	20,000.00
Bonnievale	PTRF QUANDO	POLE MOUNTED	25	1967	2012	40,000.00
Bonnievale	PTRF PUMP 3	POLE MOUNTED	75	1967	2012	75,000.00
Bonnievale	PTRF 2 LANGVERWACHT	POLE MOUNTED	100	1968	2013	75,000.00
Bonnievale	PTRF JACKSON HOUSEE	POLE MOUNTED	25	1968	2013	40,000.00
Bonnievale	PTRF LANGVERWACHT HOUSEE	POLE MOUNTED	50	1968	2013	55,000.00
Bonnievale	PTRF 3 GOEDVERWACHT LANDGOED	POLE MOUNTED	75	1968	2013	75,000.00
Bonnievale	PTRF HOUSEE 4	POLE MOUNTED	10	1969	2014	20,000.00
Bonnievale	PTRF NYERS VAN DE MERWE 2	POLE MOUNTED	10	1970	2015	20,000.00
Bonnievale	PTRF MIDDELFARM	POLE MOUNTED	10	1970	2015	20,000.00
Bonnievale	PTRF BOESMAN HOUSEE	POLE MOUNTED	10	1970	2015	20,000.00
Bonnievale	PTRF 2 GROENLAND	POLE MOUNTED	10	1970	2015	20,000.00
Bonnievale	PTRF ANDRIES JONHEER 1	POLE MOUNTED	10	1972	2017	20,000.00
Bonnievale	PTRF LANGWERWACHT WINKEL	POLE MOUNTED	25	1970	2015	40,000.00
Bonnievale	PTRF PAKKIE PUMP 2	POLE MOUNTED	50	1972	2017	55,000.00
Bonnievale	PTRF VAALKAMP 1	POLE MOUNTED	25	1973	2018	40,000.00
Bonnievale	PTRF LUKAS WENSEL 2	POLE MOUNTED	100	1973	2018	75,000.00
Bonnievale	PTRF VAN REENS	POLE MOUNTED	10	1973	2018	20,000.00
Bonnievale	PTRF JACKSON PUMP 1	POLE MOUNTED	15	1973	2018	20,000.00
Bonnievale	PTRF PUMP 4	POLE MOUNTED	25	1973	2018	40,000.00
Bonnievale	PTRF BOESMAN PUMP	POLE MOUNTED	25	1973	2018	40,000.00
Bonnievale	PTRF 3 EYONA	POLE MOUNTED	50	1973	2018	55,000.00
Bonnievale	PTRF MARAISDAL	POLE MOUNTED	50	1973	2018	55,000.00
Bonnievale	PTRF NYERS VAN DE MERWE 1	POLE MOUNTED	25	1975	2020	40,000.00
Bonnievale	PTRF VAN GRAAN	POLE MOUNTED	16	1975	2020	20,000.00
Bonnievale	PTRF RESEVIOR	POLE MOUNTED	50	1975	2020	55,000.00
Bonnievale	PTRF SKERPIONKOP 3	POLE MOUNTED	50	1975	2020	55,000.00
Bonnievale	PTRF MOOIUITSIG HUISE 2	POLE MOUNTED	16	1975	2020	20,000.00
Bonnievale	PTRF 2 WOLVENDRIFT CLAASSEN	POLE MOUNTED	50	1975	2020	55,000.00
Bonnievale	PTRF REVEIRA	POLE MOUNTED	75	1975	2020	75,000.00
Bonnievale	PTRF ROOI KAMP	POLE MOUNTED	16	1976	2021	20,000.00
Bonnievale	PTRF KIEWIET ROSSOUW	POLE MOUNTED	50			55,000.00
Bonnievale	PTRF THYS WESEL 2	POLE MOUNTED	25	1976	2021	40,000.00
Bonnievale	PTRF PIET DE WET 1	POLE MOUNTED	50	1976	2021	55,000.00
Bonnievale	PTRF PLAKKERSKAMP	POLE MOUNTED	315	1976	2021	190,000.00
Bonnievale	PTRF BO FARM PUMP 2	POLE MOUNTED	100	1976	2021	75,000.00
Bonnievale	PTRF LANDSFONTEIN	POLE MOUNTED	100	1976	2021	75,000.00
Bonnievale	PTRF DR CASO	POLE MOUNTED	10	1976	2021	20,000.00
Bonnievale	PTRF 4 JACQUES	POLE MOUNTED	200	1976	2021	130,000.00
Bonnievale	PTRF BLOK 2 APPLKOSE	POLE MOUNTED	50	1976	2021	55,000.00
Bonnievale	PTRF VAALKAMP 2	POLE MOUNTED	50			55,000.00
Bonnievale	PTRF BO LANGVERWACHT	POLE MOUNTED	16	1977	2022	20,000.00
Bonnievale	PTRF 1 WOLVENDRIFT JOHAN VILJOEN	POLE MOUNTED	50	1977	2022	20,000.00
Bonnievale	PTRF 3 WOLVENDRIFT JOHAN VILJOEN	POLE MOUNTED	25	1977	2022	55,000.00
Bonnievale	PTRF 1 VAN ZYL	POLE MOUNTED	16	1978	2023	20,000.00
Bonnievale	PTRF 2 WOLVEN DRIFT KOBUS LE ROUX	POLE MOUNTED	25	1979	2024	40,000.00
Bonnievale	PTRF WAKKERSTROOM	POLE MOUNTED	16	1979	2024	20,000.00

Bonnievale	PTRF JANEZA TELKOM	POLE MOUNTED	16	1979	2024	20,000.00
Bonnievale	PTRF RIVER CABINS	POLE MOUNTED	50	1979	2024	55,000.00
Bonnievale	PTRF DULIT PUMP	POLE MOUNTED	100	1979	2024	75,000.00
Bonnievale	TRF2 BONNIEVALE WYNKELDER	GROUND MOUNTED	400	1980	2025	520,381.40
Bonnievale	PTRF SKERPIONKOP 2	POLE MOUNTED	50	1980	2025	55,000.00
Bonnievale	PTRF VOLKSHUISE MERTYLE GROVE 2	POLE MOUNTED	100	1980	2025	75,000.00
Bonnievale	PTRF 3 VAN ZYL PUMP 2	POLE MOUNTED	100	1980	2025	75,000.00
Bonnievale	PTRF 2 VAN ZYL PUMP 1	POLE MOUNTED	100	1980	2025	75,000.00
Bonnievale	Bo Plaas Wolvendrift	POLE MOUNTED	25	1980	2025	40,000.00
Bonnievale	PTRF BONNIEVALE ROAD	POLE MOUNTED	25	1980	2025	40,000.00
Bonnievale	PTRF PAKKIE PUMP 3	POLE MOUNTED	25	1980	2025	40,000.00
Bonnievale	PTRF LANGVERWAG PUMP	POLE MOUNTED	25	1980	2025	40,000.00
Bonnievale	PTRF 2 ZEEMAN	POLE MOUNTED	50	1980	2025	55,000.00
Bonnievale	PTRF MIDDELFARM	POLE MOUNTED	50	1980	2025	55,000.00
Bonnievale	TRF1 BONNIEVALE WYNKELDER	GROUND MOUNTED	400	1981	2026	520,381.40
Bonnievale	PTRF KARREFAAN PARK	POLE MOUNTED	25	1981	2026	40,000.00
Bonnievale	PTRF PAKKIE PUMP 1	POLE MOUNTED	16	1981	2026	20,000.00
Bonnievale	PTRF PIKKIE PUMP 5	POLE MOUNTED	16	1981	2026	20,000.00
Bonnievale	PTRF 2 CONCORDIA FARM	POLE MOUNTED	50	1981	2026	55,000.00
Bonnievale	PTRF MOOIUITSIG FARM	POLE MOUNTED	25	1981	2026	40,000.00
Bonnievale	PTRF RIVIERA	POLE MOUNTED	25	1981	2026	40,000.00
Bonnievale	PTRF HOUSEE 1	POLE MOUNTED	25	1981	2026	40,000.00
Bonnievale	PTRF PAKKIE HOUSEE	POLE MOUNTED	50	1981	2026	55,000.00
Bonnievale	PTRF BONNIEVALE KELLER INGANG	POLE MOUNTED	16	1982	2027	20,000.00
Bonnievale	PTRF PINT PLAAS	POLE MOUNTED	100	1982	2027	75,000.00
Bonnievale	PTRF NAUDE	POLE MOUNTED	25	1982	2027	40,000.00
Bonnievale	PTRF MOOIUITSIG FARM	POLE MOUNTED	50	1982	2027	55,000.00
Bonnievale	PTRF BOESMANDRIF 2	POLE MOUNTED	100	1983	2028	75,000.00
Bonnievale	PTRF KAPTEINSDRIF TWIRL WESSELS	POLE MOUNTED	100	1983	2028	75,000.00
Bonnievale	PTRF SCHALK WENSEL 2	POLE MOUNTED	100	1983	2028	75,000.00
Bonnievale	PTRF ANDRIES JONHEER 2	POLE MOUNTED	100	1983	2028	75,000.00
Bonnievale	PTRF LUKAS WENSEL 3	POLE MOUNTED	10	1983	2028	20,000.00
Bonnievale	PTRF LUKAS WENSEL 6	POLE MOUNTED	16	1983	2028	20,000.00
Bonnievale	PTRF LUKAS WENSEL 7	POLE MOUNTED	50	1983	2028	55,000.00
Bonnievale	PTRF MERTYLE RIGG	POLE MOUNTED	100	1983	2028	75,000.00
Bonnievale	PTRF 2 JANEZA	POLE MOUNTED	16	1983	2028	20,000.00
Bonnievale	PTRF 2 BO FARM	POLE MOUNTED	25	1983	2028	40,000.00
Bonnievale	PTRF MIDDELFARM	POLE MOUNTED	50	1983	2028	55,000.00
Bonnievale	PTRF 5 GOEDVERWACHT FARM	POLE MOUNTED	25	1983	2028	40,000.00
Bonnievale	PTRF GERIE & JANE CLAASSEN 1	POLE MOUNTED	10	1983	2028	20,000.00
Bonnievale	TRF NORDALE WYNKELDER	FLOOR STANDING	800	1984	2029	575,542.00
Bonnievale	PTRF 6 GOEDVERWACHT FARM	POLE MOUNTED	25	1984	2029	40,000.00
Bonnievale	PTRF BO LANGVERWACHT	POLE MOUNTED	50	1984	2029	55,000.00
Bonnievale	PTRF VAN LOVERAN PUMP	POLE MOUNTED	75	1984	2029	75,000.00
Bonnievale	PTRF 1 JANEZA	POLE MOUNTED	100	1986	2031	75,000.00
Bonnievale	PTRF 1 WOLVEN DRIFT KOBUS LE ROUX	POLE MOUNTED	75			75,000.00
Bonnievale	PTRF MOOIUITSIG HUISE 1	POLE MOUNTED	100	1987	2032	75,000.00
Bonnievale	PTRF HOOFWEG 6	POLE MOUNTED	100			75,000.00
Bonnievale	PTRF BOESMAN 1	POLE MOUNTED	50	1987	2032	55,000.00
Bonnievale	PTRF ONS HUISIE	POLE MOUNTED	100	1988	2033	75,000.00
Bonnievale	PTRF 1 CONCORDIA FARM	POLE MOUNTED	50	1988	2033	55,000.00
Bonnievale	PTRF 4 WOLVENDRIFT CLAASSEN	POLE MOUNTED	75	1988	2033	75,000.00
Bonnievale	PTRF DUIWELSKAMP	POLE MOUNTED	25	1990	2035	40,000.00
Bonnievale	PTRF ASHTON INGANG	POLE MOUNTED	16	1990	2035	20,000.00
Bonnievale	PTRF HOOFWEG 1	POLE MOUNTED	160	1990	2035	130,000.00
Bonnievale	PTRF REDE AND VREDE 2	POLE MOUNTED	100	1990	2035	75,000.00
Bonnievale	PTRF QUANDO 2	POLE MOUNTED	25	1990	2035	40,000.00
Bonnievale	PTRF MOOIUITSIG FARM	POLE MOUNTED	50	1990	2035	55,000.00
Bonnievale	PTRF RIVER CABINS	POLE MOUNTED	50	1990	2035	55,000.00
Bonnievale	PTRF REDE AND VREDE	POLE MOUNTED	25	1990	2035	40,000.00
Bonnievale	PTRF LANGWERWATCH H3	POLE MOUNTED	50	1990	2035	55,000.00
Bonnievale	PTRF SLAGPALE 1	POLE MOUNTED	200	1991	2036	130,000.00
Bonnievale	PTRF HANNEPOOT STR	POLE MOUNTED	160	1991	2036	130,000.00
Bonnievale	PTRF DE WET	POLE MOUNTED	50	1991	2036	55,000.00
Bonnievale	PTRF PARMALAT KAASWINKEL	POLE MOUNTED	200	1992	2037	130,000.00
Bonnievale	PTRF HENNIE DE WET 2	POLE MOUNTED	25	1992	2037	40,000.00
Bonnievale	PTRF 2 DIE GAATJIE	POLE MOUNTED	50	1992	2037	55,000.00

Bonnievale	PTRF MOOIUITSIG FARM	POLE MOUNTED	50	1992	2037	55,000.00
Bonnievale	PTRF 1 ZEEMAN	POLE MOUNTED	50	1992	2037	55,000.00
Bonnievale	PTRF DE WET PUMP	POLE MOUNTED	50	1992	2037	55,000.00
Bonnievale	PTRF DR CASO 2	POLE MOUNTED	50	1992	2037	55,000.00
Bonnievale	PTRF QUANDO	POLE MOUNTED	100	1993	2038	75,000.00
Bonnievale	PTRF 1 DANTJIE ZEEMAN	POLE MOUNTED	50	1993	2038	55,000.00
Bonnievale	PTRF 4 WOLVENDRIFT JOHAN VILJOEN	POLE MOUNTED	50	1993	2038	55,000.00
Bonnievale	PTRF 1 VORENTOE	POLE MOUNTED	75	1993	2038	75,000.00
Bonnievale	PTRF QUANDO	POLE MOUNTED	75	1993	2038	75,000.00
Bonnievale	PTRF 2 VORENTOE	POLE MOUNTED	75	1993	2038	75,000.00
Bonnievale	PTRF EXSITE POMP	POLE MOUNTED	100	1995	2040	75,000.00
Bonnievale	PTRF LUKAS WENSEL 5	POLE MOUNTED	100	1995	2040	75,000.00
Bonnievale	PTRF BRYTENBACH FARM	POLE MOUNTED	100	1995	2040	75,000.00
Bonnievale	PTRF ARENDSIG	POLE MOUNTED	50	1995	2040	55,000.00
Bonnievale	PTRF BO FARM PUMP 1	POLE MOUNTED	100	1995	2040	75,000.00
Bonnievale	PTRF VAN LOOVEN PUMP 2	POLE MOUNTED	100	1995	2040	75,000.00
Bonnievale	PTRF JOHN HOUSEE	POLE MOUNTED	16	1995	2040	20,000.00
Bonnievale	PTRF MOOIUITSIG FARM	POLE MOUNTED	50	1995	2040	55,000.00
Bonnievale	PTRF SILVERTHORN FARM	POLE MOUNTED	50	1995	2040	55,000.00
Bonnievale	PTRF 3 WOLVENDRIFT CLAASSEN	POLE MOUNTED	50	1995	2040	55,000.00
Bonnievale	PTRF HOOGENDROOG FARM	POLE MOUNTED	25	1996	2041	40,000.00
Bonnievale	PTRF 3 BON VALLON FARM	POLE MOUNTED	100	1996	2041	75,000.00
Bonnievale	PTRF 4 LANGVERWACHT	POLE MOUNTED	50	1996	2041	55,000.00
Bonnievale	PTRF RIOOLPOMP PARMALAT BRUG	POLE MOUNTED	25	1997	2042	40,000.00
Bonnievale	PTRF THYS WENSEL 3	POLE MOUNTED	100	1997	2042	75,000.00
Bonnievale	PTRF RIOOL POMPSTASIE 4	POLE MOUNTED	100	1997	2042	75,000.00
Bonnievale	PTRF KEERBOOM LAAN 2	POLE MOUNTED	200	1997	2042	130,000.00
Bonnievale	PTRF FARMWAG PUMP	POLE MOUNTED	25	1997	2042	40,000.00
Bonnievale	PTRF 4 VAN ZYL PUMP 3	POLE MOUNTED	50	1997	2042	55,000.00
Bonnievale	PTRF ETIENE BRUWER	POLE MOUNTED	100	1998	2043	75,000.00
Bonnievale	PTRF ANDRIES JONHEER 4	POLE MOUNTED	16	1998	2043	20,000.00
Bonnievale	PTRF KEERBOOM LAAN 1	POLE MOUNTED	200	1998	2043	130,000.00
Bonnievale	PTRF 2 BON VALLON FARM	POLE MOUNTED	100	1998	2043	75,000.00
Bonnievale	PTRF 3 WOLVENDRIFT	POLE MOUNTED	100	1998	2043	75,000.00
Bonnievale	PTRF 2 WOLVENDRIFT CLAASSEN	POLE MOUNTED	100	1998	2043	75,000.00
Bonnievale	PTRF 3 WOLVENDRIFT CLAASSEN	POLE MOUNTED	100	1998	2043	75,000.00
Bonnievale	PTRF 1 DIE GAATJIE	POLE MOUNTED	100	1998	2043	75,000.00
Bonnievale	PTRF STEEGMAN HOUSEE	POLE MOUNTED	50	1998	2043	55,000.00
Bonnievale	Mooi Uitsig Pomp	GROUND MOUNTED	500	1999	2044	520,381.40
Bonnievale	PTRF WATERKANT STR	POLE MOUNTED	100	1999	2044	75,000.00
Bonnievale	PTRF REITZ STR	POLE MOUNTED	100	1999	2044	75,000.00
Bonnievale	PTRF HANNEPOOT GANG	POLE MOUNTED	500	1999	2044	350,000.00
Bonnievale	PTRF PALM STR	POLE MOUNTED	200	1999	2044	130,000.00
Bonnievale	PTRF KELKIEWYN STR 2	POLE MOUNTED	315	1999	2044	190,000.00
Bonnievale	PTRF HOOFWEG 4	POLE MOUNTED	200	1999	2044	130,000.00
Bonnievale	PTRF HOOFWEG 2	POLE MOUNTED	160	1999	2044	130,000.00
Bonnievale	PTRF 2 DANTJIE ZEEMAN	POLE MOUNTED	100	1999	2044	75,000.00
Bonnievale	PTRF RIVER CABINS	POLE MOUNTED	100	1999	2044	75,000.00
Bonnievale	PTRF RUS AND VREDE	POLE MOUNTED	100	1999	2044	75,000.00
Bonnievale	PTRF HOISE 5	POLE MOUNTED	100	1999	2044	75,000.00
Bonnievale	PTRF LUKAS WENSEL 4	POLE MOUNTED	10	2000	2045	20,000.00
Bonnievale	PTRF BUSHMAN FARM HOUSEE 2	POLE MOUNTED	100	2000	2045	75,000.00
Bonnievale	PTRF PIKKIE 8	POLE MOUNTED	50	2000	2045	55,000.00
Bonnievale	PTRF JACKSON PUMP 2	POLE MOUNTED	50	2000	2045	55,000.00
Bonnievale	PTRF 5 LANGVERWACHT	POLE MOUNTED	50	2000	2045	55,000.00
Bonnievale	PTRF BONNIEVALE KAASFABRIEK 1/2	POLE MOUNTED	100	2002	2047	75,000.00
Bonnievale	PTRF 1 BO FARM	POLE MOUNTED	100	2002	2047	75,000.00
Bonnievale	PTRF DOLF VAN DE MERWE	POLE MOUNTED	100	2003	2048	75,000.00
Bonnievale	PTRF IVAN BURGER	POLE MOUNTED	100	2003	2048	75,000.00
Bonnievale	PTRF 2 GOEDVERWACHT FARM	POLE MOUNTED	100	2003	2048	75,000.00
Bonnievale	PTRF WAKKERSTROM GAWIE VILJOEN	POLE MOUNTED	100	2003	2048	75,000.00
Bonnievale	PTRF RUS EN VREDE	POLE MOUNTED	25	2003	2048	40,000.00
Bonnievale	PTRF 2 GOEDVERWACHT LANDGOED	POLE MOUNTED	25	2003	2048	40,000.00
Bonnievale	PTRF 4 GOEDVERWACHT FARM	POLE MOUNTED	50	2003	2048	55,000.00
Bonnievale	PTRF BOSMAN PUMP 2	POLE MOUNTED	50	2003	2048	55,000.00
Bonnievale	PTRF BUITEKANT STR	POLE MOUNTED	200	2004	2049	130,000.00
Bonnievale	PTRF MORGENSTOND	POLE MOUNTED	100	2004	2049	75,000.00

Bonnievale	PTRF 1 WOLVENDRIFT D ZEEMAN Jnr	POLE MOUNTED	100	2004	2049	75,000.00
Bonnievale	PTRF 3 JANEZA	POLE MOUNTED	100	2004	2049	75,000.00
Bonnievale	PTRF ANGORA STUD	POLE MOUNTED	100	2005	2050	75,000.00
Bonnievale	PTRF 2 EYONA	POLE MOUNTED	50	2005	2050	55,000.00
Bonnievale	TRF WELTEVREDE	FLOOR STANDING	200	2006	2051	464,288.00
Bonnievale	PTRF HOOFWEG 3	POLE MOUNTED	200	2006	2051	130,000.00
Bonnievale	PTRF 1 GOEDVERWACHT LANDGOED	POLE MOUNTED	100	2006	2051	75,000.00
Bonnievale	TRF RIOOL SUIWERING	FLOOR STANDING	500	2007	2052	520,381.40
Bonnievale	PTRF KAPTEINSDRIF F.J VAN ZYL	POLE MOUNTED	200	2007	2052	130,000.00
Bonnievale	PTRF PARMALAT RIOOLPOMP	POLE MOUNTED	100	2007	2052	75,000.00
Bonnievale	PTRF LUKAS WENSEL 1	POLE MOUNTED	160	2007	2052	130,000.00
Bonnievale	PTRF 1 GOEDVERWACHT FARM	POLE MOUNTED	100	2007	2052	75,000.00
Bonnievale	PTRF BOESMANSDRIF 1	POLE MOUNTED	200	2008	2053	130,000.00
Bonnievale	PTRF 3 GOEDVERWACHT FARM	POLE MOUNTED	200	2008	2053	130,000.00
Bonnievale	PTRF KLEUTERSKOOL	POLE MOUNTED	100	2010	2055	75,000.00
Bonnievale	PTRF 1 WOLVENDRIFT	POLE MOUNTED	100	2010	2055	75,000.00
Bonnievale	PTRF KELKIEWYM STR 3	POLE MOUNTED	200	2010	2055	130,000.00
Bonnievale	TRANSFORMER	FLOOR STANDING		1967	2012	464,288.00
Bonnievale	TRANSFORMER 1	FLOOR STANDING	315	1957	2002	20,000.00
Bonnievale	TRF MILNER STR 1	FLOOR STANDING	300	1982	2027	464,288.00
Bonnievale	TRF MOLLER	POLE MOUNTED	315	1978	2023	190,000.00
Bonnievale	SS VAN LOVEREN BOTTLING FACILITY	GROUND MOUNTED	200	1968	2013	464,288.00
Bonnievale	TRF LOUISEANA	FLOOR STANDING	200	1975	2020	464,288.00
Bonnievale	TRF KANAAL STR	FLOOR STANDING	500	2007	2052	520,381.40
Bonnievale	TRF GOLF BAAN	FLOOR STANDING	300	1973	2018	464,288.00
Bonnievale	TRF NUWE DORP	FLOOR STANDING	300			464,288.00
Bonnievale	TRF UITSIG	FLOOR STANDING	500	1977	2022	520,381.40
Bonnievale	BOESMAN 2	POLE MOUNTED	50			55,000.00
Bonnievale	Dre Carso	FLOOR STANDING	50			464,288.00
Bonnievale	PTRF PIKKIE NIET	POLE MOUNTED	50			55,000.00
Bonnievale	No name1	POLE MOUNTED	200			130,000.00
Bonnievale	No name2	POLE MOUNTED	25			40,000.00
Bonnievale	Parmalat	GROUND MOUNTED	0			464,288.00
Bonnievale	Parmalat	GROUND MOUNTED	0			464,288.00
Bonnievale	Parmalat	GROUND MOUNTED	0			464,288.00
Bonnievale		GROUND MOUNTED	0			464,288.00
Bonnievale	Parmalat	GROUND MOUNTED	0			464,288.00
Bonnievale	Parmalat	GROUND MOUNTED	0			464,288.00
Bonnievale	Parmalat	GROUND MOUNTED	0			464,288.00
Bonnievale	PTRF SLAGPALE 2	POLE MOUNTED	315			190,000.00
Bonnievale	No name 1	POLE MOUNTED	25			40,000.00
Bonnievale	NO NAME 2	POLE MOUNTED	25			40,000.00
Bonnievale	KEURBOOM LAAN 3	POLE MOUNTED	200			130,000.00
Bonnievale	HOOFWEG	POLE MOUNTED	100			75,000.00
Bonnievale	No Plate 1	POLE MOUNTED	0			75,000.00
Bonnievale	PTRF 1246	POLE MOUNTED	50			55,000.00
Bonnievale	TFR POLICE STATION	FLOOR STANDING	300			464,288.00
Bonnievale		POLE MOUNTED	0			75,000.00
Bonnievale		POLE MOUNTED	100			75,000.00
Bonnievale		POLE MOUNTED	50			55,000.00
Bonnievale		POLE MOUNTED	0			75,000.00
Bonnievale		POLE MOUNTED	100			75,000.00
Bonnievale		POLE MOUNTED	16			20,000.00
Bonnievale		POLE MOUNTED	25			40,000.00
Bonnievale		POLE MOUNTED	25			40,000.00
Bonnievale		POLE MOUNTED	15			20,000.00
Bonnievale		POLE MOUNTED	25			40,000.00
Bonnievale		POLE MOUNTED	10			20,000.00
Bonnievale		POLE MOUNTED				75,000.00
Bonnievale		POLE MOUNTED				75,000.00
Bonnievale		POLE MOUNTED	25			40,000.00
Bonnievale		POLE MOUNTED				75,000.00
Bonnievale		POLE MOUNTED	100			75,000.00
Bonnievale		FLOOR STANDING	160			464,288.00
Bonnievale		FLOOR STANDING	50			464,288.00
Bonnievale		POLE MOUNTED	50			55,000.00

						27,175,014.40

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 5 – NETWORK TECHNICAL LOSSES CALCULATION

 LANGEBERG MUNISIPALITEIT MUNICIPALITY MASIPALA	 ixengineers Infrastructure Excellence	Langeberg Municipality - Energy Losses	
ELECTRICAL ENERGY LOSSES CALCULATION - BONNIEVALLE		Langeberg	PAGE 2
		ix P302015	REV. 0

Calculation of network losses in support of NRS 080 Reporting

CALCULATION SHEET NOTES

Langeberg Municipality - Energy Losses

NETWORK ANALYSIS AND ENERGY LOSSES

Energy losses calculation

Notes:

Energy losses comprises:

- 1 System losses due to I^2R losses in distribution networks as calculated by loadflow analysis
- 2 No load losses of inductive element's magnetic circuits.
- 3 Load losses of transformers proportional to loading
- 4 Partial discharge losses - not considered due to destructive nature and maintenance requirements
- 5 Dielectric losses - Not considered
- 6 Similar network LV distribution losses used, no information available on LV Network

Calculation base:

- 1 Network I^2R losses derived from network load-flow analysis
- 2 Network I^2R losses adjusted for averaged load
- 3 Monthly maximum demand and energy statistics required

Definitions

- 1 Demand - Apparent power drawn from supply network
- 2 Load (Connected, etc) - The total connected load on the system.
- 3 Load Factor (LF) - The average power in the typical monthly period divided by the peak apparent power
- 4 Demand factor (DF) - The maximum demand divided by the connected load (indicative of reserve capacity)

PREPARED FOR:



Langeberg Municipality
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ELECTRICAL ENERGY LOSSES CALCULATION - BONNIEVALE

Langeberg

PAGE

3

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REV.

0

Date

6/17/2022

MV Network losses					Billing/log data					
Simu- lato	Network peak power:		P kW	9260	Month	Demand kVA	Energy kWh	Load factor	Demand Factor	
	Network losses from load flow:		P _{loss} kW	148.08	Apr	9494	4931109	0.71	0.34	
Network Average power			kVA	6147	May	8059	4088431	0.69	0.28	
Total electrical losses			kW	kWh/month	% loss	Jun	8549	4085572	0.65	0.30
Transformer No load Losses			79.1	57743	1.29%	Jul	7984	4314308	0.74	0.28
Transformer Partial Load losses			90.7	66211	1.48%	Aug	8154	4153366	0.70	0.29
HV & MV Network system losses pm			98.3	71794	1.60%	Sep	7842	4266016	0.74	0.28
LV Network losses calculated pm				99615	2.22%	Oct	8393	4322774	0.71	0.30
Total losses				295363	6.58%	Nov	8911	4318049	0.66	0.31
Technical Loss Factor tlf :				1.066	Dec	8547	4695230	0.75	0.30	
					Jan	9359	5019408	0.73	0.33	
					Feb	9673	4673901	0.66	0.34	
					Mar	9747	4977577	0.70	0.34	
					Avg demand	8726	4487145	0.70	0.31	
					Avg power	6147				
					Installed Transformer and reactor losses					
					Qty	kVA	Losses/unit kW		Total loss kW	
							No load	Load	No load	FL loss
					34	16	0.095	0.41	3.23	13.94
					40	25	0.12	0.57	4.8	22.8
63	50	0.18	1	11.34	63					
71	100	0.3	1.7	21.3	120.7					
6	160	0.44	2.4	2.64	14.4					
18	200	0.52	2.7	9.36	48.6					
0	250	0.62	3.2	0	0					
9	315	0.72	3.8	6.48	34.2					
2	400	0.91	5.4	1.82	10.8					
15	500	1.1	5.4	16.5	81					
0	630	1.3	6.4	0	0					
1	800	1.6	8	1.6	8					
0	1000	1.9	9.5	0	0					
0	1600	2.75	13.5	0	0					
0	2000	3.25	16	0	0					
259			79.07	417.44						
Total installed capacity kVA		28289								

Notes:

- 1) Transformer quantities from single line diagram
- 2) Billing/Logs Eskom period Apr 2021 to Mar 2022.

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 6 – SSEG IMPACT ON MUNICIPAL REVENUE

This report was generated on	5/25/2022
For	Langeberg Municipality

Developed by

G:ENESIS
UNLOCKING VALUE

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SOUTH AFRICAN LOCAL
GOVERNMENT ASSOCIATION
Inspiring service delivery

**german
cooperation**
DEUTSCHE ZUSAMMENARBEIT

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an initiative of GIZ AG

Table 1: SSEG tariffs chosen by the municipality

		Summer				Winter			
		Residential	Small business	Medium business	Large business	Residential	Small business	Medium business	Large business
Tariff type	TOU or flat tariff structure	Flat	Flat	TOU	TOU	Same as summer			
	Monthly or annual clearing of balances	Monthly clearing	Monthly clearing	Monthly clearing	Monthly clearing				
	Payment of credit balances to customers	No payments	No payments	No payments	No payments				
	Escalation of export tariff	Changes over time	Changes over time	Changes over time	Changes over time				
TOU tariffs	Import tariff								
	Fixed charge (R/m)			2,368	2,368			2,368	2,368
	Monthly demand charge (R/kVA)			276	254			276	254
	Peak (c/KWh)			94	93			94	93
	Standard (c/KWh)			94	93			94	93
	Off-peak (c/KWh)			94	93			94	93
	Export tariff								
	Peak (c/KWh)			68	68			68	68
	Standard (c/KWh)			68	68			68	68
Off-peak (c/KWh)			68	68			68	68	
Flat tariffs	Import tariff								
	Fixed charge (R/m)	1,538	1,538			1,538	1,538		
	Monthly demand charge (R/kVA)	-	-			-	-		
	Variable charge (c/KWh)	190	190			190	190		
	Export tariff								
	Variable charge (c/KWh)	68	68			68	68		

Table 2: Total revenue impact * (%)

% of customers on the relevant tariff that install rooftop PV	Residential	Small business	Medium business	Large business	Total
1%	0.40%	-0.14%	0.08%	-0.02%	0.25%
5%	1.98%	-0.70%	0.41%	-0.11%	1.23%
10%	3.96%	-1.40%	0.83%	-0.21%	2.46%
20%	7.92%	-2.79%	1.65%	-0.42%	4.91%

Notes: * Total revenue impact = (Reduction in municipal revenue + Value of Solar)/Municipal revenue prior to introduction of Solar PV SSEG tariffs

Chart 1: Total revenue impact (%)

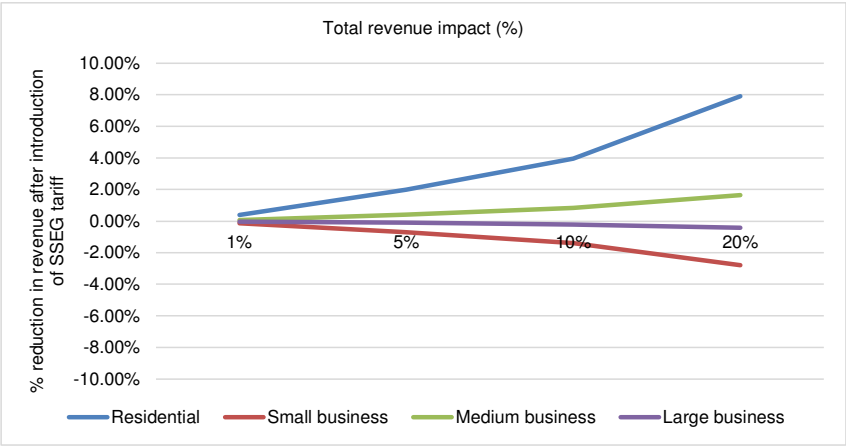


Table 3: Reduction in revenue, Value of Solar and Total effect (Rm)

	Residential	Small business	Medium business	Large business	Total
1% of customers install rooftop PV					
Reduction in revenue (Rm) (A)	1.1	-0.2	-0.2	-0.1	0.6
Value of Solar (Rm) (B)	0.6	0.1	0.3	0.1	1.0
Total effect (Rm) (A + B)	1.8	-0.1	0.0	0.0	1.7
5% of customers install rooftop PV					
Reduction in revenue (Rm) (A)	5.6	-1.2	-1.0	-0.3	3.1
Value of Solar (Rm) (B)	3.2	0.5	1.3	0.3	5.2
Total effect (Rm) (A + B)	8.8	-0.7	0.2	-0.1	8.3
10% of customers install rooftop PV					
Reduction in revenue (Rm) (A)	11.3	-2.3	-2.1	-0.7	6.2
Value of Solar (Rm) (B)	6.3	0.9	2.6	0.5	10.4
Total effect (Rm) (A + B)	17.6	-1.4	0.5	-0.1	16.5
20% of customers install rooftop PV					
Reduction in revenue (Rm) (A)	22.5	-4.6	-4.2	-1.4	12.3
Value of Solar (Rm) (B)	12.7	1.8	5.1	1.1	20.7
Total effect (Rm) (A + B)	35.2	-2.8	0.9	-0.3	33.0

Table 4: Business case for the Solar PV customer for the chosen SSEG tariffs

	Residential	Small business	Medium business	Large business	Key for PBP and IRR results:	Key for NPV results:
Net present value (Rands)	-263,700	648,328	409,308	4,101,820	Unfavourable	Negative
Pay-back period (PBP) (Years)	>26	3	11	6	Average	Positive
Internal rate of return	0%	36%	10%	19%	Very good	
LCOE (Rands)	0.94	1.04	0.97	0.89		
Monthly bill for one Solar PV customer (Rands)	R 2,608	R 11,891	R 8,485	R 259,127		

Table 5: Average electricity consumption per annum, average solar self-consumption rate per annum and peak demand per season

	Residential	Small business	Medium business	Large business
Avg elect cons/annum (KWh/a)	10,853	87,831	92,013	2,415,350
Avg solar self-cons rate/annum*	71%	100%	43%	100%
Summer peak demand (kW)	2.21	12.19	12.78	346.05
Winter peak demand (kW)	3.36	17.13	17.95	503.08

Notes: * Avg solar self-cons rate/annum = Rooftop PV electricity consumed on-site/Total rooftop PV electricity produced

Chart 2: Energy balances

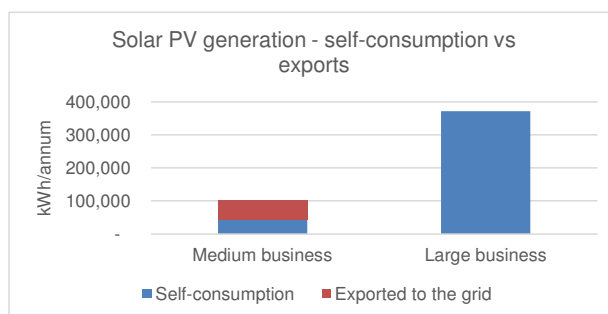
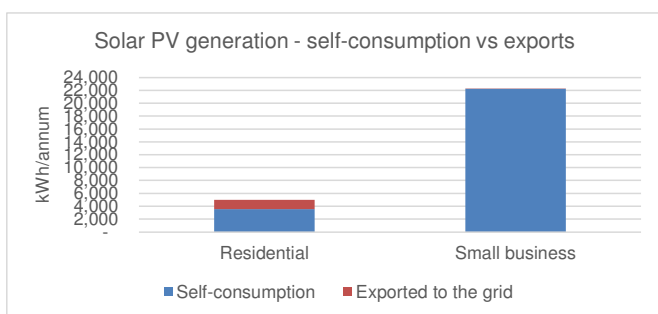


Table 6: Revenue Available for Network Costs and Average Bulk Energy Costs

		Residential	Small business	Medium business	Large business
Revenue per customer available for Network Costs (ZAR/month)	non-SSEG	R 1,280	R 9,688	R 7,482	R 132,456
	SSEG*	R 2,028	R 7,545	R 5,219	R 126,505
Average Bulk Purchase Costs (c/kWh)	non-SSEG	88.51	78.15	78.15	77.28
	SSEG	93.56	79.53	77.14	77.86

*Includes value of solar exports

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 7 – ALTERNATIVE ENERGY SUPPLY OPTION FOR MUNICIPAL FEED IN POINTS

Bonnievale 2MWp Langeberg Masterplan, Robertson, South Africa

Report

Project Name	Langeberg Masterplan
Project Address	Robertson, South Africa
Prepared By	Wiets Snyman info@ixengineers.co.za



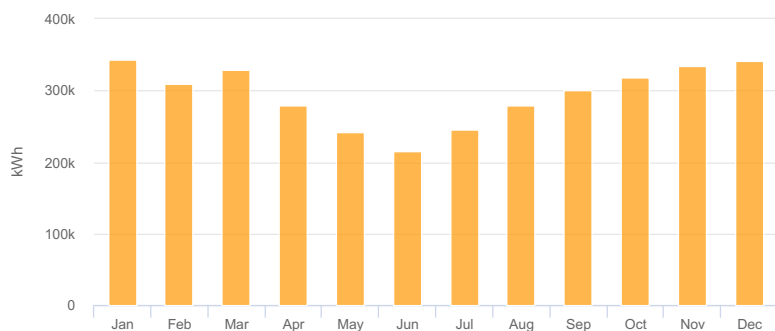
System Metrics

Design	Bonnievale 2MWp
Module DC Nameplate	2.00 MW
Inverter AC Nameplate	1.61 MW Load Ratio: 1.24
Annual Production	3,535 GWh
Performance Ratio	80.9%
kWh/kWp	1,765.1
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)
Simulator Version	4e8ad109b5-7184273f86-abd41a2ac5-1253cc88f6

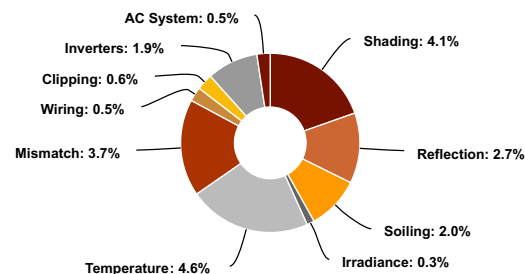
Project Location



Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m ²)	Annual Global Horizontal Irradiance	1,902.8	
	POA Irradiance	2,181.1	14.6%
	Shaded Irradiance	2,091.7	-4.1%
	Irradiance after Reflection	2,036.2	-2.7%
	Irradiance after Soiling	1,995.5	-2.0%
	Total Collector Irradiance	1,995.4	0.0%
Energy (kWh)	Nameplate	3,999,287.0	
	Output at Irradiance Levels	3,987,982.6	-0.3%
	Output at Cell Temperature Derate	3,803,989.9	-4.6%
	Output After Mismatch	3,665,017.7	-3.7%
	Optimal DC Output	3,645,183.0	-0.5%
	Constrained DC Output	3,622,818.3	-0.6%
	Inverter Output	3,552,999.7	-1.9%
	Energy to Grid	3,535,234.8	-0.5%
Temperature Metrics			
	Avg. Operating Ambient Temp		20.3 °C
	Avg. Operating Cell Temp		30.3 °C
Simulation Metrics			
	Operating Hours	4607	
	Solved Hours	4607	

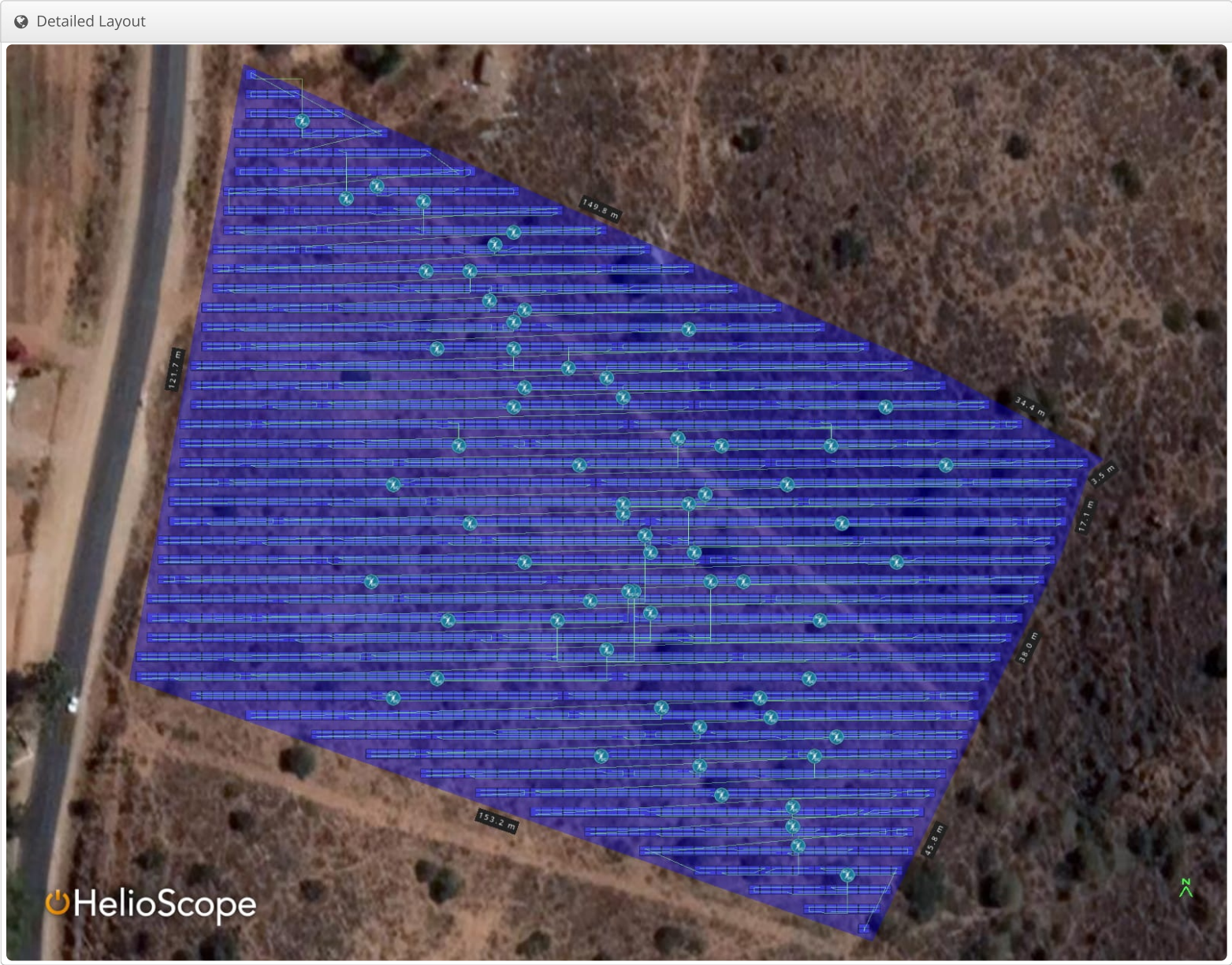
Condition Set

Description	Condition Set 1											
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											
Module Characterizations	Module	Uploaded By						Characterization				
	CS3W-440MB-AG (Canadian Solar)	HelioScope						Spec Sheet Characterization, PAN				
Component Characterizations	Device	Uploaded By						Characterization				
	Sunny Tripower 24000TL-US (SMA)	HelioScope						Modified CEC				

Components		
Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	67 (1.61 MW)
Strings	10 AWG (Copper)	272 (16,364.3 m)
Module	Canadian Solar, CS3W-440MB-AG (440W)	4,552 (2.00 MW)

Wiring Zones			
Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	-	4-19	Along Racking

Field Segments									
Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	32°	0°	2.0 m	2x1	2,276	4,552	2.00 MW

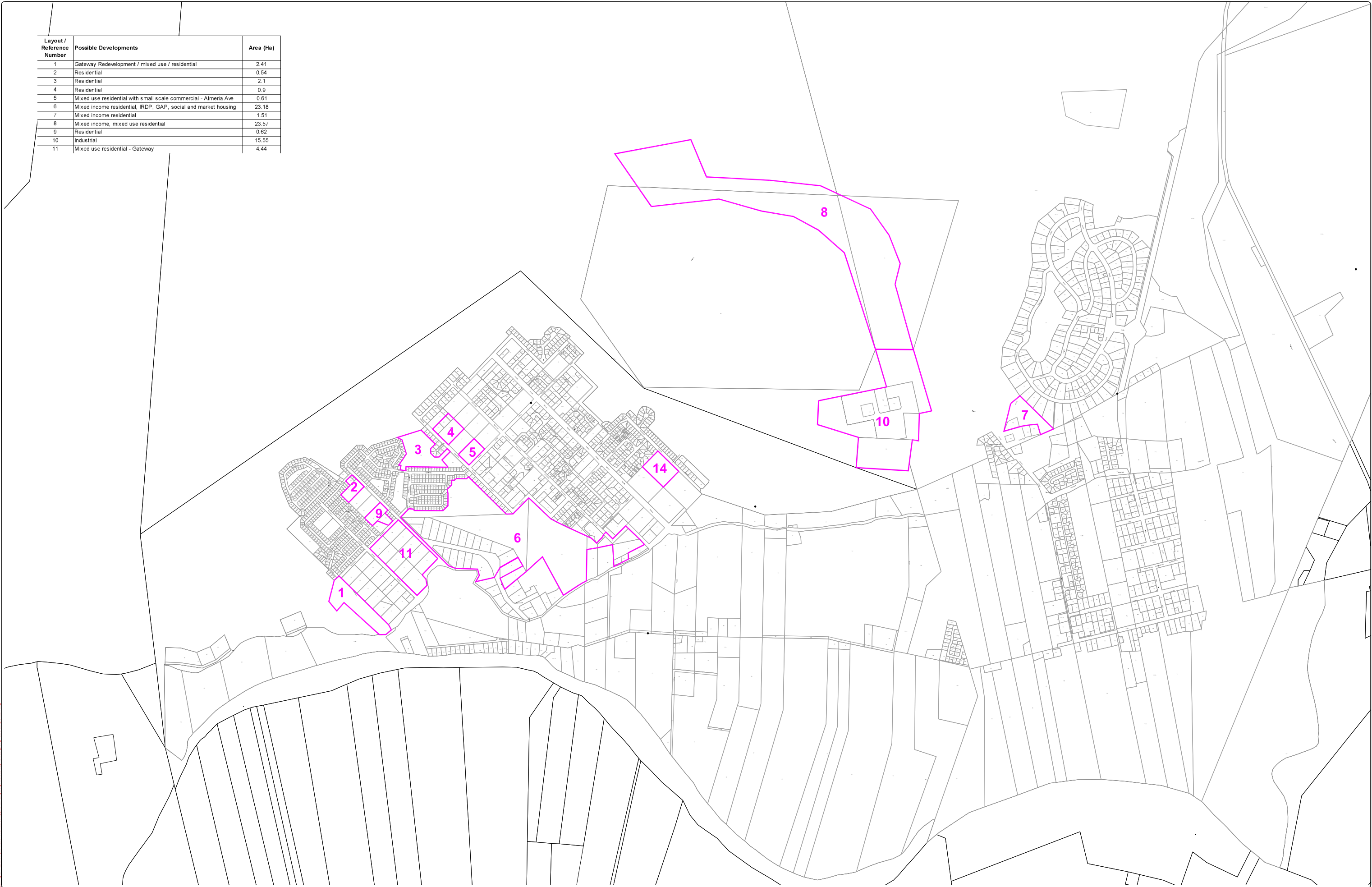


LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 8 – PROPOSED DEVELOPMENTS

Layout / Reference Number	Possible Developments	Area (Ha)
1	Gateway Redevelopment / mixed use / residential	2.41
2	Residential	0.54
3	Residential	2.1
4	Residential	0.9
5	Mixed use residential with small scale commercial - Almeria Ave	0.61
6	Mixed income residential, IRDP, GAP, social and market housing	23.18
7	Mixed income residential	1.51
8	Mixed income, mixed use residential	23.57
9	Residential	0.62
10	Industrial	15.55
11	Mixed use residential - Gateway	4.44



NOTES

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SIGNATURE			
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WS	WS	WMS	



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MUNISIPALITEIT MUNICIPALITY MASIPALA

PO BOX 62 • ROBERTSON • 6105
TEL: (023) 626 • 2426 • FAX: (023) 626 • 8200

PROJECT

BONNIEVALE

DRAWING DESCRIPTION

FUTURE DEVELOPMENTS

SCALE FOR REDUCED PLAN

0 5 10 20 40 60 80 100 METERS

DATE

SEP'2021

SCALE

1: 5000

ORIGINAL SIZE

A0

DRAWING NUMBER

P302015-E-BON-01

REV

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ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

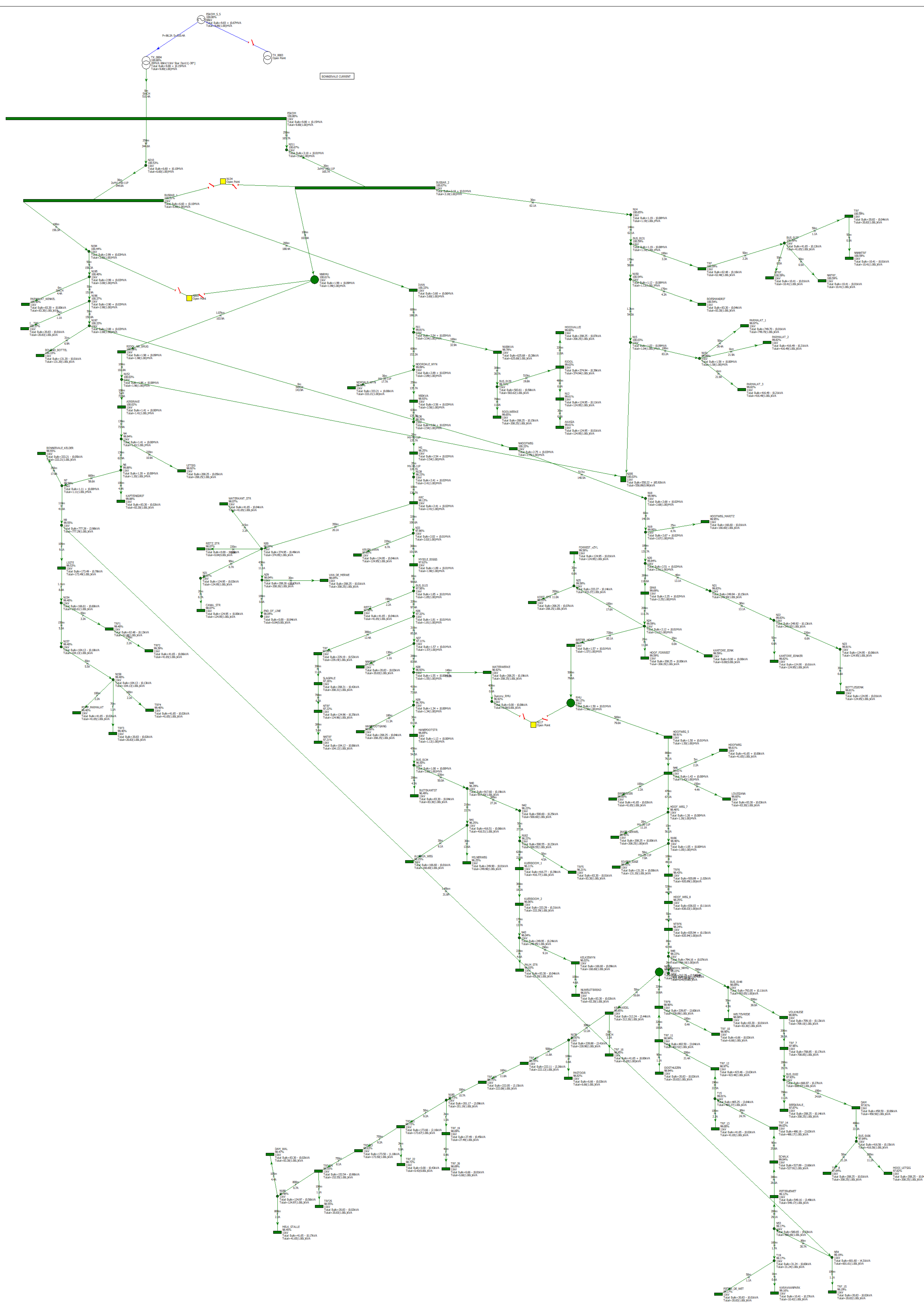
APPENDIX 9 – LOAD GROWTH FORECAST

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ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 10 – CURRENT MAXIMUM DEMAND LOAD FLOW ANALYSIS



LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 11 – PROSPECTIVE FAULT LEVEL STUDY

Bonnievale Prospective Fault Level Study

SUBSTATION/TRANSFORMER	3ø Fault (kA)	ø-G Fault (kA)
ESKOM	9.39	0.33
BUSBAR_1	8.33	0.33
BUSBAR_2	8.33	0.33
N14	8.21	0.33
NNRMU	8.03	0.33
N194	8.02	0.33
N195	7.87	0.33
PARMALAT_WINKEL	7.87	0.33
IVAN	7.73	0.33
N196	7.73	0.33
BUS_0131	7.69	0.33
I__TRF__	7.63	0.33
NHOOFWEG	7.58	0.33
N197	7.58	0.33
BOLAND_BOTTEL	7.47	0.33
TRF__	7.41	0.33
N150	7.3	0.33
BUS_0137	7.27	0.33
TRF__	7.14	0.32
NTRF__	7.14	0.32
NNTRF__	7.1	0.32
NNNNTRF	7.01	0.32
BOESMANDRIF	6.72	0.32
N18	6.31	0.32
RIOOL_NA_BRUG	6.29	0.32
N11	6.24	0.32
N15	6.23	0.32
N152	6.23	0.32
N205	6.23	0.32
N19	6.18	0.32
AIRBRAKE	6.17	0.32
HOOFWEG_MARITZ	6.11	0.32
N151	6.02	0.32
N100KVA	5.96	0.32
PARMALAT_1	5.89	0.32
N20	5.83	0.32
N4	5.81	0.32
N21	5.73	0.32
N22	5.51	0.32
N6	5.49	0.32
KANTORE_JONKER	5.4	0.32
SPAR	5.38	0.31
UITSIG	5.28	0.32

KAPTEINSDRIF	5.26	0.32
BUS_0129	5.24	0.32
N24	5.07	0.31
N23	5.03	0.31
KANTORE_JONK	5.03	0.31
HOOF_FORREST	5.03	0.31
BOTTLESJONK	4.97	0.31
N25	4.93	0.31
FORREST_vZYL	4.87	0.31
NOORDALE_WYN	4.83	0.31
NORDALE_WYN	4.79	0.31
N50KVA	4.51	0.31
KORT_STR	4.32	0.31
RIOOL	4.29	0.31
N7	4.23	0.31
BESTER_HOOF	4.18	0.31
N9	4.07	0.31
PARMALAT_2	4.04	0.31
PARMALAT_3	4.04	0.31
ROOLWERKE	4.01	0.31
BONNIEVALE_KELDER	3.88	0.31
LIGTE	3.88	0.31
MOOIVALLEI	3.84	0.31
RMU	3.72	0.3
N12	3.67	0.3
AKASIA	3.64	0.3
N136	3.63	0.3
MS	3.62	0.3
N138	3.6	0.3
ARC	3.49	0.3
HOOFWEG_5	3.31	0.29
N33	3.18	0.3
N30	3.16	0.3
N31	3.08	0.3
CANAL_STR	3.06	0.3
KRUIJN_LAAN	3	0.3
WATERKANT_STR	2.98	0.29
REITZ_STR	2.97	0.29
MYBILE_BIGGS	2.93	0.29
BUS_0115	2.87	0.29
N46	2.83	0.29
N29	2.82	0.29
HOOFWEG	2.82	0.29
VAN_DE_MERWE	2.79	0.29
BREERIVIER	2.76	0.29
REITZ	2.74	0.29
LOUISIANA	2.73	0.29

END_OF_LINE	2.69	0.29
N54	2.68	0.29
N36	2.66	0.29
HOOF_WEG_7	2.62	0.28
N53	2.62	0.29
JAKES_GERWEL	2.61	0.28
N166	2.61	0.28
TRF_15	2.59	0.29
RIVERS_EDGE	2.59	0.28
TRF6	2.57	0.28
T19	2.55	0.29
PIETER_DE_WET	2.53	0.29
N154	2.52	0.29
PIETERdEWET	2.5	0.29
TRF1	2.48	0.29
N37	2.47	0.29
N157	2.47	0.29
N158	2.45	0.29
TRF	2.43	0.29
NNNTRF	2.4	0.29
TRF3	2.39	0.29
POMP_PARMALAT	2.37	0.29
TRF4	2.37	0.29
N38	2.33	0.28
HOOF_WEG_8	2.3	0.28
SCHALK	2.3	0.29
SLAGPALE	2.28	0.28
TRF2	2.28	0.28
NTRF6	2.28	0.28
WATERWERKE	2.26	0.28
TRF_14	2.26	0.28
N48	2.25	0.28
T15	2.22	0.28
KARAVANPARK	2.2	0.28
TRF_13	2.17	0.28
N39	2.14	0.28
TRF_12	2.14	0.28
HANEPOOTSTR	2.13	0.28
Dummy_RMU	2.09	0.28
HANEPOOTGANG	2.07	0.28
TRF_11	2.06	0.28
BUS_0148	2.05	0.27
WELTEVREDE	2.04	0.27
OOSTHUIZEN	2.02	0.28
NTRF	1.99	0.28
BUS_0134	1.96	0.28
TRF9	1.94	0.28

VOLKHUISE	1.93	0.27
TRF_10	1.91	0.28
BUITEKANTST	1.89	0.27
TRF_7	1.89	0.26
NNTRF	1.89	0.27
BUS_0102	1.85	0.26
NRMU	1.84	0.27
KROKKEDIL	1.83	0.27
TRF_16	1.83	0.27
N40	1.79	0.27
N176	1.74	0.27
N41	1.73	0.27
ALMERIA_WEG	1.72	0.27
MILNERWEG	1.72	0.27
PASTOOR	1.72	0.27
N42	1.7	0.27
N162	1.69	0.27
TRF5	1.67	0.27
BEEKRALE_	1.65	0.26
Dummy_NRMU	1.62	0.26
TRF_17	1.61	0.27
DAM	1.58	0.25
TRF_18	1.56	0.26
KUERBOOM_1	1.54	0.26
N180	1.49	0.26
TRF_21	1.48	0.26
KUERBOOM_2	1.47	0.26
N43	1.43	0.26
PALM_STR	1.39	0.26
KELKIEWYN	1.38	0.26
BUS_0106	1.38	0.25
TRF_8	1.37	0.25
NUWEUITBREAD	1.36	0.26
TRF_23	1.29	0.25
MOOI_ITSIG	1.23	0.24
TRF_24	1.14	0.24
TRF25	1.12	0.24
TRF_19	1.06	0.24
TRF_20	1.06	0.24
TRF_22	1.06	0.24
N188	1.01	0.24
DAM_WAL	1	0.23
MELK_STALLE	0.91	0.23

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 12 – CURRENT MAXIMUM DEMAND LOAD FLOW ANALYSIS – VOLTAGE LEVEL STUDY

Bonnievale Current Voltage Level Study

Node Name	Min Voltage	Difference
ESKOM	100.80%	
BUSBAR_2	100.67%	0.13%
N211	100.67%	0.13%
N14	100.65%	0.15%
NNRMU	100.61%	0.19%
BUS_0131	100.59%	0.21%
TRF_	100.59%	0.21%
BUS_0137	100.59%	0.21%
TRF__	100.59%	0.21%
NNNNTRF	100.59%	0.21%
NTRF_	100.59%	0.21%
NNTRF_	100.59%	0.21%
BOESMANDRIF	100.54%	0.26%
N150	100.54%	0.26%
N210	100.53%	0.27%
BUSBAR_1	100.51%	0.29%
N194	100.44%	0.36%
N195	100.40%	0.40%
PARMALAT_WINKEL	100.40%	0.40%
N196	100.37%	0.43%
I__TRF_	100.37%	0.43%
IVAN	100.33%	0.47%
NHOOFWEG	100.33%	0.47%
N197	100.33%	0.47%
BOLAND_BOTTEL	100.33%	0.47%
RIOOL_NA_BRUG	100.08%	0.72%
N15	100.03%	0.77%
N152	100.03%	0.77%
N205	100.03%	0.77%
AIRBRAKE	100.02%	0.78%
ESKOM_S_S	100.00%	0.80%
N18	99.99%	0.81%
N151	99.99%	0.81%
PARMALAT_1	99.97%	0.83%
N19	99.95%	0.85%
HOOFWEG_MARITZ	99.95%	0.85%
N4	99.94%	0.86%
UITSIG	99.92%	0.88%
N6	99.88%	0.92%
KAPTEINSDRIF	99.88%	0.92%
N20	99.84%	0.96%
N21	99.83%	0.97%
N22	99.83%	0.97%

PARMALAT_2	99.82%	0.98%
PARMALAT_3	99.82%	0.98%
KANTORE_JONKER	99.82%	0.98%
N11	99.81%	0.99%
N23	99.81%	0.99%
BOTTLESJONK	99.81%	0.99%
N100KVA	99.78%	1.02%
BUS_0129	99.71%	1.09%
SPAR	99.69%	1.11%
ROOLWERKE	99.65%	1.15%
RIOOL	99.63%	1.17%
N12	99.61%	1.19%
AKASIA	99.61%	1.19%
MOOIVALLEI	99.60%	1.20%
N24	99.59%	1.21%
KANTORE_JONK	99.59%	1.21%
HOOF_FORREST	99.59%	1.21%
N7	99.58%	1.22%
N25	99.58%	1.22%
FORREST_vZYL	99.58%	1.22%
BONNIEVALE_KELDER	99.55%	1.25%
N9	99.55%	1.25%
KORT_STR	99.55%	1.25%
LIGTE	99.53%	1.27%
N154	99.40%	1.40%
TRF1	99.40%	1.40%
N157	99.40%	1.40%
N158	99.40%	1.40%
POMP_PARMALAT	99.40%	1.40%
TRF3	99.40%	1.40%
TRF4	99.40%	1.40%
TRF2	99.39%	1.41%
BESTER_HOOF	99.31%	1.49%
N54	99.19%	1.61%
TRF_15	99.19%	1.61%
N53	99.17%	1.63%
T19	99.17%	1.63%
PIETER_DE_WET	99.17%	1.63%
KARAVANPARK	99.16%	1.64%
RMU	99.12%	1.68%
PIETERdEWET	99.12%	1.68%
NOORDALE_WYN	99.09%	1.71%
NORDALE_WYN	99.08%	1.72%
SCHALK	99.04%	1.76%
TRF_14	99.02%	1.78%
T15	99.01%	1.79%
TRF_13	99.00%	1.80%

TRF_12	98.97%	1.83%
TRF_11	98.94%	1.86%
OOSTHUIZEN	98.94%	1.86%
N50KVA	98.93%	1.87%
HOOFWEG_5	98.91%	1.89%
TRF9	98.90%	1.90%
TRF_10	98.90%	1.90%
NRMU	98.86%	1.94%
KROKKEDIL	98.85%	1.95%
TRF_16	98.85%	1.95%
N176	98.82%	1.98%
PASTOOR	98.82%	1.98%
TRF_17	98.78%	2.02%
TRF_18	98.75%	2.05%
N180	98.73%	2.07%
TRF_21	98.72%	2.08%
TRF_22	98.72%	2.08%
TRF_19	98.69%	2.11%
TRF_20	98.69%	2.11%
TRF_23	98.63%	2.17%
N46	98.61%	2.19%
HOOFWEG	98.61%	2.19%
BREERIVIER	98.60%	2.20%
LOUISIANA	98.60%	2.20%
TRF_24	98.55%	2.25%
TRF25	98.55%	2.25%
N188	98.48%	2.32%
DAM_WAL	98.47%	2.33%
HOOF_WEG_7	98.46%	2.34%
JAKES_GERWEL	98.46%	2.34%
N166	98.46%	2.34%
RIVERS_EDGE	98.45%	2.35%
MELK_STALLE	98.45%	2.35%
TRF6	98.43%	2.37%
N136	98.26%	2.54%
HOOF_WEG_8	98.25%	2.55%
MS	98.25%	2.55%
NTRF6	98.24%	2.56%
N138	98.23%	2.57%
N48	98.22%	2.58%
Dummy_NRMU	98.22%	2.58%
ARC	98.13%	2.67%
BUS_0148	98.09%	2.71%
WELTEVREDE	98.08%	2.72%
N30	98.07%	2.73%
REITZ_STR	98.07%	2.73%
N31	98.07%	2.73%

CANAL_STR	98.07%	2.73%
WATERKANT_STR	98.07%	2.73%
N29	98.04%	2.76%
END_OF_LINE	98.04%	2.76%
VAN_DE_MERWE	98.04%	2.76%
VOLKHUISE	98.00%	2.80%
TRF_7	97.96%	2.84%
BUS_0102	97.93%	2.87%
DAM	97.91%	2.89%
BEEKRALE_	97.87%	2.93%
N33	97.86%	2.94%
KRUIJN_LAAN	97.85%	2.95%
BUS_0106	97.84%	2.96%
TRF_8	97.84%	2.96%
MOOI_UITSIG	97.82%	2.98%
MYBILE_BIGGS	97.62%	3.18%
BUS_0115	97.56%	3.24%
REITZ	97.56%	3.24%
N36	97.32%	3.48%
TRF	97.28%	3.52%
SLAGPALE	97.26%	3.54%
NTRF	97.22%	3.58%
NNTRF	97.21%	3.59%
N37	97.11%	3.69%
NNNTRF	97.11%	3.69%
N38	96.93%	3.87%
WATERWERKE	96.92%	3.88%
Dummy_RMU	96.92%	3.88%
N39	96.70%	4.10%
HANEPOOTSTR	96.69%	4.11%
HANEPOOTGANG	96.68%	4.12%
BUS_0134	96.50%	4.30%
BUI TEKANTST	96.49%	4.31%
N40	96.29%	4.51%
N41	96.25%	4.55%
ALMERIA_WEG	96.25%	4.55%
MILNERWEG	96.25%	4.55%
N42	96.23%	4.57%
N162	96.22%	4.58%
TRF5	96.21%	4.59%
KUERBOOM_1	96.11%	4.69%
KUERBOOM_2	96.06%	4.74%
N43	96.04%	4.76%
PALM_STR	96.03%	4.77%
KELKIEWYN	96.02%	4.78%
NUWEUITBREAD	96.01%	4.79%

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 13 – CURRENT MAXIMUM DEMAND LOAD FLOW ANALYSIS – CONDUCTOR THERMAL CAPACITY STUDY

Bonnievale Current Feeder Loading

Feeder to	Feeder % Loading
N210	73.35%
MS	58.98%
NOORDALE_WYN	58.97%
BUSBAR_1	56.51%
N138	55.94%
IVAN	52.33%
N136	52.18%
N11	51.73%
ARC	49.48%
TX_0004	48.63%
N194	43.43%
N195	43.43%
N196	42.22%
N197	41.91%
N33	41.76%
MYBILE_BIGGS	39.19%
N19	39.04%
N18	39.04%
BUS_0115	38.33%
N50KVA	37.68%
N36	37.46%
N20	36.61%
N211	35.26%
SPAR	32.96%
N37	32.71%
N38	32.27%
N24	31.04%
RIOOL_NA_BRUG	28.86%
NNRMU	28.86%
N152	28.56%
N4	28.41%
N39	27.94%
BUSBAR_2	27.17%
N6	24.20%
N14	23.88%
BUS_0131	23.88%
HANEPOOTSTR	23.59%
BESTER_HOOF	23.11%
N151	23.10%
N7	22.52%
RMU	22.13%
HOOFWEG_5	22.13%
N46	21.15%

BUS_0134	20.98%
N15	20.96%
N40	19.24%
HOOF_WEG_7	18.69%
HOOF_WEG_8	17.21%
N150	16.34%
N9	15.76%
N166	15.60%
PARMALAT_1	15.14%
TRF6	13.66%
N100KVA	12.66%
NORDALE_WYN	12.61%
NTRF6	12.43%
N54	12.24%
BUS_0129	11.82%
N53	11.82%
N48	11.81%
BUS_0148	11.81%
PIETERdEWET	11.18%
SCHALK	10.76%
VOLKHUISE	10.57%
TRF_7	10.57%
N42	10.50%
N162	10.50%
ESKOM	10.21%
BUS_0102	9.95%
TRF_14	9.91%
T15	9.49%
DAM	9.48%
KUERBOOM_1	8.75%
N41	8.74%
TRF_12	8.64%
BUS_0106	8.62%
PARMALAT_2	8.42%
PARMALAT_3	8.42%
TRF_11	8.21%
JAKES_GERWEL	7.93%
N30	7.72%
RIOOL	7.60%
KUERBOOM_2	7.00%
TRF9	6.94%
BONNIEVALE_KELDER	6.76%
NRMU	6.38%
TRF_18	6.21%
AIRBRAKE	5.68%
N180	5.63%
N43	5.25%

MILNERWEG	5.24%
N21	5.05%
N22	5.05%
RIVERS_EDGE	5.00%
N25	4.88%
TRF_21	4.86%
TRF_23	4.86%
LIGTE	4.82%
TRF	4.76%
N176	4.68%
N154	4.63%
KROKKEDIL	4.61%
TRF_17	4.54%
HANEPOOTGANG	4.35%
WATERWERKE	4.34%
SLAGPALE	4.32%
MOOI_UITSIG	4.31%
TRF_8	4.31%
BEESKRALE_	4.30%
N29	4.29%
VAN_DE_MERWE	4.29%
TRF_24	4.28%
ROOLWERKE	4.22%
MOOIVALLEI	4.22%
HOOF_FORREST	4.22%
KORT_STR	4.22%
UITSIG	4.21%
N188	3.51%
KELKIEWYN	3.50%
ALMERIA_WEG	3.49%
HOOFWEG_MARITZ	3.36%
NHOOFWEG	2.88%
BOLAND_BOTTEL	2.64%
NTRF	2.59%
KRUIIN_LAAN	2.58%
N31	2.57%
CANAL_STR	2.57%
N12	2.53%
AKASIA	2.53%
N23	2.53%
BOTTLESJONK	2.53%
FORREST_vZYL	2.53%
KANTORE_JONKER	2.53%
TRF5	2.39%
DAM_WAL	2.34%
NNTRF	2.16%
PALM_STR	1.75%

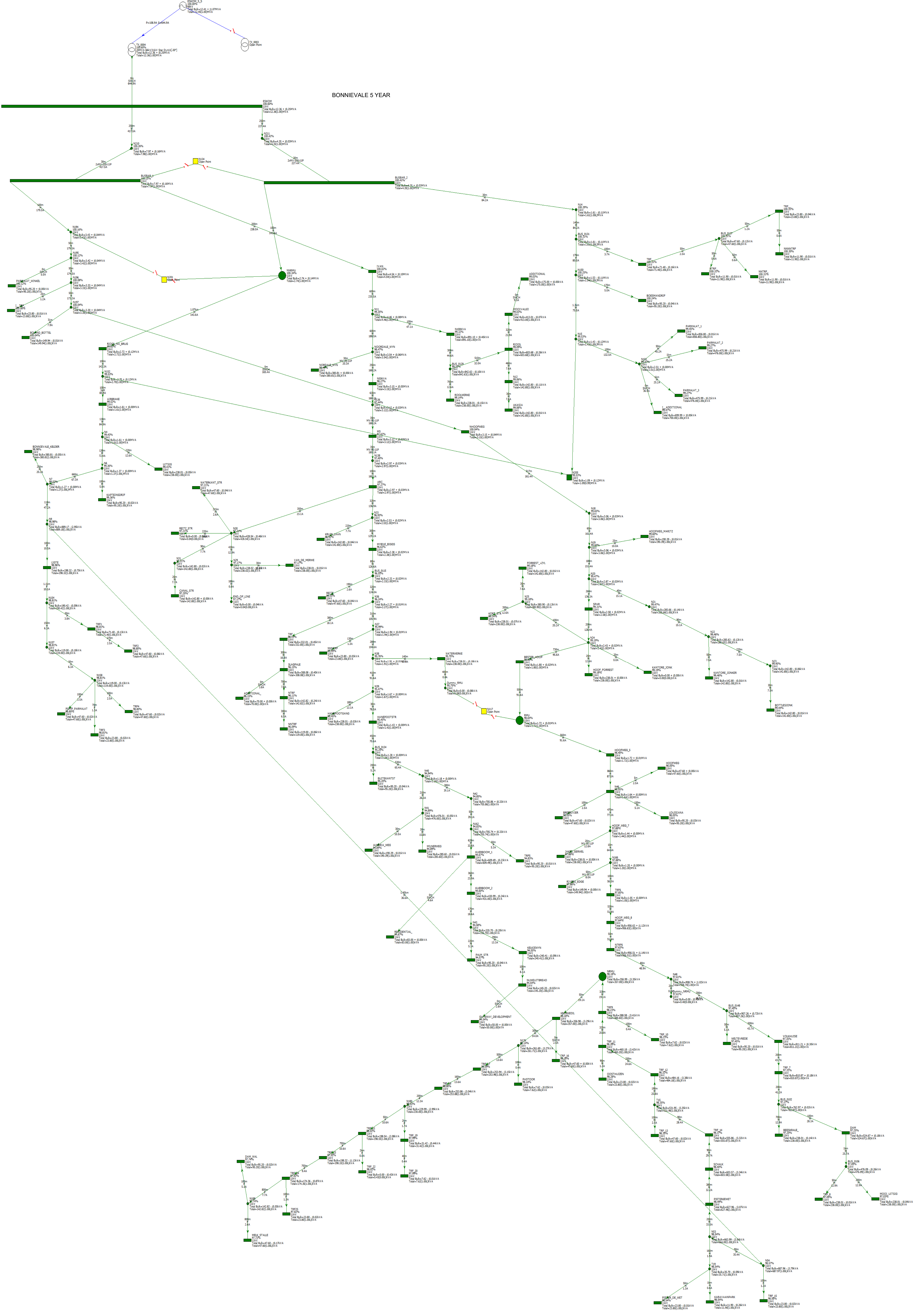
NUWEUITBREAD	1.75%
BUITEKANTST	1.74%
TRF1	1.74%
LOUISIANA	1.71%
WELTEVREDE	1.71%
KAPTEINSDRIF	1.68%
BOESMANDRIF	1.67%
N157	1.53%
N158	1.53%
MELK_STALLE	1.17%
TRF2	1.16%
POMP_PARMALAT	1.16%
TRF4	1.16%
TRF_	0.91%
REITZ	0.86%
WATERKANT_STR	0.86%
BREERIVIER	0.85%
TRF_13	0.85%
HOOFWEG	0.85%
TRF_19	0.77%
BUS_0137	0.60%
TRF_15	0.58%
TRF3	0.58%
TRF25	0.58%
T19	0.46%
NNNTRF	0.43%
OOSTHUIZEN	0.42%
I_TRF_	0.42%
PIETER_DE_WET	0.31%
TRF__	0.30%
NNTRF_	0.21%
TRF_20	0.19%
KARAVANPARK	0.15%
NNNNTRF	0.15%
NTRF_	0.15%
TRF_10	0.14%
PASTOOR	0.10%
PARMALAT_WINKEL	0.09%
TRF_16	0.04%
TRF_22	0.01%

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ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 14 – 5-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS

BONNIEVILLE 5 YEAR



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ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 15 – 5-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS – VOLTAGE LEVEL STUDY

Bonnievale 5 Year Voltage Level Study

Node Name	Min Voltage	Difference
ESKOM	100.60%	
N211	100.42%	0.18%
BUSBAR_2	100.41%	0.19%
N14	100.39%	0.21%
NNRMU	100.34%	0.26%
BUS_0131	100.31%	0.29%
TRF_	100.31%	0.29%
BUS_0137	100.31%	0.29%
TRF__	100.31%	0.29%
NTRF_	100.31%	0.29%
NNTRF_	100.31%	0.29%
NNNNTRF	100.30%	0.30%
N210	100.26%	0.34%
BUSBAR_1	100.25%	0.35%
N150	100.25%	0.35%
BOESMANDRIF	100.24%	0.36%
N194	100.16%	0.44%
N195	100.12%	0.48%
PARMALAT_WINKEL	100.12%	0.48%
N196	100.08%	0.52%
I__TRF_	100.08%	0.52%
NHOOFWEG	100.04%	0.56%
N197	100.04%	0.56%
BOLAND_BOTTEL	100.04%	0.56%
IVAN	100.02%	0.58%
ESKOM_S_S	100.00%	0.60%
N18	99.65%	0.95%
RIOOL_NA_BRUG	99.60%	1.00%
N19	99.60%	1.00%
HOOFWEG_MARITZ	99.60%	1.00%
N15	99.53%	1.07%
N152	99.53%	1.07%
N205	99.53%	1.07%
AIRBRAKE	99.52%	1.08%
N20	99.47%	1.13%
N21	99.47%	1.13%
N151	99.47%	1.13%
I__ADDITIONAL	99.47%	1.13%
N22	99.46%	1.14%
KANTORE_JONKER	99.46%	1.14%
PARMALAT_1	99.45%	1.15%
N23	99.45%	1.15%
BOTTLESJONK	99.44%	1.16%

N4	99.43%	1.17%
UITSIG	99.41%	1.19%
N6	99.36%	1.24%
KAPTEINSDRIF	99.36%	1.24%
N11	99.35%	1.25%
N100KVA	99.32%	1.28%
SPAR	99.31%	1.29%
PARMALAT_2	99.27%	1.33%
PARMALAT_3	99.27%	1.33%
BUS_0129	99.21%	1.39%
N24	99.19%	1.41%
KANTORE_JONK	99.19%	1.41%
N25	99.18%	1.42%
HOOFF_FORREST	99.18%	1.42%
FORREST_vZYL	99.18%	1.42%
ROOLWERKE	99.14%	1.46%
KORT_STR	99.14%	1.46%
RIOOL	99.09%	1.51%
N12	99.06%	1.54%
AKASIA	99.06%	1.54%
MOOIVALLEI	99.03%	1.57%
ADDITIONAL	99.03%	1.57%
N7	99.02%	1.58%
BONNIEVALE_KELDER	98.98%	1.62%
N9	98.98%	1.62%
LIGTE	98.96%	1.64%
BESTER_HOOF	98.86%	1.74%
N154	98.81%	1.79%
TRF1	98.81%	1.79%
N157	98.81%	1.79%
N158	98.81%	1.79%
TRF3	98.81%	1.79%
TRF2	98.80%	1.80%
POMP_PARMALAT	98.80%	1.80%
TRF4	98.80%	1.80%
RMU	98.64%	1.96%
N54	98.57%	2.03%
TRF_15	98.56%	2.04%
N53	98.54%	2.06%
T19	98.54%	2.06%
KARAVANPARK	98.54%	2.06%
PIETER_DE_WET	98.54%	2.06%
PIETERdEWET	98.49%	2.11%
NOORDALE_WYN	98.47%	2.13%
NORDALE_WYN	98.46%	2.14%
HOOFWEG_5	98.40%	2.20%
SCHALK	98.40%	2.20%

TRF_14	98.37%	2.23%
T15	98.35%	2.25%
TRF_13	98.35%	2.25%
TRF_12	98.32%	2.28%
TRF_11	98.28%	2.32%
OOSTHUIZEN	98.28%	2.32%
N50KVA	98.27%	2.33%
TRF9	98.23%	2.37%
TRF_10	98.23%	2.37%
NRMU	98.18%	2.42%
KROKKEDIL	98.18%	2.42%
TRF_16	98.18%	2.42%
N176	98.14%	2.46%
PASTOOR	98.14%	2.46%
TRF_17	98.09%	2.51%
TRF_18	98.06%	2.54%
N46	98.05%	2.55%
BREERIVIER	98.05%	2.55%
LOUISIANA	98.05%	2.55%
HOOFWEG	98.05%	2.55%
N180	98.03%	2.57%
TRF_21	98.02%	2.58%
TRF_22	98.02%	2.58%
TRF_19	97.99%	2.61%
TRF_20	97.99%	2.61%
TRF_23	97.92%	2.68%
HOOF_WEG_7	97.88%	2.72%
JAKES_GERWEL	97.88%	2.72%
N166	97.88%	2.72%
RIVERS_EDGE	97.88%	2.72%
TRF6	97.85%	2.75%
TRF_24	97.82%	2.78%
TRF25	97.82%	2.78%
N188	97.74%	2.86%
DAM_WAL	97.74%	2.86%
MELK_STALLE	97.72%	2.88%
HOOF_WEG_8	97.64%	2.96%
NTRF6	97.63%	2.97%
N48	97.61%	2.99%
Dummy_NRMU	97.61%	2.99%
BUS_0148	97.45%	3.15%
WELTEVREDE	97.45%	3.15%
N136	97.44%	3.16%
MS	97.42%	3.18%
N138	97.40%	3.20%
VOLKHUISE	97.35%	3.25%
TRF_7	97.31%	3.29%

ARC	97.27%	3.33%
BUS_0102	97.27%	3.33%
DAM	97.25%	3.35%
N30	97.21%	3.39%
REITZ_STR	97.21%	3.39%
N31	97.21%	3.39%
WATERKANT_STR	97.21%	3.39%
BEESKRALE_	97.20%	3.40%
CANAL_STR	97.20%	3.40%
N29	97.17%	3.43%
END_OF_LINE	97.17%	3.43%
VAN_DE_MERWE	97.17%	3.43%
BUS_0106	97.05%	3.55%
TRF_8	97.05%	3.55%
MOOI_UITSIG	97.03%	3.57%
N33	96.93%	3.67%
KRUIJN_LAAN	96.92%	3.68%
MYBILE_BIGGS	96.63%	3.97%
BUS_0115	96.55%	4.05%
REITZ	96.55%	4.05%
N36	96.24%	4.36%
TRF	96.19%	4.41%
SLAGPALE	96.15%	4.45%
ADDITIONAL_	96.15%	4.45%
NTRF	96.11%	4.49%
NNTRF	96.09%	4.51%
N37	95.99%	4.61%
NNNTRF	95.99%	4.61%
N38	95.76%	4.84%
WATERWERKE	95.75%	4.85%
Dummy_RMU	95.75%	4.85%
N39	95.47%	5.13%
HANEPOOTGANG	95.45%	5.15%
HANEPOOTSTR	95.45%	5.15%
BUS_0134	95.20%	5.40%
BUITEKANTST	95.20%	5.40%
N40	94.94%	5.66%
N41	94.89%	5.71%
ALMERIA_WEG	94.89%	5.71%
MILNERWEG	94.89%	5.71%
N42	94.85%	5.75%
N162	94.83%	5.77%
TRF5	94.83%	5.77%
KUERBOOM_1	94.67%	5.93%
RESIDENTIAL_	94.67%	5.93%
KUERBOOM_2	94.60%	6.00%
N43	94.58%	6.02%

PALM_STR	94.57%	6.03%
KELKIEWYN	94.55%	6.05%
NUWEUITBREAD	94.54%	6.06%
GATEWAY_DEVELOPMENT	94.54%	6.06%

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 16 – 5-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS – CONDUCTOR THERMAL CAPACITY STUDY

Bonnievale 5 Year Feeder Loading

Feeder to	Feeder % Loading
N210	88.84%
MS	73.11%
NOORDALE_WYN	72.48%
N138	69.60%
BUSBAR_1	68.45%
IVAN	66.12%
N11	65.43%
N136	64.68%
ARC	61.57%
TX_0004	61.44%
N33	52.67%
N194	49.86%
N195	49.86%
MYBILE_BIGGS	49.70%
BUS_0115	48.70%
N196	48.48%
N211	48.38%
N197	48.13%
N36	47.71%
N50KVA	46.71%
N19	44.84%
N18	44.84%
N20	42.05%
N37	40.74%
N38	40.24%
RIOOL_NA_BRUG	39.88%
NNRMU	39.88%
N152	39.53%
SPAR	37.86%
BUSBAR_2	37.28%
N151	36.80%
N24	35.66%
N39	35.22%
N4	32.67%
N14	32.39%
BUS_0131	32.39%
HANEPOOTSTR	30.19%
N15	29.05%
N6	27.84%
BUS_0134	27.17%
BESTER_HOOF	26.56%
N7	25.90%
RMU	25.44%

HOOFWEG_5	25.44%
N40	25.15%
N46	24.31%
N150	22.36%
HOOF_WEG_7	21.48%
HOOF_WEG_8	19.78%
N9	18.14%
N100KVA	18.11%
N166	17.94%
PARMALAT_1	17.39%
BUS_0129	17.15%
TRF6	15.70%
N42	15.02%
N162	15.02%
NORDALE_WYN	14.50%
NTRF6	14.28%
N54	14.09%
N53	13.60%
N48	13.57%
BUS_0148	13.57%
KUERBOOM_1	13.00%
ESKOM	12.90%
PIETERdEWET	12.87%
SCHALK	12.38%
RIOOL	12.30%
VOLKHUISE	12.15%
TRF_7	12.15%
BUS_0102	11.44%
TRF_14	11.41%
T15	10.92%
DAM	10.89%
N41	10.13%
TRF_12	9.94%
BUS_0106	9.90%
PARMALAT_2	9.68%
PARMALAT_3	9.68%
TRF_11	9.45%
KUERBOOM_2	9.20%
JAKES_GERWEL	9.12%
N30	8.90%
MOOIVALLEI	8.42%
TRF9	7.99%
BONNIEVALE_KELDER	7.77%
NRMU	7.34%
N43	7.17%
TRF_18	7.15%
TRF	6.97%

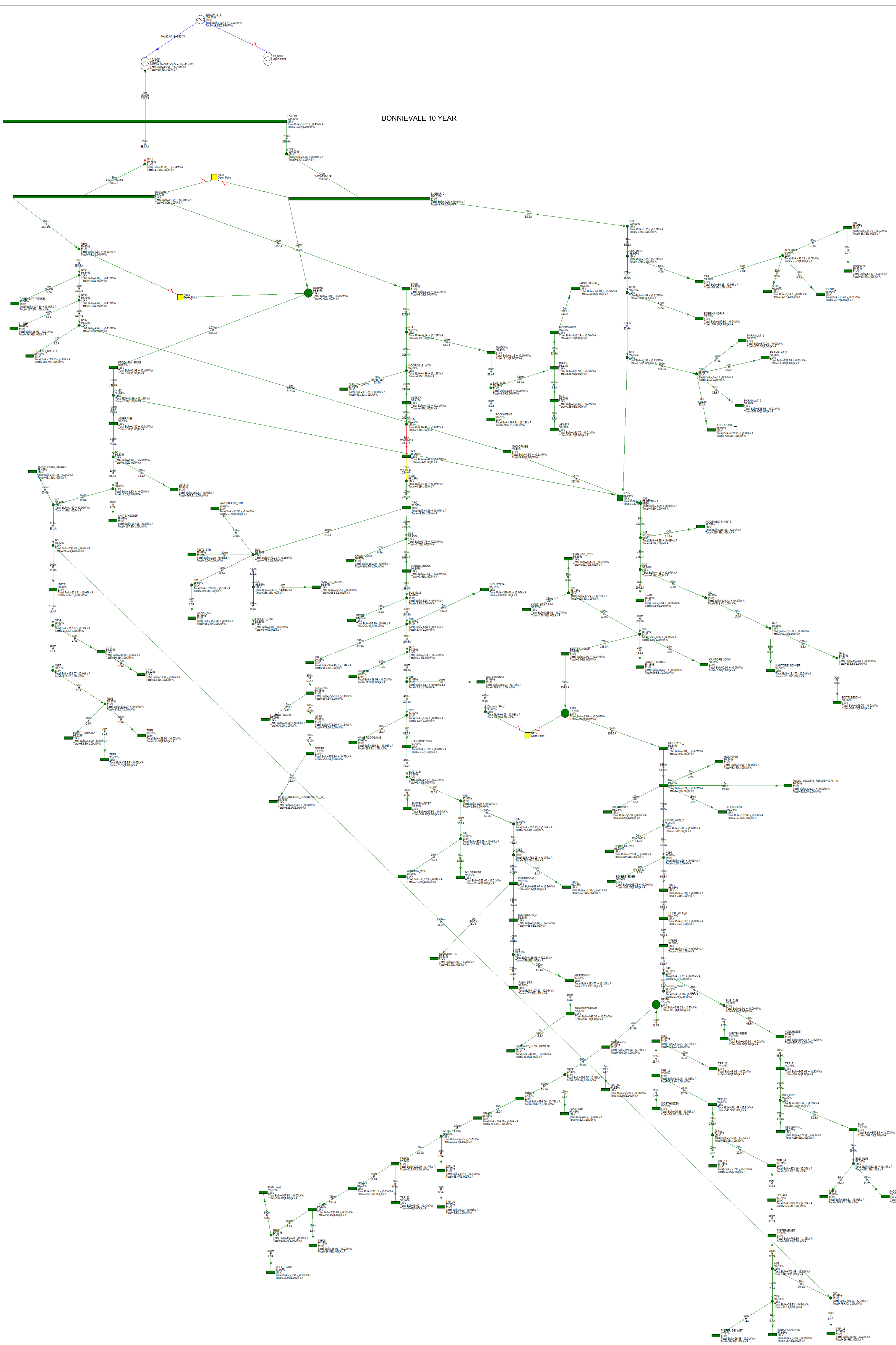
AIRBRAKE	6.53%
N180	6.48%
SLAGPALE	6.47%
MILNERWEG	6.08%
N21	5.80%
N22	5.80%
RIVERS_EDGE	5.74%
N25	5.60%
TRF_21	5.60%
TRF_23	5.60%
LIGTE	5.54%
N176	5.38%
N154	5.32%
KROKKEDIL	5.30%
TRF_17	5.23%
KELKIEWYN	5.13%
HANEPOOTGANG	5.03%
WATERWERKE	5.02%
MOOI_UITSIG	4.95%
TRF_8	4.95%
BEESKRALE_	4.94%
N29	4.94%
VAN_DE_MERWE	4.94%
TRF_24	4.92%
ROOLWERKE	4.85%
KORT_STR	4.85%
HOOF_FORREST	4.84%
UITSIG	4.83%
ALMERIA_WEG	4.05%
N188	4.04%
HOOFWEG_MARITZ	3.86%
NHOOFWEG	3.31%
NUWEUITBREAD	3.10%
BOLAND_BOTTEL	3.03%
NTRF	3.00%
N31	2.97%
CANAL_STR	2.97%
KRUIJN_LAAN	2.97%
N12	2.91%
AKASIA	2.91%
FORREST_vZYL	2.91%
N23	2.90%
BOTTLESJONK	2.90%
KANTORE_JONKER	2.90%
TRF5	2.77%
DAM_WAL	2.69%
NNTRF	2.50%

PALM_STR	2.03%
BUITEKANTST	2.02%
TRF1	2.00%
WELTEVREDE	1.97%
LOUISIANA	1.96%
KAPTEINSDRIF	1.93%
BOESMANDRIF	1.92%
N157	1.76%
N158	1.76%
MELK_STALLE	1.35%
TRF2	1.33%
POMP_PARMALAT	1.33%
TRF4	1.33%
TRF_	1.04%
REITZ	1.00%
WATERKANT_STR	0.99%
BREERIVIER	0.98%
TRF_13	0.98%
HOOFWEG	0.98%
TRF_19	0.89%
I__ADDITIONAL	0.74%
BUS_0137	0.69%
TRF_15	0.67%
TRF3	0.67%
TRF25	0.67%
T19	0.53%
NNNTRF	0.50%
OOSTHUIZEN	0.49%
I__TRF_	0.48%
TRF__	0.35%
PIETER_DE_WET	0.35%
NNTRF_	0.24%
TRF_20	0.21%
ADDITIONAL	0.19%
KARAVANPARK	0.18%
NNNNTRF	0.17%
NTRF_	0.17%
TRF_10	0.16%
PASTOOR	0.11%
PARMALAT_WINKEL	0.10%
RESIDENTIAL_	0.09%
ADDITIONAL_	0.08%
GATEWAY_DEVELOPMENT	0.06%
TRF_16	0.05%

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 17 – 10-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS



LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 18 – 10-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS – VOLTAGE LEVEL STUDY

Bonnievale 10 Year Voltage Level Study

Node Name	Min Voltage	Difference
ESKOM	100.22%	
N211	100.02%	0.20%
BUSBAR_2	100.01%	0.21%
N14	99.98%	0.24%
NNRMU	99.93%	0.29%
BUS_0131	99.89%	0.33%
TRF_	99.88%	0.34%
BUS_0137	99.88%	0.34%
TRF__	99.88%	0.34%
NNNNTRF	99.88%	0.34%
NTRF_	99.88%	0.34%
NNTRF_	99.88%	0.34%
N150	99.82%	0.40%
BOESMANDRIF	99.81%	0.41%
N210	99.73%	0.49%
BUSBAR_1	99.71%	0.51%
N194	99.58%	0.64%
N195	99.52%	0.70%
PARMALAT_WINKEL	99.52%	0.70%
N196	99.46%	0.76%
I__TRF_	99.46%	0.76%
NHOOFWEG	99.41%	0.81%
N197	99.41%	0.81%
BOLAND_BOTTEL	99.40%	0.82%
IVAN	99.38%	0.84%
RIOOL_NA_BRUG	99.10%	1.12%
N152	99.02%	1.20%
N205	99.02%	1.20%
AIRBRAKE	99.01%	1.21%
N15	99.01%	1.21%
N151	98.94%	1.28%
ADDITIONAL__	98.94%	1.28%
PARMALAT_1	98.92%	1.30%
N4	98.91%	1.31%
UITSIG	98.88%	1.34%
N6	98.83%	1.39%
N18	98.83%	1.39%
KAPTEINSDRIF	98.82%	1.40%
N19	98.76%	1.46%
HOOFWEG_MARITZ	98.76%	1.46%
PARMALAT_2	98.72%	1.50%
PARMALAT_3	98.72%	1.50%
N20	98.57%	1.65%

N21	98.57%	1.65%
N22	98.55%	1.67%
KANTORE_JONKER	98.55%	1.67%
N23	98.54%	1.68%
BOTTLESJONK	98.54%	1.68%
N7	98.43%	1.79%
N11	98.43%	1.79%
BONNIEVALE_KELDER	98.39%	1.83%
N9	98.39%	1.83%
N100KVA	98.38%	1.84%
LIGTE	98.37%	1.85%
SPAR	98.32%	1.90%
BUS_0129	98.25%	1.97%
N154	98.20%	2.02%
TRF1	98.20%	2.02%
N157	98.20%	2.02%
N158	98.20%	2.02%
TRF3	98.20%	2.02%
TRF2	98.19%	2.03%
POMP_PARMALAT	98.19%	2.03%
TRF4	98.19%	2.03%
ROOLWERKE	98.17%	2.05%
N24	98.13%	2.09%
KANTORE_JONK	98.13%	2.09%
HOOF_FORREST	98.13%	2.09%
N25	98.12%	2.10%
FORREST_vZYL	98.12%	2.10%
KORT_STR	98.08%	2.14%
RIOOL	98.07%	2.15%
N12	98.04%	2.18%
AKASIA	98.04%	2.18%
MOOIVALLEI	97.99%	2.23%
ADDITIONAL_	97.99%	2.23%
N54	97.92%	2.30%
TRF_15	97.92%	2.30%
N53	97.89%	2.33%
T19	97.89%	2.33%
KARAVANPARK	97.89%	2.33%
PIETER_DE_WET	97.89%	2.33%
PIETERdEWET	97.83%	2.39%
SCHALK	97.73%	2.49%
TRF_14	97.70%	2.52%
T15	97.68%	2.54%
TRF_13	97.68%	2.54%
TRF_12	97.64%	2.58%
TRF_11	97.59%	2.63%
OOSTHUIZEN	97.59%	2.63%

BESTER_HOOF	97.58%	2.64%
TRF9	97.54%	2.68%
TRF_10	97.54%	2.68%
NRMU	97.48%	2.74%
KROKKEDIL	97.48%	2.74%
TRF_16	97.48%	2.74%
N176	97.44%	2.78%
PASTOOR	97.44%	2.78%
TRF_17	97.38%	2.84%
TRF_18	97.35%	2.87%
N180	97.31%	2.91%
TRF_21	97.30%	2.92%
TRF_22	97.30%	2.92%
TRF_19	97.26%	2.96%
TRF_20	97.26%	2.96%
RMU	97.21%	3.01%
TRF_23	97.18%	3.04%
NOORDALE_WYN	97.15%	3.07%
NORDALE_WYN	97.14%	3.08%
TRF_24	97.08%	3.14%
TRF25	97.07%	3.15%
N188	96.98%	3.24%
DAM_WAL	96.98%	3.24%
MELK_STALLE	96.95%	3.27%
N50KVA	96.85%	3.37%
HOOFWEG_5	96.80%	3.42%
N46	96.19%	4.03%
BREERIVIER	96.19%	4.03%
LOUISIANA	96.19%	4.03%
HOOFWEG	96.19%	4.03%
MIXED_INCOME_RESIDENTIAL__6_	96.19%	4.03%
HOOF_WEG_7	96.00%	4.22%
JAKES_GERWEL	95.99%	4.23%
N166	95.99%	4.23%
RIVERS_EDGE	95.99%	4.23%
TRF6	95.96%	4.26%
HOOF_WEG_8	95.72%	4.50%
NTRF6	95.71%	4.51%
N48	95.68%	4.54%
Dummy_NRMU	95.68%	4.54%
N136	95.63%	4.59%
MS	95.60%	4.62%
N138	95.57%	4.65%
BUS_0148	95.50%	4.72%
WELTEVREDE	95.50%	4.72%
ARC	95.38%	4.84%
VOLKHUISE	95.38%	4.84%

TRF_7	95.34%	4.88%
N30	95.31%	4.91%
REITZ_STR	95.31%	4.91%
N31	95.30%	4.92%
CANAL_STR	95.30%	4.92%
WATERKANT_STR	95.30%	4.92%
BUS_0102	95.29%	4.93%
DAM	95.27%	4.95%
N29	95.26%	4.96%
END_OF_LINE	95.26%	4.96%
VAN_DE_MERWE	95.26%	4.96%
BEESKRALE_	95.21%	5.01%
BUS_0106	95.04%	5.18%
TRF_8	95.03%	5.19%
MOOI_UITSIG	95.01%	5.21%
N33	94.85%	5.37%
KRUIN_LAAN	94.84%	5.38%
MYBILE_BIGGS	94.38%	5.84%
BUS_0115	94.25%	5.97%
REITZ	94.25%	5.97%
N36	93.76%	6.46%
INDUSTRIAL	93.76%	6.46%
TRF	93.60%	6.62%
N37	93.47%	6.75%
SLAGPALE	93.47%	6.75%
NNNTRF	93.47%	6.75%
I_ADDITIONAL	93.47%	6.75%
NTRF	93.23%	6.99%
N38	93.21%	7.01%
WATERWERKE	93.19%	7.03%
Dummy_RMU	93.19%	7.03%
NNTRF	93.13%	7.09%
MIXED_INCOME_RESIDENTIAL__8_	93.13%	7.09%
N39	92.88%	7.34%
HANEPOOTGANG	92.85%	7.37%
HANEPOOTSTR	92.85%	7.37%
BUS_0134	92.57%	7.65%
BUI TEKANTST	92.56%	7.66%
N40	92.27%	7.95%
N41	92.22%	8.00%
ALMERIA_WEG	92.22%	8.00%
MILNERWEG	92.21%	8.01%
N42	92.17%	8.05%
N162	92.15%	8.07%
TRF5	92.14%	8.08%
KUERBOOM_1	91.97%	8.25%
RESIDENTIAL	91.97%	8.25%

KUERBOOM_2	91.89%	8.33%
N43	91.87%	8.35%
PALM_STR	91.86%	8.36%
KELKIEWYN	91.83%	8.39%
NUWEUITBREAD	91.83%	8.39%
GATEWAY_DEVELOPMENT	91.83%	8.39%

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 19 – 10-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS – CONDUCTOR THERMAL CAPACITY STUDY

Bonnievale 10 Year Feeder Loading

Feeder to	Feeder % Loading
N210	124.20%
MS	105.95%
N138	101.92%
BUSBAR_1	95.70%
N136	93.68%
IVAN	91.80%
N11	91.01%
ARC	90.16%
N33	80.07%
TX_0004	79.42%
MYBILE_BIGGS	76.71%
BUS_0115	75.56%
N36	74.43%
NOORDALE_WYN	74.01%
N194	70.37%
N195	70.37%
N196	68.81%
N197	68.42%
N50KVA	67.66%
N19	64.71%
N18	64.71%
N20	61.57%
SPAR	56.88%
N24	54.36%
N211	53.20%
N37	45.95%
N38	45.38%
BESTER_HOOF	44.10%
RIOOL_NA_BRUG	43.96%
NNRMU	43.95%
N152	43.56%
HOOFWEG_5	42.83%
RMU	42.81%
N46	41.53%
BUSBAR_2	40.99%
N151	40.01%
N39	39.65%
N4	36.75%
N14	35.46%
BUS_0131	35.46%
HANEPOOTSTR	33.95%
N15	31.71%
N6	31.32%

BUS_0134	30.46%
N7	29.15%
N40	28.15%
HOOF_WEG_7	24.50%
N150	24.45%
N100KVA	23.56%
HOOF_WEG_8	22.56%
BUS_0129	22.45%
TRF	21.09%
SLAGPALE	20.54%
N166	20.46%
N9	20.41%
PARMALAT_1	19.79%
TRF6	17.93%
RIOOL	16.99%
NTRF	16.76%
ESKOM	16.67%
N42	16.58%
N162	16.58%
NORDALE_WYN	16.55%
NTRF6	16.31%
NNTRF	16.21%
N54	15.86%
N48	15.49%
BUS_0148	15.49%
N53	15.31%
PIETERdEWET	14.50%
KUERBOOM_1	14.29%
SCHALK	13.96%
TRF_7	13.87%
VOLKHUISE	13.86%
BUS_0102	13.05%
TRF_14	12.85%
MOOIVALLEI	12.67%
DAM	12.44%
T15	12.29%
N41	11.57%
BUS_0106	11.30%
TRF_12	11.20%
PARMALAT_2	11.02%
PARMALAT_3	11.02%
TRF_11	10.66%
JAKES_GERWEL	10.52%
KUERBOOM_2	10.19%
N30	10.09%
TRF9	9.00%
BONNIEVALE_KELDER	8.84%

NRMU	8.27%
TRF_18	8.06%
N43	7.83%
AIRBRAKE	7.35%
N180	7.30%
MILNERWEG	7.03%
RIVERS_EDGE	6.63%
N21	6.54%
N22	6.54%
N25	6.33%
TRF_23	6.31%
TRF_21	6.30%
LIGTE	6.23%
N176	6.06%
N154	5.99%
KROKKEDIL	5.98%
TRF_17	5.89%
HANEPOOTGANG	5.82%
WATERWERKE	5.80%
MOOI_UITSIG	5.72%
TRF_8	5.72%
BEESKRALE_	5.71%
VAN_DE_MERWE	5.68%
N29	5.61%
KORT_STR	5.55%
TRF_24	5.55%
KELKIEWYN	5.54%
ROOLWERKE	5.54%
HOOF_FORREST	5.54%
UITSIG	5.50%
NHOOFWEG	4.75%
ALMERIA_WEG	4.69%
N188	4.55%
HOOFWEG_MARITZ	4.41%
BOLAND_BOTTEL	3.45%
KRUIJN_LAAN	3.42%
CANAL_STR	3.40%
N31	3.36%
AKASIA	3.33%
FORREST_vZYL	3.33%
BOTTLESJONK	3.31%
KANTORE_JONKER	3.31%
N12	3.29%
N23	3.27%
NUWEUITBREAD	3.22%
TRF5	3.21%
DAM_WAL	3.07%

PALM_STR	2.35%
BUITEKANTST	2.34%
WELTEVREDE	2.28%
LOUISIANA	2.26%
TRF1	2.25%
KAPTEINSDRIF	2.20%
BOESMANDRIF	2.18%
N157	1.98%
N158	1.98%
MELK_STALLE	1.54%
TRF2	1.52%
POMP_PARMALAT	1.52%
TRF4	1.52%
TRF_	1.17%
REITZ	1.15%
BREERIVIER	1.13%
WATERKANT_STR	1.13%
HOOFWEG	1.13%
TRF_13	1.11%
TRF_19	1.01%
MIXED_INCOME_RESIDENTIAL__6_	1.01%
BUS_0137	0.78%
TRF25	0.77%
TRF_15	0.76%
TRF3	0.76%
ADDITIONAL__	0.74%
MIXED_INCOME_RESIDENTIAL__8_	0.70%
T19	0.59%
NNNTRF	0.58%
OOSTHUIZEN	0.56%
I__TRF_	0.55%
PIETER_DE_WET	0.40%
TRF__	0.39%
INDUSTRIAL	0.39%
ADDITIONAL_	0.37%
NNTRF_	0.27%
TRF_20	0.24%
KARAVANPARK	0.20%
NNNNTRF	0.20%
NTRF_	0.20%
TRF_10	0.18%
PASTOOR	0.13%
PARMALAT_WINKEL	0.11%
RESIDENTIAL	0.09%
I__ADDITIONAL	0.08%
TRF_16	0.06%
GATEWAY_DEVELOPMENT	0.05%

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - BONNIEVALE AREA OF SUPPLY

APPENDIX 20 – RECOMMENDED CAPITAL UPGRADES

Langeberg Municipality Electrical Engineering Services Infrastructure: Capital Projects - Bonnievale

Priority	Ward	Project Description As per masterplan	Budget 2022/23	Budget 2023/24	Budget 2024/25	Budget 2025/26	Budget 2026/27	Budget 2027/28	Budget 2028/29	Budget 2029/30	Budget 2030/31	Budget 2031/32	Project Total
1. CAPITAL PROJECTS													R0.00
													R0.00
1.1		Electrical Network Uitsig Bonnievale		R700,000.00	R500,000.00								R1,200,000.00
1.2		Install RMU (CCV) in Bonnievale on 11kV overhead	R300,000.00										R0.00
1.3		Replacement of Prepaid Meters (PLC)											R0.00
1.4		Replace existing street lights with LED street lights		R100,000.00	R100,000.00	R100,000.00	R100,000.00	R100,000.00					R500,000.00
													R0.00
2. MASTERPLAN RECOMMENDATIONS													R0.00
													R0.00
2.1		Miniature Substation replacements								R575,000.00			R575,000.00
2.2		Transformer replacements		R300,000.00	R300,000.00	R300,000.00	R300,000.00	R300,000.00	R300,000.00	R300,000.00	R300,000.00	R300,000.00	R2,700,000.00
2.3		Create ring network towards between Hoofddorp and Nordale feeders at Landbou Street				R400,000.00							
		Total	R0.00	R1,100,000.00	R900,000.00	R400,000.00	R400,000.00	R400,000.00	R300,000.00	R875,000.00	R300,000.00	R300,000.00	R4,975,000.00

Notes

All amounts excl VAT