

**LANGEBERG MUNICIPALITY**



# **ELECTRICITY MASTERPLAN**

## **Robertson Area of Supply**

P302015-ELE-MPL-001-C

SEPTEMBER 2022

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## LANGEBERG MUNICIPALITY

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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 Robertson supply area of Langeberg Municipality. The current notified maximum demand is 36MVA with recent maximum demand peaking at 36.18MVA. Application has been made to increase NMD to 38MVA. The load growth is forecasted at 1.85% per year based on historical average with several developments planned and applications already submitted indicating that the revised NMD of 38MVA might be exceeded by 2024.

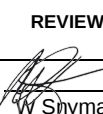
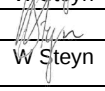
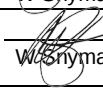
The impact of the load growth and new developments on the existing infrastructure was determined and recommendations were made on how to make sure that the electricity supply for the whole area remains reliable and of an acceptable quality.

Major proposed capital projects include the replacement of the main substation power transformers and associated works that have exceeded their useful life. Furthermore, some 11kV switching stations require switchgear upgrades.

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-001-C

| REV | DESCRIPTION         | ORIG                                                                                           | REVIEW                                                                                          | iXengineers<br>APPROVAL | DATE       | CLIENT<br>APPROVAL | DATE |
|-----|---------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------|------------|--------------------|------|
| B   | Issued for approval | <br>W Steyn | <br>W Shyman | N/A                     | 2022-06-27 |                    |      |
| C   | Issued for approval | <br>W Steyn | <br>W Shyman | N/A                     | 2022-09-12 |                    |      |

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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             |
| STS   | Standard Transfer Specification             |
| SWH   | Solar Water Heater                          |
| TID   | Token Identifier                            |
| XLPE  | Cross-linked Polyethylene                   |

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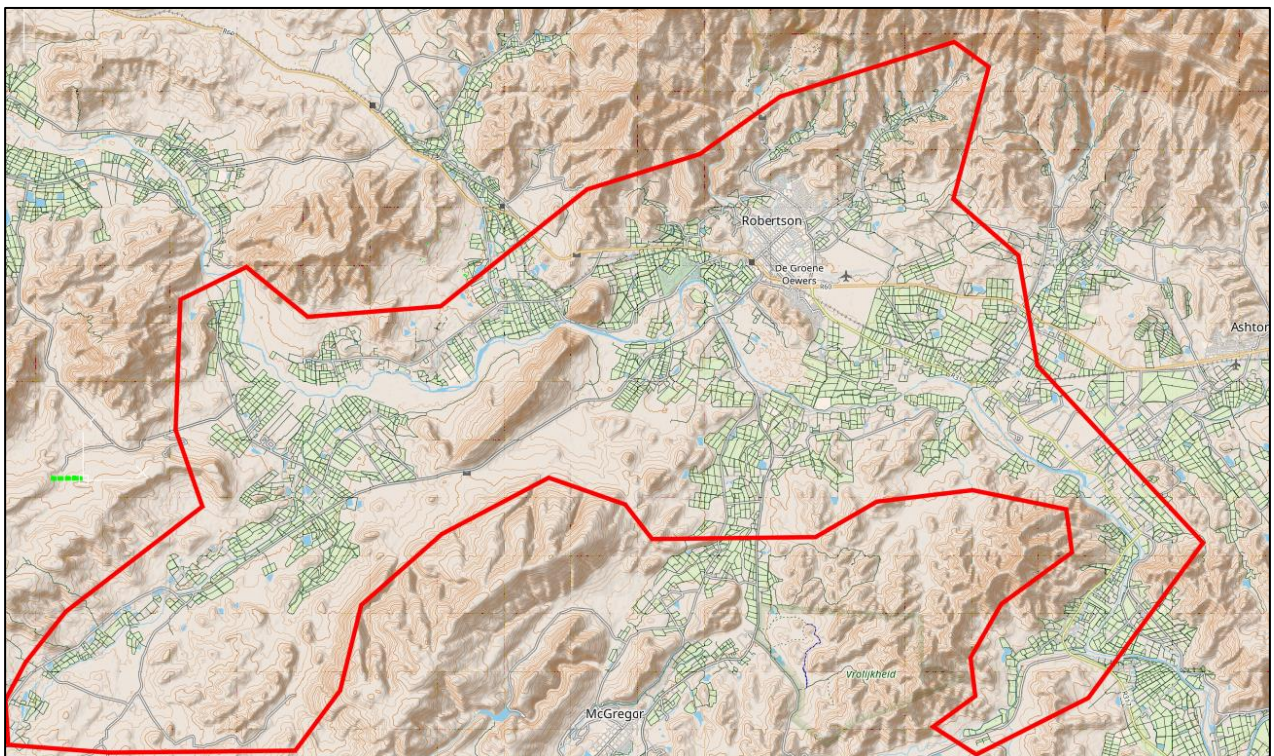
## **2 INTRODUCTION**

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 Robertson 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: Robertson Distribution Area**

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### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

#### 3.1 BULK SUPPLY

Robertson is currently supplied in bulk from the Eskom 132 / 66 kV Klipdrif substation via a 66kV ACSR Chicadee single circuit overhead line that feeds to the Eskom Uitspan 66kV switching station located next to the Robertson municipal substation.

Supply to the municipal substation is taken at 66kV from the Uitspan switching station.

Robertson area is on the Megaflex tariff.

| Supply Conductor | Supply Conductor Capacity (MVA) | Supply Voltage (kV) | Maximum Demand (MVA) | Notified Maximum Demand (MVA) |
|------------------|---------------------------------|---------------------|----------------------|-------------------------------|
| ACSR Chicadee    | 60.6                            | 66                  | 36.18*               | 36                            |

\*Maximum demand figure from March 2022.

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

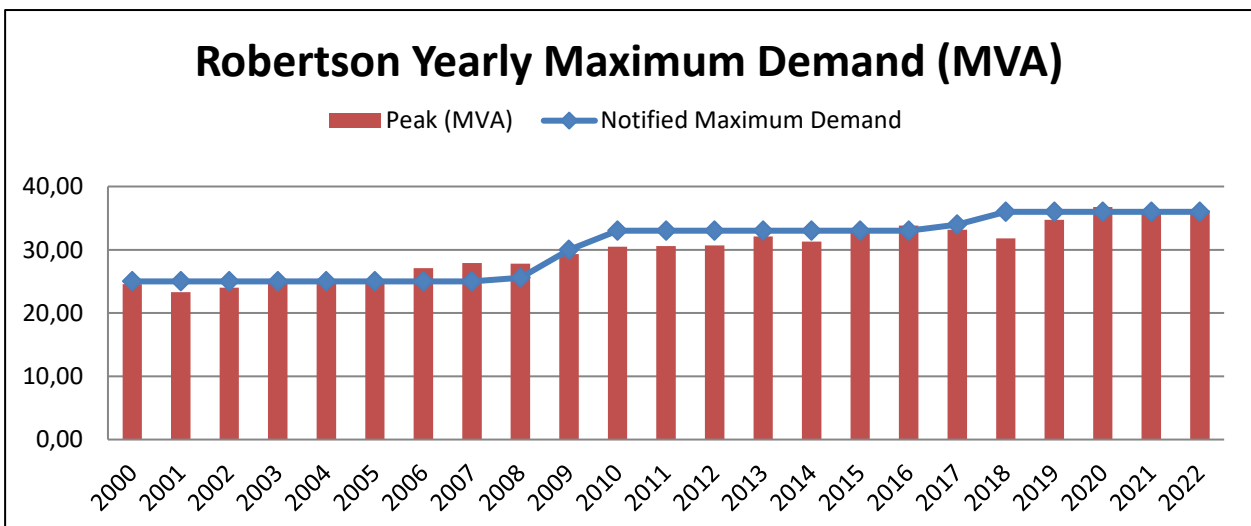


Figure 2: Robertson Yearly Maximum Demand Figures

The maximum demand has been steadily increasing over the last few years and is envisioned to increase further in future with several planned developments in the area.

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### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

The current notified maximum demand (NMD) is 36 MVA. Application has been made to increase the NMD to 38 MVA.

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

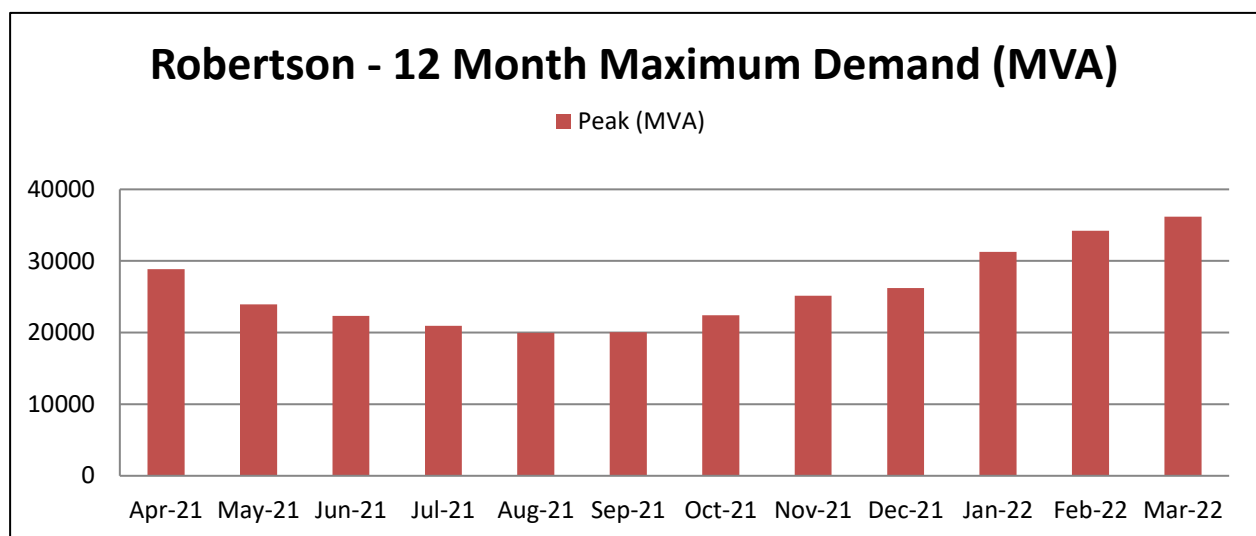


Figure 3: Robertson Monthly Maximum Demand Figures

## 3.2 66kV INFRASTRUCTURE

The Robertson main substation is fed from the Eskom Uitsig switching station to the municipal 66kV outdoor switching yard and busbar. From the 66kV busbar it feeds three 15MVA 66 / 11kV transformers that can be operated in parallel.

From the Robertson main substation, Goudmyn and Le Chasseur substations are fed via overhead ACSR Raccoon lines at 66kV. Capacity of Raccoon conductor is 34.3 MVA which is sufficient for the installed capacity at both substations.

Goudmyn Substation consists of an outdoor 66kV switching yard and two 10MVA, 66/ 11kV transformers.

Le Chasseur Substation consists of an outdoor 66kV switching yard and two 5MVA, 66/ 11kV transformers.

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#### 3.3 11kV INFRASTRUCTURE

From the 66/11kV transformers the 11kV network is fed via 3 x 300mm<sup>2</sup> (Transformer 1 and 2) and 3 x 400mm<sup>2</sup> (Transformer 3) single core cables to the main 11kV switching station building. The transfer capacity of the 11kV feeders from the transformers are 16,38 MVA and 17,91 MVA respectively and sufficient until such time as when the transformers are upgraded to a larger size.

The bus section (2 off) in the main substation are operated normally closed.

The 11kV feeders from Robertson main substation supply areas such as Noree, Le Chasseur, McGregor, Goudmyn, Ashton and other rural areas and loads are managed by moving open points.

The supply to town and surrounding areas are via several ring networks and should a fault occur on a cable or transformer, the rings can be switched to restore power to unaffected areas.

There are some feeders namely Plaaslike from Waterwerke SS, Hahn from Droehewel SS and Eerstelaan from Gemeenskap Sentrum SS that are currently on spur feeders. Should there be a fault on these feeders, the entire consumer base on that feeder will be without power.

The 11kV cable feeders used in Robertson area are predominantly PILC copper cable type.

PILC cables have a slightly higher initial cost compared to XLPE type cables but perform better in terms of lower dielectric loss, resistance to moisture ingress due to lead sheath and does not succumb to thermal expansion during heating as is the case with XLPE.

Based on the above it is recommended that future installations and replacement of existing cables be implemented using PILC type cables. The use of aluminium conductor could also be considered in lieu of copper as a deterrent to theft. Aluminium cables have a lower current carrying capacity compared to copper cable. Aluminium cables can conduct around 77% of the capacity of similar size copper cables. If considered, implementation should be on a case to case basis as supplying large loads will require substantially sized cables.

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

Goudmyn and Le Chasseur substations supply the rural areas that form part of the Robertson network. These networks consist of overhead lines that feed to pole mounted transformers. The existing 11kV network layouts for Goudmyn and Le Chasseur supply areas are included in Appendix 3.

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The simplified 66/11kV single line diagram for the Robertson area is included in Appendix 4. Additional switching diagrams including the rural areas are attached to Appendix 5 and consist of the following:

- Diagram 1 – Agterkliphoogte, Clariswold, Le Chasseur and Eilandia
- Diagram 2 – McGregor, Olifantsdoorn, Takkap and Koningsrivier
- Diagram 3 – Ashton, Sandvliet, Goedemoed and Goudmyn
- Diagram 4 – Langvlei, Goree and Noree
- Diagram 5 – Keurkloof and De Hoop

## **3.4 NETWORK ASSESSMENT**

### **3.4.1 66kV NETWORK**

Eskom have indicated that the network is already constrained and that a new 132kV overhead line is planned from Bacchus substation to Klipdrif 132 / 66kV substation which will solve the thermal loading and voltage constraints currently experienced. These works are provisionally planned for +/-2026.

In the event of a fault on the Klipdrif substation or overhead line feeding the Uitspan switching station, Robertson supply area will be dependent on the Hex - Noree 66kV line which will not be able to supply the entire demand and loads will have to be shed.

With the introduction of the new 132kV line from Bacchus substation, consideration must be given into the option of supplying Goudmyn substation directly from Klipdrif substation 66kV busbar.

The existing 66kV overhead line from Robertson to Goudmyn substation runs within 100m of the Klipdrif substation.

### **3.4.2 11kV NETWORK**

The Robertson main 11kV switching station's maximum demand meter readings were taken in November 2021. See Appendix 6 for summary. It must be noted that these readings are only an indication and that several factors such as resetting of meters, switching of open points in the network etc. affect the accuracy.

From the above the following can be derived:

- The Robertson Kelder SS feeder, maximum current of 250A, exceeds the cable thermal limits. 95mm<sup>2</sup> PILC Cu cable has a rating of 240A.

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### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

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- There are instances where there are quite significant differences between the three phase values (R, W, B). This could be due to inaccuracies as described above but could be due to incorrect balancing of phases downstream.

#### 3.4.2.1 ROBERTSON – MCGREGOR 11kV OVERHEAD LINE INTERLINKING

The following is a high-level investigation into the feeder capability with available information and recommendations proposed. The information in terms of loads on the existing schematic diagrams between Robertson and McGregor are not indicated.

The 11kV overhead line feeder from Robertson Main SS to McGregor booster transformer consists predominantly of Rabbit conductor. The Rabbit overhead line is rated at 240A (4.6MVA). The feeder also supplies the Nkqubela area (connected load estimated at 1.28MVA)

The current maximum demand on the feeder is 2.8MVA which causes the protection to operate. The open point is at the booster transformer towards McGregor. Total distance of +/-15.4km

Simulations for both the Rabbit and upgrade to Hare conductor up to the booster transformer indicate voltage levels well outside allowable limits. The thermal loading on the feeder is well within thermal limits.

Information such as the status of voltage regulators, position and sizing of loads, confirmation of N/O positions on the line is required to accurately investigate.

Possible upgrades to extend the reach of the supply from Robertson to McGregor is the upgrading of the entire line to Hare, a section of this line from McGregor up to close vicinity of the booster transformer was recently upgraded to Hare conductor, and another recommendation is the removal of the Nkqubela area from the feeder. A review of the protection settings should also be considered.

### 3.5 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 7.

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

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### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

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| 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**

#### 3.5.1 SUBSTATION

The substation assets, including HV switchgear and transformers, at Muiskraalskop substation are included.

As per the asset register, majority of the HV switchgear at Muiskraalskop are due for replacement. The transformers (1 and 2) should also be replaced as soon as possible due to exceeding their useful life. Transformer 3 was replaced in 2021.

Consideration should be given to install larger size transformers when the transformers are replaced. Larger transformer sizes should be selected keeping in mind that the transformers are operated in parallel and the effect the larger size has on load sharing. Cooling fans could also be fitted to the transformers increasing capacity by up to 25% should it be needed in the interim. (e.g  $15\text{MVA} \times 3 = 45\text{MVA} + 25\% = \pm 56\text{MVA}$ )

Goudmyn and Le Chasseur substation transformers are shown separately.

#### 3.5.2 SWITCHGEAR

As per the information from the asset register, Sentraal SS and White Str SS are due for replacement. The switching stations that do not have information regarding installation dates, were not indicated on the asset register.

#### 3.5.3 MINIATURE SUBSTATIONS

The assessment indicates that only one miniature substation currently exceeds the expected useful life.

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#### 3.5.4 TRANSFORMERS

The assessment indicates that 57 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.

#### 3.5.5 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.

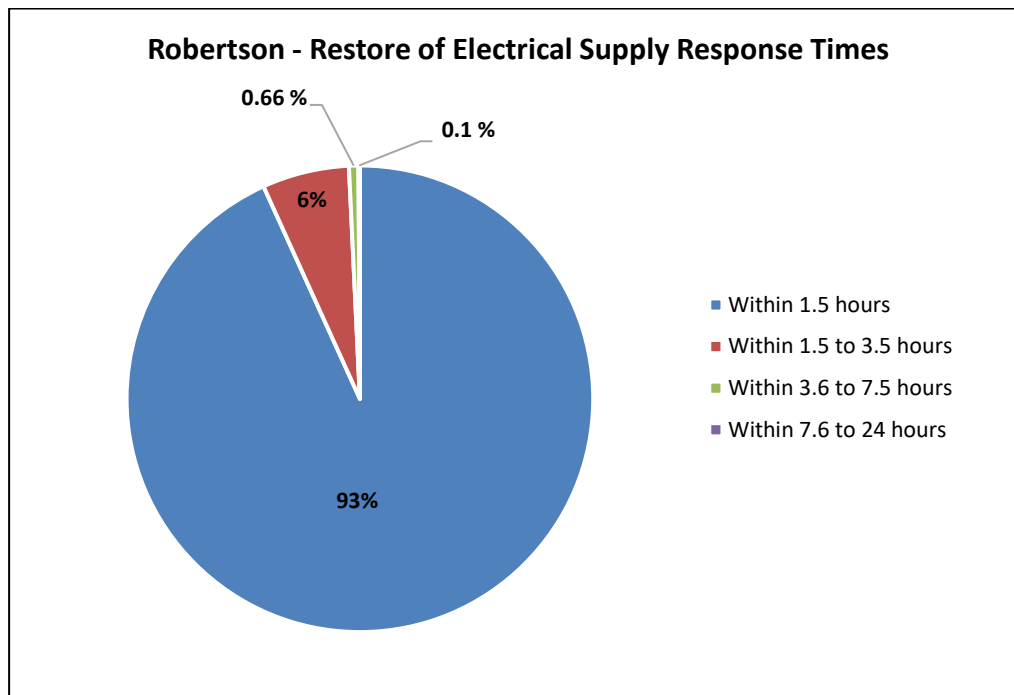
## 4 ASSESMENT OF EFFICIENCY LEVELS AND SERVICE DELIVERY

### 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.

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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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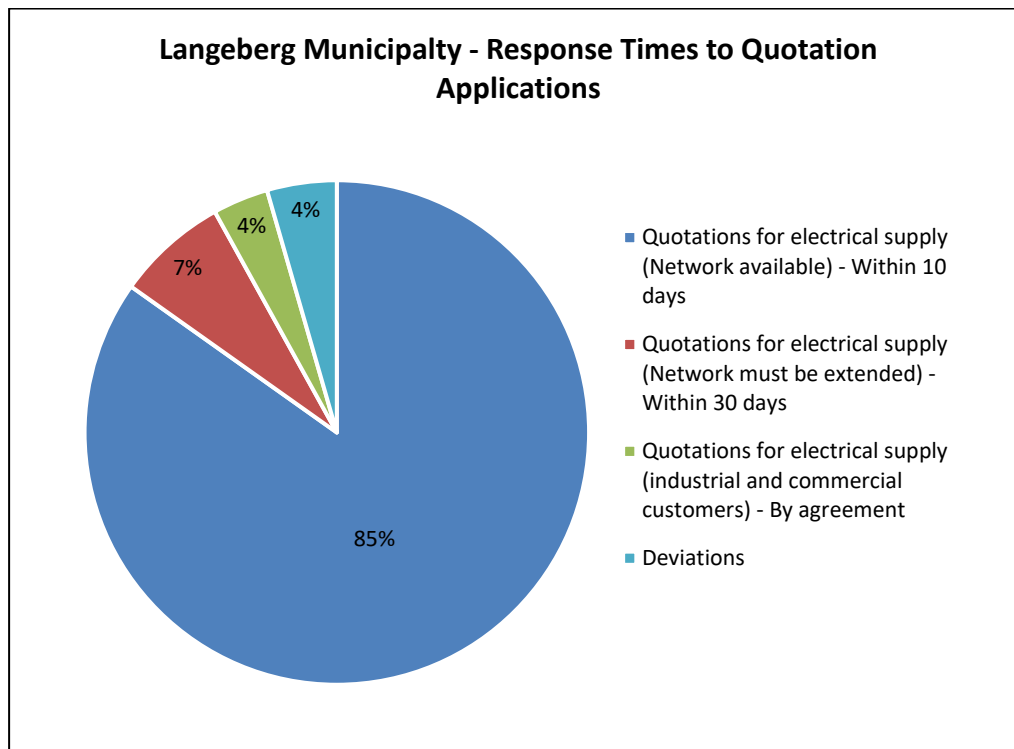


Figure 5: Quotation Application Response Times (Jun 20 – Jul 21)

## 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

Robertson area of supply in Langeberg Municipality currently exceeds their notified maximum demand. Even with the increase in NMD to 38MVA, expected shortly, this spare capacity will rapidly be assigned to developments already waiting to increase their capacity.

This motivates the implementation of demand management initiatives to reduce the municipality's demand from Eskom.

Robertson has a ripple controller system installed at the Robertson Main substation that is used to switch electrical geysers via a high frequency signal over the electrical network.

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.

## LANGEBERG MUNICIPALITY

### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

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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 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 ROBERTSON TECHNICAL LOSSES

An investigation was done to determine the level of technical losses in the Robertson 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 8 for the technical losses calculation.:

| Network Element                  | % loss contribution |
|----------------------------------|---------------------|
| Transformers No Load Losses      | <b>0.67</b>         |
| Transformers Partial Load Losses | <b>1.30</b>         |
| MV Network Losses                | <b>1.41</b>         |
| LV Network Losses                | <b>2.22</b>         |
| <b>Total losses</b>              | <b>5.61</b>         |

The estimated technical loss factor for Robertson is therefore 1.0561. The Robertson network can be classified as a mixed load between industrial, 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.                  | Electrification of Kanana Housing Project                                | 2019/20    | T39/2018          | R 4,347,830.00              |
| 3.                  | Replace 11kV insulated switchgear                                        | 2019/20    | T66C/2018         | R1,596,240.00               |
| 4.                  | Replace 66kV Switchgear (Goudmyn, Le Chasseur)                           | 2019/20    |                   | R 1,155,980.00              |
| 5.                  | Replace 66kV Transformers at Robertson Main Substation                   | 2020/21    | T65/2018          | R 7,019,335.27              |
| 6.                  | Upgrade 11kV Cable Feeder from White Street Substation to Van Zyl Street | 2020/21    | T66E/2018         | R 851,580.00                |
| 7.                  | Electrification Erf 136 Nkqubela                                         | 2020/21    |                   | R 2,713,040.00              |
| Total               |                                                                          |            |                   | R 17,684,005.27             |

## 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                                  |
|--------------------------------|-----------------------------------------------------------|----------------------------------------------------|-----------------------------------------------------------------------|
| <b>Economic Infrastructure</b> | 90% of people with access to the electricity grid by 2030 | LED strategy confirmed that 94% of households used | Objective Achieved, continuously monitor new developments and provide |

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|                                                    |                                                                                                                                           |                                                                                                                                |                                                                                                                                                                    |
|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                    |                                                                                                                                           | electricity as energy source for lighting. (2017)                                                                              | 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 provide the base for broad band access and attract private investment | N/A                                                                                                                            | Fibre-optic ducts could be installed, at relatively low cost, with new or replacement of existing cables on strategic routes to reduce double excavations.         |
| <b>Environmental Sustainability and Resilience</b> | 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. |
| <b>Inclusive Rural Economy</b>                     | Improved infrastructure and service delivery to activate rural economies                                                                  | Installation of networks as required.                                                                                          | Continuous implementation.                                                                                                                                         |
| <b>Social Protection</b>                           | 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.                                                                                                               |

## LANGEBERG MUNICIPALITY

### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

## 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.

Robertson area of supply has a total of 30 SSEG installations with a total of 1,556.68 kW installed capacity. The total installed capacity of SSEG's in Langeberg Municipal area is 1,863.28kW.

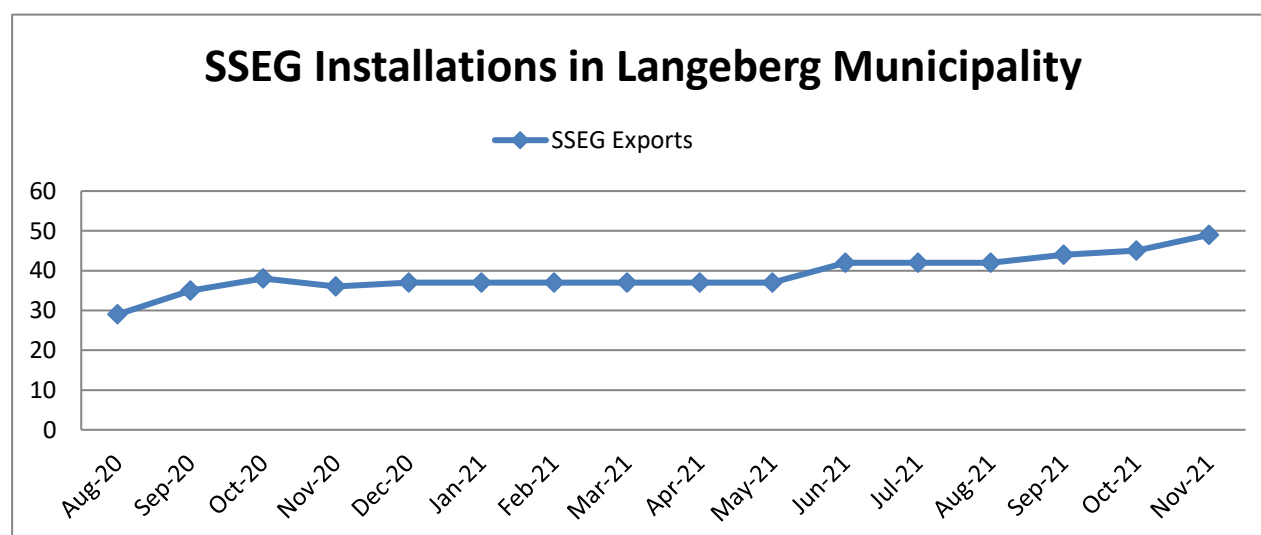


Figure 6: SSEG Installations in Langeberg Municipal Area

### 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 9. Residential, Small Business, Medium Business and Large Business installations were considered.

## LANGEBERG MUNICIPALITY

### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

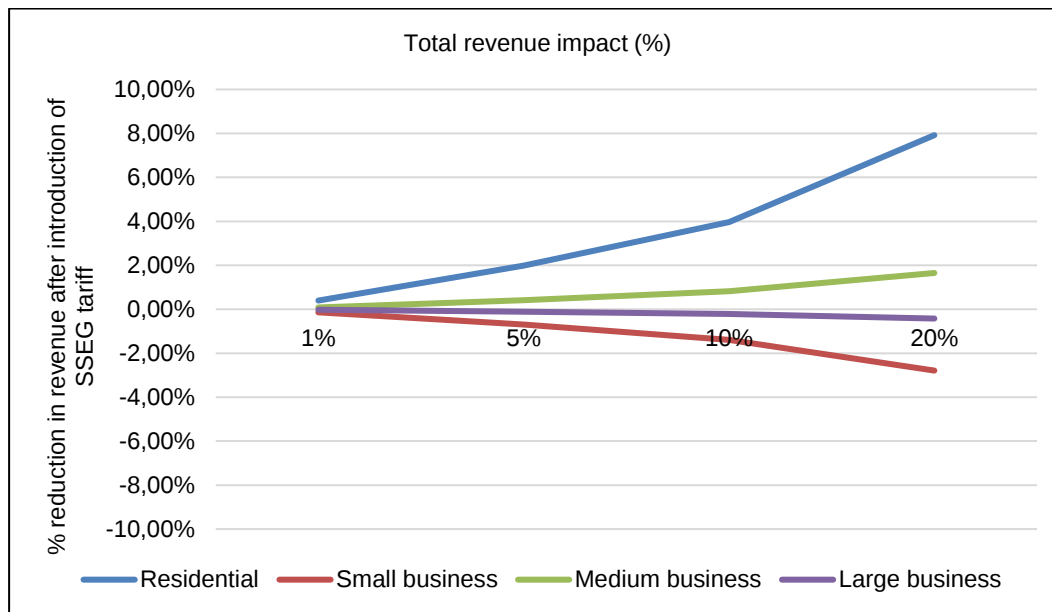


Figure 7: Revenue Impact of SSEG Installations

### 8.3 ALTERNATIVE ENERGY SUPPLY FOR MUNICIPAL BUILDINGS

A 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. The available north facing roof space allows for a total of 25.9kW of solar PV panels to be installed.

The annual production report is included in Appendix 10.

Typical costs of installation would be in the region of R450,000.00 (Excl VAT). This estimate excludes battery backup.

With detailed load profile information and electricity usage, a proper investigation can be done, and the system proposed could be optimised to suite requirements.

A typical payback periods for similar systems would be within 10 years.

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### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

#### 8.4 ALTERNATIVE ENERGY SUPPLY OPTION FOR MUNICIPAL FEED IN POINTS

A high-level investigation into the possibility of implementing a 5MWp (DC) solar PV plant at the Robertson Main substation has been undertaken. The area directly at the back of the substation was used as a hypothetical area that could be utilised for the plant. An area of approximate 4.7 Ha would be required and the estimated annual production would be around 8.8GWh, refer to Appendix 11 for the simulation report.

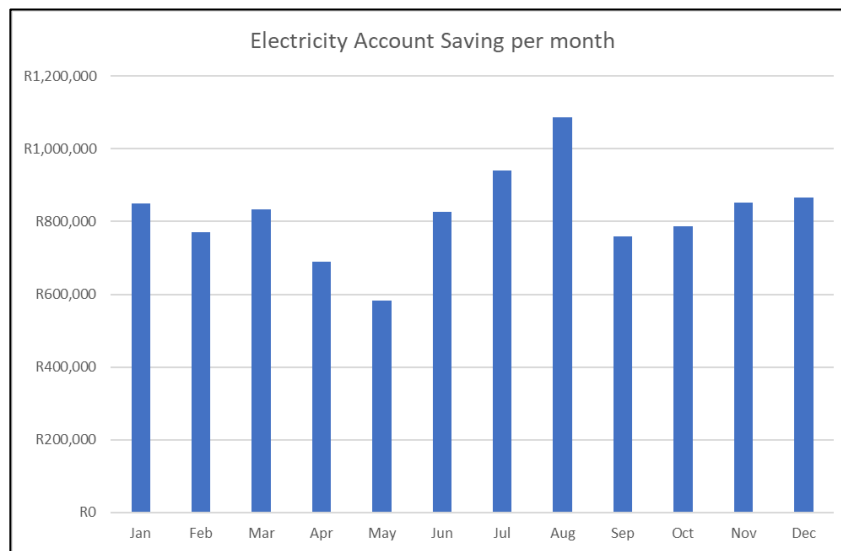
Below is a high-level cost estimate of both the capital and operation costs:

|                                    |                   |
|------------------------------------|-------------------|
| <b>Capital Costs</b>               |                   |
|                                    |                   |
| <b>Solar PV Plant</b>              | <b>Total</b>      |
| - Solar PV                         | 60,000,000        |
| -Perimeter Fence (electrified)     | 3,468,000         |
| - CCTV                             | 1,500,000         |
| - Sundries                         | 1,000,000         |
| - Contingencies                    | 6,596,800         |
| <b>Sub-total 1:</b>                | <b>72,564,800</b> |
|                                    |                   |
| <b>Grid Connection</b>             |                   |
| - Cable works                      | 750,000           |
| - Substation works                 | 1,000,000         |
| - Contingencies                    | 175,000           |
| <b>Sub-total 2:</b>                | <b>1,925,000</b>  |
|                                    |                   |
| <b>Professional Fees and Costs</b> |                   |
| - Professional Fees                | 6,704,082         |
| - Professional Costs               | 670,408           |
| <b>Sub-total 3:</b>                | <b>7,374,490</b>  |
|                                    |                   |
| <b>Total (Sub-total 1+2+3)</b>     | <b>81,864,290</b> |
|                                    |                   |
| <b>Operational Costs per Annum</b> | <b>1,250,000</b>  |

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 R9.84million. The chart below indicates the estimated saving per month:

## LANGEBERG MUNICIPALITY

### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

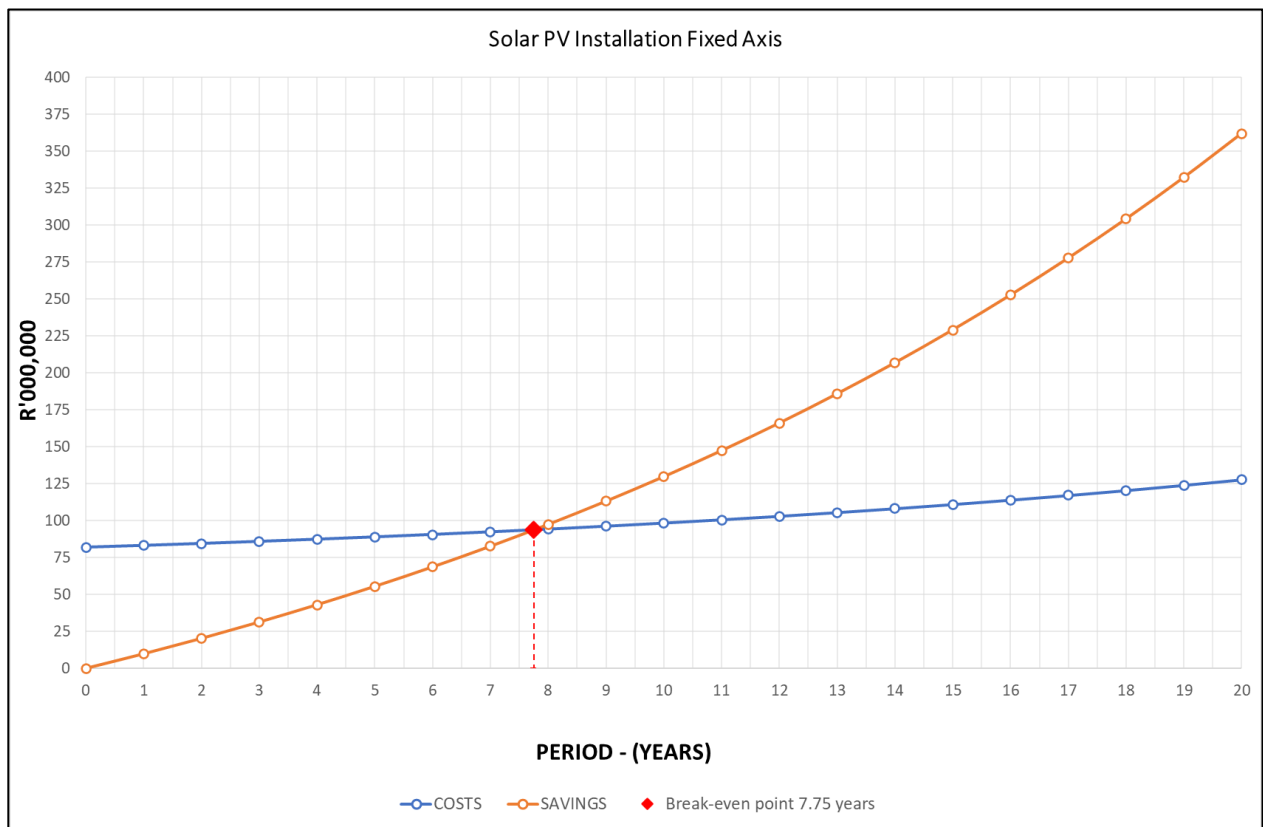


From the above a simple payback has been calculated without accounting for the costs of capital or the time cost of money. An annually compounded inflation rate of 6% has been assumed for both the O&M costs as well as tariff increases. The calculation indicates a break-even point of 7.752 years:

| Solar PV - Fixed Axis |                    |           |                      |           |                           |
|-----------------------|--------------------|-----------|----------------------|-----------|---------------------------|
| PERIOD                | Costs (R 'million) |           | Savings (R 'million) |           | NET Cashflow (R 'million) |
|                       | OPEX               | Cum total | Annual               | Cum total |                           |
| 0                     |                    | 81.86     |                      | 0         | 81.864                    |
| 1                     | 1.250              | 83.11     | 9.845                | 9.845     | 73.270                    |
| 2                     | 1.325              | 84.44     | 10.435               | 20.280    | 64.159                    |
| 3                     | 1.405              | 85.84     | 11.061               | 31.341    | 54.503                    |
| 4                     | 1.489              | 87.33     | 11.725               | 43.066    | 44.266                    |
| 5                     | 1.578              | 88.91     | 12.429               | 55.495    | 33.416                    |
| 6                     | 1.673              | 90.58     | 13.174               | 68.669    | 21.914                    |
| 7                     | 1.773              | 92.36     | 13.965               | 82.634    | 9.723                     |
| 8                     | 1.880              | 94.24     | 14.803               | 97.436    | -3.200                    |
| 9                     | 1.992              | 96.23     | 15.691               | 113.127   | -16.899                   |
| 10                    | 2.112              | 98.34     | 16.632               | 129.759   | -31.419                   |
| 11                    | 2.239              | 100.58    | 17.630               | 147.389   | -46.810                   |
| 12                    | 2.373              | 102.95    | 18.688               | 166.077   | -63.126                   |
| 13                    | 2.515              | 105.47    | 19.809               | 185.886   | -80.419                   |
| 14                    | 2.666              | 108.13    | 20.998               | 206.884   | -98.751                   |
| 15                    | 2.826              | 110.96    | 22.258               | 229.142   | -118.183                  |
| 16                    | 2.996              | 113.95    | 23.593               | 252.735   | -138.780                  |
| 17                    | 3.175              | 117.13    | 25.009               | 277.744   | -160.613                  |
| 18                    | 3.366              | 120.50    | 26.509               | 304.253   | -183.756                  |
| 19                    | 3.568              | 124.06    | 28.100               | 332.352   | -208.288                  |
| 20                    | 3.782              | 127.85    | 29.786               | 362.138   | -234.292                  |

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**ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY**



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## 8.5 ALTERNATIVE ENERGY SUPPLY ON HIGH VOLTAGE NETWORK

The grid capacity of renewable energy that can be installed on the Municipal HV (66kV) system without causing stability problems envisaged by NRS097 has been assessed. This entails the two 66kV feeders from Robertson Main SS to Goudmyn SS and from Robertson Main SS to Le Chasseur SS.

The maximum capacity that can be added to each of these lines are limited by the rapid voltage change as a percentage of the nominal voltage  $\Delta U/U_n$  limit. Rapid voltage changes (dips and surges) can occur during sudden energization or de-energization of network components for example a fault on the generator, or a sudden drop in active power e.g. drop in wind in case of wind turbines, or sudden cloud cover in the case of PV installations. NRS048-4 provides indicative planning levels for rapid voltage changes at HV level as a function of frequency of repetition:

| Repetition rate of changes in a period of time<br>$r$ | Rapid voltage changes as a percentage of nominal voltage<br>$\Delta U/U_n$<br>% |
|-------------------------------------------------------|---------------------------------------------------------------------------------|
| $r \leq 1$ per day                                    | 3-5                                                                             |
| $1 < r \leq 4$ per day                                | 3-4                                                                             |
| $r \leq 1$ per hour                                   | 3                                                                               |
| $1 < r \leq 10$ per hour                              | 2,5                                                                             |

For the purposes of this study and as an additional precaution a maximum  $\Delta U/U_n$  limit of 3% has been used. This allow for further voltage drop on the Eskom network upstream of the 132/66kV substation that might be present. Further studies should confirm this assumption in consultation with Eskom.

The total demand of 36MVA at Robertson Main SS and 10MVA at each of the two substations (Goudmyn and Le Chasseur) have been used as a worst-case scenario.

## LANGEBERG MUNICIPALITY

### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

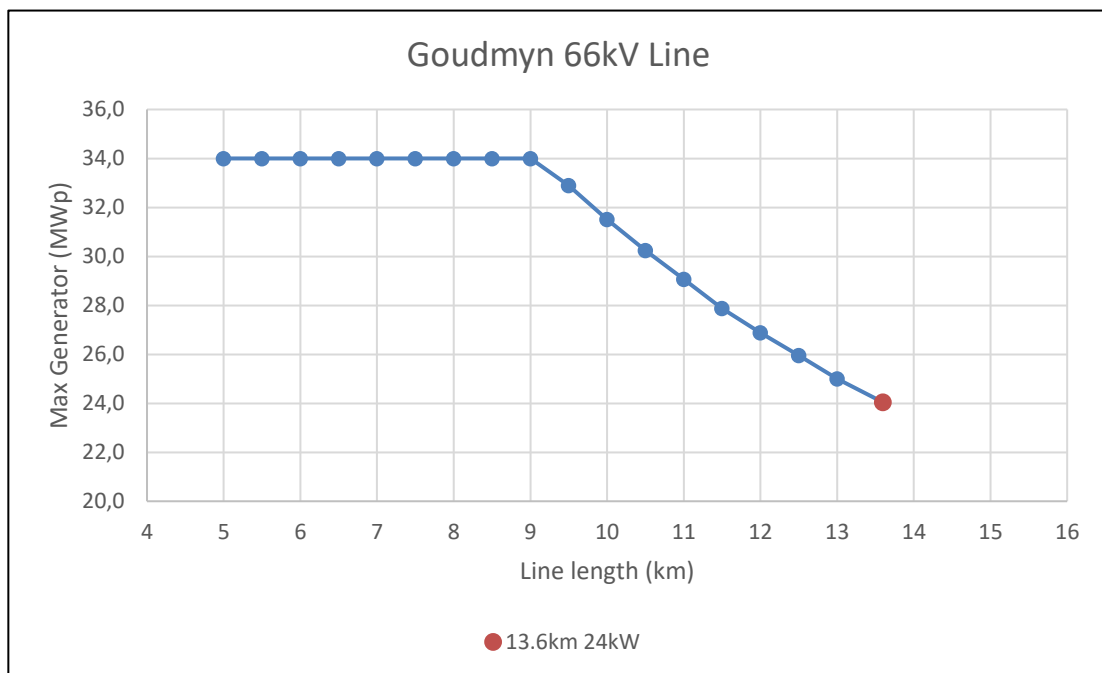
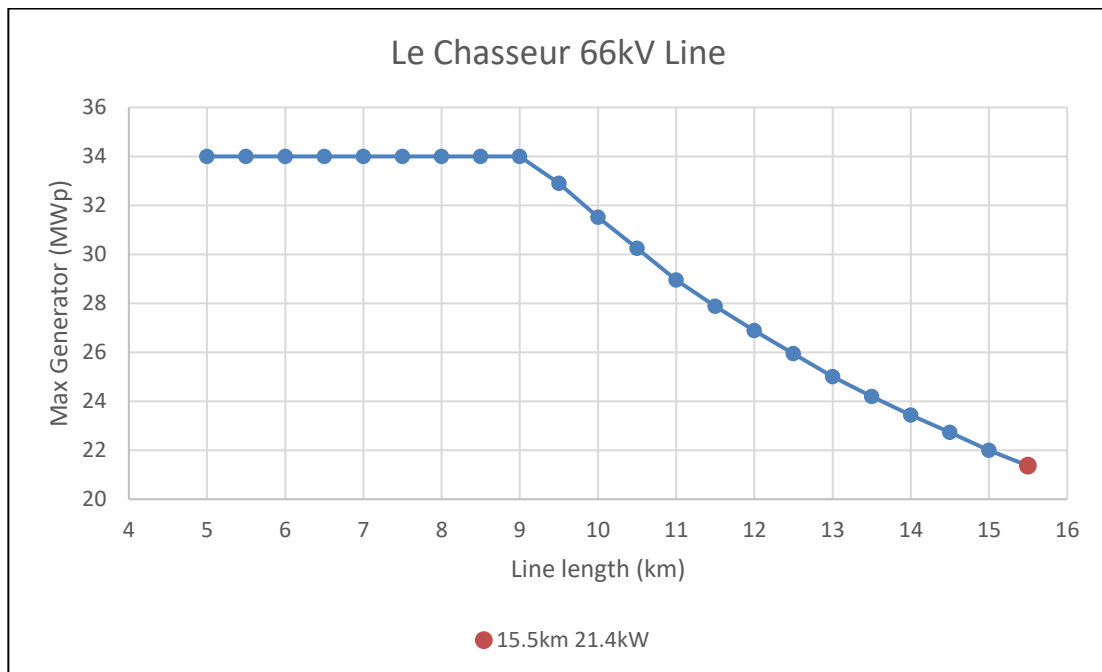
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Both feeders are single circuit Raccoon conductor with a transfer capacity of 300A, the maximum generator that can be added to either feeder is therefore capped to 34MVA. Below charts indicate the results i.e.:

- The maximum generation capacity that can be connected to Goudmyn SS @ 66kV is 24kWp
- The maximum generation capacity that can be connected to Le Chasseur SS @ 66kV is 21kWp
- The maximum cap of 34MW is reached at approximately 9km from Robertson Main SS on both lines.

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## LANGEBERG MUNICIPALITY

### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

## 8.6 OPTION TO REDUCE NMD THROUGH ENERGY STORAGE

The option to reduce the current NMD at Robertson Main Substation through a grid size battery energy storage system (BESS) has been considered.

Two days during the preceding 12 month period (June 2021 to May 2022) has been used to determine the typical storage capacity that would be required:

- 15 February 2022, Highest maximum demand with no load shedding – 33.98MVA
- 10 March 2022, Highest maximum demand with load shedding – 36.84MVA

The following parameters has been used in setting up the storage model:

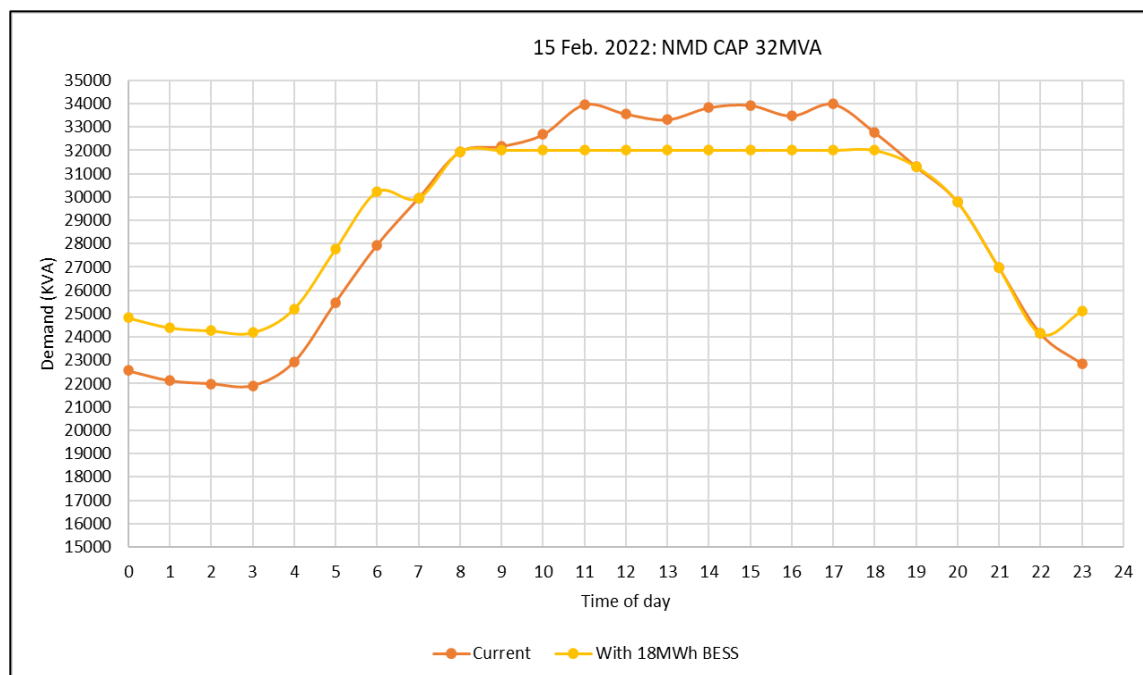
BESS Round Trip efficiency – 88%

Maintenance Factor - 95%

Spare Capacity - 10%

BESS total cost - USD400/kWh

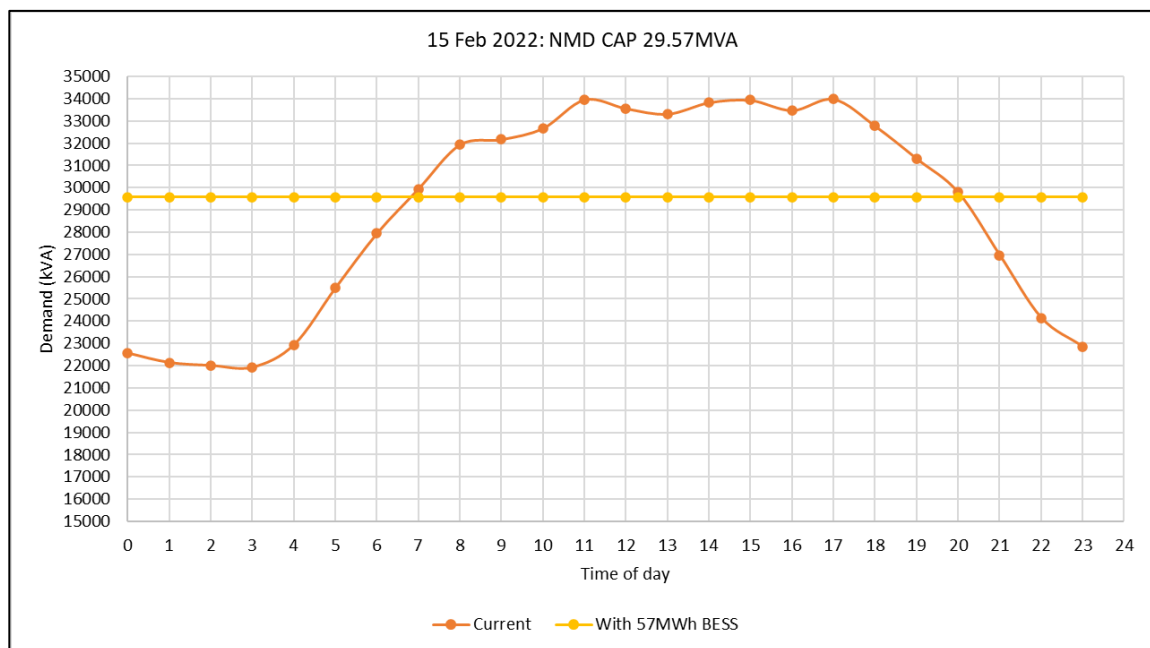
As an example, the maximum demand for 15 Feb. 2022 can be reduced to 32MVA by adding a battery storage system with a capacity of 18MWh, as shown in the below chart:



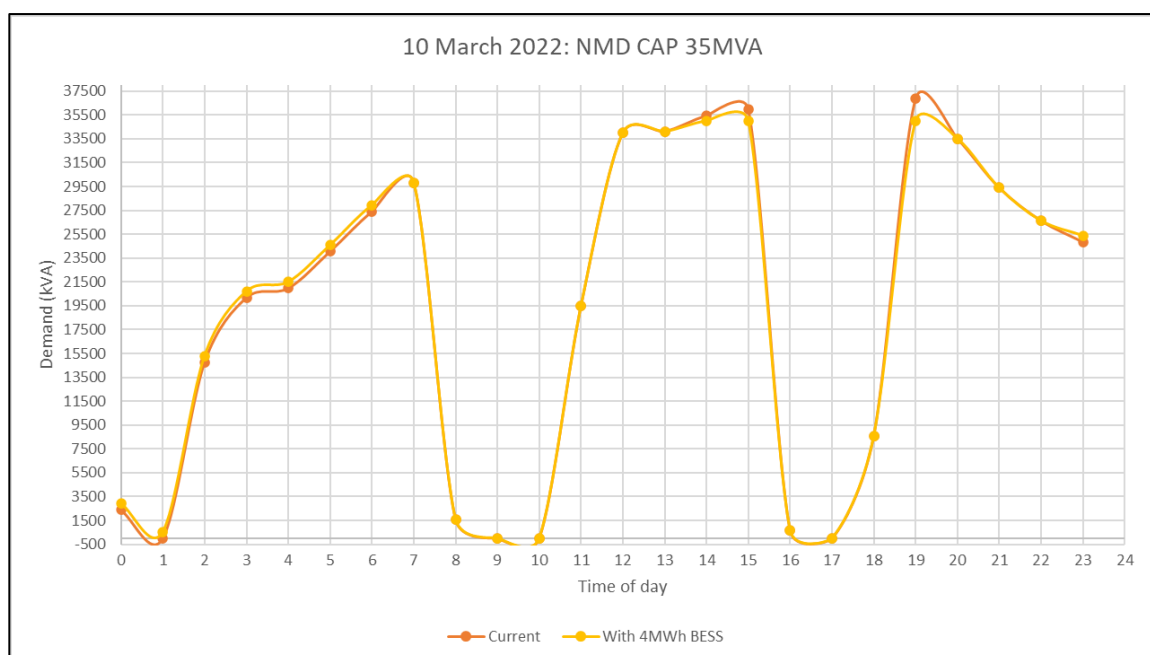
## LANGEBERG MUNICIPALITY

### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

The lowest the demand can be reduced to for 15 February 2022 is 29.57MVA, which will require a BESS of 57MWh:



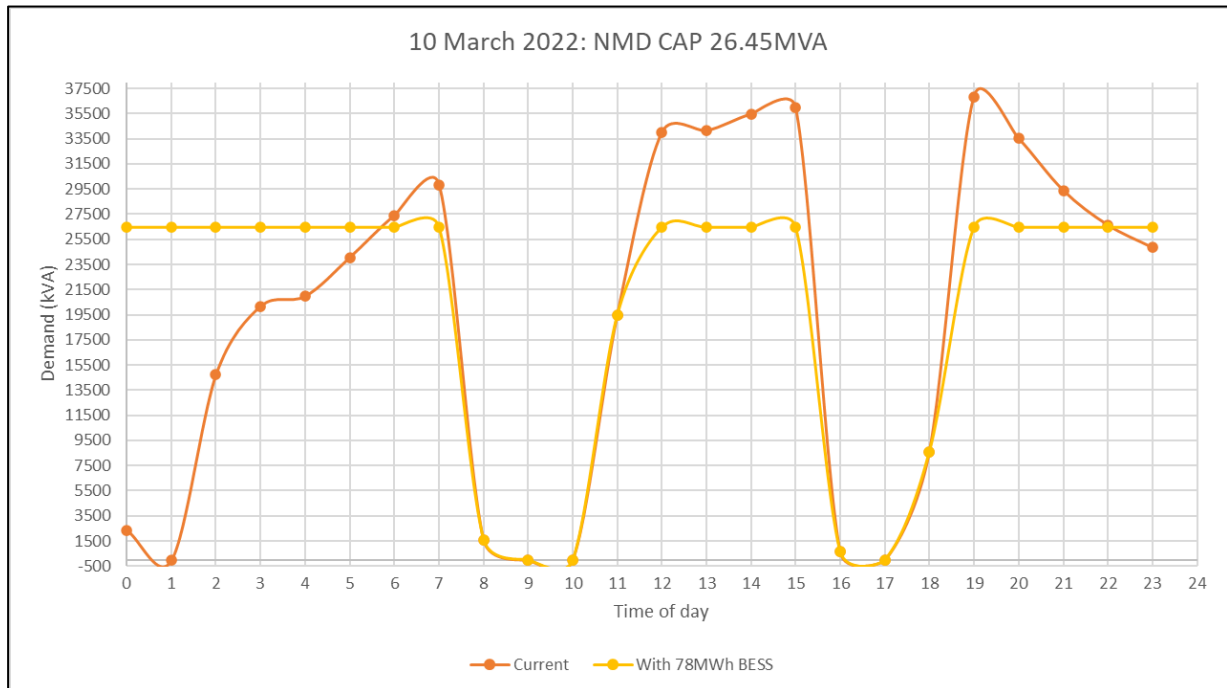
Similarly for 10 March 2022, the maximum demand can be reduced to 35MVA by adding a BESS of 4MWh:



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The lowest the demand for 10 March 2022 can be reduced to is 26.45MVA which will require a BESS of 78MWh:



The below tables summarize the required BESS capacity for a reduced NMD for both days being considered including the typical capital costs for the system/s:

| 15-Mar-22            | Maximum Demand<br>34MVA |                  |
|----------------------|-------------------------|------------------|
| Reduced Demand (MVA) | BESS (MWh)              | Cost (USD '1000) |
| 33                   | 7                       | \$2,694          |
| 32                   | 18                      | \$7,276          |
| 31                   | 33                      | \$13,251         |
| 30                   | 49                      | \$19,631         |
| 29.57                | 57                      | \$22,706         |

| 10-Mar-22            | Maximum Demand<br>36MVA |                  |
|----------------------|-------------------------|------------------|
| Reduced Demand (MVA) | BESS (MWh)              | Cost (USD '1000) |
| 35                   | 4                       | \$1,722          |
| 34                   | 8                       | \$3,381          |
| 33                   | 16                      | \$6,314          |
| 32                   | 24                      | \$9,504          |
| 30                   | 40                      | \$15,884         |
| 26.45                | 78                      | \$31,184         |

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An additional advantage of the BESS is that although the round trip efficiency is around 88% the system will predominantly charge during off-peak periods and discharge during peak periods thereby achieving a significant overall saving in energy costs. This saving can be utilized throughout the year. To quantify the potential saving a business plan will need to be prepared by simulating a full year's utilization of the BESS and applying the applicable energy tariffs and cost of capital. This study is outside the scope of the masterplan.

## 9 FUTURE DEVELOPMENTS / LOAD GROWTH FORECAST

### 9.1 HISTORIC LOAD GROWTH TREND

Historic maximum demand figures for the Robertson MV network, which include Le Chasseur and Goudmyn on the 66kV bus were:

- Year 2000 : 24.57MVA
- Year 2005 : 24.95MVA
- Year 2010 : 30.48MVA
- Year 2015 : 33.10MVA
- Year 2020 : 36.76MVA

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 1.85% year on year average. It is believed that this growth trend will continue for the Robertson area. Using the historical figures, a graph was compiled to forecast future growth and included below:

## LANGEBERG MUNICIPALITY

### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

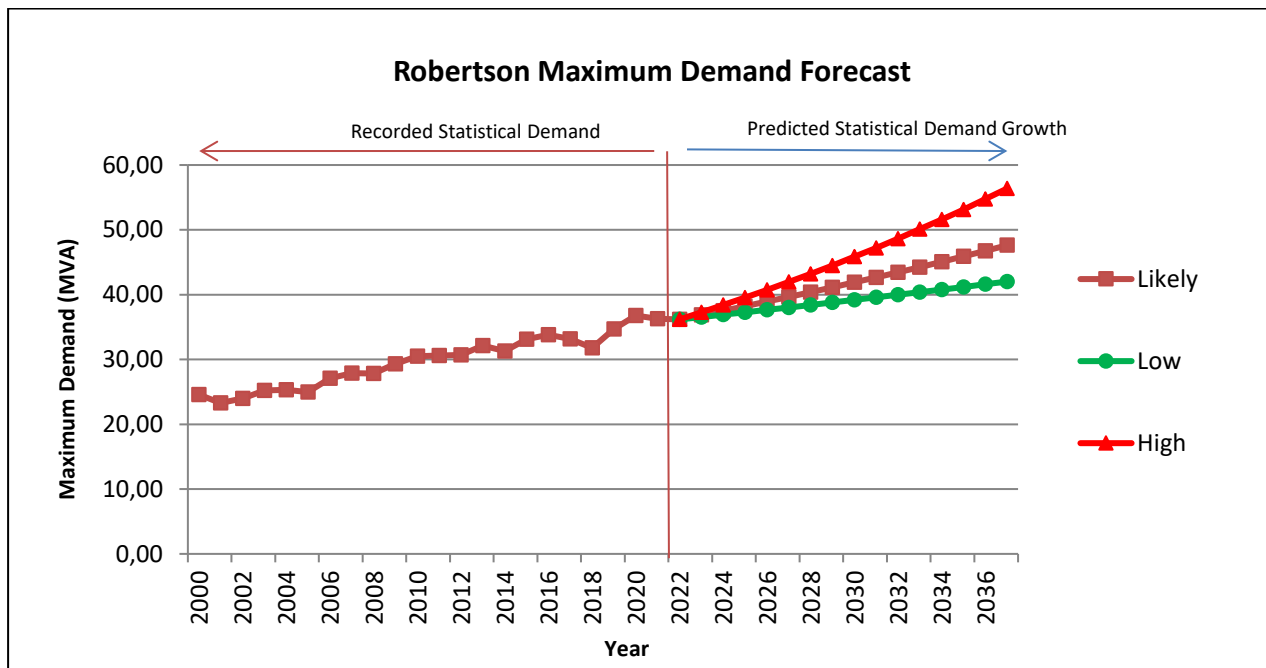


Figure 8: Robertson Maximum Demand Forecast

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

| Growth Prediction | Current   | 2027      | 2032      |
|-------------------|-----------|-----------|-----------|
| Low (1%)          | 36.18 MVA | 38.03 MVA | 39.97 MVA |
| Likely (1.85%)    |           | 39.65 MVA | 43.45 MVA |
| High (3%)         |           | 41.95 MVA | 48.63 MVA |

## LANGEBERG MUNICIPALITY

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## 9.2 PROPOSED DEVELOPMENTS

The proposed future developments as indicated on the layout in Appendix 12 and detailed forecast in Appendix 13 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 Robertson network is subject to several new residential and commercial developments evident from the application for electricity supply already submitted to the municipality for these developments.

Further to this, the correspondence received from large power users in the Robertson area indicate a positive response for increase in demand in future.

Also, important to note that correspondence received from the Sentraal Breërivier Watergebruikersvereniging indicated that new water channels are in the process of being implemented from the Greater Brandvlei Water Scheme amounting to an approximate increase of 20%. This increase will require an increase in demand related to new pumping equipment (river and irrigation pumps), pack stores, cellars etc.

Only loads of significant size are demonstrated separately, the remaining form part of the "Other Load Growth"

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

## LANGEBERG MUNICIPALITY

### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

Summary of Load Growth Forecast:

| Layout / Reference Number | Possible Developments                 | Area (Ha) | Number of erven | Total Load (kVA) | Growth | Coinc. Factor | 2022   | 2023   | 2024   | 2025   | 2026   | 2027   | 2028   | 2029   | 2030   | 2031   | 2032   |
|---------------------------|---------------------------------------|-----------|-----------------|------------------|--------|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                           |                                       |           |                 |                  |        |               |        |        |        |        |        |        |        |        |        |        |        |
|                           | Developments as per detailed Appendix |           |                 |                  |        |               |        |        |        |        |        |        |        |        |        |        |        |
|                           |                                       |           |                 |                  |        |               |        |        |        |        |        |        |        |        |        |        |        |
|                           | Other Load Growth                     |           |                 | 51,690           | 1.85%  | 0.7           | 51,525 | 52,478 | 53,449 | 54,438 | 55,445 | 56,471 | 57,515 | 58,579 | 59,663 | 60,767 | 61,891 |
|                           |                                       |           |                 |                  |        |               |        |        |        |        |        |        |        |        |        |        |        |
|                           | Total undiversified                   |           |                 |                  |        |               | 51,690 | 53,565 | 56,028 | 58,527 | 60,663 | 64,637 | 66,865 | 69,170 | 71,341 | 73,483 | 76,542 |
|                           | Total diversified (kVA)               |           |                 |                  |        |               | 36,183 | 37,425 | 39,080 | 40,759 | 42,184 | 44,756 | 46,105 | 47,509 | 48,819 | 50,108 | 52,039 |
|                           | Total diversified (MVA)               |           |                 |                  |        |               | 36.18  | 37.43  | 39.08  | 40.76  | 42.18  | 44.76  | 46.11  | 47.51  | 48.82  | 50.11  | 52.04  |
|                           | Notified Maximum Demand               |           |                 |                  |        |               | 36.00  | 38.00  | 38.00  | 38.00  | 38.00  | 38.00  | 38.00  | 38.00  | 38.00  | 38.00  | 38.00  |
|                           |                                       |           |                 |                  |        |               |        |        |        |        |        |        |        |        |        |        |        |

**LANGEBERG MUNICIPALITY****ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY**

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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:

- Robertson, including Goudmyn and Le Chasseur

The load flow simulations were performed on the network to provide insight into the Robertson 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 1.85% 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 Robertson MV Network, including Le Chasseur and Goudmyn at 66kV, represents a diversified maximum demand of 36.183MVA (measured in March 2022). This implies that the Robertson MV network (Excluding Le Chasseur at 3.8MVA and Goudmyn at 9MVA) has a diversified maximum demand of 23.38MVA (36.183MVA – 12.80MVA).

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### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

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The Robertson MV Network (excluding Le Chasseur and Goudmyn) has a total installed capacity of 54.900MVA. Therefore, the Robertson network appears relatively lightly loaded, with a demand factor of approximately 0.43 ( $23.380 / 54.900 = 0.43$ ).

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 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 are three 15MVA 66/11kV transformer which supplies the Robertson MV network.

The simulation was performed applying a scaling factor of 0.75 to all the loads, which returned a maximum demand of 36.2 MVA compared to the actual maximum demand of 36.183 MVA. A difference of 17kVA, which is an acceptable difference.

Refer to Appendix 14 for the current maximum demand load flow analysis.

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#### 10.2.1.1 PROSPECTIVE FAULT CURRENT STUDY

The prospective short circuit fault current study was performed, and results included in Appendix 15. 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.

The study was done with all three transformers operating in parallel and with the two bus sections closed. This indicated the worst-case scenario.

#### 10.2.1.2 VOLTAGE LEVEL STUDY

Refer to Appendix 16. The following feeders exceed the voltage limits, the highest percentage voltage drop is indicated below:

| Feeder                   | Load       | Percentage |
|--------------------------|------------|------------|
| WHITE STR 2 (BERGSIG SS) | SHELL      | 3.62%      |
| WATERWERKE (WATSON RMU)  | WATSONIA   | 3.69%      |
| DROEHEUWEL SS (HAHN)     | BLOEKOMBOS | 3.95%      |
| WATERWERKE SS (AFRICA)   | IGLOO      | 4.36%      |
| WATERWERKE SS (COETZEE)  | GUM GROVE  | 5.12%      |

All the above loads are fed from the GOEDEHOOP – WATERWERKE feeder.

It should also be noted that although some of the feeders do exceed the voltage limits, automatic voltage regulation is done on the power transformers feeding the 11kV main busbar via tap changers. Voltage measurements are taken from the busbar and according to predetermined set bandwidths, the tap changers will automatically adjust the voltage to the required level.

The other feeders are all within limits.

#### 10.2.1.3 CONDUCTOR THERMAL CAPACITY STUDY

Refer to Appendix 17. The feeders' percentage loading indicated below:

## LANGEBERG MUNICIPALITY

### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

| Main Switching Station Feeders | Thermal Loading |
|--------------------------------|-----------------|
| ROBERTSON KELDER RMU           | 49.3%           |
| INDUSTRIELE SS                 | 37.8%           |
| NESTLE                         | 7.2%            |
| GOEDEHOOP 1                    | 13.7%           |
| RIPPLE RMU                     | 34.8%           |
| GOEDEHOOP                      | 120.8%          |
| WHITE STR SS 2                 | 56.6%           |
| WHITE STR SS 1                 | 47.3%           |
| KWV RMU                        | 86%             |

The feeder from Muiskraalskop switching station to Goedeheop SS and feeder from Goedeheop to Waterwerke SS exceeds its thermal limit.

The Bergsig SS feeder from White Str SS exceeds its thermal limits (118.6%).

The feeders to the rural areas namely Langvlei, McGregor, Noree, Ashton, Le Chasseur etc are not indicated above as the sizes of the feeders are not known. The maximum demand load for each feeder was included in the simulation.

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 0.825 to all the loads, which returned a maximum demand of 39.90 MVA compared to the predicted maximum demand of 39.65 MVA. This was done prior to the adding of any known future loads

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### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

The following loads were added:

| Description – 5 Year                  | kVA                                  |
|---------------------------------------|--------------------------------------|
| Mixed use Residential (1)             | $430 \times 0.7 = 301\text{kVA}$     |
| Mixed use Residential (21)            | $144 \times 0.7 = 101\text{kVA}$     |
| GAP Housing (2)                       | $247 \times 0.7 = 173\text{kVA}$     |
| Residential (4, 5, 6, 7)              | $280 \times 0.7 = 196\text{kVA}$     |
| Residential (9)                       | $68 \times 0.7 = 48\text{kVA}$       |
| Robertson Lifestyle Estate (18)       | $540 \times 0.7 = 378\text{kVA}$     |
| Mixed use Residential/Industrial (19) | $200 \times 0.7 = 140\text{kVA}$     |
| Market Related Residential (22)       | $303 \times 0.7 = 212\text{kVA}$     |
| Industrial (23)                       | $500 \times 0.7 = 350\text{kVA}$     |
| Industrial (24, 25)                   | $400 \times 0.7 = 280\text{kVA}$     |
| Lucerne Pack (30)                     | $500 \times 0.7 = 350\text{kVA}$     |
| Swiegers Broers (31)                  | $300 \times 0.7 = 210\text{kVA}$     |
| Wandsbeck (32)                        | $100 \times 0.7 = 70\text{kVA}$      |
| 1 van Graan (33)                      | $75 \times 0.7 = 53\text{kVA}$       |
| Skultheplaas (34)                     | $50 \times 0.7 = 35\text{kVA}$       |
| Freshness First Pack (36)             | $500 \times 0.7 = 350\text{kVA}$     |
| Grootrivier (41)                      | $50 \times 0.7 = 35\text{kVA}$       |
| Laerskool Dagbreek (42)               | $100 \times 0.7 = 70\text{kVA}$      |
| Habatha (43, 44, 45)                  | $500 \times 0.7 = 350\text{kVA}$     |
| Springfield (47)                      | $50 \times 0.7 = 35\text{kVA}$       |
| Robertson Water Works (48)            | $100 \times 0.7 = 70\text{kVA}$      |
| Robertson Winery                      | $1,000 \times 0.7 = 700\text{kVA}$   |
| Roodezandt                            | $400 \times 0.7 = 280\text{kVA}$     |
|                                       |                                      |
| <b>Total</b>                          | $6,837 \times 0.7 = 4,786\text{kVA}$ |

## LANGEBERG MUNICIPALITY

### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

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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 18 for the 5-year maximum demand load flow analysis.

#### 10.2.2.1 VOLTAGE LEVEL STUDY

Refer to Appendix 19. The following feeders exceed the voltage limits, the highest percentage voltage drop is indicated below:

| Feeder                   | Load       | Percentage |
|--------------------------|------------|------------|
| WHITE STR 2 (BERGSIG SS) | SHELL      | 4.23%      |
| WATERWERKE (WATSON RMU)  | WATSONIA   | 4.53%      |
| DROEHEUWEL SS (HAHN)     | BLOEKOMBOS | 4.86%      |
| WATERWERKE SS (AFRICA)   | IGLOO      | 5.38%      |
| WATERWERKE SS (COETZEE)  | GUM GROVE  | 6.03%      |

As per the Current Load Flow Analysis voltage study the above loads are all fed from the GOEDEHOOP – WATERWERKE feeder.

#### 10.2.2.2 CONDUCTOR THERMAL CAPACITY STUDY

Refer to Appendix 20. The feeders' percentage loading indicated below:

| Main Switching Station Feeders | Thermal Loading |
|--------------------------------|-----------------|
| ROBERTSON KELDER RMU           | 70.6%           |
| INDUSTRIELE SS                 | 41.3%           |
| NESTLE                         | 22.1%           |
| GOEDEHOOP 1                    | 15.2%           |
| RIPPLE RMU                     | 50.7%           |
| GOEDEHOOP                      | 149.4%          |

## LANGEBERG MUNICIPALITY

### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

|                |       |
|----------------|-------|
| WHITE STR SS 2 | 64.1% |
| WHITE STR SS 1 | 64.1% |
| KWV RMU        | 99.9% |

As per the current status the feeder from Muiskraalskop switching station to Goedeheop SS and feeder from Goedeheop to Waterwerke SS exceeds its thermal limit.

The Bergsig SS feeder from White Str SS has further exceeded its thermal limits (138.5%).

The remainder of the feeders operate within their thermal limits.

#### 10.2.3 10-YEAR MAXIMUM DEMAND LOAD FLOW

Simulation 3 was performed applying a scaling factor of 0.9 to all the loads, which returned a maximum demand of 43.5 MVA compared to the predicted maximum demand of 43.45 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                                  |
|---------------------------------------|--------------------------------------|
| Mixed use Residential (1)             | $1,504 \times 0.7 = 1,053\text{kVA}$ |
| Mixed use Residential (21)            | $402 \times 0.7 = 281\text{kVA}$     |
| Residential (4, 5, 6, 7)              | $349 \times 0.7 = 244\text{kVA}$     |
| Residential (9)                       | $409 \times 0.7 = 286\text{kVA}$     |
| Medium Density Residential            | $338 \times 0.7 = 237\text{kVA}$     |
| Mixed use Commercial                  | $500 \times 0.7 = 350\text{kVA}$     |
| Robertson Lifestyle Estate (18)       | $990 \times 0.7 = 693\text{kVA}$     |
| Mixed use Residential/Industrial (19) | $1,200 \times 0.7 = 840\text{kVA}$   |
| Market Related Residential (22)       | $507 \times 0.7 = 355\text{kVA}$     |
| Industrial (23)                       | $1,000 \times 0.7 = 700\text{kVA}$   |

## LANGEBERG MUNICIPALITY

### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

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|                      |                                       |
|----------------------|---------------------------------------|
| Industrial (24, 25)  | $900 \times 0.7 = 630\text{kVA}$      |
| Swiegers Broers (31) | $500 \times 0.7 = 350\text{kVA}$      |
| Robertson Winery     | $1,500 \times 0.7 = 1,050\text{kVA}$  |
| Roodezandt           | $800 \times 0.7 = 560\text{kVA}$      |
|                      |                                       |
| Total                | $10,899 \times 0.7 = 7,629\text{kVA}$ |

Refer to Appendix 21 for the 10-year maximum demand load flow analysis.

#### 10.2.3.1 VOLTAGE LEVEL STUDY

Refer to Appendix 22. The following feeders exceed the voltage limits, the highest percentage voltage drop is indicated below:

| Feeder                   | Load       | Percentage |
|--------------------------|------------|------------|
| WHITE STR 2 (BERGSIG SS) | SHELL      | 4.75%      |
| WATERWERKE (WATSON RMU)  | WATSONIA   | 5.40%      |
| DROEHEUWEL SS (HAHN)     | BLOEKOMBOS | 5.76%      |
| WATERWERKE SS (AFRICA)   | IGLOO      | 6.20%      |
| WATERWERKE SS (COETZEE)  | GUM GROVE  | 7.11%      |

All the above loads are all fed from the GOEDEHOOP – WATERWERKE feeder.

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### ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

#### 10.2.3.2 CONDUCTOR THERMAL CAPACITY STUDY

Refer to Appendix 23. The feeders' percentage loading indicated below:

| Main Switching Station Feeders | Thermal Loading |
|--------------------------------|-----------------|
| ROBERTSON KELDER RMU           | 82.9%           |
| INDUSTRIELE SS                 | 49.2%           |
| NESTLE                         | 38.6%           |
| GOEDEHOOP 1                    | 16.5%           |
| RIPPLE RMU                     | 81.1%           |
| GOEDEHOOP                      | 179.4%          |
| WHITE STR SS 2                 | 78.4%           |
| WHITE STR SS 1                 | 58.6%           |
| KWV RMU                        | 115.72%         |

As per the current status the feeder from Muiskraalskop switching station to Goedeheop SS and feeder from Goedeheop to Waterwerke SS exceeds its thermal limit.

The Bergsig SS feeder from White Str SS has further exceeded its thermal limits (155.4%).

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 Robertson 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 |                           | 1] Close N/O point: Kelder RMU fed from | A] Goedeheop Laan 1 Feeder remains at 13% |

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| # | Critical Supply Scenarios                                    | Action Required                                                                     | Effect on Network                                                                                                                                                                                                                                                                                                 |
|---|--------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | Fault on Feeder: Robertson Kelder                            | Nestle feed in Muiskraalskop Substation                                             | B] Nestle Feeder from 7.2% to 56.9%<br>C] Goedehoop Laan 2 Feeder remains at 120.8%<br>D] White Street 1 Feeder remains at 47.3%<br>E] Load Control Feeder remains at 34.8%<br>F] White Street 2 feeder remains at 56.6%<br>G] KWV Feeder remains at 86%                                                          |
| 2 | Fault on Feeder: Nestle                                      | 1] Close N/O point: Kelder RMU fed from Nestle feed in Muiskraalskop Substation     | A] Goedeheoop Laan 1 Feeder remains at 13%<br>B] Robertson Kelder Feeder from 49.3% to 56.8%<br>C] Goedehoop Laan 2 Feeder remains at 120.8%<br>D] White Street 1 Feeder remains at 47.3%<br>E] Load Control Feeder remains at 34.8%<br>F] White Street 2 feeder remains at 56.6%<br>G] KWV Feeder remains at 86% |
| 3 | Fault on Feeder: Goedeheoop Laan in Muiskraalskop Substation | 1] Close n/o point: Goedeheoop Laan Substation situated in Muiskraalskop Substation | A] Goedeheoop Laan Feeder increases from 0% to 75.1%<br>B] Robertson Kelder Feeder remains at 29.3%<br>C] Nestle Feeder remains at 5.3%<br>D] White Street 1 Feeder remains at 75.6%                                                                                                                              |

# LANEBERG MUNICIPALITY

## ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

| # | Critical Supply Scenarios                                   | Action Required                                                  | Effect on Network                              |
|---|-------------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------|
|   |                                                             | 2] Close n/o point: Muiskraalskop 1 at Goedeheop Laan Substation | E] Load Control Feeder remains at 68.2%        |
|   |                                                             |                                                                  | F] White Street 2 feeder remains at 63.6%      |
|   |                                                             |                                                                  | G] KWV Feeder remains at 56.8%                 |
| 4 | Fault on Feeder: White Street 1 in Muiskraalskop Substation | 1] Close N/O point: Waterwerke at White Str 1 Substation         | A] Goedeheop Laan 1 Feeder remains at 13%      |
|   |                                                             |                                                                  | B] Robertson Kelder Feeder remains at 49.3%    |
|   |                                                             |                                                                  | C] Nestle Feeder remains at 7.2%               |
|   |                                                             |                                                                  | D] Goedeheop Laan 2 Feeder from 73.6% to 41.3% |
|   |                                                             |                                                                  | E] Load Control Feeder remains at 34.8%        |
|   |                                                             |                                                                  | F] White Street 2 feeder from 63.6% to 86.6%   |
|   |                                                             | 2] Close N/O point: Victoria RMU                                 | G] KWV Feeder from 86% to 108.8%               |
| 5 | Fault on Feeder: Load Control                               | 1] Close N/O point: Industrial SS                                | A] Goedeheop Laan 1 Feeder remains at 13%      |
|   |                                                             |                                                                  | B] Robertson Kelder Feeder remains at 49.3%    |
|   |                                                             |                                                                  | C] Nestle Feeder remains at 7.2%               |
|   |                                                             |                                                                  | D] Goedeheop Laan 2 Feeder remains at 120.8%   |
|   |                                                             |                                                                  | E] White Street 1 Feeder remains at 47.3%      |

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**ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY**

| # | Critical Supply Scenarios       | Action Required                                             | Effect on Network                               |
|---|---------------------------------|-------------------------------------------------------------|-------------------------------------------------|
|   |                                 |                                                             | F] White Street 2 feeder remains at 56.6%       |
|   |                                 |                                                             | G] KWV Feeder remains at 86%                    |
|   |                                 |                                                             | H] Industrial Feeder from 37.8% to 60.5%        |
| 6 | Fault on Feeder: White Street 2 |                                                             | A] Goedehoop Laan 1 Feeder remains at 13%       |
|   |                                 |                                                             | B] Robertson Kelder Feeder remains at 49.3%     |
|   |                                 | 1] Close N/O point: Waterwerke at White Street 1 Substation | C] Nestle Feeder remains at 7.2%                |
|   |                                 |                                                             | D] Goedehoop Laan 2 Feeder from 120.8% to 94.9% |
|   |                                 |                                                             | E] White Street 1 Feeder from 47.3% to 135.5%   |
|   |                                 |                                                             | F] Load Control Feeder remains at 34.8%         |
|   |                                 |                                                             | G] KWV Feeder from 86% to 117.4%                |
| 7 | Fault on Feeder: KWV            | 1] Close N/O point: Kelder RMU from Roodezant RMU           | A] Goedehoop Laan 1 Feeder remains at 13%       |
|   |                                 |                                                             | B] Robertson Kelder Feeder from 49.3% to 134.4% |
|   |                                 |                                                             | C] Nestle Feeder remains at 7.2%                |
|   |                                 |                                                             | D] Goedehoop Laan 2 Feeder remains at 120.8%    |
|   |                                 |                                                             | E] White Street 1 Feeder remains at 47.3%       |
|   |                                 |                                                             | F] Load Control Feeder remains at 34.8%         |

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| # | Critical Supply Scenarios | Action Required | Effect on Network                         |
|---|---------------------------|-----------------|-------------------------------------------|
|   |                           |                 | G] White Street 2 feeder remains at 56.6% |

## 11 RECOMMENDED CAPITAL UPGRADES

Refer to Appendix 24 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 Robertson area of supply:

- The maximum demand of 36,18MVA currently exceeds the notified maximum demand of 36MVA to Eskom; Application has been made for increase to 38MVA,
- The Robertson network is relatively lightly loaded, with a demand factor of 0.43. Total installed capacity of 54.900MVA,
- The current network operates within conductor thermal limits with the exception of the Goedeheop, Waterwerke feeder and the White Str SS to Bergsig SS feeder,
- The current network exceeds voltage drop limits on feeders associated with the Goedeheop, Waterwerke feeders otherwise all other loads are within limits,
- There are spur feeders on the network that need to be converted to ring networks.

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**13 RECOMMENDATIONS**

The following recommendations are made:

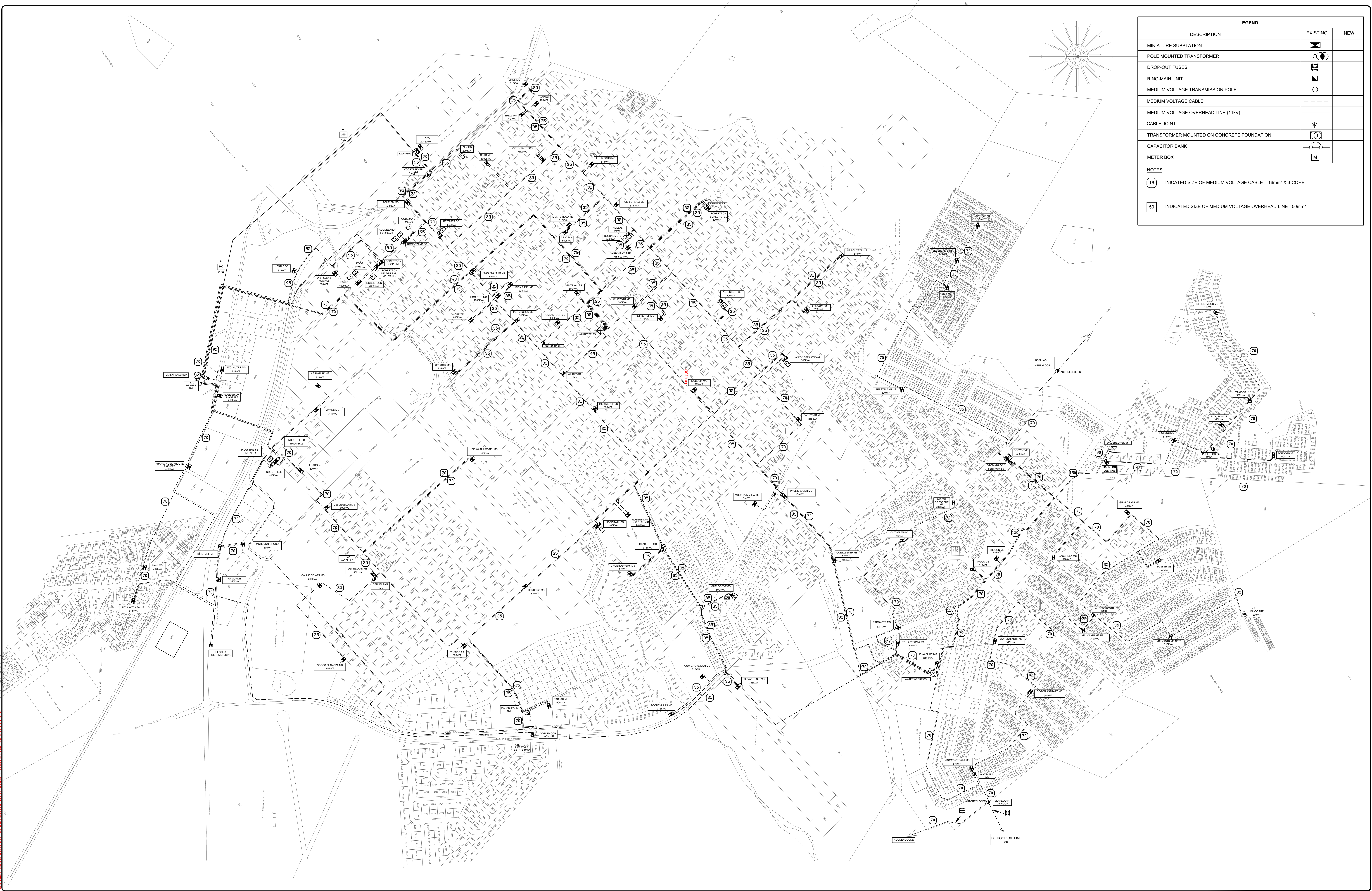
- Upgrading and replacement of network infrastructure as per the recommended capital project upgrades and masterplan recommendations,
- Regular updating of asset register,
- Information shortcomings were identified on existing layouts and schematics. Field studies to be conducted and all drawings to 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,
- Replacement of equipment that have exceeded their expected useful life as per asset condition assessment,
- 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,
- Investigation into the difference in 11kV maximum demand meter readings per phase. Meters to be reset and observed. If differences appear again, downstream study to be implemented at miniature substation / transformer level,
- Investigation into the installation of cooling fans onto the main power transformer radiators at Muiskraalskop to increase capacity (estimated increase could be up to 25% of rated value),
- Meter logging of municipal buildings electricity supply for implementation into study report for alternative energy supply e.g solar PV system,
- Closing of the current spur feeders to create ring networks.
  - Plaaslike feeder from Waterwerke Substation: Ring can be closed by connecting Meyer Crescent MS to Gemeenskap Sentrum SS
  - Hahn feeder from Droeheuwel SS and Eerstelaan feeder from Gemeenskap Sentrum SS: These feeders will be combined to form a ring when the future housing developments start.
- Installation of maximum demand meters on feeders in main switching station.

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ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

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## **APPENDIX 1 – ROBERTSON 11KV ELECTRICAL DISTRIBUTION NETWORK LAYOUT**



LEGEND

| DESCRIPTION                                | EXISTING | NEW |
|--------------------------------------------|----------|-----|
| MINIATURE SUBSTATION                       |          |     |
| POLE MOUNTED TRANSFORMER                   |          |     |
| DROP-OUT FUSES                             |          |     |
| RING-MAIN UNIT                             |          |     |
| MEDIUM VOLTAGE TRANSMISSION POLE           |          |     |
| MEDIUM VOLTAGE CABLE                       |          |     |
| MEDIUM VOLTAGE OVERHEAD LINE (11kV)        |          |     |
| CABLE JOINT                                |          |     |
| TRANSFORMER MOUNTED ON CONCRETE FOUNDATION |          |     |
| CAPACITOR BANK                             |          |     |
| METER BOX                                  |          |     |

NOTES

16

- INDICATED SIZE OF MEDIUM VOLTAGE CABLE - 16mm² X 3-CORE

50

- INDICATED SIZE OF MEDIUM VOLTAGE OVERHEAD LINE - 50mm²

NOTES

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REVISION SCHEDULE

| NO | DATE | DESCRIPTION | DRW | CHK |
|----|------|-------------|-----|-----|
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PROJECT

ROBERTSON  
ELECTRICAL DISTRIBUTION  
NETWORK

DRAWING DESCRIPTION

EXISTING 11kV  
MEDIUM VOLTAGE LAYOUT

SCALE FOR REDUCED PLAN

DATE

JUNE 2022

SCALE

1 : 4000

ORIGINAL SIZE

A0

DRAWING NUMBER

P302015-E-ROB-01

REV

0

P:\1\ix\p302015-E-ROB-01-Existing 11kV Medium Voltage Layout.dwg 1:4000 10:55:19 10/06/2022 Printed By: Cecilia Stenberg (Cape Town)

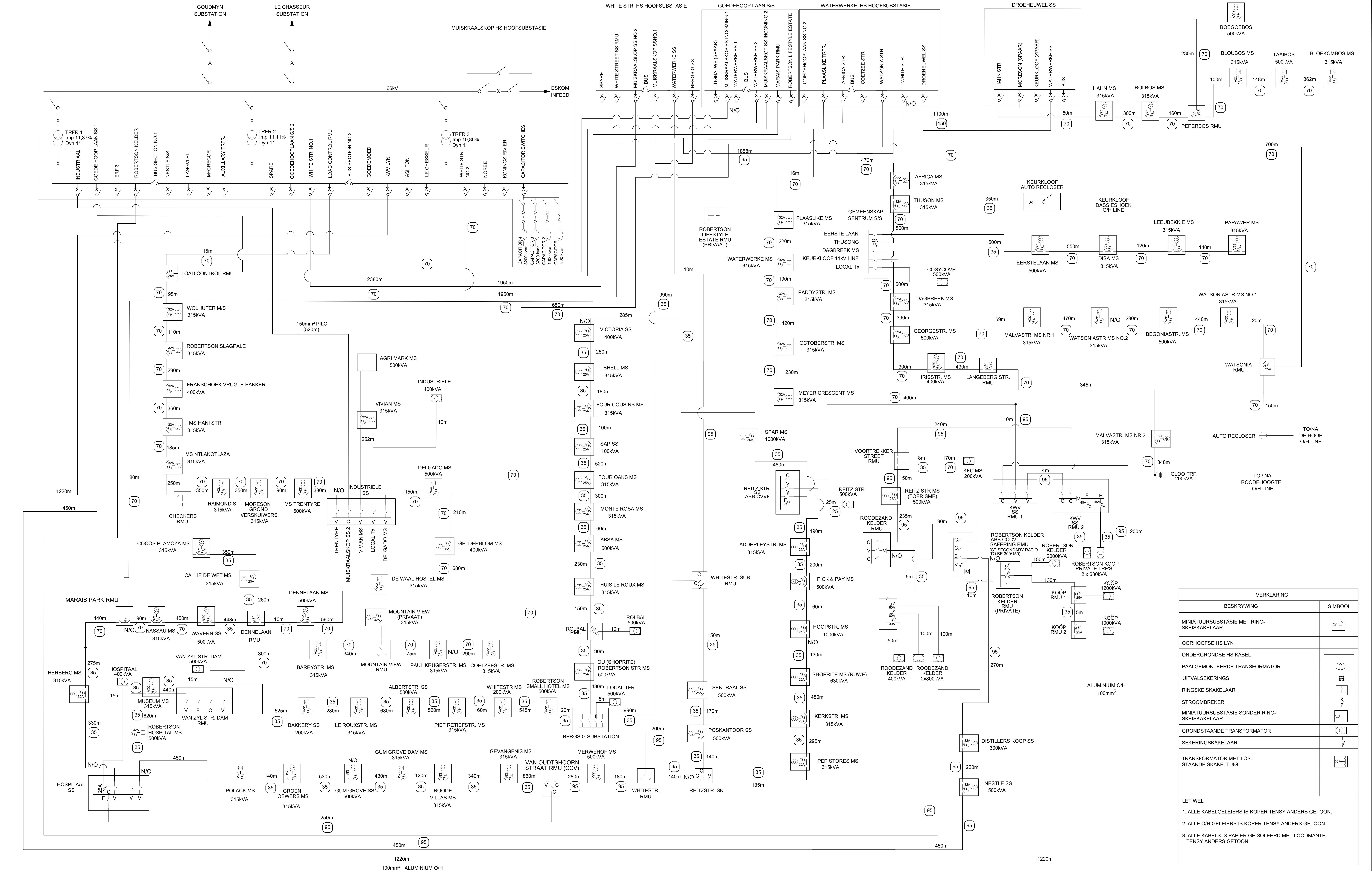
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## **APPENDIX 2 – ROBERTSON 11KV SINGLE LINE DIAGRAM**

P:\1\X\Projects\2020\15 - Langeberg Water Project\03 Drawings\03 Electrical\03 Distribution\03 Existing 11kV Single Line Diagram Rev. 2.dwg



| VERKLARING                                                              |         |
|-------------------------------------------------------------------------|---------|
| BESKRYWING                                                              | SIMBOOL |
| MINIATUURSUBSTASIE MET RING-SKEISKAKELAAR                               |         |
| OORHOOFSE HS LYN                                                        |         |
| ONDERGRONDSE HS KABEL                                                   |         |
| PAALGEMONTEEDE TRANSFORMATOR                                            |         |
| UITVALSEKERINGS                                                         |         |
| RINGSKEISKAKELAAR                                                       |         |
| STROOMBREKER                                                            |         |
| MINIATUURSUBSTASIE SONDER RING-SKEISKAKELAAR                            |         |
| GRONDSTAANDE TRANSFORMATOR                                              |         |
| SEKERINGSKAKELAAR                                                       |         |
| TRANSFORMATOR MET LOS-STAANDE SKAKELTUIG                                |         |
| LET WEL                                                                 |         |
| 1. ALLE KABELGELEIERS IS KOPER TENSY ANDERS GETOON.                     |         |
| 2. ALLE O/H GELEIERS IS KOPER TENSY ANDERS GETOON.                      |         |
| 3. ALLE KABELS IS PAPIER GEISOLEERD MET LOODMANTEL TENSY ANDERS GETOON. |         |

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|                   |      |             |         |
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PROJECT

**ROBERTSON  
ELECTRICAL DISTRIBUTION  
NETWORK**

DRAWING DESCRIPTION

**EXISTING 11kV  
SINGLE LINE DIAGRAM**

SCALE FOR REDUCED PLAN

DATE: JUNE 2022  
SCALE: NTS  
ORIGINAL SIZE: A0

DRAWING NUMBER: P302015-E-ROB-02  
REV: 0

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ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

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## **APPENDIX 3 – GOUDMYN AND LE CHASSEUR 11KV ELECTRICAL DISTRIBUTION NETWORK LAYOUT**

# Goudmyn Substation

OPEN

OPEN

| LEGENDE                                                               |       |      |
|-----------------------------------------------------------------------|-------|------|
| BESKRYWING                                                            | BEST. | NUUT |
| MINIATURE SUBSTATION                                                  |       |      |
| POLE MOUNTED TRANSFORMER                                              |       |      |
| DROP-OUT FUSES                                                        |       |      |
| RING-MAIN UNIT                                                        |       |      |
| MEDIUM VOLTAGE TRANSMISSION POLE                                      |       |      |
| MEDIUM VOLTAGE CABLE                                                  |       |      |
| MEDIUM VOLTAGE OVERHEAD LINE (11kV)                                   |       |      |
| CABLE JOINT                                                           |       |      |
| TRANSFORMER MOUNTED ON CONCRETE FOUNDATION                            |       |      |
| CAPACITOR BANK                                                        |       |      |
| METER BOX                                                             |       |      |
| NOTES                                                                 |       |      |
| - INDICATED SIZE OF MEDIUM VOLTAGE CABLE - 16mm <sup>2</sup> X 3-CORE |       |      |
| - INDICATED SZE OF MEDIUM VOLTAGE OVERHEAD LINE - 50mm <sup>2</sup>   |       |      |

NOTES

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| 7                 |      |             |         |
| 8                 |      |             |         |
| 9                 |      |             |         |
| 10                |      |             |         |

|                     |       |          |                |
|---------------------|-------|----------|----------------|
| CONSULTING ENGINEER |       | 20050166 | SEPTEMBER 2021 |
| SIGNATURE           |       | PR No    | DATE           |
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PROJECT

**GOUDMYN  
ELECTRICAL DISTRIBUTION  
NETWORK**

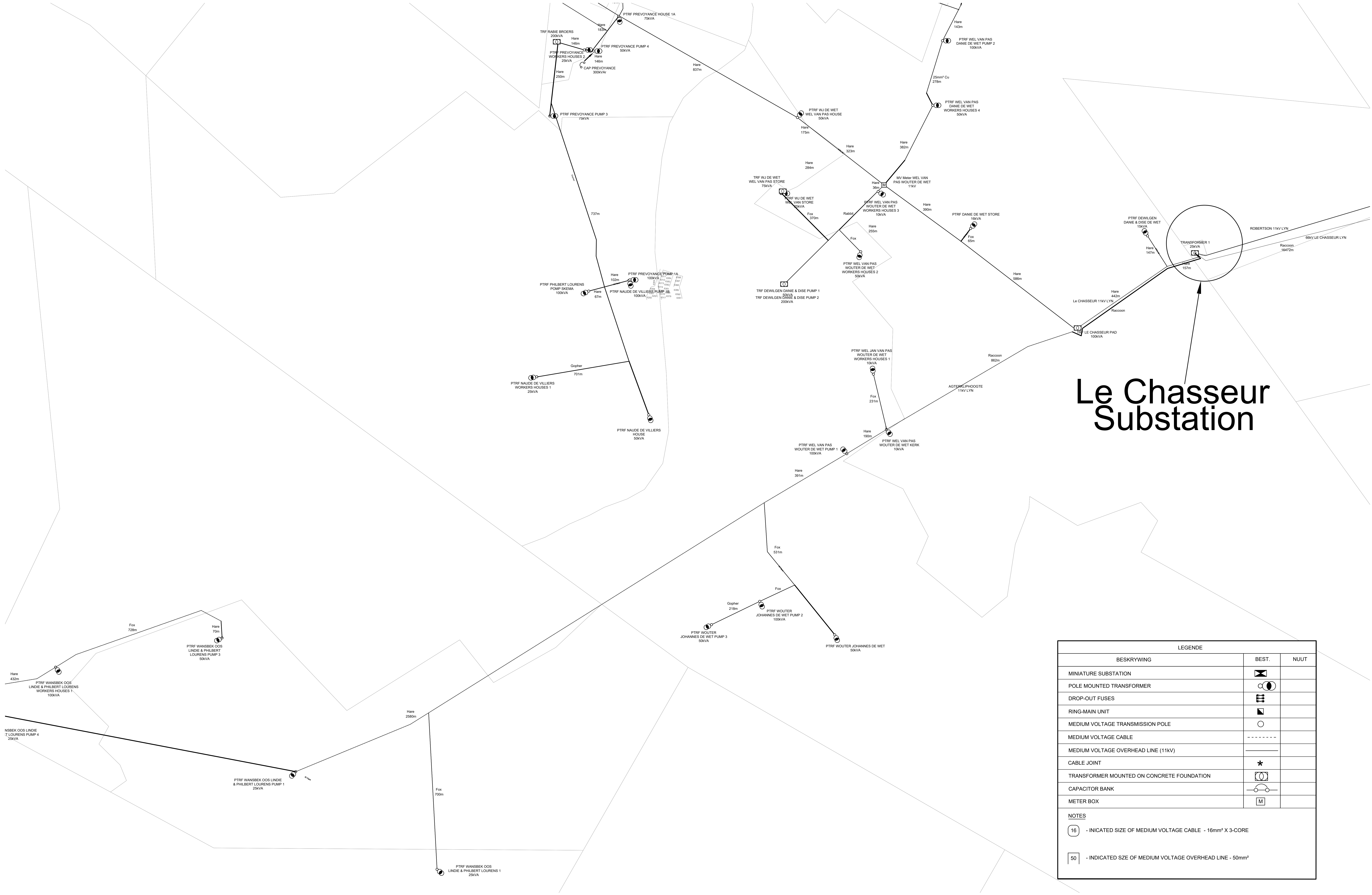
DRAWING DESCRIPTION

**EXISTING 11kV  
MEDIUM VOLTAGE  
LAYOUT**

SCALE FOR REDUCED PLAN

DATE: SEP2021 SCALE: 1:5000 ORIGINAL SIZE: A0

DRAWING NUMBER: P302015-E-GOU-01 REV: 0



# Le Chasseur Substation

| LEGENDE                                                      |       |      |
|--------------------------------------------------------------|-------|------|
| BESKRYWING                                                   | BEST. | NUUT |
| MINIATURE SUBSTATION                                         |       |      |
| POLE MOUNTED TRANSFORMER                                     |       |      |
| DROP-OUT FUSES                                               |       |      |
| RING-MAIN UNIT                                               |       |      |
| MEDIUM VOLTAGE TRANSMISSION POLE                             |       |      |
| MEDIUM VOLTAGE CABLE                                         |       |      |
| MEDIUM VOLTAGE OVERHEAD LINE (11kV)                          |       |      |
| CABLE JOINT                                                  |       |      |
| TRANSFORMER MOUNTED ON CONCRETE FOUNDATION                   |       |      |
| CAPACITOR BANK                                               |       |      |
| METER BOX                                                    |       |      |
| NOTES                                                        |       |      |
| 16 - INDICATED SIZE OF MEDIUM VOLTAGE CABLE - 16mm² X 3-CORE |       |      |
| 50 - INDICATED SIZE OF MEDIUM VOLTAGE OVERHEAD LINE - 50mm²  |       |      |

NOTES

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|-------------------|------|-------------|-----|-----|
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| 5                 |      |             |     |     |
| 6                 |      |             |     |     |
| 7                 |      |             |     |     |
| 8                 |      |             |     |     |
| 9                 |      |             |     |     |
| 10                |      |             |     |     |

| CONSULTING ENGINEER |          |                |
|---------------------|----------|----------------|
|                     | 20050166 | SEPTEMBER 2021 |
| SIGNATURE           | PR No    | DATE           |
| CLIENT              |          |                |
| SIGNATURE           | DATE     |                |
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| WS                  | WS       | WMS            |
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PROJECT

LE CHASSEUR ELECTRICAL DISTRIBUTION NETWORK

DRAWING DESCRIPTION

EXISTING 11kV MEDIUM VOLTAGE LAYOUT

SCALE FOR REDUCED PLAN

DATE: SEP'2021

SCALE: 1:5000

ORIGINAL SIZE: A0

DRAWING NUMBER: P302015-E-LEC-01

REV: 0

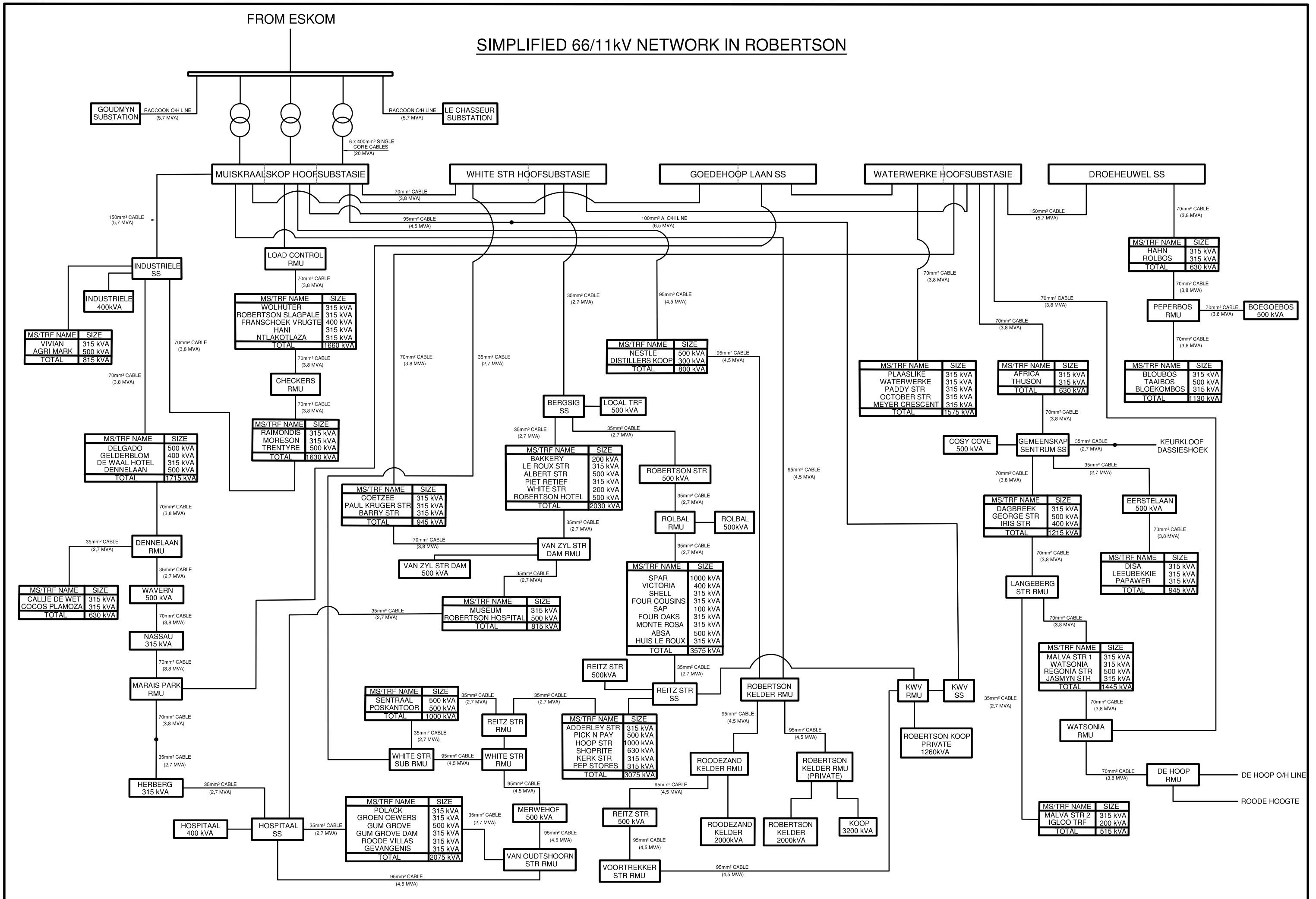
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## **APPENDIX 4 – SIMPLIFIED 66/11KV SINGLE LINE DIAGRAM**

## SIMPLIFIED 66/11kV NETWORK IN ROBERTSON



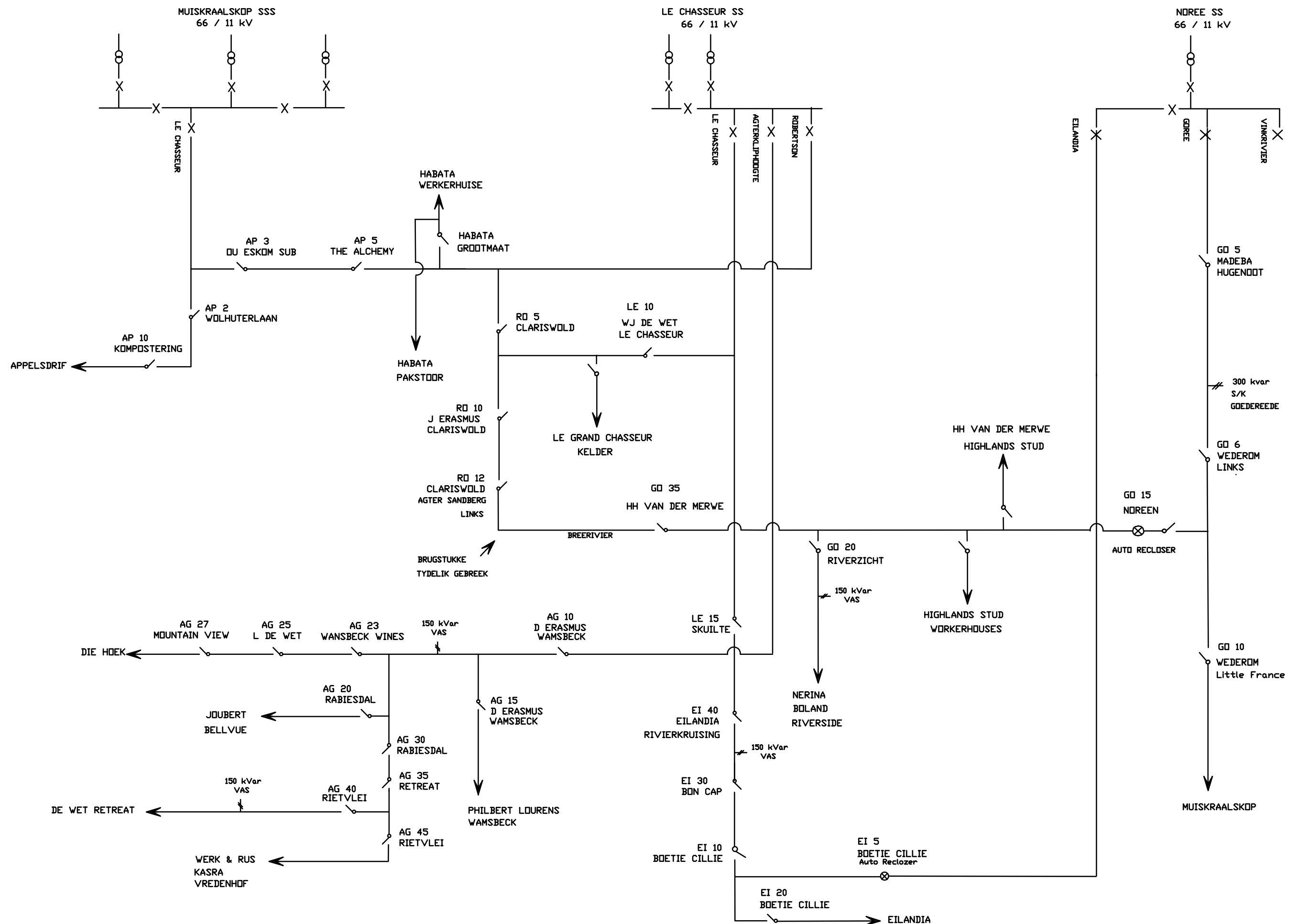
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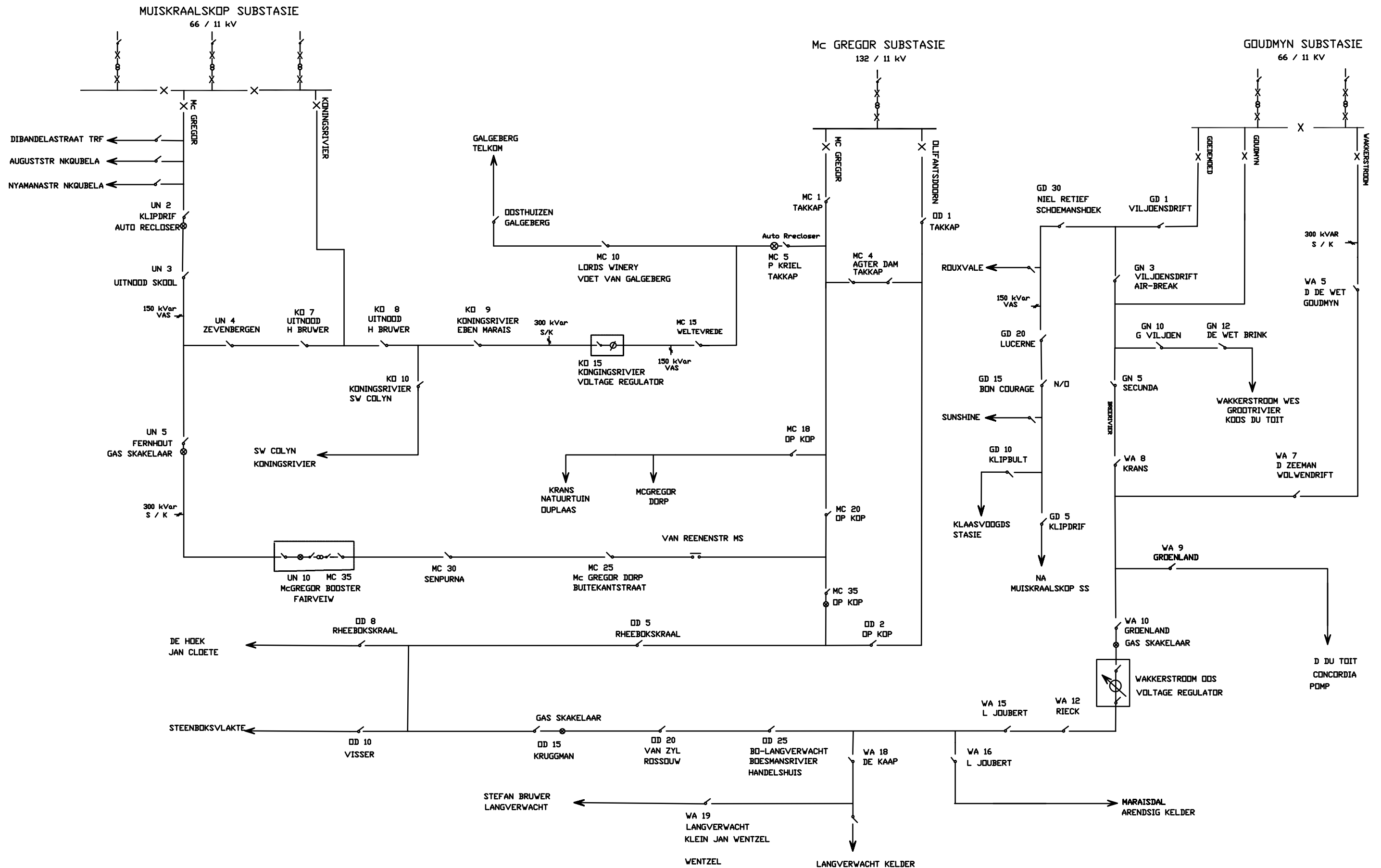
## **APPENDIX 5 – ROBERTSON RURAL AREAS SWITCHING DIAGRAMS**

DIAGRAM 1: AGTERKLIPHOOGE, CLARISWOLD, LE CHASSEUR & EILANDIA



BELANGRIK: GEEN PARALLEL SKAKELING OP 11 KV NETWERK MAG GEDOEN WORD TUSSEN

1. McGREGOR 132kV SUBSTASIE EN MUISKRAALSKOP 66kV SUBSTASIE NIE.
2. McGREGOR 132 kV SUBSTASIE EN GOUDMYN 66 kV SUBSTASIE NIE



# DIAGRAM 3: ASHTON, SANDVLIEDT, GOEDEMOED EN GOUDMYN

BELANGRIK: GEEN PARALLEL SKAKELING MAG GEDOEN WORD OP 11 KV NETWERK TUSSEN  
 1. MCGREGOR 132 kV SUBSTASIE EN MUISKRAALSKOP 66kV SUBSTASIE NIE.  
 2. MCGREGOR 132 kV SUBSTASIE EN GOUDMYN 66 kV SUBSTASIE NIE

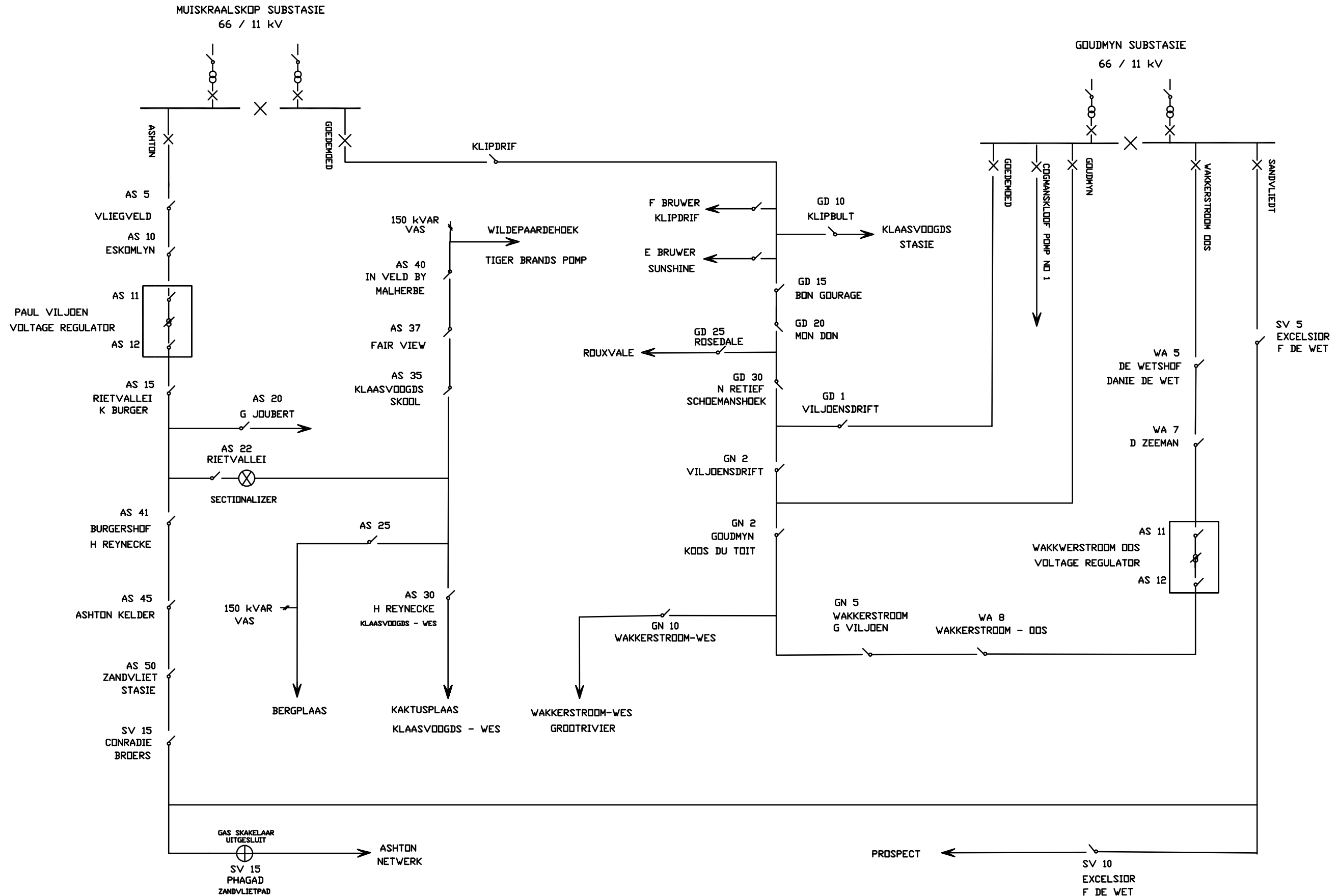
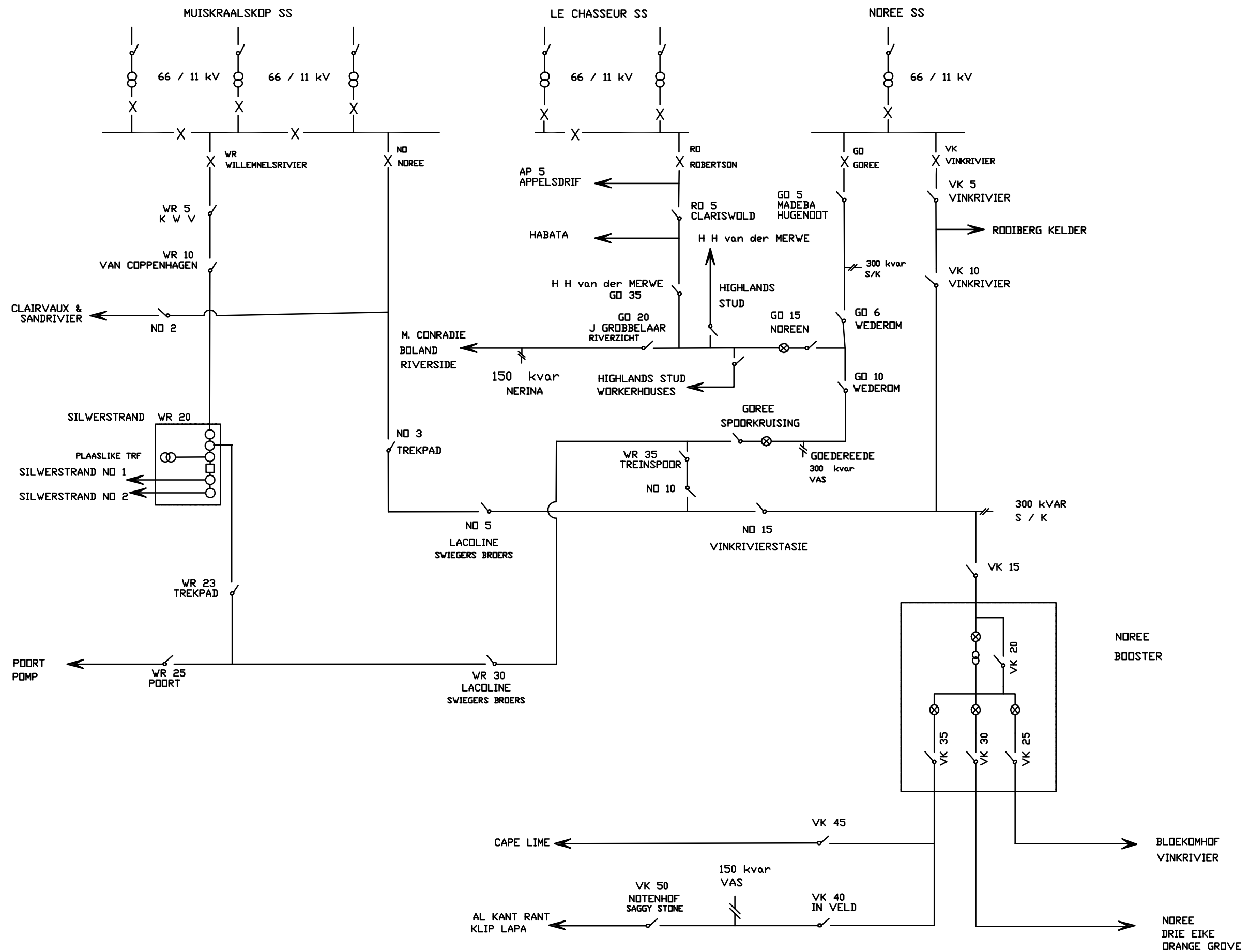
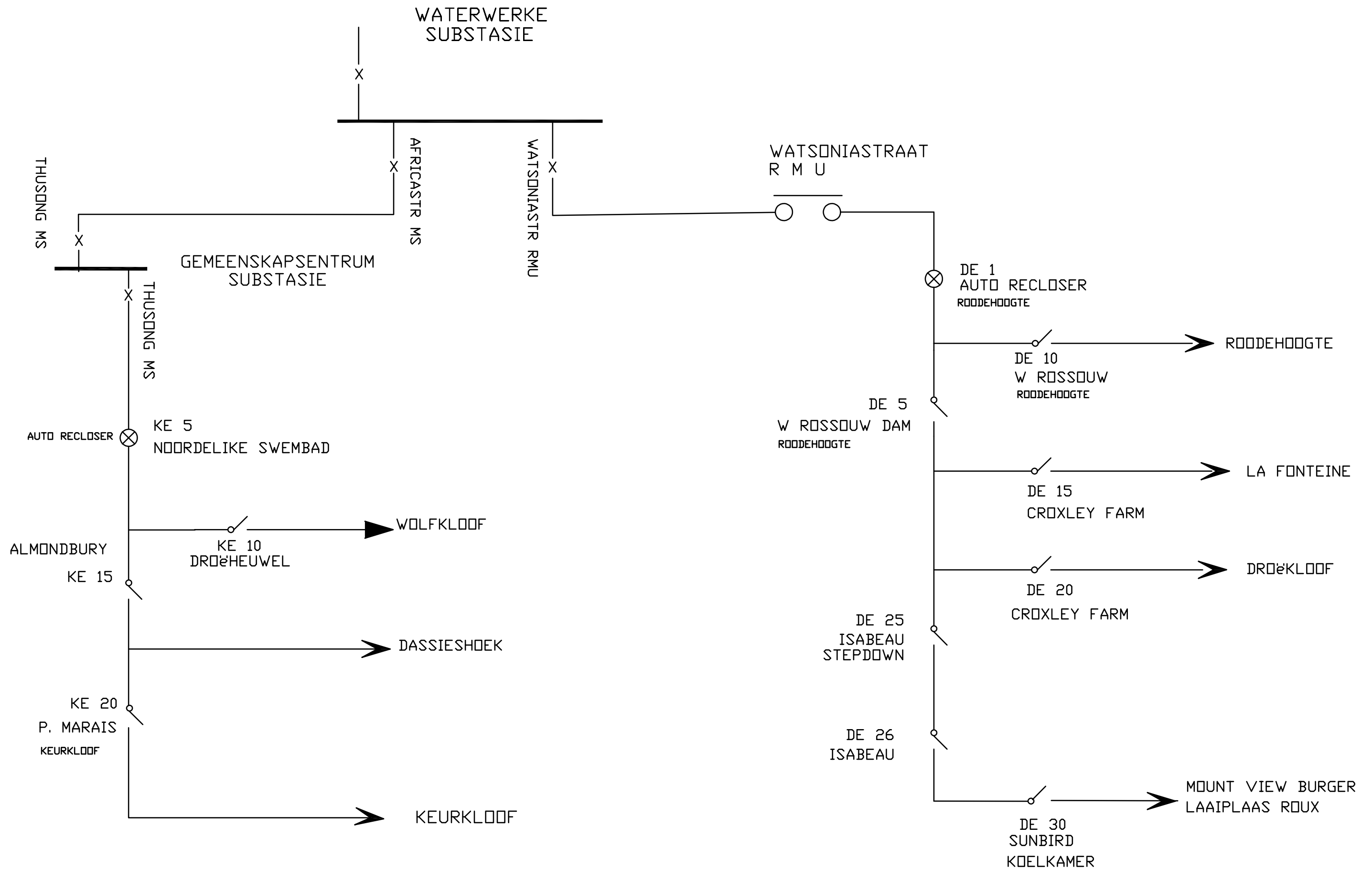


DIAGRAM 4: LANGVLEI, GOREE EN NOREE



## DIAGRAM 5: KEURKLOOF & DE HOOP



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## **APPENDIX 6 – ROBERTSON MAIN 11KV SWITCHING STATION MAXIMUM DEMAND METER READINGS**

MUISKRAALSKOP 11kV SWITCHING STATION - 3 November 2021

| 11kV Feeder Panel     | Phase | A   |      | max A | kVA   |
|-----------------------|-------|-----|------|-------|-------|
| TRANSFORMER NO.1      | R     | 560 |      | 560   | 10.67 |
|                       | W     | 560 |      |       |       |
|                       | B     | 560 |      |       |       |
| INDUSTRIELE SS        | R     | 60  |      | 60    | 1.14  |
|                       | W     | 50  |      |       |       |
|                       | B     | 50  |      |       |       |
| GOEDE HOOP LAAN SS 1  | R     | 103 |      | 103   | 1.96  |
|                       | W     | 90  |      |       |       |
|                       | B     | 90  |      |       |       |
| ERF 3                 | R     | 0   | Open |       |       |
|                       | W     | 0   | Open |       |       |
|                       | B     | 0   | Open |       |       |
| ROBERTSON KELDER SS   | R     | 250 |      | 250   | 4.76  |
|                       | W     | 245 |      |       |       |
|                       | B     | 245 |      |       |       |
| BUS SECTION 1         | R     | 440 |      | 440   | 8.38  |
|                       | W     | 420 |      |       |       |
|                       | B     | 400 |      |       |       |
| NESTLE SS             | R     | 80  |      | 120   | 2.29  |
|                       | W     | 120 |      |       |       |
|                       | B     | 105 |      |       |       |
| LANGVLEI              | R     | 82  |      | 90    | 1.71  |
|                       | W     | 90  |      |       |       |
|                       | B     | 90  |      |       |       |
| MCGREGOR              | R     | 65  |      | 65    | 1.24  |
|                       | W     | 65  |      |       |       |
|                       | B     | 63  |      |       |       |
| AUXILIARY TRANSFORMER | R     | 0   |      |       |       |
|                       | W     | 0   |      |       |       |
|                       | B     | 0   |      |       |       |
| TRANSFORMER NO.2      | R     | 660 |      | 660   | 12.57 |
|                       | W     | 635 |      |       |       |
|                       | B     | 640 |      |       |       |
| SPARE                 | R     | 0   | Open | 0     |       |
|                       | W     | 0   | Open |       |       |
|                       | B     | 0   | Open |       |       |
| GOEDE HOOP LAAN SS 2  | R     | 160 |      | 175   | 3.33  |
|                       | W     | 175 |      |       |       |
|                       | B     | 145 |      |       |       |
| WHITE STR. NO.1       | R     | 130 |      | 130   | 2.48  |
|                       | W     | 130 |      |       |       |
|                       | B     | 80  |      |       |       |
| LOAD CONTROL RMU      | R     | 90  |      | 90    | 1.71  |
|                       | W     | 65  |      |       |       |
|                       | B     | 80  |      |       |       |

|                  |   |     |      |     |       |
|------------------|---|-----|------|-----|-------|
| BUS SECTION NO.2 | R | 640 |      | 640 | 12.19 |
|                  | W | 605 |      |     |       |
|                  | B | 600 |      |     |       |
| GOEDEMOED        | R | 110 |      | 110 | 2.10  |
|                  | W | 110 |      |     |       |
|                  | B | 108 |      |     |       |
| KWV LYN          | R | 0   | x2   | 0   |       |
|                  | W | 10  | x2   | 20  |       |
|                  | B | 30  | x2   | 60  | 1.14  |
| ASHTON           | R | 75  |      | 80  | 1.52  |
|                  | W | 0   |      |     |       |
|                  | B | 80  |      |     |       |
| LE CHASSEUR      | R | 65  |      | 65  | 1.24  |
|                  | W | 0   |      |     |       |
|                  | B | 63  |      |     |       |
| TRANSFORMER NO.3 | R | 0   | Open | 0   |       |
|                  | W | 0   | Open |     |       |
|                  | B | 0   | Open |     |       |
| WHITE STR, NO.2  | R | 122 |      | 122 | 2.32  |
|                  | W | 105 |      |     |       |
|                  | B | 115 |      |     |       |
| NOREE            | R | 95  |      | 115 | 2.19  |
|                  | W | 115 |      |     |       |
|                  | B | 115 |      |     |       |
| KONINGS RIVIER   | R | 90  |      | 90  | 1.71  |
|                  | W | 90  |      |     |       |
|                  | B | 0   |      |     |       |
| CAPACITOR        | R | 340 |      | 340 | 6.48  |
|                  | W | 340 |      |     |       |
|                  | B | 325 |      |     |       |

Incomers 23.24

Feeders 32.87

CF (0.7) 23.01

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## **APPENDIX 7 – ASSET CONDITION ASSESSMENT**

**Robertson Substation Asset Condition**

| Area (Suburb) | Asset Location  | Name                           | Installation Date | Replacement Date | Replacement Cost |
|---------------|-----------------|--------------------------------|-------------------|------------------|------------------|
| Robertson     | Muiskraalkop SS | Eskom 66kV Line Isolator 2     | 1973              | 2018             | 125,000.00       |
| Robertson     | Muiskraalkop SS | Eskom 66kV Line Isolator 1     | 1973              | 2018             | 125,000.00       |
| Robertson     | Muiskraalkop SS | Eskom 66kV Bus Isolator        | 1973              | 2018             | 125,000.00       |
| Robertson     | Muiskraalkop SS | Eskom Incomer 66kV C/B         | 1973              | 2018             | 344,000.00       |
| Robertson     | Muiskraalkop SS | Eskom Incomer1 66kV CT         | 1973              | 2018             | 222,000.00       |
| Robertson     | Muiskraalkop SS | Eskom Incomer 66kV VT          | 1973              | 2018             | 186,000.00       |
| Robertson     | Muiskraalkop SS | 66/11kV Trfr 1 - 15MVA         | 1973              | 2018             | 5,750,000.00     |
| Robertson     | Muiskraalkop SS | 66/11kV Trfr 2 - 15 MVA        | 1973              | 2018             | 5,750,000.00     |
| Robertson     | Muiskraalkop SS | 66/11kV Trfr 3 - 15 MVA        | 2021              | 2066             | 5,750,000.00     |
| Robertson     | Muiskraalkop SS | 66kV Trfr 1 C/B                | 2011              | 2056             | 344,000.00       |
| Robertson     | Muiskraalkop SS | 66kV Trfr 2 C/B                | 2011              | 2056             | 344,000.00       |
| Robertson     | Muiskraalkop SS | 66kV Trfr 3 C/B                | 2011              | 2056             | 344,000.00       |
| Robertson     | Muiskraalkop SS | 66kV Trfr 1 Isolator           | 1973              | 2018             | 125,000.00       |
| Robertson     | Muiskraalkop SS | 66kV Trfr 2 Isolator           | 1973              | 2018             | 125,000.00       |
| Robertson     | Muiskraalkop SS | 66kV Trfr 3 Isolator           | 2011              | 2056             | 125,000.00       |
| Robertson     | Muiskraalkop SS | 66kV Trfr 1 CT                 | 2011              | 2056             | 222,000.00       |
| Robertson     | Muiskraalkop SS | 66kV Trfr 2 CT                 | 2011              | 2056             | 222,000.00       |
| Robertson     | Muiskraalkop SS | 66kV Trfr 3 CT                 | 2011              | 2056             | 222,000.00       |
| Robertson     | Muiskraalkop SS | 11000/400V Aux Trfr            | 1992              | 2037             | 130,000.00       |
| Robertson     | Muiskraalkop SS | 66kV Goudmyn Bus Isolator      | 1974              | 2019             | 125,000.00       |
| Robertson     | Muiskraalkop SS | 66kV Goudmyn C/B               | 2011              | 2056             | 344,000.00       |
| Robertson     | Muiskraalkop SS | 66kV Goudmyn CT                | 2011              | 2056             | 222,000.00       |
| Robertson     | Muiskraalkop SS | 66kV Goudmyn Line Isolator     | 1974              | 2019             | 125,000.00       |
| Robertson     | Muiskraalkop SS | 66kV Le Chasseur Bus Isolator  | 1988              | 2033             | 125,000.00       |
| Robertson     | Muiskraalkop SS | 66kV Le Chasseur C/B           | 2011              | 2056             | 344,000.00       |
| Robertson     | Muiskraalkop SS | 66kV Le Chasseur CT            | 2011              | 2056             | 222,000.00       |
| Robertson     | Muiskraalkop SS | 66kV Le Chasseur Line Isolator | 1988              | 2033             | 125,000.00       |
| Robertson     | Muiskraalkop SS | Cap Bank 1                     | 1973              | 2018             | 40,000.00        |
| Robertson     | Muiskraalkop SS | Cap Bank 2                     | 1973              | 2018             | 60,000.00        |
| Robertson     | Muiskraalkop SS | Cap Bank 3                     | 1973              | 2018             | 80,000.00        |
| Robertson     | Muiskraalkop SS | Cap Bank 4                     | 1973              | 2018             | 80,000.00        |
| Robertson     | Muiskraalkop SS | Cap Bank 1 Control Panel       | 1973              | 2018             | 20,000.00        |
| Robertson     | Muiskraalkop SS | Cap Bank 2 Control Panel       | 1973              | 2018             | 20,000.00        |
| Robertson     | Muiskraalkop SS | Cap Bank 3 Control Panel       | 1973              | 2018             | 20,000.00        |
| Robertson     | Muiskraalkop SS | Cap Bank 4 Control Panel       | 1973              | 2018             | 20,000.00        |
| Robertson     | Muiskraalkop SS | BTU 1                          | 2011              | 2056             | 50,000.00        |
| Robertson     | Muiskraalkop SS | BTU 2                          | 1973              | 2018             | 50,000.00        |
|               |                 |                                |                   |                  |                  |
|               |                 |                                |                   |                  | 22,652,000.00    |

Goudmyn Substation Asset Condition

| Area (Suburb) | Asset Location | Name           | Installation Date | Replacement Date | Replacement Cost |
|---------------|----------------|----------------|-------------------|------------------|------------------|
|               |                |                |                   |                  |                  |
| Montagu       | Goudmyn SS     | Trfr 1 - 10MVA | 1988              | 2033             | 5,000,000.00     |
| Montagu       | Goudmyn SS     | Trfr 2 - 10MVA | 1992              | 2037             | 5,000,000.00     |
|               |                |                |                   |                  |                  |
|               |                |                |                   |                  | 10,000,000.00    |

**Le Chasseur Substation Asset Condition**

| Area (Suburb) | Asset Location | Name          | Installation Date | Replacement Date | Replacement Cost |
|---------------|----------------|---------------|-------------------|------------------|------------------|
|               |                |               |                   |                  |                  |
| McGregor      | Le Chasseur SS | Trfr 1 - 5MVA | 1980              | 2025             | 4,250,000.00     |
| McGregor      | Le Chasseur SS | Aux Trfr 1    | 1988              | 2033             | 125,000.00       |
| McGregor      | Le Chasseur SS | Trfr 2 - 5MVA | 1980              | 2025             | 4,250,000.00     |
| McGregor      | Le Chasseur SS | Aux Trfr 2    | 1988              | 2033             | 125,000.00       |
|               |                |               |                   |                  |                  |
|               |                |               |                   |                  | 8,750,000.00     |

**Robertson 11kV Switchgear Asset Condition**

| Area (Suburb) | Asset Location   | Name                                             | Function    | Installation Date | Replacement Date | Replacement Cost |
|---------------|------------------|--------------------------------------------------|-------------|-------------------|------------------|------------------|
| Robertson     | SS DROEHEUWEL    | MORESON SWITCH                                   | FEEDER      | 1999              | 2044             | 450,000.00       |
| Robertson     | SS DROEHEUWEL    | KEURKLOOF SWITCH                                 | FEEDER      | 1999              | 2044             | 450,000.00       |
| Robertson     | SS DROEHEUWEL    | INCOMER                                          | INCOMER     | 1999              | 2044             | 450,000.00       |
| Robertson     | SS DROEHEUWEL    | BUS SECTION                                      | FEEDER      | 1999              | 2044             | 450,000.00       |
| Robertson     | SS Droeheuwel    | DROEHEUWEL SWITCH                                | FEEDER      | 1999              | 2044             | 450,000.00       |
| Robertson     | SS Waterwerke    | MVMB GOEDEHOOP SUB STATION                       | INCOMER     | 1993              | 2038             | 400,000.00       |
| Robertson     | SS Waterwerke    | MVMB AFRICA STR                                  | FEEDER      | 1993              | 2038             | 400,000.00       |
| Robertson     | SS Waterwerke    | MVMB BUS SECTION                                 | FEEDER      | 1993              | 2038             | 400,000.00       |
| Robertson     | SS Waterwerke    | MVMB COETZEE STREET MS                           | FEEDER      | 1993              | 2038             | 400,000.00       |
| Robertson     | SS Waterwerke    | MVMB WATSONIA STR MS                             | FEEDER      | 1993              | 2038             | 400,000.00       |
| Robertson     | SS Waterwerke    | MVMB WHITE STR MS                                | FEEDER      | 1994              | 2039             | 400,000.00       |
| Robertson     | SS Waterwerke    | MVMB DROEHEUWEL SUBSTASIE                        | FEEDER      | 1993              | 2038             | 650,000.00       |
| Robertson     | SS Waterwerke    | MVMB LOCAL TRANSFORMER                           | FEEDER      | 1993              | 2038             | 400,000.00       |
| Robertson     | SS Sentraal      | MVSG TRF LOCAL                                   | FEEDER      | 1960              | 2005             | 400,000.00       |
| Robertson     | SS Sentraal      | MVSG OUTGOING 1                                  | FEEDER      | 1960              | 2005             | 400,000.00       |
| Robertson     | RMU Sentraal     | MVSG BUS SECTION                                 | FEEDER      | 1960              | 2005             | 450,000.00       |
| Robertson     | RMUSentraal      | MVSG OUTGOING 2                                  | FEEDER      | 1960              | 2005             | 400,000.00       |
| Robertson     | SS Bergsig       | TRF LOCAL                                        | FEEDER      |                   |                  | 400,000.00       |
| Robertson     | SS Bergsig       | RMU Shoprite MS                                  | FEEDER      |                   |                  | 400,000.00       |
| Robertson     | SS Bergsig       | RMU White str SS                                 | FEEDER      |                   |                  | 400,000.00       |
| Robertson     | RMU Albert str   | MVMB Piet Retief str                             | FEEDER      |                   |                  | 400,000.00       |
| Robertson     | RMU Albert str   | MVMB Albert Str SS                               | FEEDER      |                   |                  | 400,000.00       |
| Robertson     | RMU Albert str   | MVMB Le Roux str                                 | FEEDER      |                   |                  | 400,000.00       |
| Robertson     | SS White Str     | MVSG WHITE STREET RMU                            | FEEDER      | 1976              | 2021             | 400,000.00       |
| Robertson     | SS White str     | SG - SPARE - NOT IN USE                          | FEEDER      | 1976              | 2021             | 400,000.00       |
| Robertson     | SS White str     | MVSG WHITE STREET                                | FEEDER      | 1976              | 2021             | 400,000.00       |
| Robertson     | SS White str     | MVSG MUISKRAALSKOP 2                             | INCOMER     | 1976              | 2021             | 400,000.00       |
| Robertson     | SS White str     | MVSG STAMSEKSIE                                  | FEEDER      | 1976              | 2021             | 400,000.00       |
| Robertson     | SS White str     | MVSG MUISKRAALSKOP 1                             | INCOMER     | 1976              | 2021             | 400,000.00       |
| Robertson     | SS White str     | MVSG WATERWERKE                                  | FEEDER      | 1976              | 2021             | 400,000.00       |
| Robertson     | SS White str     | MVSG BERGSIG                                     | FEEDER      | 1976              | 2021             | 400,000.00       |
| Robertson     | RMU Merwe Hoff   | MVSG MERWE HOFF                                  | FEEDER      |                   |                  | 400,000.00       |
| Robertson     | RMU Marais Park  | RMU-NASSAU SINGLE MS                             | FEEDER      |                   |                  | 400,000.00       |
| Robertson     | RMU Marais Park  | RMU-HERBERG MS                                   | FEEDER      |                   |                  | 400,000.00       |
| Robertson     | RMU Marais Park  | RMU-GOEDEHOOP SS                                 | INCOMER     |                   |                  | 400,000.00       |
| Robertson     | SS Goedeheop Ave | SS-WATERWERKE NO 2                               | FEEDER      |                   |                  | 650,000.00       |
| Robertson     | SS Goedeheop Ave | BUS-SECTION                                      | FEEDER      |                   |                  | 650,000.00       |
| Robertson     | SS Goedeheop Ave | SS-WATERWERKE NO 1                               | FEEDER      |                   |                  | 650,000.00       |
| Robertson     | SS Goedeheop Ave | MS-LUGHAWE                                       | FEEDER      |                   |                  | 650,000.00       |
| Robertson     | SS Goedeheop Ave | RMU-MARAIS PARK                                  | FEEDER      |                   |                  | 650,000.00       |
| Robertson     | SS Goedeheop Ave | MS-UITBREIDING 9                                 | FEEDER      |                   |                  | 650,000.00       |
| Robertson     | SS Robertson     | Muiskraalkop SS 11kV Fdr 03: GOEDEHOOP SS1       | FEEDER      |                   |                  | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 04: ERF 3               | FEEDER      |                   |                  | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 05: ROBERTSON KELDER SS | FEEDER      |                   |                  | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV 06: BUS SECTION NO.1        | FEEDER      |                   |                  | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 07: NESTLE              | FEEDER      |                   |                  | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 08: LANGVLEI            | FEEDER      |                   |                  | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 09: MC GREGOR           | FEEDER      |                   |                  | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 10: AUX TRFR            | FEEDER      |                   |                  | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 01: TRANSFORMER NO.1    | INCOMER     | 2011              | 2056             | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 02: INDUSTRIELE SS      | FEEDER      | 2011              | 2056             | 650,000.00       |
| Robertson     | SS Robertson     | Muiskraalkop SS 11kV Fdr 13: GOEDEHOOP SS2       | FEEDER      | 2011              | 2056             | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 11: TRANSFORMER NO. 2   | INCOMER     | 2011              | 2056             | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 12: SPARE               | FEEDER      | 2011              | 2056             | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 14: WHITE STR NO. 1     | FEEDER      | 2011              | 2056             | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 15: LOAD CONTROL RMU    | FEEDER      | 2011              | 2056             | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV BS 16: BUSSECTION NO. 2     | BUS SECTION | 2011              | 2056             | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 17: GOEDEMOED           | FEEDER      | 2011              | 2056             | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 18: KWV LYN             | FEEDER      | 2011              | 2056             | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 19: ASHTON              | FEEDER      | 2011              | 2056             | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 20: LE CHASSEUR         | FEEDER      | 2011              | 2056             | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 21: TRANSFORMER NO. 3   | INCOMER     | 2011              | 2056             | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 22: WHITE STR NO. 2     | FEEDER      | 2011              | 2056             | 650,000.00       |
| Robertson     | Muiskraalkop SS  | Muiskraalkop SS 11kV Fdr 23: NOREE               | FEEDER      | 2011              | 2056             | 650,000.00       |

|           |                 |                                             |             |      |      |               |
|-----------|-----------------|---------------------------------------------|-------------|------|------|---------------|
| Robertson | Muiskraalkop SS | Muiskraalkop SS 11kV Fdr 24: KONINGS RIVIER | FEEDER      | 2011 | 2056 | 650,000.00    |
| Robertson | Muiskraalkop SS | Muiskraalkop SS 11kV Fdr 25: CAP BANKS      | FEEDER      | 2011 | 2056 | 650,000.00    |
|           |                 |                                             |             |      |      |               |
| Robertson | RMU Reitz str   | RMU Adderly str                             | FEEDER      |      |      | 400,000.00    |
| Robertson | RMU Reitz str   | RMU KWV                                     | FEEDER      |      |      | 400,000.00    |
| Robertson | RMU Reitz str   | RMU SPAR MS                                 | FEEDER      |      |      | 400,000.00    |
| Robertson | RMU Reitz str   | RMU SS REITZ                                | FEEDER      |      |      | 400,000.00    |
|           |                 |                                             |             |      |      |               |
| Robertson | RMU Van Zyl str | MVSG TRF VAN ZYL STR                        | FEEDER      |      |      | 400,000.00    |
| Robertson | RMU Van Zyl str | MVSG BAKKERY SS                             | FEEDER      |      |      | 400,000.00    |
| Robertson | RMU Van Zyl str | MVSG MUSEUM STR MS                          | FEEDER      |      |      | 400,000.00    |
|           |                 |                                             |             |      |      |               |
| Robertson | SS Goudmyn      | MVSG GOEDEMOED                              | FEEDER      |      |      | 650,000.00    |
| Robertson | SS Goudmyn      | MVSG COGMANSKLOOF                           | FEEDER      |      |      | 400,000.00    |
| Robertson | SS Goudmyn      | MVSG GOUDMYN                                | FEEDER      |      |      | 400,000.00    |
| Robertson | SS Goudmyn      | MVSG TRANSFOMER NO.1                        | FEEDER      |      |      | 450,000.00    |
| Robertson | SS Goudmyn      | MVSG BUS SECTION                            | BUS SECTION |      |      | 400,000.00    |
| Robertson | SS Goudmyn      | MVSG TRANSFOMER NO .2                       | FEEDER      |      |      | 450,000.00    |
| Robertson | SS Goudmyn      | MVSG WAKKERSTROOM OOS                       | FEEDER      |      |      | 400,000.00    |
| Robertson | SS Goudmyn      | MVSG SANDVLIET                              | FEEDER      |      |      | 400,000.00    |
| Robertson | Goudmyn SS      | MVSG CAPBANK FDR                            | FEEDER      |      |      | 400,000.00    |
|           |                 |                                             |             |      |      |               |
| Robertson | SS LE CHASSEUR  | 5MVA Power Transformer No.2                 | INCOMER     |      |      | 400,000.00    |
| Robertson | SS LE CHASSEUR  | BUS SECTION                                 | FEEDER      |      |      | 400,000.00    |
| Robertson | SS LE CHASSEUR  | 5MVA Power Transformer No.1                 | INCOMER     |      |      | 400,000.00    |
| Robertson | SS LE CHASSEUR  | ROBERTSON                                   | FEEDER      |      |      | 400,000.00    |
| Robertson | SS LE CHASSEUR  | AGTERKLIPHOOGE                              | FEEDER      |      |      | 400,000.00    |
| Robertson | SS LE CHASSEUR  | LE CHASSEUR                                 | FEEDER      |      |      | 400,000.00    |
|           |                 |                                             |             |      |      |               |
|           |                 |                                             |             |      |      | 43,850,000.00 |
|           |                 |                                             |             |      |      |               |

# Robertson Miniature Substation Asset Condition

| Area (Suburb) | Name                          | Rating | Installation Date | Replacement Date | Replacement Cost |
|---------------|-------------------------------|--------|-------------------|------------------|------------------|
| Robertson     | MS GELDEBLUM                  | 315    | 1976              | 2021             | 525,000.00       |
| Robertson     | MS DE WAAL HOSTEL             | 315    | 1978              | 2023             | 525,000.00       |
| Robertson     | MS 1 WATSONIA STR             | 315    | 1979              | 2024             | 525,000.00       |
| Robertson     | MS LE ROUX                    | 315    | 1979              | 2024             | 525,000.00       |
| Robertson     | MS HERBERG                    | 315    | 1979              | 2024             | 525,000.00       |
| Robertson     | MS NASSAU STR                 | 315    | 1979              | 2024             | 525,000.00       |
| Robertson     | MS 2 WATSONIA STR             | 500    | 1979              | 2024             | 575,000.00       |
| Robertson     | MS-COETZEE STR                | 315    | 1980              | 2025             | 525,000.00       |
| Robertson     | MS COCOS PLAMOSA              | 315    | 1980              | 2025             | 525,000.00       |
| Robertson     | MS GEVANGENIS                 | 315    | 1980              | 2025             | 525,000.00       |
| Robertson     | MS WATERWERKE                 | 315    | 1980              | 2025             | 525,000.00       |
| Robertson     | MS CALLIE DE WET SPORTSGROUND | 315    | 1982              | 2027             | 525,000.00       |
| Robertson     | MS HOOP STR                   | 1000   | 2012              | 2057             | 650,000.00       |
| Robertson     | MS-PIET RETIEF                | 500    | 1985              | 2030             | 575,000.00       |
| Robertson     | MS Dennelaan                  | 500    | 1986              | 2031             | 575,000.00       |
| Robertson     | MS DAGBREEK                   | 315    | 1987              | 2032             | 525,000.00       |
| Robertson     | MS-MALVA STR 2                | 500    | 1987              | 2032             | 575,000.00       |
| Robertson     | MS 1 MALVA STR                | 500    | 1987              | 2032             | 575,000.00       |
| Robertson     | MS RICHTER STR                | 315    | 1989              | 2034             | 525,000.00       |
| Robertson     | MS-SHOPRITE MS                | 315    | 1989              | 2034             | 525,000.00       |
| Robertson     | MS WOHLUTER STR               | 315    | 1990              | 2035             | 525,000.00       |
| Robertson     | MS-HOUSE LE ROUX              | 315    | 1990              | 2035             | 525,000.00       |
| Robertson     | MS 2 KERK STR                 | 315    | 1990              | 2035             | 525,000.00       |
| Robertson     | MS POLACK STR                 | 500    | 1991              | 2036             | 575,000.00       |
| Robertson     | MS PICK AND PAY               | 500    | 1992              | 2037             | 575,000.00       |
| Robertson     | MS EERSTELAAN                 | 400    | 1993              | 2038             | 575,000.00       |
| Robertson     | MS-PADDY STR                  | 315    | 1993              | 2038             | 525,000.00       |
| Robertson     | MS IRIS                       | 400    | 1993              | 2038             | 575,000.00       |
| Robertson     | MS MEYER STR                  | 315    | 1994              | 2039             | 525,000.00       |
| Robertson     | MS ADDERLEY STR VIVAN         | 315    | 1999              | 2044             | 525,000.00       |
| Robertson     | MS NTLAKOTKAZA STR            | 160    | 1996              | 2041             | 450,000.00       |
| Robertson     | MS HANI STR                   | 200    | 1996              | 2041             | 450,000.00       |
| Robertson     | MS OCTOBER STR                | 315    | 1996              | 2041             | 525,000.00       |
| Robertson     | MS REITZ STR PEP STORE        | 315    | 1996              | 2041             | 525,000.00       |
| Robertson     | MS ROBERTSON PUREE            | 315    | 1996              | 2041             | 525,000.00       |
| Robertson     | MS ABSA                       | 500    | 1996              | 2041             | 575,000.00       |
| Robertson     | MS KFC                        | 315    | 1996              | 2041             | 525,000.00       |
| Robertson     | MS-BLOEKOMBOS                 | 315    | 1998              | 2043             | 525,000.00       |
| Robertson     | MS-BLOUBOS                    | 315    | 1998              | 2043             | 525,000.00       |
| Robertson     | MS ROLBOS                     | 315    | 2008              | 2053             | 525,000.00       |
| Robertson     | MS-PAPAWER LAAN               | 315    | 1998              | 2043             | 525,000.00       |
| Robertson     | MS LEEUBEKIE LAAN             | 315    | 1998              | 2043             | 525,000.00       |
| Robertson     | MS DISA LAAN                  | 315    | 1998              | 2043             | 525,000.00       |
| Robertson     | MS-TAAIBOS                    | 500    | 1999              | 2044             | 575,000.00       |
| Robertson     | MS-HAHN                       | 315    | 1999              | 2044             | 525,000.00       |
| Robertson     | MS GEORGE                     | 315    | 1999              | 2044             | 525,000.00       |
| Robertson     | MS BOEGOEBOS                  | 500    | 1999              | 2044             | 575,000.00       |
| Robertson     | MS ADDERLEY STR               | 315    | 2002              | 2047             | 525,000.00       |

|           |                             |      |      |      |               |
|-----------|-----------------------------|------|------|------|---------------|
| Robertson | MS 2 BARRY STR              | 400  | 2002 | 2047 | 575,000.00    |
| Robertson | MS TREN TYRE                | 500  | 2003 | 2048 | 575,000.00    |
| Robertson | MS-WHITE STR                | 200  | 2005 | 2050 | 450,000.00    |
| Robertson | MS-DE GROENE OEWEERS        | 315  | 2005 | 2050 | 525,000.00    |
| Robertson | MS ROODEHOOGTE              | 315  | 2005 | 2050 | 525,000.00    |
| Robertson | MS DELGADO                  | 500  | 2005 | 2050 | 575,000.00    |
| Robertson | MS SPAR                     | 1000 | 2007 | 2052 | 650,000.00    |
| Robertson | MS PAUL KRUGER              | 315  | 2006 | 2051 | 525,000.00    |
| Robertson | MS-DROS                     | 315  | 2006 | 2051 | 525,000.00    |
| Robertson | MS MONTE ROSSA              | 315  | 2006 | 2051 | 525,000.00    |
| Robertson | MS-FOUR OAKS                | 315  | 2007 | 2052 | 525,000.00    |
| Robertson | MS-BARRY STR 1              | 315  | 2008 | 2053 | 525,000.00    |
| Robertson | MS BERGSIG                  | 500  | 2008 | 2053 | 575,000.00    |
| Robertson | MS REITZ STR                | 500  | 2006 | 2051 | 575,000.00    |
| Robertson | MS MORESON GRONDVERSKUIWERS | 315  | 2007 | 2052 | 525,000.00    |
| Robertson | MS Hospitaal                | 500  | 2013 | 2058 | 575,000.00    |
| Robertson | MS-MUSEUM                   | 315  | 2013 | 2058 | 525,000.00    |
| Robertson | MS-AFRICA                   | 315  | 1999 | 2044 | 525,000.00    |
| Robertson | MS-TOESONG                  | 315  |      |      | 525,000.00    |
| Robertson | MS RAIMONDIS                |      | 2009 | 2054 | 525,000.00    |
| Robertson |                             | 315  |      |      | 525,000.00    |
| Robertson | MS Gum Grove Dam            | 315  | 2006 | 2051 | 525,000.00    |
| Robertson | MS-Begonia                  | 500  | 1987 | 2032 | 575,000.00    |
| Robertson |                             |      | 2008 | 2053 | 525,000.00    |
| Robertson | ms springbok                |      | 2019 | 2064 | 525,000.00    |
| Robertson | ms bontebok                 |      | 2019 | 2064 | 525,000.00    |
| Robertson | ms hospital new             |      | 2019 | 2064 | 525,000.00    |
| Robertson | ms Robertson golf club      |      |      |      | 525,000.00    |
| Robertson | ms silverstrand 1           |      |      |      | 525,000.00    |
| Robertson | ms silverstrand 2           |      |      |      | 525,000.00    |
| Robertson | ms silverstrand 3           |      |      |      | 525,000.00    |
| Robertson | ms silverstrand 4           |      |      |      | 525,000.00    |
| Robertson | ms silverstrand 1a          |      |      |      | 525,000.00    |
| Robertson | Robertson Rioolwerke        | 500  | 2012 | 2057 | 575,000.00    |
| Robertson | Kaap Agri MS                |      |      |      | 525,000.00    |
|           |                             |      |      |      |               |
|           |                             |      |      |      | 44,600,000.00 |
|           |                             |      |      |      |               |

**Robertson Transformer Asset Condition**

| Area (Suburb) | Name                                                       | Type of Transformer | Rating | Installation Date | Replacement Date | Replacement Cost |
|---------------|------------------------------------------------------------|---------------------|--------|-------------------|------------------|------------------|
| Robertson     | PTRF UITSIG FARM PUMP 01                                   | POLE MOUNTED        | 100    | 1957              | 2002             | 75,000.00        |
| Robertson     | PTRF CROXLEY FARM PUMP 01                                  | POLE MOUNTED        | 10     | 1962              | 2007             | 20,000.00        |
| Robertson     | TRF KEURKLOOF QUARRY                                       | GROUND MOUNTED      | 300    | 1963              | 2008             | 464,288.00       |
| Robertson     | PTRF STREETLIGHT                                           | POLE MOUNTED        | 20     | 1963              | 2008             | 20,000.00        |
| Robertson     | PTRF KEURKLOOF 2                                           | POLE MOUNTED        | 100    | 1964              | 2009             | 75,000.00        |
| Robertson     | PTRF HIGHLANDS FARM HOUSE 4                                | POLE MOUNTED        | 15     | 1965              | 2010             | 20,000.00        |
| Robertson     | PTRF MADEBA WORKER HOUSES 1                                | POLE MOUNTED        | 25     | 1965              | 2010             | 20,000.00        |
| Robertson     | PTRF FRIKANA FARM PUMP 1                                   | POLE MOUNTED        | 25     | 1966              | 2011             | 40,000.00        |
| Robertson     | PTRF DIE WIE                                               | POLE MOUNTED        | 25     | 1966              | 2011             | 40,000.00        |
| Robertson     | PTRF SILVERSTRAND KAFEE                                    | POLE MOUNTED        | 75     | 1966              | 2011             | 75,000.00        |
| Robertson     | PTRF BOLAND PUMP 1                                         | POLE MOUNTED        | 75     | 1966              | 2011             | 75,000.00        |
| Robertson     | TRF HIGHLANDS FARM PUMP 1                                  | GROUND MOUNTED      | 200    | 1968              | 2013             | 464,288.00       |
| Robertson     | PTRF BILLY KLOPPERS HOUSE 2                                | POLE MOUNTED        | 25     | 1968              | 2013             | 40,000.00        |
| Robertson     | PTRF VINKRIVIER IGNASIUS DU PLESSIS STORE                  | POLE MOUNTED        | 50     | 1968              | 2013             | 55,000.00        |
| Robertson     | PTRF ARBEIDSGENOT PUMP 2                                   | POLE MOUNTED        | 50     | 1968              | 2013             | 55,000.00        |
| Robertson     | PTRF NERINA GUEST FARM HOUSE 1                             | POLE MOUNTED        | 10     | 1969              | 2014             | 20,000.00        |
| Robertson     | PTRF GOEDEREDE GASTHOUSE                                   | POLE MOUNTED        | 50     | 1969              | 2014             | 55,000.00        |
| Robertson     | PTRF CLERMONT STORE 1                                      | POLE MOUNTED        | 50     | 1969              | 2014             | 55,000.00        |
| Robertson     | PTRF MOUNT VIEW WORKER HOUSES 3                            | POLE MOUNTED        | 5      | 1969              | 2014             | 20,000.00        |
| Robertson     | PTRF VliegTUG VliegVELD                                    | POLE MOUNTED        | 10     | 1970              | 2015             | 20,000.00        |
| Robertson     | PTRF GOREERS HOOGTE PUMP                                   | POLE MOUNTED        | 10     | 1970              | 2015             | 20,000.00        |
| Robertson     | PTRF OPPIE FARM IZAK & JULIANA VERSTER                     | POLE MOUNTED        | 10     | 1970              | 2015             | 20,000.00        |
| Robertson     | PTRF OLYFENBOSCH COTTAGES                                  | POLE MOUNTED        | 10     | 1970              | 2015             | 20,000.00        |
| Robertson     | PTRF STR LIGHT                                             | POLE MOUNTED        | 10     | 1970              | 2015             | 20,000.00        |
| Robertson     | PTRF TIERHOEK PUMP 1                                       | POLE MOUNTED        | 15     | 1972              | 2017             | 20,000.00        |
| Robertson     | PTRF ORANGE GROVE FARM ARAUJO WERKERSHOUSE                 | POLE MOUNTED        | 50     | 1973              | 2018             | 20,000.00        |
| Robertson     | PTRF NOREE JOOD LE ROUX JONIOR HOUSE                       | POLE MOUNTED        | 10     | 1973              | 2018             | 20,000.00        |
| Robertson     | PTRF NO NAME WORKER HOUSES                                 | POLE MOUNTED        | 15     | 1973              | 2018             | 20,000.00        |
| Robertson     | PTRF ZANDBERG MOUNTAIN WORKERS HOUSES                      | POLE MOUNTED        | 25     | 1973              | 2018             | 40,000.00        |
| Robertson     | PTRF EDUARD BRUWER HOUSE 1                                 | POLE MOUNTED        | 50     | 1973              | 2018             | 55,000.00        |
| Robertson     | PTRF NO NAME PUMP 1                                        | POLE MOUNTED        | 75     | 1973              | 2018             | 75,000.00        |
| Robertson     | PTRF PAUL FARM                                             | POLE MOUNTED        | 75     | 1973              | 2018             | 75,000.00        |
| Robertson     | PTRF PROEFFARM WORKERS HOUSES                              | POLE MOUNTED        | 50     | 1974              | 2019             | 55,000.00        |
| Robertson     | PTRF ROODEZANT PUMP                                        | POLE MOUNTED        | 50     | 1975              | 2020             | 55,000.00        |
| Robertson     | PTRF BARRY LE ROUX WORKER HOUSES                           | POLE MOUNTED        | 50     | 1975              | 2020             | 55,000.00        |
| Robertson     | PTRF HERMAN                                                | POLE MOUNTED        | 50     | 1975              | 2020             | 55,000.00        |
| Robertson     | PTRF NERINA GUEST FARM PUMP 04                             | POLE MOUNTED        | 50     | 1975              | 2020             | 55,000.00        |
| Robertson     | PTRF KLIPLAPA HOUSE                                        | POLE MOUNTED        | 75     | 1975              | 2020             | 75,000.00        |
| Robertson     | PTRF WOLFKLOOF HOUSE 2                                     | POLE MOUNTED        | 100    | 1976              | 2021             | 75,000.00        |
| Robertson     | PTRF VINKRIVIER LAERSKOOL                                  | POLE MOUNTED        | 10     | 1976              | 2021             | 20,000.00        |
| Robertson     | PTRF GOREE ROAD 1                                          | POLE MOUNTED        | 10     | 1976              | 2021             | 20,000.00        |
| Robertson     | PTRF SILVERSTRAND 1                                        | POLE MOUNTED        | 75     | 1976              | 2021             | 75,000.00        |
| Robertson     | PTRF MONT BLOIS HOUSE 1                                    | POLE MOUNTED        | 100    | 1977              | 2022             | 75,000.00        |
| Robertson     | PTRF DASSIEHOEK HOUSE 1                                    | POLE MOUNTED        | 10     | 1977              | 2022             | 20,000.00        |
| Robertson     | PTRF VOORSPOED BOERDERY KRUISPAD PUMP 2                    | POLE MOUNTED        | 50     | 1977              | 2022             | 20,000.00        |
| Robertson     | PTRF DIE VLAKTE FARM STORE 1                               | POLE MOUNTED        | 50     | 1977              | 2022             | 55,000.00        |
| Robertson     | PTRF DASSIEHOEK HOUSE 2                                    | POLE MOUNTED        | 10     | 1978              | 2023             | 20,000.00        |
| Robertson     | PTRF HOUSEE                                                | POLE MOUNTED        | 25     | 1978              | 2023             | 40,000.00        |
| Robertson     | PTRF KLEINFARM PUMP 1                                      | POLE MOUNTED        | 50     | 1978              | 2023             | 55,000.00        |
| Robertson     | PTRF ROODEHOOGTE KWEKERY HOUSE 1                           | POLE MOUNTED        | 10     | 1979              | 2024             | 20,000.00        |
| Robertson     | PTRF VINKRIVIER IGNASIUS DU PLESSIS PUMP 2B                | POLE MOUNTED        | 16     | 1979              | 2024             | 20,000.00        |
| Robertson     | PTRF RANDRIVIER BOERDERY PUMP 1                            | POLE MOUNTED        | 25     | 1979              | 2024             | 40,000.00        |
| Robertson     | PTRF NOREE JOOD LE ROUX JONIOR PUMP 1                      | POLE MOUNTED        | 25     | 1979              | 2024             | 40,000.00        |
| Robertson     | PTRF ISA BEAU PUMP 2                                       | POLE MOUNTED        | 25     | 1979              | 2024             | 40,000.00        |
| Robertson     | PTRF FARMWERF PUMP 2                                       | POLE MOUNTED        | 25     | 1979              | 2024             | 40,000.00        |
| Robertson     | PTRF VOORSPOED BOERDERY NOREE HOUSE                        | POLE MOUNTED        | 75     | 1979              | 2024             | 75,000.00        |
| Robertson     | PTRF BERGZICHT LEVEY FOURIE                                | POLE MOUNTED        | 75     | 1979              | 2024             | 75,000.00        |
| Robertson     | PTRF PAUL FARM HOUSEE                                      | POLE MOUNTED        | 25     | 1980              | 2025             | 20,000.00        |
| Robertson     | PTRF LAAIFARM HOUSE 1                                      | POLE MOUNTED        | 15     | 1980              | 2025             | 20,000.00        |
| Robertson     | PTRF KEURKLOOF 1                                           | POLE MOUNTED        | 16     | 1980              | 2025             | 20,000.00        |
| Robertson     | PTRF TIERHOEK HOUSE                                        | POLE MOUNTED        | 25     | 1980              | 2025             | 40,000.00        |
| Robertson     | PTRF ALMONDBURY FARM PUMP                                  | POLE MOUNTED        | 50     | 1980              | 2025             | 55,000.00        |
| Robertson     | PTRF HIGHLANDS FARM HOUSE 1                                | POLE MOUNTED        | 50     | 1980              | 2025             | 55,000.00        |
| Robertson     | PTRF TESTING FARM PUMP                                     | POLE MOUNTED        | 50     | 1980              | 2025             | 55,000.00        |
| Robertson     | PTRF FARM TESTING                                          | POLE MOUNTED        | 50     | 1980              | 2025             | 55,000.00        |
| Robertson     | PTRF SKURWEKOP HOUSE                                       | POLE MOUNTED        | 100    | 1981              | 2026             | 75,000.00        |
| Robertson     | PTRF RED GOLD FARM PUMP                                    | POLE MOUNTED        | 15     | 1981              | 2026             | 20,000.00        |
| Robertson     | PTRF ROODEHOOGTE MELKERY PUMP 1                            | POLE MOUNTED        | 15     | 1981              | 2026             | 20,000.00        |
| Robertson     | PTRF VOORUITSIG HOUSE 1                                    | POLE MOUNTED        | 15     | 1981              | 2026             | 20,000.00        |
| Robertson     | PTRF WENTZEL HOUSE 1                                       | POLE MOUNTED        | 25     | 1981              | 2026             | 40,000.00        |
| Robertson     | PTRF HIGHLANDS FARM HOUSE 2                                | POLE MOUNTED        | 30     | 1981              | 2026             | 55,000.00        |
| Robertson     | PTRF LA COLLINE 2                                          | POLE MOUNTED        | 50     | 1981              | 2026             | 55,000.00        |
| Robertson     | PTRF GOREERS HOOGTE MELKFARM PUMP                          | POLE MOUNTED        | 50     | 1981              | 2026             | 55,000.00        |
| Robertson     | PTRF AA CILLIER EILANDIA PUMP 2                            | POLE MOUNTED        | 50     | 1981              | 2026             | 55,000.00        |
| Robertson     | PTRF AMANDALIA VINEYARD PETER & JUNE ROBINSON PUMP(RETAKE) | POLE MOUNTED        | 50     | 1981              | 2026             | 55,000.00        |
| Robertson     | PTRF LITTLE FRANCE                                         | POLE MOUNTED        | 75     | 1981              | 2026             | 75,000.00        |
| Robertson     | PTRF MOUNT VIEW WORKER HOUSES 2                            | POLE MOUNTED        | 16     | 1982              | 2027             | 20,000.00        |
| Robertson     | PTRF SUNBIRD WORKER HOUSES 1                               | POLE MOUNTED        | 50     | 1982              | 2027             | 55,000.00        |
| Robertson     | PTRF MONT BLOIS WORKER HOUSES                              | POLE MOUNTED        | 75     | 1982              | 2027             | 75,000.00        |
| Robertson     | PTRF WOLFKLOOF                                             | POLE MOUNTED        | 75     | 1982              | 2027             | 75,000.00        |
| Robertson     | PTRF BONCAP PUMP                                           | POLE MOUNTED        | 100    | 1983              | 2028             | 75,000.00        |

|           |                                                      |                |     |      |      |            |
|-----------|------------------------------------------------------|----------------|-----|------|------|------------|
| Robertson | PTRF BONCAP 1                                        | POLE MOUNTED   | 100 | 1983 | 2028 | 75,000.00  |
| Robertson | PTRF HIGHLANDS FARM PUMP 2                           | POLE MOUNTED   | 100 | 1983 | 2028 | 75,000.00  |
| Robertson | PTRF NOREE JOOD LE ROUX JONIOR PUMP 2                | POLE MOUNTED   | 50  | 1983 | 2028 | 20,000.00  |
| Robertson | PTRF TIERHOEK PUMP 2                                 | POLE MOUNTED   | 10  | 1983 | 2028 | 20,000.00  |
| Robertson | PTRF DRIE EIKE JAN & SEUN PUMP 2                     | POLE MOUNTED   | 15  | 1983 | 2028 | 20,000.00  |
| Robertson | PTRF VINKRIVIER PUMP                                 | POLE MOUNTED   | 160 | 1983 | 2028 | 130,000.00 |
| Robertson | PTRF ROTENBERG AM BREEDE THOMAS HOUSE                | POLE MOUNTED   | 16  | 1983 | 2028 | 20,000.00  |
| Robertson | PTRF LA COLLINE PUMP 4                               | POLE MOUNTED   | 25  | 1983 | 2028 | 40,000.00  |
| Robertson | PTRF VOORSPOED BOERDERY NOREE WORKERS HOUSES         | POLE MOUNTED   | 25  | 1983 | 2028 | 40,000.00  |
| Robertson | PTRF DS ALEX GERBER NATURE RESERVE                   | POLE MOUNTED   | 25  | 1983 | 2028 | 40,000.00  |
| Robertson | PTRF GRAHAM BECK WINES PUMP 1                        | POLE MOUNTED   | 100 | 1983 | 2028 | 40,000.00  |
| Robertson | PTRF BETANIE FARM PUMP 1                             | POLE MOUNTED   | 50  | 1983 | 2028 | 40,000.00  |
| Robertson | PTRF VRUCHTBAAR ALWYN & FRANCOIS BRUWER              | POLE MOUNTED   | 50  | 1983 | 2028 | 55,000.00  |
| Robertson | PTRF THE GOSPEL EXPRESS                              | POLE MOUNTED   | 50  | 1983 | 2028 | 55,000.00  |
| Robertson | PTRF RIVER HOUSE STEYTLER                            | POLE MOUNTED   | 50  | 1983 | 2028 | 55,000.00  |
| Robertson | PTRF MGRÖBLERSDAL PUMP                               | POLE MOUNTED   | 50  | 1983 | 2028 | 55,000.00  |
| Robertson | PTRF VOORSPOED BOERDERY DIE EIKE                     | POLE MOUNTED   | 50  | 1983 | 2028 | 55,000.00  |
| Robertson | PTRF TOIINGSRIVIER PIERRE & ELNETTE AURET HOUSE      | POLE MOUNTED   | 50  | 1983 | 2028 | 55,000.00  |
| Robertson | PTRF AMANDALIA VINEYARD PHILLIP & BARBARA ROBINSON   | POLE MOUNTED   | 50  | 1983 | 2028 | 55,000.00  |
| Robertson | PTRF KULPLAPA                                        | POLE MOUNTED   | 50  | 1983 | 2028 | 55,000.00  |
| Robertson | PTRF DAGERRAAK HOUSE 2                               | POLE MOUNTED   | 50  | 1983 | 2028 | 55,000.00  |
| Robertson | PTRF ARBEIDSGENOT HOUSE                              | POLE MOUNTED   | 50  | 1983 | 2028 | 55,000.00  |
| Robertson | PTRF BUITENSTEKLOOF 2                                | POLE MOUNTED   | 50  | 1983 | 2028 | 55,000.00  |
| Robertson | PTRF LA COLLINE 3                                    | POLE MOUNTED   | 75  | 1983 | 2028 | 75,000.00  |
| Robertson | PTRF PROEFFARM OFFICE                                | POLE MOUNTED   | 50  | 1983 | 2028 | 55,000.00  |
| Robertson | PTRF VULLISTEREIN HOUSE                              | POLE MOUNTED   | 10  | 1983 | 2028 | 20,000.00  |
| Robertson | PTRF ZANDBERG MOUNTAIN LOOKOUT HOUSE                 | POLE MOUNTED   | 50  | 1983 | 2028 | 55,000.00  |
| Robertson | PTRF BILLY KLOPPERS HOUSE 1                          | POLE MOUNTED   | 50  | 1983 | 2028 | 55,000.00  |
| Robertson | PTRF SILVERSTRAND 2                                  | POLE MOUNTED   | 25  | 1983 | 2028 | 40,000.00  |
| Robertson | PTRF VINKRIVIER IGNASIUS DU PLESSIS                  | POLE MOUNTED   | 10  | 1983 | 2028 | 20,000.00  |
| Robertson | PTRF VINKRIVIER IGNASIUS DU PLESSIS WORKERS HOUSES 2 | POLE MOUNTED   | 25  | 1983 | 2028 | 40,000.00  |
| Robertson | PTRF VINKRIVIER IGNASIUS DU PLESSIS PUMP 2A          | POLE MOUNTED   | 16  | 1983 | 2028 | 20,000.00  |
| Robertson | PTRF ORANGE GROVE FARM PUMP 2                        | POLE MOUNTED   | 25  | 1983 | 2028 | 40,000.00  |
| Robertson | PTRF AMANDALIA VINEYARD PETER & JUNE ROBINSON STORE  | POLE MOUNTED   | 20  | 1983 | 2028 | 20,000.00  |
| Robertson | PTRF ALEXIA PUMP 1B                                  | FLOOR STANDING | 50  | 1983 | 2028 | 40,000.00  |
| Robertson | PTRF KLIPPIESDAL                                     | POLE MOUNTED   | 50  | 1983 | 2028 | 55,000.00  |
| Robertson | PTRF BUITENSTEKLOOF 1                                | POLE MOUNTED   | 5   | 1983 | 2028 | 20,000.00  |
| Robertson | TRF HIGHLANDS GUEST HOUSE                            | GROUND MOUNTED | 500 | 1984 | 2029 | 520,381.40 |
| Robertson | PTRF RIVER HOUSE STEYTLER OFFICE                     | POLE MOUNTED   | 25  | 1984 | 2029 | 40,000.00  |
| Robertson | PTRF CILLIER OEWER PUMP 2                            | POLE MOUNTED   | 25  | 1984 | 2029 | 40,000.00  |
| Robertson | PTRF BETANIE FARM HOUSE 1                            | POLE MOUNTED   | 25  | 1984 | 2029 | 40,000.00  |
| Robertson | PTRF BILLY KLOPPERS PUMP 1                           | POLE MOUNTED   | 50  | 1984 | 2029 | 55,000.00  |
| Robertson | PTRF LA COLLINE 1                                    | POLE MOUNTED   | 100 | 1985 | 2030 | 75,000.00  |
| Robertson | PTRF AGTER DIE BOS PUMP                              | POLE MOUNTED   | 75  | 1985 | 2030 | 75,000.00  |
| Robertson | PTRF VOORUITSIG PUMP 1                               | POLE MOUNTED   | 75  | 1985 | 2030 | 75,000.00  |
| Robertson | PTRF VOORSPOED BOERDERY NOREE PUMP 1                 | POLE MOUNTED   | 25  | 1986 | 2031 | 40,000.00  |
| Robertson | PTRF LITTLE FRANCE PUMP 1                            | POLE MOUNTED   | 25  | 1986 | 2031 | 40,000.00  |
| Robertson | PTRF WONDERFONTEIN WORKERS HOUSES                    | POLE MOUNTED   | 50  | 1986 | 2031 | 55,000.00  |
| Robertson | PTRF RANDRIVIER SA BRUWER HOUSE                      | POLE MOUNTED   | 100 | 1987 | 2032 | 75,000.00  |
| Robertson | PTRF ROODEHOOGTE GAWIE                               | POLE MOUNTED   | 50  | 1987 | 2032 | 55,000.00  |
| Robertson | PTRF SILVER VALE STEFAN & MICHELLE BRUWER            | POLE MOUNTED   | 50  | 1987 | 2032 | 55,000.00  |
| Robertson | PTRF GILLIER OEWER PUMP 1                            | POLE MOUNTED   | 50  | 1987 | 2032 | 55,000.00  |
| Robertson | PTRF GOREERS HOOGTE BERGPUMP                         | POLE MOUNTED   | 75  | 1987 | 2032 | 75,000.00  |
| Robertson | PTRF VULLISTEREIN                                    | POLE MOUNTED   | 10  | 1988 | 2033 | 20,000.00  |
| Robertson | PTRF ISA BEAU PUMP 3                                 | POLE MOUNTED   | 10  | 1988 | 2033 | 20,000.00  |
| Robertson | PTRF NENTSA STR                                      | POLE MOUNTED   | 160 | 1988 | 2033 | 130,000.00 |
| Robertson | PTRF DE OUDE OPSTAL PUMP                             | POLE MOUNTED   | 16  | 1988 | 2033 | 20,000.00  |
| Robertson | PTRF RED GOLD FARM HOUSE                             | POLE MOUNTED   | 25  | 1988 | 2033 | 40,000.00  |
| Robertson | PTRF TIERHOEK BERGPUMP                               | POLE MOUNTED   | 25  | 1988 | 2033 | 40,000.00  |
| Robertson | PTRF RANDRIVIER PUMP                                 | POLE MOUNTED   | 75  | 1988 | 2033 | 75,000.00  |
| Robertson | PTRF DUVON PUMP 1                                    | POLE MOUNTED   | 75  | 1988 | 2033 | 75,000.00  |
| Robertson | PTRF 1 BOLAND                                        | POLE MOUNTED   | 100 | 1989 | 2034 | 75,000.00  |
| Robertson | PTRF PROEFFARM HOUSE                                 | POLE MOUNTED   | 16  | 1989 | 2034 | 20,000.00  |
| Robertson | PTRF RIVERSIDE PRIMARY                               | POLE MOUNTED   | 15  | 1989 | 2034 | 20,000.00  |
| Robertson | PTRF LIVERSIDE HOUSEE                                | POLE MOUNTED   | 16  | 1989 | 2034 | 20,000.00  |
| Robertson | PTRF SKURWEKOP WORKER HOUSES 1                       | POLE MOUNTED   | 25  | 1989 | 2034 | 40,000.00  |
| Robertson | PTRF NERINA GUEST FARM HOUSE 2                       | POLE MOUNTED   | 50  | 1989 | 2034 | 55,000.00  |
| Robertson | PTRF ROODEHOOGTE                                     | POLE MOUNTED   | 50  | 1990 | 2035 | 55,000.00  |
| Robertson | PTRF VOORSPOED ERENT PUMP 2                          | POLE MOUNTED   | 75  | 1990 | 2035 | 75,000.00  |
| Robertson | PTRF NOREE JOOD & ANNA MARIE                         | POLE MOUNTED   | 100 | 1991 | 2036 | 75,000.00  |
| Robertson | PTRF VAN KOPENHAGEN                                  | POLE MOUNTED   | 25  | 1991 | 2036 | 40,000.00  |
| Robertson | PTRF BEAUMONT POMEGRANATE FARM HOUSE                 | POLE MOUNTED   | 50  | 1991 | 2036 | 55,000.00  |
| Robertson | PTRF MADEBA WORKER HOUSES 2                          | POLE MOUNTED   |     | 1992 | 2037 | 75,000.00  |
| Robertson | PTRF HUGUENOOT PRIMARY 2                             | POLE MOUNTED   | 200 | 1992 | 2037 | 130,000.00 |
| Robertson | PTRF GROBLERSDAL PERDE STAL                          | POLE MOUNTED   | 50  | 1992 | 2037 | 55,000.00  |
| Robertson | PTRF WOLVENKLOOF HOUSE 1                             | POLE MOUNTED   | 50  | 1992 | 2037 | 55,000.00  |
| Robertson | PTRF LAAIFARM WORKER HOUSES 1                        | POLE MOUNTED   | 25  | 1993 | 2038 | 40,000.00  |
| Robertson | PTRF SMITH                                           | POLE MOUNTED   | 100 | 1994 | 2039 | 75,000.00  |
| Robertson | PTRF ARBEIDSGENOT WORKERS HOUSES                     | POLE MOUNTED   | 25  | 1994 | 2039 | 40,000.00  |
| Robertson | PTRF RED GOLD FARM RESTUARANT                        | POLE MOUNTED   | 100 | 1994 | 2039 | 55,000.00  |
| Robertson | PTRF BIRDS PARADISE                                  | POLE MOUNTED   | 100 | 1995 | 2040 | 75,000.00  |
| Robertson | PTRF IGLOO HOUSES                                    | POLE MOUNTED   | 160 | 1995 | 2040 | 130,000.00 |
| Robertson | PTRF ROBERTSON WINERY                                | POLE MOUNTED   | 25  | 1995 | 2040 | 40,000.00  |
| Robertson | PTRF RIVER HOUSE STEYTLER PUMP 2                     | POLE MOUNTED   | 50  | 1995 | 2040 | 55,000.00  |
| Robertson | PTRF HIGHLANDS FARM WORKER HOUSES 1                  | POLE MOUNTED   | 50  | 1995 | 2040 | 55,000.00  |

|           |                                                     |                |     |      |      |            |
|-----------|-----------------------------------------------------|----------------|-----|------|------|------------|
| Robertson | PTRF RIVERSIDE 1                                    | POLE MOUNTED   | 50  | 1995 | 2040 | 55,000.00  |
| Robertson | PTRF VOORSPOED ERENT PUMP 1                         | POLE MOUNTED   | 100 | 1996 | 2041 | 75,000.00  |
| Robertson | PTRF MOUNTAIN VIEW HOUSE 1                          | POLE MOUNTED   | 100 | 1996 | 2041 | 75,000.00  |
| Robertson | PTRF RIVER BEND FARMS                               | POLE MOUNTED   | 100 | 1996 | 2041 | 75,000.00  |
| Robertson | PTRF DAGERAAC PUMP 1                                | POLE MOUNTED   | 100 | 1996 | 2041 | 75,000.00  |
| Robertson | PTRF AA CILLIER IILANDIA PUMP 1                     | POLE MOUNTED   | 100 | 1996 | 2041 | 75,000.00  |
| Robertson | PTRF 2 BOLAND                                       | POLE MOUNTED   | 100 | 1996 | 2041 | 75,000.00  |
| Robertson | PTRF LONG VALLEY FARM HOUSE 2                       | POLE MOUNTED   | 100 | 1996 | 2041 | 75,000.00  |
| Robertson | PTRF NENTSA STR                                     | POLE MOUNTED   | 160 | 1996 | 2041 | 130,000.00 |
| Robertson | PTRF MKHAFU STR                                     | POLE MOUNTED   | 200 | 1996 | 2041 | 130,000.00 |
| Robertson | PTRF GROBLERSDAL TORING                             | POLE MOUNTED   | 25  | 1996 | 2041 | 40,000.00  |
| Robertson | PTRF RANDRIVIER                                     | POLE MOUNTED   | 50  | 1996 | 2041 | 55,000.00  |
| Robertson | PTRF UITSIG WORKER HOUSES 1                         | POLE MOUNTED   | 50  | 1996 | 2041 | 55,000.00  |
| Robertson | PTRF FARMWERF PUMP 1                                | POLE MOUNTED   | 50  | 1996 | 2041 | 55,000.00  |
| Robertson | PTRF PERASIM HOUSE 1                                | POLE MOUNTED   | 100 | 1997 | 2042 | 75,000.00  |
| Robertson | PTRF ZANDBERG MOUNTAIN LOOKOUT PUMP 1               | POLE MOUNTED   | 25  | 1997 | 2042 | 40,000.00  |
| Robertson | PTRF RIVER HOUSE STEYTLER PUMP 1                    | POLE MOUNTED   | 25  | 1997 | 2042 | 40,000.00  |
| Robertson | PTRF KLAASVOOGDS LINE 4                             | POLE MOUNTED   | 50  | 1997 | 2042 | 55,000.00  |
| Robertson | PTRF ROODEHOOGTE PUMP                               | POLE MOUNTED   | 50  | 1997 | 2042 | 55,000.00  |
| Robertson | PTRF GROOT GENOEG STORE 1                           | POLE MOUNTED   | 50  | 1997 | 2042 | 55,000.00  |
| Robertson | PTRF GOREERS HOOGTE HOUSE                           | POLE MOUNTED   | 100 | 1998 | 2043 | 75,000.00  |
| Robertson | PTRF DAGERAAC HOUSE 1                               | POLE MOUNTED   | 100 | 1998 | 2043 | 75,000.00  |
| Robertson | PTRF ARBEIDSGENOT PUMP 1                            | POLE MOUNTED   | 100 | 1998 | 2043 | 75,000.00  |
| Robertson | PTRF ISA BEAU STORE 1                               | POLE MOUNTED   | 25  | 1998 | 2043 | 40,000.00  |
| Robertson | PTRF DRIE EIKE JAN & SEUN PUMP 1                    | POLE MOUNTED   | 15  | 1998 | 2043 | 55,000.00  |
| Robertson | PTRF SPAARKLOOF GILSON                              | POLE MOUNTED   | 50  | 1998 | 2043 | 55,000.00  |
| Robertson | PTRF RIVERSCAPE                                     | POLE MOUNTED   | 50  | 1998 | 2043 | 55,000.00  |
| Robertson | PTRF ROODEHOOGTE MELKERY MAIN HOUSE 1               | POLE MOUNTED   | 100 | 1999 | 2044 | 75,000.00  |
| Robertson | PTRF ZOOTIGHEYD VOORMAN HOUSE                       | POLE MOUNTED   | 100 | 1999 | 2044 | 75,000.00  |
| Robertson | PTRF WEDEROM GUEST HOUSE                            | POLE MOUNTED   | 100 | 1999 | 2044 | 75,000.00  |
| Robertson | PTRF PERASIM WORKER HOUSES                          | POLE MOUNTED   | 100 | 1999 | 2044 | 75,000.00  |
| Robertson | PTRF DB S6                                          | POLE MOUNTED   | 25  | 1999 | 2044 | 40,000.00  |
| Robertson | PTRF ROODEHOOGTE MELKERY                            | POLE MOUNTED   | 25  | 1999 | 2044 | 40,000.00  |
| Robertson | PTRF LITTLE FRANCE GUEST HOUSE                      | POLE MOUNTED   | 50  | 1999 | 2044 | 55,000.00  |
| Robertson | PTRF LA MAISON PUMP 2                               | POLE MOUNTED   | 200 | 2000 | 2045 | 130,000.00 |
| Robertson | PTRF WATERFALL LODGE                                | POLE MOUNTED   | 25  | 2000 | 2045 | 40,000.00  |
| Robertson | PTRF CLAIRVAUX                                      | POLE MOUNTED   | 50  | 2000 | 2045 | 55,000.00  |
| Robertson | PTRF MOUNT VIEW WORKER HOUSES 1                     | POLE MOUNTED   | 50  | 2000 | 2045 | 55,000.00  |
| Robertson | PTRF DE GOREE FARMING PUMP 1                        | POLE MOUNTED   | 50  | 2000 | 2045 | 55,000.00  |
| Robertson | PTRF RIVIERZICHT STORE 1                            | POLE MOUNTED   | 50  | 2000 | 2045 | 55,000.00  |
| Robertson | PTRF NTONZIMA STR                                   | POLE MOUNTED   | 200 | 2001 | 2046 | 130,000.00 |
| Robertson | PTRF VOORSPOED BOERDERY KRUISPAD PUMP 1             | POLE MOUNTED   | 100 | 2002 | 2047 | 75,000.00  |
| Robertson | PTRF DIBANDLELA STR                                 | POLE MOUNTED   | 200 | 2002 | 2047 | 130,000.00 |
| Robertson | PTRF NTLANGO STR                                    | POLE MOUNTED   | 200 | 2002 | 2047 | 130,000.00 |
| Robertson | PTRF RORWANA STR                                    | POLE MOUNTED   | 200 | 2002 | 2047 | 130,000.00 |
| Robertson | PTRF DIBANDLELA STR                                 | POLE MOUNTED   | 200 | 2002 | 2047 | 130,000.00 |
| Robertson | PTRF MADEBA GRAHAM BECKS WINES PUMP 1               | POLE MOUNTED   | 200 | 2002 | 2047 | 130,000.00 |
| Robertson | PTRF GRAHAM BECK WINES HOUSE                        | POLE MOUNTED   | 200 | 2002 | 2047 | 130,000.00 |
| Robertson | PTRF VAN KOPENHAGEN GROENHOF                        | POLE MOUNTED   | 50  | 2002 | 2047 | 55,000.00  |
| Robertson | PTRF ORANGE GROVE FARM PUMP 1                       | POLE MOUNTED   | 50  | 2002 | 2047 | 55,000.00  |
| Robertson | PTRF HIGHLANDS FARM HOUSE 3                         | POLE MOUNTED   | 50  | 2002 | 2047 | 55,000.00  |
| Robertson | PTRF RED GOLD FARM KWEKERY                          | POLE MOUNTED   | 100 | 2003 | 2048 | 75,000.00  |
| Robertson | PTRF DIE POORD LA COLLINE SWIEGERS PUMP 1           | POLE MOUNTED   | 100 | 2003 | 2048 | 75,000.00  |
| Robertson | PTRF SPAARKLOOF GILSON STORE                        | POLE MOUNTED   | 100 | 2003 | 2048 | 75,000.00  |
| Robertson | PTRF AMANDALIA VINEYARD PETER & JUNE ROBINSON HOUSE | POLE MOUNTED   | 100 | 2003 | 2048 | 75,000.00  |
| Robertson | PTRF SMITH PUMP 1                                   | POLE MOUNTED   | 100 | 2003 | 2048 | 75,000.00  |
| Robertson | PTRF ALEXIA PUMP 1A                                 | POLE MOUNTED   | 100 | 2003 | 2048 | 75,000.00  |
| Robertson | PTRF BON ROUGE BON CAP                              | POLE MOUNTED   | 100 | 2003 | 2048 | 75,000.00  |
| Robertson | PTRF NERINA GUEST HOUSE PUMP 1                      | POLE MOUNTED   | 100 | 2003 | 2048 | 75,000.00  |
| Robertson | PTRF SKURWEKOP WORKER HOUSES 1                      | POLE MOUNTED   | 100 | 2003 | 2048 | 75,000.00  |
| Robertson | PTRF BILLY KLOPPERS DIE POORD GASTEHOUSEE           | POLE MOUNTED   | 50  | 2003 | 2048 | 55,000.00  |
| Robertson | PTRF VINKRIVIER IGNASIUS DU PLESSIS PUMP 1          | POLE MOUNTED   | 50  | 2003 | 2048 | 55,000.00  |
| Robertson | PTRF ORANGE GROVE FARM HOUSE                        | POLE MOUNTED   | 50  | 2004 | 2049 | 55,000.00  |
| Robertson | PTRF HUGUENOOT PRIMARY 3                            | POLE MOUNTED   | 25  | 2005 | 2050 | 40,000.00  |
| Robertson | PTRF LONG VALLEY FARM HOUSE 1                       | POLE MOUNTED   | 50  | 2005 | 2050 | 55,000.00  |
| Robertson | PTRF TOWER                                          | POLE MOUNTED   | 100 | 2006 | 2051 | 75,000.00  |
| Robertson | PTRF DIBANDLELA                                     | POLE MOUNTED   | 160 | 2006 | 2051 | 130,000.00 |
| Robertson | PTRF KLAASVOOGDS LINE 6                             | POLE MOUNTED   | 25  | 2006 | 2051 | 40,000.00  |
| Robertson | PTRF ROBERTSON DEPO                                 | POLE MOUNTED   | 25  | 2006 | 2051 | 40,000.00  |
| Robertson | PTRF MOUNT VIEW PUMP 01                             | POLE MOUNTED   | 50  | 2006 | 2051 | 55,000.00  |
| Robertson | PTRF ROOIBERG SECTOR POLICE STATION                 | POLE MOUNTED   | 100 | 2007 | 2052 | 75,000.00  |
| Robertson | PTRF ROBERTSON ABORTTOIR                            | POLE MOUNTED   | 50  | 2007 | 2052 | 55,000.00  |
| Robertson | PTRF ISA BEAU WORKER HOUSES 6                       | POLE MOUNTED   | 100 | 2008 | 2053 | 75,000.00  |
| Robertson | PTRF LA MAISON STORE 1                              | POLE MOUNTED   | 100 | 2008 | 2053 | 75,000.00  |
| Robertson | PTRF BETANIE FARM HOUSE 2                           | POLE MOUNTED   | 25  | 2011 | 2056 | 40,000.00  |
| Robertson | PTRF DIE LAATJIE HOUSE 1                            | POLE MOUNTED   | 50  | 2008 | 2053 | 55,000.00  |
| Robertson | PTRF HUGUENOOT HOUSE                                | POLE MOUNTED   | 100 | 2009 | 2054 | 75,000.00  |
| Robertson | PTRF HUGUENOOT PRIMARY 1                            | POLE MOUNTED   | 25  | 2009 | 2054 | 40,000.00  |
| Robertson | PTRF CROXLEY FARM                                   | POLE MOUNTED   | 25  | 2009 | 2054 | 40,000.00  |
| Robertson | PTRF ROTENBERG AM BREEDE HOUSE                      | POLE MOUNTED   | 50  | 2009 | 2054 | 55,000.00  |
| Robertson | PTRF SMITH PUMP 3                                   | POLE MOUNTED   | 50  | 2009 | 2054 | 55,000.00  |
| Robertson | PTRF DIE POORD GROOT PUMP                           | POLE MOUNTED   | 100 | 2010 | 2055 | 75,000.00  |
| Robertson | PTRF ROODEHOOGTE WORKER HOUSES                      | POLE MOUNTED   | 50  | 2009 | 2054 | 55,000.00  |
| Robertson | TRANSFORMER                                         | FLOOR STANDING |     | 1981 | 2026 | 464,288.00 |
| Robertson | POLE TRANSFORMER                                    | POLE MOUNTED   | 10  | 1981 | 2026 | 20,000.00  |

|           |                                           |                |     |      |      |            |
|-----------|-------------------------------------------|----------------|-----|------|------|------------|
| Robertson | SS-EERSTE LAAN                            | GROUND MOUNTED | 500 | 1983 | 2028 | 520,381.40 |
| Robertson | SS - VAN ZYL STR                          | GROUND MOUNTED | 500 | 1981 | 2026 | 520,381.40 |
| Robertson | SS - KEEROM STR                           | GROUND MOUNTED | 200 | 1963 | 2008 | 464,288.00 |
| Robertson | LEEUWIN LAAN                              | FLOOR STANDING | 500 | 1981 | 2026 | 520,381.40 |
| Robertson | TRANSFORMER                               | FLOOR STANDING | 500 | 1970 | 2015 | 520,381.40 |
| Robertson | SS - MERWE HOFF                           | GROUND MOUNTED | 500 | 1991 | 2036 | 520,381.40 |
| Robertson | SS - ALBERT STR                           | GROUND MOUNTED | 300 | 1974 | 2019 | 464,288.00 |
| Robertson | SS - BERGSIG                              | GROUND MOUNTED | 500 | 1997 | 2042 | 520,381.40 |
| Robertson | SS-ROLBAL BAAN                            | FLOOR STANDING | 500 | 1980 | 2025 | 520,381.40 |
| Robertson | SS - POLISIE STASIE                       | GROUND MOUNTED | 100 | 1974 | 2019 | 464,288.00 |
| Robertson | SS - VICTORIA STR - TRANSFORMER           | FLOOR STANDING | 400 | 1980 | 2025 | 520,381.40 |
| Robertson | SS - SENTRAAL                             | GROUND MOUNTED | 800 | 2010 | 2055 | 575,542.00 |
| Robertson | SS - Reitz str                            | FLOOR STANDING | 500 | 1976 | 2021 | 520,381.40 |
| Robertson | SS-ROBERTSON DISTILLERY                   | GROUND MOUNTED | 300 | 1962 | 2007 | 464,288.00 |
| Robertson | SS-INDUSTRIAL-TRANSFORMER                 | GROUND MOUNTED | 400 | 1972 | 2017 | 520,381.40 |
| Robertson | SS-NESTLE                                 | FLOOR STANDING | 500 | 1973 | 2018 | 520,381.40 |
| Robertson | TRANSFORMER                               | GROUND MOUNTED | 500 | 1975 | 2020 | 520,381.40 |
| Robertson | TRANSFORMER                               | GROUND MOUNTED | 100 | 1978 | 2023 | 464,288.00 |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 55,000.00  |
| Robertson | 1149                                      | FLOOR STANDING | 25  |      |      | 464,288.00 |
| Robertson |                                           | GROUND MOUNTED | 0   |      |      | 464,288.00 |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 55,000.00  |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 55,000.00  |
| Robertson |                                           | POLE MOUNTED   | 25  |      |      | 40,000.00  |
| Robertson |                                           | POLE MOUNTED   | 100 |      |      | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 55,000.00  |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 55,000.00  |
| Robertson | no name                                   | POLE MOUNTED   | 0   |      |      | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 55,000.00  |
| Robertson |                                           | POLE MOUNTED   | 25  |      |      | 40,000.00  |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 55,000.00  |
| Robertson |                                           | POLE MOUNTED   | 100 |      |      | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 55,000.00  |
| Robertson | SS-HOSPITAL                               | FLOOR STANDING | 400 |      |      | 520,381.40 |
| Robertson | CT/VT metering unit. MV Robertson winery  | GROUND MOUNTED | 0   |      |      | 464,288.00 |
| Robertson |                                           | FLOOR STANDING | 50  |      |      | 464,288.00 |
| Robertson |                                           | FLOOR STANDING | 25  |      |      | 464,288.00 |
| Robertson |                                           | FLOOR STANDING | 100 |      |      | 464,288.00 |
| Robertson | PTRF ROODEHOOGTE PUMP 1                   | POLE MOUNTED   | 25  | 1983 | 2028 | 40,000.00  |
| Robertson | PTRF ROODEHOOGTE HOUSE 1                  | POLE MOUNTED   | 16  | 1983 | 2028 | 20,000.00  |
| Robertson | TRF ROODEHOOGTE BRAAM MARAIS HOUSE 1      | FLOOR STANDING | 100 | 1997 | 2042 | 464,288.00 |
| Robertson |                                           | FLOOR STANDING | 50  |      |      | 464,288.00 |
| Robertson | PTRF LA FONTAINE HOUSE 1                  | POLE MOUNTED   | 75  | 1986 | 2031 | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 55,000.00  |
| Robertson | PTRF LA FONTAINE PUMP 1                   | POLE MOUNTED   | 25  | 2003 | 2048 | 40,000.00  |
| Robertson | TRF DIE HOOP                              | FLOOR STANDING | 500 | 2004 | 2049 | 520,381.40 |
| Robertson | PTRF ISA BEAU WORKER HOUSES 1             | POLE MOUNTED   | 25  | 1980 | 2025 | 40,000.00  |
| Robertson | PTRF HOOPSRIVIER PRIMARY                  | POLE MOUNTED   | 50  | 1970 | 2015 | 55,000.00  |
| Robertson | PTRF ISA BEAU PUMP 1                      | POLE MOUNTED   | 20  | 1982 | 2027 | 20,000.00  |
| Robertson | PTRF ISA BEAU WORKER HOUSES 2             | POLE MOUNTED   | 100 | 1980 | 2025 | 75,000.00  |
| Robertson | TRF MONT BLOIS                            | FLOOR STANDING | 315 | 2001 | 2046 | 20,000.00  |
| Robertson | PTRF SUNBIRD PUMP 1                       | POLE MOUNTED   | 100 | 2000 | 2045 | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 0   |      |      | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 25  |      |      | 40,000.00  |
| Robertson |                                           | POLE MOUNTED   | 25  |      |      | 40,000.00  |
| Robertson |                                           | POLE MOUNTED   | 0   |      |      | 75,000.00  |
| Robertson |                                           | FLOOR STANDING | 200 |      |      | 464,288.00 |
| Robertson |                                           | POLE MOUNTED   | 16  |      |      | 20,000.00  |
| Robertson | 3 Eike                                    | POLE MOUNTED   | 100 |      |      | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 315 |      |      | 190,000.00 |
| Robertson |                                           | POLE MOUNTED   |     |      |      | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 75,000.00  |
| Robertson | PTRF BILLY KLOPPERS DIE POORD PUMP 1      | POLE MOUNTED   | 50  | 1979 | 2024 | 55,000.00  |
| Robertson | PTRF DIE POORD GROOT PUMP                 | POLE MOUNTED   | 100 | 2010 | 2055 | 75,000.00  |
| Robertson | PTRF DIE POORD GROOT PUMP                 | POLE MOUNTED   | 100 | 2010 | 2055 | 75,000.00  |
| Robertson | PTRF DIE POORD GROOT PUMP                 | POLE MOUNTED   | 100 | 2010 | 2055 | 75,000.00  |
| Robertson | PTRF DIE POORD LA COLLINE SWIEGERS PUMP 2 | POLE MOUNTED   | 100 | 2005 | 2050 | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 500 |      |      | 350,000.00 |
| Robertson |                                           | POLE MOUNTED   |     |      |      | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 75,000.00  |
| Robertson |                                           | FLOOR STANDING | 100 |      |      | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 100 |      |      | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   |     |      |      | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 50  |      |      | 75,000.00  |
| Robertson | PTRF DASSIEHOEK HOUSE 1                   | POLE MOUNTED   | 10  | 1977 | 2022 | 20,000.00  |
| Robertson |                                           | FLOOR STANDING | 50  |      |      | 464,288.00 |
| Robertson | Mont Blois                                | POLE MOUNTED   |     |      |      | 75,000.00  |
| Robertson |                                           | POLE MOUNTED   | 100 |      |      | 75,000.00  |

|           |                          |              |     |  |  |               |
|-----------|--------------------------|--------------|-----|--|--|---------------|
| Robertson |                          | POLE MOUNTED | 25  |  |  | 40,000.00     |
| Robertson |                          | POLE MOUNTED | 100 |  |  | 75,000.00     |
| Robertson |                          | POLE MOUNTED | 10  |  |  | 20,000.00     |
| Robertson | MTN Tower Aasvoelsnes    |              | 100 |  |  | 75,000.00     |
| Robertson | Pole Mounted Transformer |              | 200 |  |  | 130,000.00    |
|           |                          |              |     |  |  |               |
|           |                          |              |     |  |  | 34,593,447.00 |
|           |                          |              |     |  |  |               |

**LANGEBERG MUNICIPALITY**

**ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY**

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## **APPENDIX 8 – NETWORK TECHNICAL LOSSES CALCULATION**



|                                                                                                                                               |                                                                                                                                      |                                                |                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|------------------|
| <br><b>LANGEBERG</b><br>MUNISIPALITEIT MUNICIPALITY MASIPALA | <br><b>ixengineers</b><br>Infrastructure Excellence | <b>Langeberg Municipality - Energy Losses</b>  |                  |
| <b>ELECTRICAL ENERGY LOSSES CALCULATION - ROBERTSON</b>                                                                                       |                                                                                                                                      | Langeberg Municipality - Robertson<br><b>0</b> | PAGE<br><b>2</b> |
|                                                                                                                                               |                                                                                                                                      | ix<br><b>P302015</b>                           | REV.<br><b>0</b> |

## 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)

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## Langeberg Municipality - Energy Losses

### ELECTRICAL ENERGY LOSSES CALCULATION - ROBERTSON

Langeberg Municipality - Robertson

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6/27/2022

| MV Network losses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                |          |                      |           | Billing/log data |       |            |                |             |               |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------|----------------------|-----------|------------------|-------|------------|----------------|-------------|---------------|---------|--|--|---------|------|---------|---------|----|----|-------|------|-------|-------|----|----|------|------|------|-------|----|----|------|---|-------|----|----|-----|-----|-----|-----|------|---|-----|------|-----|---|---|---|-----|------|-----|------|------|---|-----|------|-----|---|---|----|-----|------|-----|-------|-------|---|-----|------|-----|------|------|----|-----|-----|-----|------|-------|---|-----|-----|-----|-----|------|---|-----|-----|---|-----|----|---|------|-----|-----|-----|------|---|------|------|------|---|---|---|------|------|----|---|---|-----|--|--|---------|--------|--|------------------------------|--|-------|--|--|--|-----|-------|----------|------|------|
| Simu-<br>lato                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Network peak power:            |          | P kW                 |           | 34374            | Month | Demand kVA | Energy kWh     | Load factor | Demand Factor |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Network losses from load flow: |          | P <sub>loss</sub> kW |           | 484.61           | Apr   | 28858      | 14636122       | 0.69        | 0.61          |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| Network Average power                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                |          | kVA                  |           | 17825            | May   | 23918      | 11397930       | 0.65        | 0.51          |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| Total electrical losses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                |          | kW                   | kWh/month | % loss           | Jun   | 22335      | 10257757       | 0.63        | 0.47          |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| Transformer No load Losses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                |          | 120.2                | 87746     | 0.67%            | Jul   | 20951      | 10249736       | 0.67        | 0.44          |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| Transformer Partial Load losses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                |          | 232.6                | 169798    | 1.30%            | Aug   | 19945      | 9794599        | 0.67        | 0.42          |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| MV Network system losses pm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                |          | 251.3                | 183478    | 1.41%            | Sep   | 20057      | 9774013        | 0.67        | 0.42          |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| LV Network losses calculated pm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                |          |                      | 288880    | 2.22%            | Oct   | 22420      | 11067517       | 0.68        | 0.47          |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| Total losses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                |          |                      | 729902    | 5.61%            | Nov   | 25126      | 12795985       | 0.70        | 0.53          |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| Technical Loss Factor tlf :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                |          |                      |           | 1.056            | Dec   | 26209      | 14432564       | 0.75        | 0.55          |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| <div>Installed Transformer and reactor losses</div> <table><tr><th>Qty</th><th>kVA</th><th colspan="2">Losses/unit kW</th><th colspan="2">Total loss kW</th></tr><tr><th colspan="2"></th><th>No load</th><th>Load</th><th>No load</th><th>FL loss</th></tr><tr><td>95</td><td>16</td><td>0.095</td><td>0.41</td><td>9.025</td><td>38.95</td></tr><tr><td>49</td><td>25</td><td>0.12</td><td>0.57</td><td>5.88</td><td>27.93</td></tr><tr><td>79</td><td>50</td><td>0.18</td><td>1</td><td>14.22</td><td>79</td></tr><tr><td>15</td><td>100</td><td>0.3</td><td>1.7</td><td>4.5</td><td>25.5</td></tr><tr><td>0</td><td>160</td><td>0.44</td><td>2.4</td><td>0</td><td>0</td></tr><tr><td>4</td><td>200</td><td>0.52</td><td>2.7</td><td>2.08</td><td>10.8</td></tr><tr><td>0</td><td>250</td><td>0.62</td><td>3.2</td><td>0</td><td>0</td></tr><tr><td>51</td><td>315</td><td>0.72</td><td>3.8</td><td>36.72</td><td>193.8</td></tr><tr><td>7</td><td>400</td><td>0.91</td><td>5.4</td><td>6.37</td><td>37.8</td></tr><tr><td>26</td><td>500</td><td>1.1</td><td>5.4</td><td>28.6</td><td>140.4</td></tr><tr><td>3</td><td>630</td><td>1.3</td><td>6.4</td><td>3.9</td><td>19.2</td></tr><tr><td>2</td><td>800</td><td>1.6</td><td>8</td><td>3.2</td><td>16</td></tr><tr><td>3</td><td>1000</td><td>1.9</td><td>9.5</td><td>5.7</td><td>28.5</td></tr><tr><td>0</td><td>1600</td><td>2.75</td><td>13.5</td><td>0</td><td>0</td></tr><tr><td>0</td><td>2000</td><td>3.25</td><td>16</td><td>0</td><td>0</td></tr><tr><td>334</td><td colspan="2"></td><td>120.195</td><td colspan="2">617.88</td></tr><tr><td colspan="2">Total installed capacity kVA</td><td colspan="4">47350</td></tr></table> |                                |          |                      |           |                  | Qty   | kVA        | Losses/unit kW |             | Total loss kW |         |  |  | No load | Load | No load | FL loss | 95 | 16 | 0.095 | 0.41 | 9.025 | 38.95 | 49 | 25 | 0.12 | 0.57 | 5.88 | 27.93 | 79 | 50 | 0.18 | 1 | 14.22 | 79 | 15 | 100 | 0.3 | 1.7 | 4.5 | 25.5 | 0 | 160 | 0.44 | 2.4 | 0 | 0 | 4 | 200 | 0.52 | 2.7 | 2.08 | 10.8 | 0 | 250 | 0.62 | 3.2 | 0 | 0 | 51 | 315 | 0.72 | 3.8 | 36.72 | 193.8 | 7 | 400 | 0.91 | 5.4 | 6.37 | 37.8 | 26 | 500 | 1.1 | 5.4 | 28.6 | 140.4 | 3 | 630 | 1.3 | 6.4 | 3.9 | 19.2 | 2 | 800 | 1.6 | 8 | 3.2 | 16 | 3 | 1000 | 1.9 | 9.5 | 5.7 | 28.5 | 0 | 1600 | 2.75 | 13.5 | 0 | 0 | 0 | 2000 | 3.25 | 16 | 0 | 0 | 334 |  |  | 120.195 | 617.88 |  | Total installed capacity kVA |  | 47350 |  |  |  | Jan | 31272 | 17042515 | 0.75 | 0.66 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                |          |                      |           |                  | Qty   | kVA        | Losses/unit kW |             | Total loss kW |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                |          |                      |           |                  |       |            | No load        | Load        | No load       | FL loss |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                |          |                      |           |                  | 95    | 16         | 0.095          | 0.41        | 9.025         | 38.95   |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                |          |                      |           |                  | 49    | 25         | 0.12           | 0.57        | 5.88          | 27.93   |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                |          |                      |           |                  | 79    | 50         | 0.18           | 1           | 14.22         | 79      |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                |          |                      |           |                  | 15    | 100        | 0.3            | 1.7         | 4.5           | 25.5    |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                |          |                      |           |                  | 0     | 160        | 0.44           | 2.4         | 0             | 0       |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                |          |                      |           |                  | 4     | 200        | 0.52           | 2.7         | 2.08          | 10.8    |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                |          |                      |           |                  | 0     | 250        | 0.62           | 3.2         | 0             | 0       |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| 51                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 315                            | 0.72     | 3.8                  | 36.72     | 193.8            |       |            |                |             |               |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 400                            | 0.91     | 5.4                  | 6.37      | 37.8             |       |            |                |             |               |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| 26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 500                            | 1.1      | 5.4                  | 28.6      | 140.4            |       |            |                |             |               |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 630                            | 1.3      | 6.4                  | 3.9       | 19.2             |       |            |                |             |               |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 800                            | 1.6      | 8                    | 3.2       | 16               |       |            |                |             |               |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1000                           | 1.9      | 9.5                  | 5.7       | 28.5             |       |            |                |             |               |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1600                           | 2.75     | 13.5                 | 0         | 0                |       |            |                |             |               |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2000                           | 3.25     | 16                   | 0         | 0                |       |            |                |             |               |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| 334                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                |          | 120.195              | 617.88    |                  |       |            |                |             |               |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| Total installed capacity kVA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                | 47350    |                      |           |                  |       |            |                |             |               |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| Feb                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 34223                          | 17068041 | 0.68                 | 0.72      |                  |       |            |                |             |               |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| Mar                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 36183                          | 17634471 | 0.67                 | 0.76      |                  |       |            |                |             |               |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| Avg demand                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 25958                          | 13012604 | 0.68                 | 0.55      |                  |       |            |                |             |               |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| Avg power                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 17825                          |          |                      |           |                  |       |            |                |             |               |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| Robertson                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 14512                          |          |                      |           |                  |       |            |                |             |               |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| Le Chasseur                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 983                            |          |                      |           |                  |       |            |                |             |               |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |
| Goudmyn                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2330                           |          |                      |           |                  |       |            |                |             |               |         |  |  |         |      |         |         |    |    |       |      |       |       |    |    |      |      |      |       |    |    |      |   |       |    |    |     |     |     |     |      |   |     |      |     |   |   |   |     |      |     |      |      |   |     |      |     |   |   |    |     |      |     |       |       |   |     |      |     |      |      |    |     |     |     |      |       |   |     |     |     |     |      |   |     |     |   |     |    |   |      |     |     |     |      |   |      |      |      |   |   |   |      |      |    |   |   |     |  |  |         |        |  |                              |  |       |  |  |  |     |       |          |      |      |

#### Notes:

1) Transformer quantities from single line diagram

2) Billing/Logs Eskom period Apr 2021 to Mar 2022.

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**ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY**

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## **APPENDIX 9 – SSEG IMPACT ON MUNICIPAL REVENUE**

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

Developed by



**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 (%)

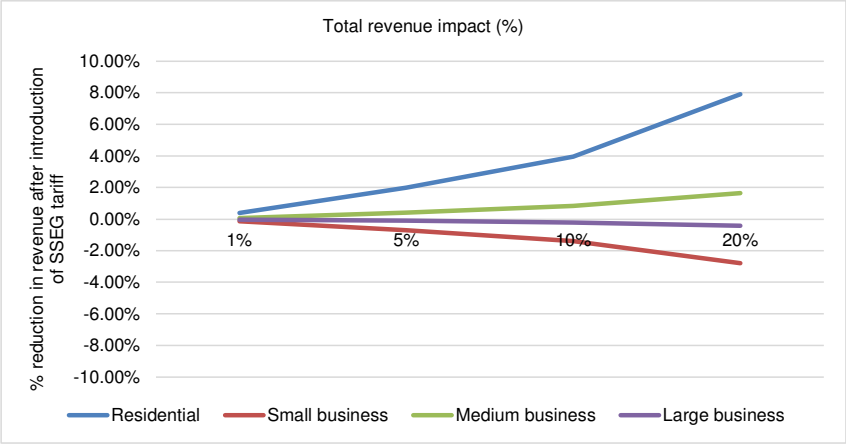


Table 3: Reduction in revenue, Value of Solar and Total effect (Rm)

|                                     | 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**

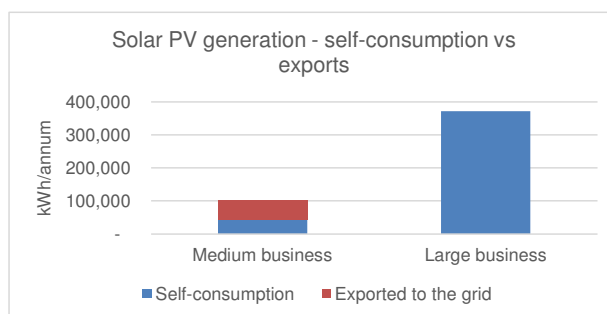
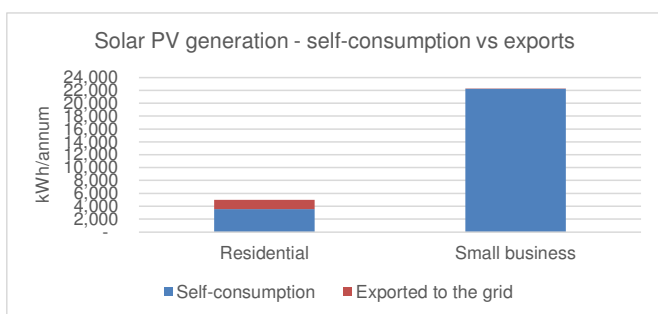
|                                                | Residential | Small business | Medium business | Large business | Key for PBP and IRR results: | Key for NPV results: |
|------------------------------------------------|-------------|----------------|-----------------|----------------|------------------------------|----------------------|
| 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

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ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

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## **APPENDIX 10 – ALTERNATIVE ENERGY OPTION FOR ROBERTSON MUNICIPAL OFFICE BUILDING**

# Design 1 Robertson Municipal Offices, kerk Straat Robertson

## Report

|                     |                                        |
|---------------------|----------------------------------------|
| Project Name        | Robertson Municipal Offices            |
| Project Description | Roof-mounted                           |
| Project Address     | kerk Straat Robertson                  |
| Prepared By         | Wiets Snyman<br>info@ixengineers.co.za |



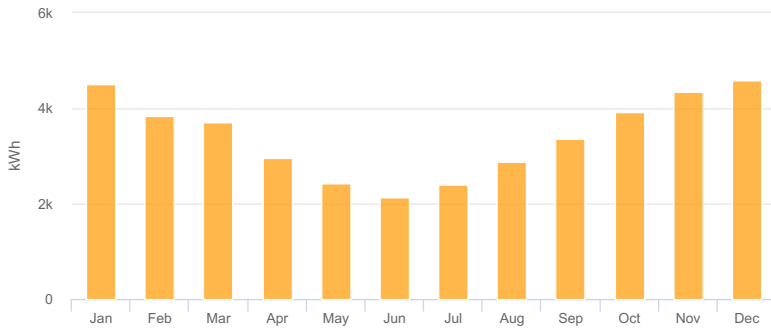
## System Metrics

|                       |                                             |
|-----------------------|---------------------------------------------|
| Design                | Design 1                                    |
| Module DC Nameplate   | 25.9 kW                                     |
| Inverter AC Nameplate | 24.1 kW<br>Load Ratio: 1.08                 |
| Annual Production     | 41.10 MWh                                   |
| Performance Ratio     | 78.1%                                       |
| kWh/kWp               | 1,585.6                                     |
| Weather Dataset       | TMY, 10km Grid, meteonorm (meteonorm)       |
| Simulator Version     | 559293434c-36a84e2c72-edbe86706d-ee22b44d10 |

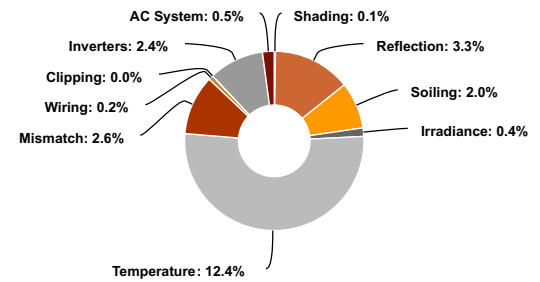
## Project Location



## Monthly Production



## Sources of System Loss



## Annual Production

|                                  | Description                         | Output          | % Delta      |
|----------------------------------|-------------------------------------|-----------------|--------------|
| Irradiance (kWh/m <sup>2</sup> ) | Annual Global Horizontal Irradiance | 1,902.8         |              |
|                                  | POA Irradiance                      | 2,030.0         | 6.7%         |
|                                  | Shaded Irradiance                   | 2,028.9         | -0.1%        |
|                                  | Irradiance after Reflection         | 1,961.2         | -3.3%        |
|                                  | Irradiance after Soiling            | 1,922.0         | -2.0%        |
|                                  | <b>Total Collector Irradiance</b>   | <b>1,922.0</b>  | <b>0.0%</b>  |
| Energy (kWh)                     | Nameplate                           | 49,841.7        |              |
|                                  | Output at Irradiance Levels         | 49,661.3        | -0.4%        |
|                                  | Output at Cell Temperature Derate   | 43,508.6        | -12.4%       |
|                                  | Output After Mismatch               | 42,393.2        | -2.6%        |
|                                  | Optimal DC Output                   | 42,309.6        | -0.2%        |
|                                  | Constrained DC Output               | 42,309.6        | 0.0%         |
|                                  | Inverter Output                     | 41,306.3        | -2.4%        |
|                                  | <b>Energy to Grid</b>               | <b>41,099.8</b> | <b>-0.5%</b> |
| Temperature Metrics              |                                     |                 |              |
|                                  | Avg. Operating Ambient Temp         |                 | 20.3 °C      |
|                                  | Avg. Operating Cell Temp            |                 | 40.5 °C      |
| Simulation Metrics               |                                     |                 |              |
|                                  | Operating Hours                     | 4607            |              |
|                                  | Solved Hours                        | 4607            |              |

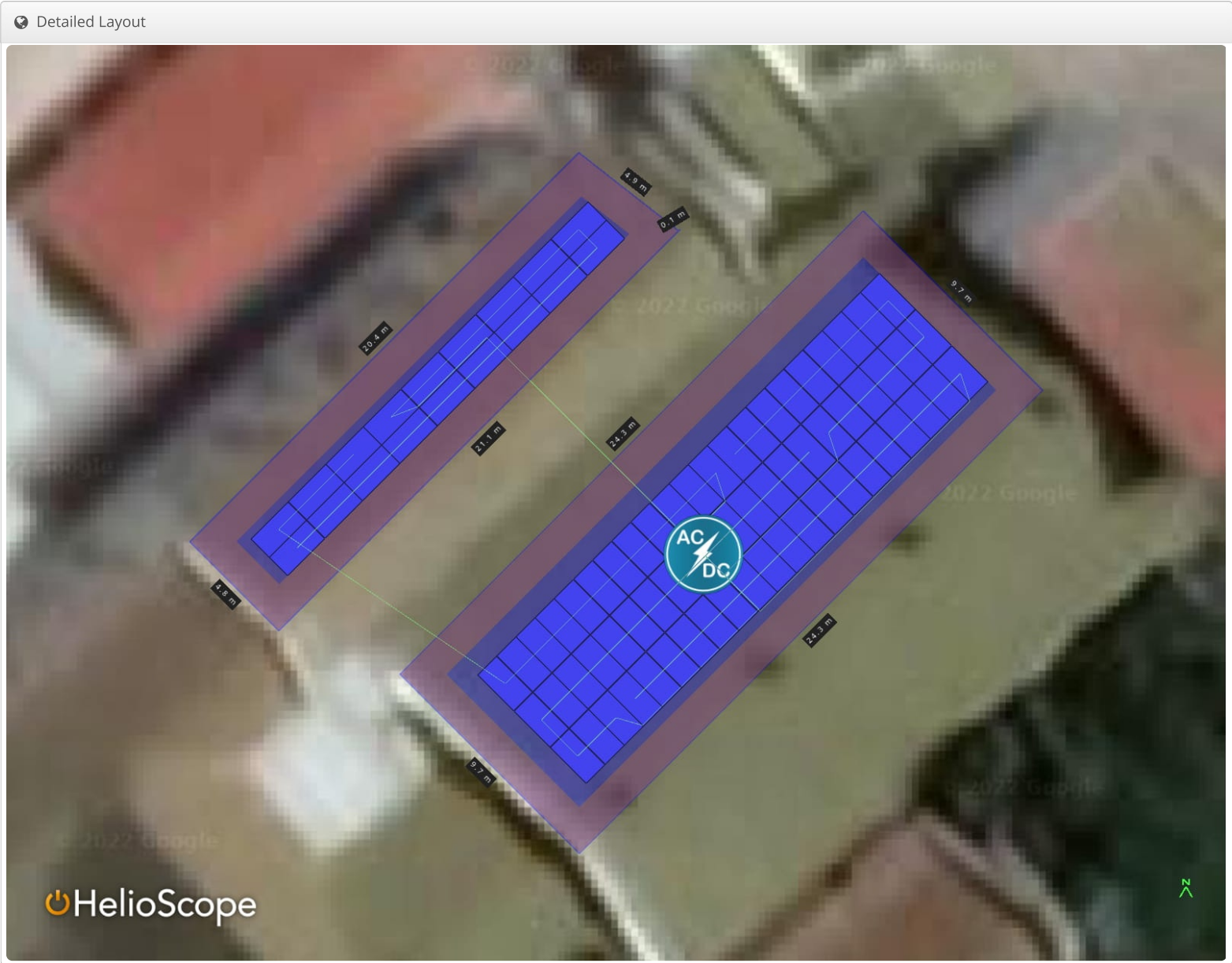
## Condition Set

| 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                 |   |   |   |
|                              | TSM-PD14 320 (May16) (Trina 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)          | 1 (24.1 kW)  |
| Strings    | 10 AWG (Copper)                          | 5 (101.5 m)  |
| Module     | Trina Solar, TSM-PD14 320 (May16) (320W) | 81 (25.9 kW) |

| Wiring Zones |                |             |                    |
|--------------|----------------|-------------|--------------------|
| Description  | Combiner Poles | String Size | Stringing Strategy |
| Wiring Zone  | -              | 5-20        | Along Racking      |

| Field Segments  |             |                        |      |         |                  |            |        |         |         |
|-----------------|-------------|------------------------|------|---------|------------------|------------|--------|---------|---------|
| Description     | Racking     | Orientation            | Tilt | Azimuth | Intrarow Spacing | Frame Size | Frames | Modules | Power   |
| Field Segment 1 | Flush Mount | Portrait (Vertical)    | 15°  | 315°    | 0.6 m            | 3x1        | 21     | 63      | 20.2 kW |
| Field Segment 2 | Flush Mount | Landscape (Horizontal) | 15°  | 315°    | 0.6 m            | 2x1        | 9      | 18      | 5.76 kW |



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## **APPENDIX 11 – ALTERNATIVE ENERGY SUPPLY OPTION FOR MUNICIPAL FEED IN POINTS**

# Design Robertson 5MWp Langeberg Masterplan, Robertson, South Africa

## Report

|                 |                                        |
|-----------------|----------------------------------------|
| Project Name    | Langeberg Masterplan                   |
| Project Address | Robertson, South Africa                |
| Prepared By     | Wiets Snyman<br>info@ixengineers.co.za |



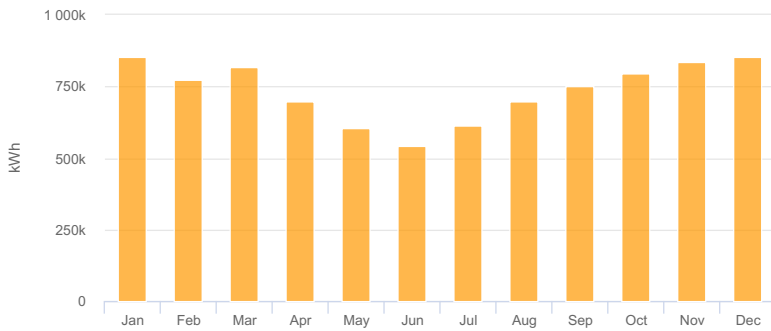
## System Metrics

|                       |                                             |
|-----------------------|---------------------------------------------|
| Design                | Design Robertson 5MWp                       |
| Module DC Nameplate   | 5.01 MW                                     |
| Inverter AC Nameplate | 4.02 MW<br>Load Ratio: 1.25                 |
| Annual Production     | 8.834 GWh                                   |
| Performance Ratio     | 80.9%                                       |
| kWh/kWp               | 1,764.6                                     |
| Weather Dataset       | TMY, 10km Grid, meteonorm (meteonorm)       |
| Simulator Version     | d9c9f76558-ac39475d2e-c4a029d14b-dab0516eb2 |

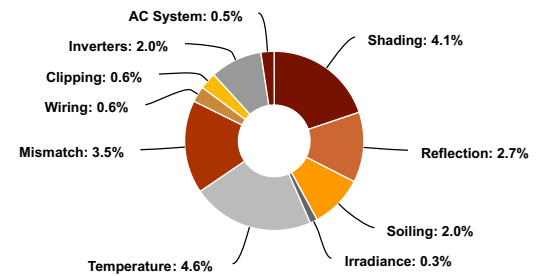
## Project Location



## Monthly Production



## Sources of System Loss



## Annual Production

|                                  | Description                         | Output             | % Delta      |
|----------------------------------|-------------------------------------|--------------------|--------------|
| Irradiance (kWh/m <sup>2</sup> ) | Annual Global Horizontal Irradiance | 1,902.8            |              |
|                                  | POA Irradiance                      | 2,181.1            | 14.6%        |
|                                  | Shaded Irradiance                   | 2,090.7            | -4.1%        |
|                                  | Irradiance after Reflection         | 2,035.2            | -2.7%        |
|                                  | Irradiance after Soiling            | 1,994.5            | -2.0%        |
|                                  | <b>Total Collector Irradiance</b>   | <b>1,994.4</b>     | <b>0.0%</b>  |
| Energy (kWh)                     | Nameplate                           | 9,991,410.8        |              |
|                                  | Output at Irradiance Levels         | 9,963,135.6        | -0.3%        |
|                                  | Output at Cell Temperature Derate   | 9,503,579.7        | -4.6%        |
|                                  | Output After Mismatch               | 9,169,303.3        | -3.5%        |
|                                  | Optimal DC Output                   | 9,114,395.9        | -0.6%        |
|                                  | Constrained DC Output               | 9,056,129.8        | -0.6%        |
|                                  | Inverter Output                     | 8,878,498.0        | -2.0%        |
|                                  | <b>Energy to Grid</b>               | <b>8,834,105.0</b> | <b>-0.5%</b> |
| 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

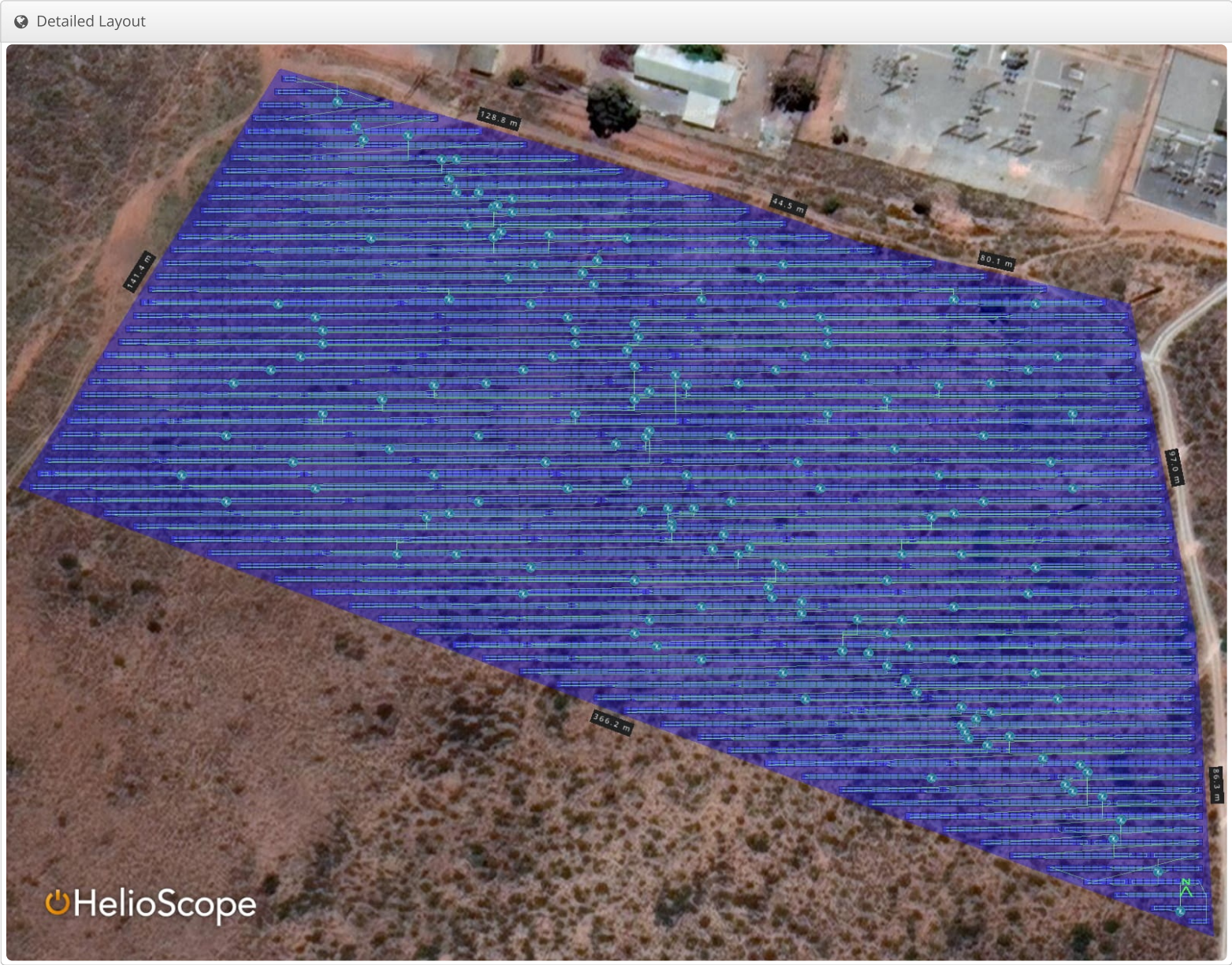
| Description                  | Condition Set 1                       |             |         |                   |   |   |   |                                  |   |   |   |   |
|------------------------------|---------------------------------------|-------------|---------|-------------------|---|---|---|----------------------------------|---|---|---|---|
| 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)      | 167 (4.02 MW)    |
| Strings    | 10 AWG (Copper)                      | 690 (50,975.8 m) |
| Module     | Canadian Solar, CS3W-440MB-AG (440W) | 11,378 (5.01 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        | 5,689  | 11,378  | 5.01 MW |



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## **APPENDIX 12 – PROPOSED DEVELOPMENTS**

| Layout / Reference Number | Possible Developments                                                | Area (Ha) |
|---------------------------|----------------------------------------------------------------------|-----------|
| 1, 21                     | Mixed use residential - Erf 1206, 2996                               | 37.25     |
| 2                         | GAP, social housing - Erf 1247                                       | 4.59      |
| 3                         | Residential / Business - Erf 1791                                    | 1.3       |
| 4, 5, 6, 7                | Residential - Erf 1771, 2445, 1239, 2481, 2482                       | 6.49      |
| 8                         | Possible market site                                                 | 0.31      |
| 9                         | Residential - Erf 1210,1107, 1106, 1099, 1105, RE/2251               | 7.59      |
| 10, 11, 12, 13            | Residential (Included as part of other load growth)                  | 9.91      |
| 14                        | Medium density residential                                           | 5.97      |
| 15, 16                    | Mixed use commercial (15 - Checkers)                                 | 3.37      |
| 17                        | Existing informal settlement (Developed)                             | 11.07     |
| 18                        | Robertson Lifestyle Estate (Erf 7545)                                | 16.68     |
| 19                        | Mixed use residential, possible school site, industrial, commercial  | 38.92     |
| 20                        | Possible high school site - Erf RE/2                                 | 6.46      |
| 22                        | Market related residential - Erf 7562                                | 11.78     |
| 23, 24, 25                | Industrial extension - Erf RE/7667, 8175, Erf 1068, 4529, 2664, 2665 | 10.9      |
| 26                        | GAP market                                                           | 1.2       |
| 27, 28                    | ECD                                                                  | 2.19      |
| 29                        | Rooilandia 472 Plaas                                                 |           |
| 30                        | Lucerne Pack                                                         |           |
| 31                        | Swiegers Broers                                                      |           |
| 32                        | Wandsbeck Plaas (Le Chasseur)                                        |           |
| 33                        | 1 van Graan                                                          |           |
| 34                        | Skulite plaas (Le Chasseur)                                          |           |
| 35                        | Vd Westhuizen (Wakerstroom wes)                                      |           |
| 36                        | Freshness First Pack                                                 |           |
| 37                        | Viljoensdrif                                                         |           |
| 38                        | Groot River (Smuts broers)                                           |           |
| 39                        | New Robertson Sewer works                                            |           |
| 40                        | Billy Klopers                                                        |           |
| 41                        | Grootriver (Malherbe/Smuts)                                          |           |
| 42                        | Laerskool Dagbreek                                                   |           |
| 43                        | Habatha (Le Grand Chasseur)                                          |           |
| 44                        | Habatha (Goreeshoogte-elandpomp)                                     |           |
| 45                        | Habatha (Goreeshoogte-Boetie Bruwer)                                 |           |
| 46                        | Ou Meul R60                                                          |           |
| 47                        | Robertson Waterwerke                                                 |           |
| 48                        | Robertson Agrimark                                                   |           |
| 49                        | Robertson Winery                                                     |           |
| 50                        | Roodezand                                                            |           |

|                                                                                                     |         |               |
|-----------------------------------------------------------------------------------------------------|---------|---------------|
| <p>SCALE FOR REDUCED PLAN</p> <p>0 5 10 20 30 40 50<br/>0 50 100 150<br/>Scale in Meters (Feet)</p> |         |               |
| DATE                                                                                                | SCALE   | ORIGINAL SIZE |
| SEP'2021                                                                                            | 1: 5000 | A0            |
| DRAWING NUMBER                                                                                      |         | REVISION      |
| P302015-E-ROB-01                                                                                    |         | 0             |

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## **APPENDIX 13 – LOAD GROWTH FORECAST**

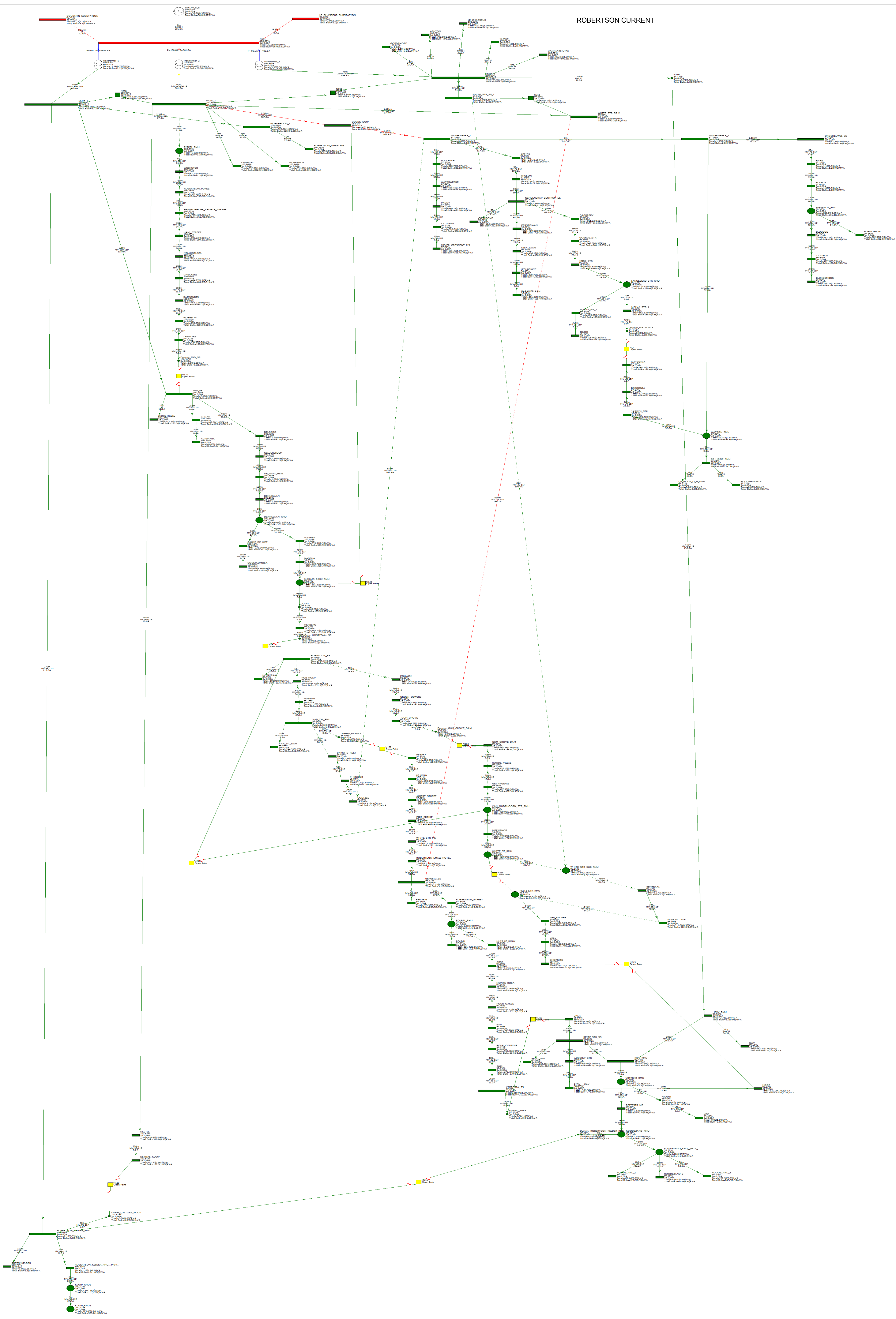
| Layout / Reference Number | Possible Developments                                                | Area (Ha) | Number of erven | Total Load (kVA) | Growth | Coinc. Factor | 2022   | 2023   | 2024   | 2025   | 2026   | 2027   | 2028   | 2029   | 2030   | 2031   | 2032   |
|---------------------------|----------------------------------------------------------------------|-----------|-----------------|------------------|--------|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1, 21                     | Mixed use residential - Erf 1206, 2996                               | 37.25     | 559             | 2,006            |        | 0.7           |        |        |        |        | 287    | 574    | 861    | 1148   | 1435   | 1722   | 2006   |
| 2                         | GAP, social housing - Erf 1247                                       | 4.59      | 69              | 247              |        | 0.7           |        |        |        | 82     | 164    | 247    | 247    | 247    | 247    | 247    | 247    |
| 3                         | Residential / Business - Erf 1791*                                   | 1.3       |                 |                  |        |               |        |        |        |        |        |        |        |        |        |        |        |
| 4, 5, 6, 7                | Residential - Erf 1771, 2445, 1239, 2481, 2482                       | 6.49      | 97              | 349              |        | 0.7           |        |        | 70     | 140    | 210    | 280    | 349    | 349    | 349    | 349    | 349    |
| 8                         | Possible market site*                                                | 0.31      |                 |                  |        |               |        |        |        |        |        |        |        |        |        |        |        |
| 9                         | Residential - Erf 1210,1107, 1106, 1099, 1105, RE/2251               | 7.59      | 114             | 409              |        | 0.7           |        |        |        |        |        | 68     | 136    | 204    | 272    | 340    | 409    |
| 10, 11, 12, 13            | Residential *                                                        |           |                 |                  |        |               |        |        |        |        |        |        |        |        |        |        |        |
| 14                        | Medium density residential                                           | 5.97      | 72              | 338              |        | 0.7           |        |        |        |        |        |        | 68     | 136    | 204    | 272    | 338    |
| 15, 16                    | Mixed use commercial (15 - Checkers)                                 | 3.37      | 1               | 500              |        | 0.7           |        |        |        |        |        |        |        | 125    | 250    | 375    | 500    |
| 17                        | Existing informal settlement (Developed) *                           |           |                 |                  |        |               |        |        |        |        |        |        |        |        |        |        |        |
| 18                        | Robertson Lifestyle Estate (Erf 7545)                                | 16.68     | 133             | 630              |        | 0.7           | 90     | 180    | 270    | 360    | 450    | 540    | 630    | 720    | 810    | 900    | 990    |
| 19                        | Mixed use residential, possible school site, industrial, commercial  | 38.92     |                 | 2,000            |        |               |        |        |        |        |        | 200    | 400    | 600    | 800    | 1000   | 1200   |
| 20                        | Possible high school site - Erf RE/2                                 | 6.46      | 1               | 50               |        | 0.7           |        |        |        |        |        |        |        |        | 50     | 50     | 50     |
| 22                        | Market related residential - Erf 7562                                | 11.78     | 141             | 507              |        | 0.7           |        |        |        | 101    | 202    | 303    | 404    | 507    | 507    | 507    | 507    |
| 23                        | Industrial extension                                                 |           | 1               | 1,000            |        |               |        | 100    | 200    | 300    | 400    | 500    | 600    | 700    | 800    | 900    | 1000   |
| 24, 25                    | Industrial extension - Erf RE/7667, 8175, Erf 1068, 4529, 2664, 2665 | 10.9      |                 | 2,000            |        | 0.7           |        |        |        | 200    | 300    | 400    | 500    | 600    | 700    | 800    | 900    |
| 26                        | GAP market*                                                          | 1.2       |                 |                  |        |               |        |        |        |        |        |        |        |        |        |        |        |
| 27, 28                    | ECD*                                                                 | 2.19      |                 |                  |        |               |        |        |        |        |        |        |        |        |        |        |        |
| 29                        | Rooilandia 472 Plaas                                                 |           |                 | 220              |        | 0.7           |        | 70     | 140    | 220    | 220    | 220    | 220    | 220    | 220    | 220    | 220    |
| 30                        | Lucerne Pack                                                         |           |                 | 500              |        | 0.7           |        |        | 250    | 500    | 500    | 500    | 500    | 500    | 500    | 500    | 500    |
| 31                        | Swiegers Broers                                                      |           |                 | 500              |        | 0.7           |        |        |        | 100    | 200    | 300    | 400    | 500    | 500    | 500    | 500    |
| 32                        | Wandsbeck Plaas (Le Chasseur)                                        |           |                 | 100              |        | 0.7           |        | 100    | 100    | 100    | 100    | 100    | 100    | 100    | 100    | 100    | 100    |
| 33                        | 1 van Graan                                                          |           |                 | 75               |        | 0.7           |        |        | 50     | 75     | 75     | 75     | 75     | 75     | 75     | 75     | 75     |
| 34                        | Skuilte plaas (Le Chasseur)                                          |           |                 | 50               |        | 0.7           |        |        | 50     | 50     | 50     | 50     | 50     | 50     | 50     | 50     | 50     |
| 35                        | Vd Westhuizen (Wakkerstroom wes)                                     |           |                 | 100              |        | 0.7           |        | 50     | 50     | 100    | 100    | 100    | 100    | 100    | 100    | 100    | 100    |
| 36                        | Freshness First Pack                                                 |           |                 | 550              |        | 0.7           |        |        | 100    | 200    | 300    | 500    | 500    | 500    | 500    | 500    | 500    |
| 37                        | Viljoensdrif                                                         |           |                 | 185              |        | 0.7           |        | 62     | 124    | 185    | 185    | 185    | 185    | 185    | 185    | 185    | 185    |
| 38                        | Groot Rivier (Smuts broers)                                          |           |                 | 50               |        | 0.7           |        | 50     | 50     | 50     | 50     | 50     | 50     | 50     | 50     | 50     | 50     |
| 39                        | New Robertson Sewer works                                            |           |                 | 500              |        | 0.7           |        | 250    | 500    | 500    | 500    | 500    | 500    | 500    | 500    | 500    | 500    |
| 40                        | Billy Kloppers                                                       |           |                 | 200              |        | 0.7           |        |        | 100    | 200    | 200    | 200    | 200    | 200    | 200    | 200    | 200    |
| 41                        | Grootrivier (Malherbe/Smuts)                                         |           |                 | 50               |        | 0.7           |        | 50     | 50     | 50     | 50     | 50     | 50     | 50     | 50     | 50     | 50     |
| 42                        | Laerskool Dagbreek                                                   |           |                 | 100              |        | 0.7           |        | 100    | 100    | 100    | 100    | 100    | 100    | 100    | 100    | 100    | 100    |
| 43                        | Habatha (Le Grand Chasseur)                                          |           |                 | 400              |        | 0.7           |        |        | 100    | 200    | 300    | 400    | 400    | 400    | 400    | 400    | 400    |
| 44                        | Habatha (Goreeshoogte-eilandpomp)                                    |           |                 | 50               |        | 0.7           |        |        | 50     | 50     | 50     | 50     | 50     | 50     | 50     | 50     | 50     |
| 45                        | Habatha (Goreeshoogte-Boetie Bruwer)                                 |           |                 | 50               |        | 0.7           |        |        | 50     | 50     | 50     | 50     | 50     | 50     | 50     | 50     | 50     |
| 46                        | Ou Meul R60                                                          |           |                 | 75               |        | 0.7           | 75     | 75     | 75     | 75     | 75     | 75     | 75     | 75     | 75     | 75     | 75     |
| 47                        | Springfield                                                          |           |                 | 50               |        | 0.7           |        |        |        |        |        | 50     | 50     | 50     | 50     | 50     | 50     |
| 48                        | Robertson Waterwerke                                                 |           |                 | 100              |        | 0.7           |        |        | 100    | 100    | 100    | 100    | 100    | 100    | 100    | 100    | 100    |
| 49                        | Robertson Winery                                                     |           |                 | 4,400            |        | 0.7           |        |        |        |        |        | 1,000  | 1,000  | 1,000  | 1,000  | 1,000  | 1,500  |
| 50                        | Roodezandt                                                           |           |                 | 1,900            |        | 0.7           |        |        |        |        |        | 400    | 400    | 400    | 400    | 400    | 800    |
|                           |                                                                      |           |                 |                  |        |               |        |        |        |        |        |        |        |        |        |        |        |
|                           | Other Load Growth                                                    |           |                 | 51,690           | 1.85%  | 0.7           | 51,525 | 52,478 | 53,449 | 54,438 | 55,445 | 56,471 | 57,515 | 58,579 | 59,663 | 60,767 | 61,891 |
|                           |                                                                      |           |                 |                  |        |               |        |        |        |        |        |        |        |        |        |        |        |
|                           | Total undiversified                                                  |           |                 |                  |        |               | 51,690 | 53,565 | 56,028 | 58,527 | 60,663 | 64,637 | 66,865 | 69,170 | 71,341 | 73,483 | 76,542 |
|                           | Total diversified (kVA)                                              |           |                 |                  |        |               | 36,183 | 37,425 | 39,080 | 40,759 | 42,184 | 44,756 | 46,105 | 47,509 | 48,819 | 50,108 | 52,039 |
|                           | Total diversified (MVA)                                              |           |                 |                  |        |               | 36.18  | 37.43  | 39.08  | 40.76  | 42.18  | 44.76  | 46.11  | 47.51  | 48.82  | 50.11  | 52.04  |
|                           | Notified Maximum Demand                                              |           |                 |                  |        |               | 36.00  | 38.00  | 38.00  | 38.00  | 38.00  | 38.00  | 38.00  | 38.00  | 38.00  | 38.00  | 38.00  |
|                           |                                                                      |           |                 |                  |        |               |        |        |        |        |        |        |        |        |        |        |        |

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## **APPENDIX 14 – CURRENT MAXIMUM DEMAND LOAD FLOW ANALYSIS**



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## **APPENDIX 15 – PROSPECTIVE FAULT LEVEL STUDY**

## Robertson Prospective Fault Level Study

| SUBSTATION/TRANSFORMER      | 3ø Fault (kA) |
|-----------------------------|---------------|
| MUISKRAALKOP_BUSBAR         | 21.26         |
| RIPPEL_RMU                  | 21.26         |
| WOLHUTER                    | 21.1          |
| ROBERTSON_PUREE             | 20.63         |
| IND_SS                      | 20.33         |
| INDUSTRIELE                 | 20.11         |
| ROBERTSON_KELDER_RMU        | 19.51         |
| ROBERTSON_KELDER_RMU__PRIV_ | 19.47         |
| DELGADO                     | 19.2          |
| FRANSCHHOEK_VRUGTE_PAKKER   | 18.41         |
| VIVIAN                      | 18.3          |
| NESTLE                      | 18.18         |
| KOOP_RMU1                   | 18.04         |
| KOOP_RMU2                   | 17.98         |
| AGRIMARK                    | 17.84         |
| RBRTSNKELDER                | 17.81         |
| Dummy_DSTLLRS_KOOP          | 17.51         |
| GELDERBLOEM                 | 17.3          |
| WHITE_STR_SS_2              | 16.96         |
| WHITE_STR_SS_1              | 16.96         |
| N211                        | 16.96         |
| WHITE_STR_SUB_RMU           | 16.62         |
| DSTLLRS_KOOP                | 16.57         |
| HANI_STREET                 | 15.15         |
| WHITE_ST_RMU                | 14.98         |
| SENTRAAL                    | 14.17         |
| MERWEHOF                    | 13.72         |
| NTLAKOTLAZA                 | 13.69         |
| N219                        | 13.63         |
| GOEDEHOOP                   | 12.34         |
| _KWV_RMU                    | 12.3          |
| KWV_                        | 12.3          |
| VAN_OUDTHOORN_STR_RMU       | 12.1          |
| CHECKERS                    | 11.95         |
| POSKANTOOR                  | 11.89         |
| DE_WAAL_HSTL                | 11.88         |
| KWV_RMU                     | 11.29         |
| REITZ_STR_RMU               | 11.2          |
| VRTRKKR_RMU                 | 10.74         |
| NJOINT                      | 10.66         |
| REITZSTR_MS                 | 10.13         |
| RAIMONDIS                   | 10.04         |
| KFC                         | 9.87          |

|                            |      |
|----------------------------|------|
| PEP_STORES                 | 9.86 |
| ROODEZAND_RMU              | 9.33 |
| ROODEZAND_RMU__PRIV_       | 9.25 |
| WATERWERKE_1               | 9.11 |
| WATERWERKE_2               | 9.11 |
| Dummy_ROBERTSON_KELDER_RMU | 9.04 |
| PLAASLIKE                  | 9.03 |
| DENNELAAN                  | 8.96 |
| DENNELAAN_RMU              | 8.92 |
| ROODEZAND_3                | 8.9  |
| MORESON                    | 8.59 |
| ROODEZAND_1                | 8.57 |
| ROODEZAND_2                | 8.57 |
| TRENTYRE                   | 8.28 |
| WATERWERKE                 | 8.23 |
| REITZ_STR_SS               | 8.05 |
| REITZ_STR                  | 7.9  |
| KERK                       | 7.8  |
| PADDY                      | 7.64 |
| AFRICA                     | 7.53 |
| Dummy_IND_SS               | 7.45 |
| GOEDEHOOP_1                | 7.4  |
| ROBERTSON_LIFESTYLE        | 7.4  |
| THUSON                     | 7.39 |
| CALLIE_DE_WET              | 7.34 |
| DROEHEUWEL_SS              | 7.23 |
| HAHN                       | 7.07 |
| COETZEE                    | 7.05 |
| ADDERLY_STR_               | 7.05 |
| BERGSIG_SS                 | 6.99 |
| BERGSIG                    | 6.97 |
| WATSON_RMU                 | 6.93 |
| ROBERTSON_SMALL_HOTEL      | 6.9  |
| JASMYN_STR                 | 6.88 |
| OCTOBER                    | 6.6  |
| DE_HOOP_RMU                | 6.58 |
| DE_HOOP_O_H_LINE           | 6.58 |
| ROODEHOOGTE                | 6.58 |
| WAVERN                     | 6.52 |
| P_KRUGER                   | 6.39 |
| ROLBOS                     | 6.33 |
| GEVANGENIS                 | 6.33 |
| GEMEENSKAP_SENTRUM_SS      | 6.23 |
| PICK__PAY                  | 6.22 |
| MEYER_CRESCENT_MS          | 6.13 |
| COSYCOVE                   | 6.13 |
| HOOP                       | 6.01 |

|                    |      |
|--------------------|------|
| BEGGONIA           | 6    |
| PEPERBOS_RMU       | 5.98 |
| SPAR               | 5.91 |
| COCSPLOMOSA        | 5.89 |
| SHOPRITE           | 5.76 |
| BARRY_STREET       | 5.72 |
| BLOUBOS            | 5.63 |
| BOEGOEBOS          | 5.54 |
| WATSONIA           | 5.51 |
| TAAIBOS            | 5.46 |
| ROBERTSON_STREET   | 5.42 |
| DAGBREEK           | 5.37 |
| ROODE_VILLAS       | 5.33 |
| VAN_ZYL_RMU        | 5.24 |
| VAN_ZYL_DAM        | 5.2  |
| ROLBAL_RMU         | 5.18 |
| ROLBAL             | 5.15 |
| NASSUA             | 5.08 |
| WHITE_STR_MS       | 5.06 |
| GUM_GROVE_DAM      | 5.02 |
| BLOKOEMBOS         | 4.9  |
| MARAIS_PARK_RMU    | 4.86 |
| GOERGE_STR         | 4.85 |
| HUIS_LE_ROUX       | 4.81 |
| EERSTELAAN         | 4.78 |
| PIET_RETIEF        | 4.69 |
| IRISS_STR          | 4.51 |
| JOINT              | 4.38 |
| ABSA               | 4.34 |
| MUSEUM             | 4.28 |
| MONTE_ROSA         | 4.23 |
| DISA_LAAN          | 4.21 |
| Dummy_BAKERY       | 4.13 |
| LEEUBEKKIE         | 4.1  |
| LANGEBERG_STR_RMU  | 4.09 |
| MALVA_STR_1        | 4.03 |
| PAPAWERLAAN        | 3.98 |
| HERBERG            | 3.83 |
| ALBERT_STREET      | 3.78 |
| FOUR_OAKES         | 3.76 |
| Dummy_WATSONIA     | 3.67 |
| MALVA_MS_2         | 3.59 |
| Dummy_HOSPITAAL_SS | 3.4  |
| ROB_HOSP           | 3.39 |
| HOSPITAAL_SS       | 3.38 |
| HOSPITAAL          | 3.36 |
| IGLOO              | 3.19 |

|              |      |
|--------------|------|
| SAP          | 3.15 |
| FOUR_COUSINS | 3.05 |
| LE_ROUX      | 3.01 |
| POLLACK      | 2.93 |
| SHELL        | 2.9  |
| GROEN_OEWERS | 2.82 |
| BAKERY       | 2.78 |
| VICTORIA_SS  | 2.69 |
| Dummy_SPAR   | 2.51 |
| _GUM_GROVE   | 2.45 |

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

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## **APPENDIX 16 – CURRENT MAXIMUM DEMAND LOAD FLOW ANALYSIS – VOLTAGE LEVEL STUDY**

## Robertson Current Voltage Level Study

| Node Name                  | Min Voltage | Difference |
|----------------------------|-------------|------------|
| MUIS_2                     | 100.94%     |            |
| RIPPEL_RMU                 | 100.92%     | 0.02%      |
| NESTLE                     | 100.91%     | 0.03%      |
| DSTLLRS_KOOP               | 100.90%     | 0.04%      |
| WOLHUTER                   | 100.89%     | 0.05%      |
| ROBERTSON_PUREE            | 100.86%     | 0.08%      |
| FRANSCHHOEK_VRUGTE_PAKKER  | 100.79%     | 0.15%      |
| HANI_STREET                | 100.73%     | 0.21%      |
| NTLAKOTLAZA                | 100.70%     | 0.24%      |
| CHECKERS                   | 100.68%     | 0.26%      |
| RAIMONDIS                  | 100.62%     | 0.32%      |
| MORESON                    | 100.57%     | 0.37%      |
| N238                       | 100.57%     | 0.37%      |
| TRENTYRE                   | 100.56%     | 0.38%      |
| Dummy_IND_SS               | 100.56%     | 0.38%      |
| ROBERTSON_KELDER_RMU       | 100.45%     | 0.49%      |
| ROBERTSON_KELDER_RMU_PRIV_ | 100.45%     | 0.49%      |
| Dummy_DSTLLRS_KOOP         | 100.45%     | 0.49%      |
| IND_SS                     | 100.43%     | 0.51%      |
| INDUSTRIELE                | 100.43%     | 0.51%      |
| VIVIAN                     | 100.42%     | 0.52%      |
| AGRIMARK                   | 100.39%     | 0.55%      |
| DELGADO                    | 100.37%     | 0.57%      |
| RBRTSNKELDER               | 100.37%     | 0.57%      |
| KOOP_RMU1                  | 100.37%     | 0.57%      |
| KOOP_RMU2                  | 100.37%     | 0.57%      |
| GELDERBLOEM                | 100.28%     | 0.66%      |
| GOEDEHOOP_1                | 100.22%     | 0.72%      |
| ROBERTSON_LIFESTYLE        | 100.22%     | 0.72%      |
| WHITE_STR_SS_1             | 100.16%     | 0.78%      |
| N211                       | 100.16%     | 0.78%      |
| WHITE_STR_SUB_RMU          | 100.12%     | 0.82%      |
| WHITE_ST_RMU               | 100.09%     | 0.85%      |
| MERWEHOF                   | 100.06%     | 0.88%      |
| VAN_OUDTHOORN_STR_RMU      | 100.05%     | 0.89%      |
| SENTRAAL                   | 100.03%     | 0.91%      |
| DE_WAAL_HSTL               | 100.01%     | 0.93%      |
| WHITE_STR_SS_2             | 100.01%     | 0.93%      |
| ESKOM_S_S                  | 100.00%     | 0.94%      |
| N161                       | 100.00%     | 0.94%      |
| N219                       | 99.99%      | 0.95%      |
| POSKANTOOR                 | 99.96%      | 0.98%      |
| REITZ_STR_RMU              | 99.93%      | 1.01%      |
| PEP_STORES                 | 99.88%      | 1.06%      |
| DENNELAAN                  | 99.82%      | 1.12%      |
| DENNELAAN_RMU              | 99.82%      | 1.12%      |

|                            |        |       |
|----------------------------|--------|-------|
| GEVANGENIS                 | 99.82% | 1.12% |
| _KWV_RMU                   | 99.82% | 1.12% |
| KWV_                       | 99.82% | 1.12% |
| KERK                       | 99.80% | 1.14% |
| CALLIE_DE_WET              | 99.78% | 1.16% |
| ROODE_VILLAS               | 99.76% | 1.18% |
| COCSPLOMOSA                | 99.75% | 1.19% |
| GUM_GROVE_DAM              | 99.75% | 1.19% |
| SHOPRITE                   | 99.74% | 1.20% |
| LE_CHASSEUR_SUBSTATION     | 99.72% | 1.22% |
| KWV_RMU                    | 99.70% | 1.24% |
| WAVERN                     | 99.69% | 1.25% |
| VRTRKKR_RMU                | 99.66% | 1.28% |
| KFC                        | 99.66% | 1.28% |
| NJOINT                     | 99.66% | 1.28% |
| REITZSTR_MS                | 99.62% | 1.32% |
| NASSUA                     | 99.61% | 1.33% |
| MARAIS_PARK_RMU            | 99.61% | 1.33% |
| JOINT                      | 99.59% | 1.35% |
| ROODEZAND_RMU              | 99.57% | 1.37% |
| Dummy_ROBERTSON_KELDER_RMU | 99.57% | 1.37% |
| HERBERG                    | 99.56% | 1.38% |
| ROODEZAND_3                | 99.56% | 1.38% |
| ROODEZAND_RMU__PRIV_       | 99.56% | 1.38% |
| Dummy_HOSPITAAL_SS         | 99.56% | 1.38% |
| ROODEZAND_1                | 99.54% | 1.40% |
| ROODEZAND_2                | 99.54% | 1.40% |
| GOUDMYN_SUBSTATION         | 99.46% | 1.48% |
| REITZ_STR_SS               | 99.33% | 1.61% |
| REITZ_STR                  | 99.32% | 1.62% |
| ADDERLY_STR_               | 99.23% | 1.71% |
| SPAR                       | 99.20% | 1.74% |
| PICK__PAY                  | 99.15% | 1.79% |
| HOOP                       | 99.13% | 1.81% |
| GOEDEHOOP                  | 98.60% | 2.34% |
| BERGSIG                    | 98.40% | 2.54% |
| BERGSIG_SS                 | 98.40% | 2.54% |
| ROBERTSON_SMALL_HOTEL      | 98.40% | 2.54% |
| WHITE_STR_MS               | 98.18% | 2.76% |
| PIET_RETIEF                | 98.12% | 2.82% |
| ROBERTSON_STREET           | 98.00% | 2.94% |
| ALBERT_STREET              | 97.98% | 2.96% |
| ROLBAL_RMU                 | 97.92% | 3.02% |
| ROLBAL                     | 97.92% | 3.02% |
| LE_ROUX                    | 97.89% | 3.05% |
| BAKERY                     | 97.88% | 3.06% |
| HUIS_LE_ROUX               | 97.82% | 3.12% |
| ABSA                       | 97.68% | 3.26% |
| MONTE_ROSA                 | 97.65% | 3.29% |
| FOUR_OAKES                 | 97.55% | 3.39% |

|                       |        |       |
|-----------------------|--------|-------|
| WATERWERKE_1          | 97.43% | 3.51% |
| WATERWERKE_2          | 97.43% | 3.51% |
| PLAASLIKE             | 97.42% | 3.52% |
| SAP                   | 97.38% | 3.56% |
| WATERWERKE            | 97.38% | 3.56% |
| FOUR_COUSINS          | 97.36% | 3.58% |
| PADDY                 | 97.35% | 3.59% |
| SHELL                 | 97.32% | 3.62% |
| OCTOBER               | 97.32% | 3.62% |
| JASMYN_STR            | 97.31% | 3.63% |
| WATSON_RMU            | 97.31% | 3.63% |
| DE_HOOP_RMU           | 97.31% | 3.63% |
| MEYER_CRESCENT_MS     | 97.31% | 3.63% |
| DE_HOOP_O_H_LINE      | 97.31% | 3.63% |
| ROODEHOOGTE           | 97.31% | 3.63% |
| VICTORIA_SS           | 97.29% | 3.65% |
| Dummy_SPAR            | 97.29% | 3.65% |
| BEGGONIA              | 97.26% | 3.68% |
| WATSONIA              | 97.25% | 3.69% |
| DROEHEUWEL_SS         | 97.21% | 3.73% |
| HAHN                  | 97.19% | 3.75% |
| AFRICA                | 97.14% | 3.80% |
| THUSON                | 97.12% | 3.82% |
| ROLBOS                | 97.10% | 3.84% |
| COETZEE               | 97.07% | 3.87% |
| PEPERBOS_RMU          | 97.06% | 3.88% |
| BOEGOEBOS             | 97.04% | 3.90% |
| BLOUBOS               | 97.02% | 3.92% |
| TAAIBOS               | 97.01% | 3.93% |
| BLOKOEMBOS            | 96.99% | 3.95% |
| P_KRUGER              | 96.93% | 4.01% |
| GEMEENSKAP_SENTRUM_SS | 96.87% | 4.07% |
| COSYCOVE              | 96.86% | 4.08% |
| BARRY_STREET          | 96.78% | 4.16% |
| DAGBREEK              | 96.75% | 4.19% |
| GOERGE_STR            | 96.68% | 4.26% |
| EERSTELAAN            | 96.67% | 4.27% |
| VAN_ZYL_RMU           | 96.65% | 4.29% |
| VAN_ZYL_DAM           | 96.65% | 4.29% |
| IRISS_STR             | 96.65% | 4.29% |
| Dummy_BAKERY          | 96.65% | 4.29% |
| LANGEBERG_STR_RMU     | 96.61% | 4.33% |
| MALVA_STR_1           | 96.61% | 4.33% |
| Dummy_WATSONIA        | 96.61% | 4.33% |
| DISA_LAAN             | 96.59% | 4.35% |
| MALVA_MS_2            | 96.59% | 4.35% |
| LEEUBEKKIE            | 96.58% | 4.36% |
| PAPAWERLAAN           | 96.58% | 4.36% |
| IGLOO                 | 96.58% | 4.36% |
| MUSEUM                | 96.38% | 4.56% |

|              |        |       |
|--------------|--------|-------|
| HOSPITAAL_SS | 96.05% | 4.89% |
| HOSPITAAL    | 96.05% | 4.89% |
| ROB_HOSP     | 96.05% | 4.89% |
| POLLACK      | 95.92% | 5.02% |
| GROEN_OEWERS | 95.89% | 5.05% |
| _GUM_GROVE   | 95.82% | 5.12% |

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ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

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## **APPENDIX 17 – CURRENT MAXIMUM DEMAND LOAD FLOW ANALYSIS – CONDUCTOR THERMAL CAPACITY STUDY**

### Robertson Current Feeder Loading

| Feeder to             | Feeder % Loading |
|-----------------------|------------------|
| GOEDEHOOP             | 120.75%          |
| WATERWERKE_1          | 120.75%          |
| BERGSIG_SS            | 118.57%          |
| _KWV_RMU              | 86.00%           |
| MUIS_1                | 76.12%           |
| WHITE_STR_SUB_RMU     | 71.98%           |
| KWV_RMU               | 71.07%           |
| ROBERTSON_STREET      | 69.84%           |
| REITZ_STR_SS          | 65.43%           |
| ROLBAL_RMU            | 60.23%           |
| AFRICA                | 58.67%           |
| MUIS_3                | 58.46%           |
| N219                  | 57.67%           |
| WHITE_STR_SS_2        | 56.64%           |
| THUSON                | 54.19%           |
| WATERWERKE_2          | 52.73%           |
| COETZEE               | 50.65%           |
| HUIS_LE_ROUX          | 50.63%           |
| GEMEENSKAP_SENTRUM_SS | 49.91%           |
| ROBERTSON_KELDER_RMU  | 49.26%           |
| DELGADO               | 48.05%           |
| WHITE_STR_SS_1        | 47.34%           |
| P_KRUGER              | 46.46%           |
| MUSEUM                | 45.01%           |
| ABSA                  | 44.59%           |
| SENTRAAL              | 43.95%           |
| KOOP_RMU1             | 42.92%           |
| BARRY_STREET          | 42.28%           |
| ROODEZAND_RMU__PRIV_  | 41.82%           |
| GELDERBLOEM           | 41.10%           |
| ROBERTSON_SMALL_HOTEL | 39.10%           |
| RBRTSNKELDER          | 39.02%           |
| ROB_HOSP              | 38.71%           |
| VAN_ZYL_RMU           | 38.11%           |
| IND_SS                | 37.84%           |
| ADDERLY_STR_          | 35.93%           |
| DE_WAAL_HSTL          | 35.55%           |
| MONTE_ROSA            | 35.02%           |
| RIPPEL_RMU            | 34.82%           |
| WOLHUTER              | 34.82%           |
| POSKANTOOR            | 34.33%           |
| HAHN                  | 32.19%           |
| VRTRKKR_RMU           | 31.51%           |

|                          |        |
|--------------------------|--------|
| REITZSTR_MS              | 31.51% |
| DENNELAAN                | 31.24% |
| ROBERTSON_PUREE          | 30.45% |
| PICK__PAY                | 29.66% |
| EERSTELAAN               | 29.54% |
| WHITE_STR_MS             | 29.45% |
| FOUR_OAKES               | 29.01% |
| HOSPITAAL_SS             | 28.81% |
| ROLBOS                   | 27.71% |
| ROBERTSON_KELDER_RMU_PRI | 26.13% |
| FRANSCHHOEK_VRUGTE_PAKKE | 26.09% |
| PIET_RETIEF              | 25.59% |
| ROODEZAND_RMU            | 25.46% |
| PEP_STORES               | 24.51% |
| DENNELAAN_RMU            | 24.32% |
| DROEHEUWEL_SS            | 24.05% |
| PEPERBOS_RMU             | 23.23% |
| SAP                      | 22.66% |
| WAVERN                   | 22.29% |
| PLAASLIKE                | 22.18% |
| DAGBREEK                 | 22.10% |
| HANI_STREET              | 21.72% |
| POLLACK                  | 21.27% |
| FOUR_COUSINS             | 20.65% |
| HOOP                     | 20.00% |
| SPAR                     | 19.99% |
| ALBERT_STREET            | 19.52% |
| KOOP_RMU2                | 19.51% |
| KERK                     | 18.46% |
| GEVANGENIS               | 18.35% |
| WATERWERKE               | 17.73% |
| GOERGE_STR               | 17.60% |
| NTLAKOTLAZA              | 17.38% |
| MERWEHOF                 | 17.10% |
| WHITE_ST_RMU             | 17.10% |
| BLOUBOS                  | 16.10% |
| JASMYN_STR               | 16.06% |
| WATSON_RMU               | 16.06% |
| ROODEZAND_1              | 15.93% |
| ROODEZAND_2              | 15.93% |
| GROEN_OEWERS             | 15.34% |
| REITZ_STR_RMU            | 14.92% |
| SHELL                    | 14.33% |
| GOUDMYN_SUBSTATION       | 13.85% |
| GOEDEHOOP_1              | 13.68% |
| DISA_LAAN                | 13.53% |
| PADDY                    | 13.27% |

|                        |        |
|------------------------|--------|
| IRISS_STR              | 13.09% |
| CHECKERS               | 13.02% |
| RAIMONDIS              | 13.02% |
| SHOPRITE               | 12.52% |
| CALLIE_DE_WET          | 12.45% |
| NASSUA                 | 12.42% |
| ROODE_VILLAS           | 12.25% |
| TAAIBOS                | 11.61% |
| BEGGONIA               | 11.58% |
| VAN_OUDTHOORN_STR_RMU  | 11.17% |
| REITZ_STR              | 9.98%  |
| ROODEZAND_3            | 9.96%  |
| LE_ROUX                | 9.90%  |
| BERGSIG                | 9.66%  |
| ROLBAL                 | 9.61%  |
| VAN_ZYL_DAM            | 9.49%  |
| _GUM_GROVE             | 9.41%  |
| LEEUBEKKIE             | 9.02%  |
| OCTOBER                | 8.84%  |
| MORESON                | 8.67%  |
| VICTORIA_SS            | 8.12%  |
| HOSPITAAL              | 7.54%  |
| LANGEBERG_STR_RMU      | 7.37%  |
| NESTLE                 | 7.23%  |
| COSYCOVE               | 7.14%  |
| BOEGOEBOS              | 7.12%  |
| N161                   | 6.36%  |
| GUM_GROVE_DAM          | 6.26%  |
| COCSPLOMOSA            | 6.22%  |
| MARAIS_PARK_RMU        | 6.21%  |
| HERBERG                | 6.21%  |
| LE_CHASSEUR_SUBSTATION | 5.83%  |
| PAPAWERLAAN            | 4.51%  |
| MALVA_STR_1            | 4.51%  |
| BLOKOEMBOS             | 4.49%  |
| WATSONIA               | 4.48%  |
| MEYER_CRESCENT_MS      | 4.48%  |
| JOINT                  | 4.35%  |
| TRENTYRE               | 4.34%  |
| VIVIAN                 | 4.30%  |
| IGLOO                  | 4.09%  |
| MALVA_MS_2             | 4.09%  |
| BAKERY                 | 3.84%  |
| INDUSTRIELE            | 3.81%  |
| DSTLLRS_KOOP           | 3.57%  |
| NOREE                  | 1.21%  |
| GOEDEMOED              | 1.15%  |

|                     |       |
|---------------------|-------|
| LANGVLEI            | 0.93% |
| KONINGSRIVIER       | 0.93% |
| ASHTON              | 0.83% |
| KWV_                | 0.70% |
| MCGREGOR            | 0.68% |
| LE_CHASSEUR         | 0.68% |
| ROBERTSON_LIFESTYLE | 0.55% |

**LANGEBERG MUNICIPALITY**

**ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY**

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## **APPENDIX 18 – 5-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS**



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ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY

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## **APPENDIX 19 – 5-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS – VOLTAGE LEVEL STUDY**

## Robertson 5 Year Voltage Level Study

| Node Name                    | Min Voltage | Difference |
|------------------------------|-------------|------------|
| MUIS_1                       | 100.96%     |            |
| N224                         | 100.96%     | 0.00%      |
| ADD                          | 100.87%     | 0.09%      |
| FRANSCHHOEK_VRUGTE_PAKKER    | 100.85%     | 0.11%      |
| IND_SS                       | 100.82%     | 0.14%      |
| INDUSTRIELE                  | 100.81%     | 0.15%      |
| ROBERTSON_KELDER_RMU         | 100.80%     | 0.16%      |
| VIVIAN                       | 100.80%     | 0.16%      |
| ROBERTSON_KELDER_RMU__PRIV__ | 100.80%     | 0.16%      |
| Dummy_DSTLLRS_KOOP           | 100.80%     | 0.16%      |
| _ADD_                        | 100.80%     | 0.16%      |
| AGRIMARK                     | 100.79%     | 0.17%      |
| HANI_STREET                  | 100.76%     | 0.20%      |
| DELGADO                      | 100.75%     | 0.21%      |
| MIXED_USE_19                 | 100.75%     | 0.21%      |
| NTLAKOTLAZA                  | 100.72%     | 0.24%      |
| RBRTSNKELDER                 | 100.71%     | 0.25%      |
| KOOP_RMU1                    | 100.71%     | 0.25%      |
| KOOP_RMU2                    | 100.71%     | 0.25%      |
| CHECKERS                     | 100.70%     | 0.26%      |
| GELDERBLOEM                  | 100.65%     | 0.31%      |
| RAIMONDIS                    | 100.63%     | 0.33%      |
| MORESON                      | 100.58%     | 0.38%      |
| GOEDEHOOP_1                  | 100.58%     | 0.38%      |
| ROBERTSON_LIFESTYLE          | 100.58%     | 0.38%      |
| TRENTYRE                     | 100.57%     | 0.39%      |
| Dummy_IND_SS                 | 100.57%     | 0.39%      |
| DE_WAAL_HSTL                 | 100.34%     | 0.62%      |
| DENNELAAN                    | 100.14%     | 0.82%      |
| DENNELAAN_RMU                | 100.14%     | 0.82%      |
| CALLIE_DE_WET                | 100.09%     | 0.87%      |
| COCSPLOMOSA                  | 100.06%     | 0.90%      |
| WHITE_STR_SS_1               | 100.04%     | 0.92%      |
| N211                         | 100.04%     | 0.92%      |
| WHITE_STR_SUB_RMU            | 100.01%     | 0.95%      |
| N161                         | 100.00%     | 0.96%      |
| WAVERN                       | 99.99%      | 0.97%      |
| WHITE_ST_RMU                 | 99.98%      | 0.98%      |
| WHITE_STR_SS_2               | 99.95%      | 1.01%      |
| MERWEHOF                     | 99.94%      | 1.02%      |
| NASSUA                       | 99.91%      | 1.05%      |
| SENTRAAL                     | 99.91%      | 1.05%      |
| VAN_OUDTHOORN_STR_RMU        | 99.91%      | 1.05%      |

|                            |        |       |
|----------------------------|--------|-------|
| MARAIS_PARK_RMU            | 99.90% | 1.06% |
| HERBERG                    | 99.88% | 1.08% |
| JOINT                      | 99.88% | 1.08% |
| Dummy_HOSPITAAL_SS         | 99.88% | 1.08% |
| POSKANTOOR                 | 99.81% | 1.15% |
| REITZ_STR_RMU              | 99.79% | 1.17% |
| N219                       | 99.75% | 1.21% |
| PEP_STORES                 | 99.74% | 1.22% |
| VAN_GRAAN                  | 99.74% | 1.22% |
| LE_CHASSEUR_SUBSTATION     | 99.70% | 1.26% |
| KERK                       | 99.65% | 1.31% |
| GEVANGENIS                 | 99.62% | 1.34% |
| MIXED_RES_21               | 99.62% | 1.34% |
| ROODE_VILLAS               | 99.57% | 1.39% |
| SHOPRITE                   | 99.56% | 1.40% |
| _KWV_RMU                   | 99.56% | 1.40% |
| KWV_                       | 99.56% | 1.40% |
| GUM_GROVE_DAM              | 99.55% | 1.41% |
| KWV_RMU                    | 99.41% | 1.55% |
| GOUDMYN_SUBSTATION         | 99.41% | 1.55% |
| VRTRKKR_RMU                | 99.37% | 1.59% |
| KFC                        | 99.37% | 1.59% |
| NJOINT                     | 99.37% | 1.59% |
| REITZSTR_MS                | 99.31% | 1.65% |
| ROODEZAND_RMU              | 99.25% | 1.71% |
| Dummy_ROBERTSON_KELDER_RMU | 99.25% | 1.71% |
| ROODEZAND_RMU_PRIV_        | 99.24% | 1.72% |
| ADD__                      | 99.24% | 1.72% |
| ROODEZAND_3                | 99.23% | 1.73% |
| ROODEZAND_1                | 99.21% | 1.75% |
| ROODEZAND_2                | 99.21% | 1.75% |
| REITZ_STR_SS               | 99.00% | 1.96% |
| REITZ_STR                  | 99.00% | 1.96% |
| ADDERLY_STR_               | 98.90% | 2.06% |
| SPAR                       | 98.86% | 2.10% |
| PICK__PAY                  | 98.81% | 2.15% |
| HOOP                       | 98.79% | 2.17% |
| GOEDEHOOP                  | 98.15% | 2.81% |
| BERGSIG_SS                 | 98.09% | 2.87% |
| BERGSIG                    | 98.08% | 2.88% |
| ROBERTSON_SMALL_HOTEL      | 98.07% | 2.89% |
| WHITE_STR_MS               | 97.84% | 3.12% |
| PIET_RETIEF                | 97.78% | 3.18% |
| ALBERT_STREET              | 97.63% | 3.33% |
| ROBERTSON_STREET           | 97.59% | 3.37% |
| LE_ROUX                    | 97.53% | 3.43% |
| BAKERY                     | 97.51% | 3.45% |

|                       |        |       |
|-----------------------|--------|-------|
| ROLBAL_RMU            | 97.50% | 3.46% |
| ROLBAL                | 97.50% | 3.46% |
| HUIS_LE_ROUX          | 97.37% | 3.59% |
| ABSA                  | 97.19% | 3.77% |
| MONTE_ROSA            | 97.15% | 3.81% |
| FOUR_OAKES            | 96.98% | 3.98% |
| MARKET_RELATED_RES_22 | 96.98% | 3.98% |
| SAP                   | 96.80% | 4.16% |
| FOUR_COUSINS          | 96.77% | 4.19% |
| SHELL                 | 96.73% | 4.23% |
| VICTORIA_SS           | 96.70% | 4.26% |
| Dummy_SPAR            | 96.70% | 4.26% |
| WATERWERKE_1          | 96.68% | 4.28% |
| PLAASLIKE             | 96.68% | 4.28% |
| WATERWERKE_2          | 96.68% | 4.28% |
| WATERWERKE            | 96.63% | 4.33% |
| _ADD                  | 96.63% | 4.33% |
| PADDY                 | 96.60% | 4.36% |
| OCTOBER               | 96.56% | 4.40% |
| MEYER_CRESCENT_MS     | 96.54% | 4.42% |
| JASMYN_STR            | 96.52% | 4.44% |
| WATSON_RMU            | 96.52% | 4.44% |
| DE_HOOP_RMU           | 96.52% | 4.44% |
| DE_HOOP_O_H_LINE      | 96.52% | 4.44% |
| ROODEHOOGTE           | 96.52% | 4.44% |
| RES_6                 | 96.52% | 4.44% |
| BEGGONIA              | 96.45% | 4.51% |
| RES_5                 | 96.45% | 4.51% |
| WATSONIA              | 96.43% | 4.53% |
| RES_7                 | 96.43% | 4.53% |
| DROEHEUWEL_SS         | 96.40% | 4.56% |
| HAHN                  | 96.38% | 4.58% |
| DAGBREEK_LS           | 96.38% | 4.58% |
| COETZEE               | 96.31% | 4.65% |
| AFRICA                | 96.31% | 4.65% |
| THUSON                | 96.28% | 4.68% |
| ROLBOS                | 96.26% | 4.70% |
| PEPERBOS_RMU          | 96.20% | 4.76% |
| BOEGOEBOS             | 96.18% | 4.78% |
| P_KRUGER              | 96.15% | 4.81% |
| BLOUBOS               | 96.15% | 4.81% |
| TAAIBOS               | 96.14% | 4.82% |
| BLOKOEMBOS            | 96.10% | 4.86% |
| HOUSING_2             | 96.10% | 4.86% |
| BARRY_STREET          | 95.97% | 4.99% |
| RES_9                 | 95.97% | 4.99% |
| GEMEENSKAP_SENTRUM_SS | 95.94% | 5.02% |

|                   |        |       |
|-------------------|--------|-------|
| COSYCOVE          | 95.93% | 5.03% |
| VAN_ZYL_RMU       | 95.84% | 5.12% |
| VAN_ZYL_DAM       | 95.84% | 5.12% |
| Dummy_BAKERY      | 95.84% | 5.12% |
| DAGBREEK          | 95.80% | 5.16% |
| GOERGE_STR        | 95.71% | 5.25% |
| RES_3             | 95.71% | 5.25% |
| IRISS_STR         | 95.66% | 5.30% |
| RES_4             | 95.66% | 5.30% |
| EERSTELAAN        | 95.63% | 5.33% |
| LANGEBERG_STR_RMU | 95.62% | 5.34% |
| MALVA_STR_1       | 95.62% | 5.34% |
| Dummy_WATSONIA    | 95.62% | 5.34% |
| MALVA_MS_2        | 95.60% | 5.36% |
| IGLOO             | 95.58% | 5.38% |
| MUSEUM            | 95.54% | 5.42% |
| DISA_LAAN         | 95.50% | 5.46% |
| LEEUBEKKIE        | 95.48% | 5.48% |
| PAPAWERLAAN       | 95.46% | 5.50% |
| MIXED_RES_1       | 95.46% | 5.50% |
| ROB_HOSP          | 95.18% | 5.78% |
| HOSPITAAL_SS      | 95.17% | 5.79% |
| HOSPITAAL         | 95.17% | 5.79% |
| POLLACK           | 95.03% | 5.93% |
| GROEN_OEWERS      | 95.00% | 5.96% |
| _GUM_GROVE        | 94.93% | 6.03% |

**LANGEBERG MUNICIPALITY**

**ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY**

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## **APPENDIX 20 – 5-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS – CONDUCTOR THERMAL CAPACITY STUDY**

### Robertson 5 Year Feeder Loading

| Feeder to             | Feeder % Loading |
|-----------------------|------------------|
| GOEDEHOOP             | 149.37%          |
| WATERWERKE_1          | 149.37%          |
| BERGSIG_SS            | 138.46%          |
| Transformer_2         | 124.51%          |
| MUIS_2                | 113.99%          |
| _KWV_RMU              | 99.87%           |
| Transformer_1         | 85.79%           |
| WHITE_STR_SUB_RMU     | 85.00%           |
| ROBERTSON_STREET      | 84.76%           |
| KWV_RMU               | 83.59%           |
| MUIS_1                | 78.54%           |
| Transformer_3         | 77.53%           |
| AFRICA                | 75.76%           |
| ROLBAL_RMU            | 74.18%           |
| REITZ_STR_SS          | 71.20%           |
| MUIS_3                | 70.97%           |
| THUSON                | 70.83%           |
| ROBERTSON_KELDER_RMU  | 70.63%           |
| WATERWERKE_2          | 68.91%           |
| N219                  | 66.97%           |
| GEMEENSKAP_SENTRUM_SS | 66.04%           |
| WHITE_STR_SS_1        | 64.12%           |
| WHITE_STR_SS_2        | 64.10%           |
| HUIS_LE_ROUX          | 63.62%           |
| ABSA                  | 56.98%           |
| COETZEE               | 56.86%           |
| ROODEZAND_RMU__PRIV_  | 55.59%           |
| DELGADO               | 52.35%           |
| P_KRUGER              | 52.26%           |
| RIPPEL_RMU            | 50.71%           |
| WOLHUTER              | 50.71%           |
| SENTRAAL              | 50.31%           |
| MUSEUM                | 49.45%           |
| KOOP_RMU1             | 47.73%           |
| BARRY_STREET          | 47.68%           |
| MONTE_ROSA            | 46.48%           |
| ROBERTSON_PUREE       | 45.89%           |
| GELDERBLOEM           | 44.78%           |
| EERSTELAAN            | 44.04%           |
| RBRTSNKELDER          | 43.39%           |
| ROBERTSON_SMALL_HOTEL | 43.07%           |
| ROB_HOSP              | 42.49%           |
| HAHN                  | 41.87%           |

|                             |        |
|-----------------------------|--------|
| VAN_ZYL_RMU                 | 41.85% |
| IND_SS                      | 41.29% |
| FRANSCHHOEK_VRUGTE_PAKKER   | 41.08% |
| VRTRKKR_RMU                 | 40.42% |
| REITZSTR_MS                 | 40.42% |
| FOUR_OAKES                  | 39.88% |
| POSKANTOOR                  | 39.64% |
| ADDERLY_STR_                | 39.10% |
| DE_WAAL_HSTL                | 38.74% |
| ROLBOS                      | 35.10% |
| DENNELAAN                   | 33.98% |
| ROODEZAND_RMU               | 33.84% |
| WHITE_STR_MS                | 32.49% |
| PICK__PAY                   | 32.28% |
| HOSPITAAL_SS                | 31.56% |
| DROEHEUWEL_SS               | 30.70% |
| PEPERBOS_RMU                | 30.16% |
| ROBERTSON_KELDER_RMU__PRIV_ | 29.06% |
| PEP_STORES                  | 28.92% |
| PIET_RETIEF                 | 28.23% |
| HANI_STREET                 | 27.45% |
| DAGBREEK                    | 27.35% |
| DENNELAAN_RMU               | 26.45% |
| PLAASLIKE                   | 26.30% |
| SAP                         | 24.91% |
| WAVERN                      | 24.25% |
| GEVANGENIS                  | 23.95% |
| POLLACK                     | 23.30% |
| DISA_LAAN                   | 22.96% |
| FOUR_COUSINS                | 22.70% |
| NTLAKOTLAZA                 | 22.63% |
| GOERGE_STR                  | 22.38% |
| BLOUBOS                     | 22.31% |
| WATSON_RMU                  | 22.10% |
| NESTLE                      | 22.05% |
| HOOP                        | 21.77% |
| SPAR                        | 21.75% |
| KOOP_RMU2                   | 21.70% |
| ALBERT_STREET               | 21.53% |
| WATERWERKE                  | 21.40% |
| MERWEHOF                    | 21.15% |
| WHITE_ST_RMU                | 21.15% |
| JASMYN_STR                  | 20.63% |
| KERK                        | 20.24% |
| LEEUBEKKIE                  | 18.01% |
| REITZ_STR_RMU               | 17.60% |
| TAAIBOS                     | 17.37% |

|                        |        |
|------------------------|--------|
| ROODEZAND_1            | 17.34% |
| ROODEZAND_2            | 17.34% |
| GROEN_OEWERS           | 16.80% |
| IRISS_STR              | 15.94% |
| SHELL                  | 15.75% |
| BEGGONIA               | 15.70% |
| GOUDMYN_SUBSTATION     | 15.25% |
| GOEDEHOOP_1            | 15.21% |
| PADDY                  | 14.64% |
| VAN_OUDTHOORN_STR_RMU  | 14.58% |
| RAIMONDIS              | 14.33% |
| CHECKERS               | 14.32% |
| SHOPRITE               | 13.65% |
| CALLIE_DE_WET          | 13.54% |
| NASSUA                 | 13.51% |
| ROODE_VILLAS           | 13.47% |
| PAPAWERLAAN            | 13.09% |
| LE_ROUX                | 10.92% |
| REITZ_STR              | 10.86% |
| ROODEZAND_3            | 10.84% |
| BERGSIG                | 10.66% |
| ROLBAL                 | 10.60% |
| VAN_ZYL_DAM            | 10.40% |
| _GUM_GROVE             | 10.31% |
| OCTOBER                | 9.75%  |
| BLOKOEMBOS             | 9.55%  |
| MORESON                | 9.51%  |
| VICTORIA_SS            | 8.92%  |
| HOSPITAAL              | 8.27%  |
| LANGEBERG_STR_RMU      | 8.15%  |
| COSYCOVE               | 7.88%  |
| BOEGOEBOS              | 7.86%  |
| N161                   | 7.75%  |
| GUM_GROVE_DAM          | 6.82%  |
| COCSPLOMOSA            | 6.77%  |
| MARAIS_PARK_RMU        | 6.75%  |
| HERBERG                | 6.75%  |
| LE_CHASSEUR_SUBSTATION | 6.42%  |
| WATSONIA               | 6.40%  |
| MALVA_STR_1            | 4.98%  |
| MEYER_CRESCENT_MS      | 4.93%  |
| VIVIAN                 | 4.78%  |
| TRENTYRE               | 4.77%  |
| JOINT                  | 4.73%  |
| IGLOO                  | 4.52%  |
| MALVA_MS_2             | 4.52%  |
| BAKERY                 | 4.24%  |

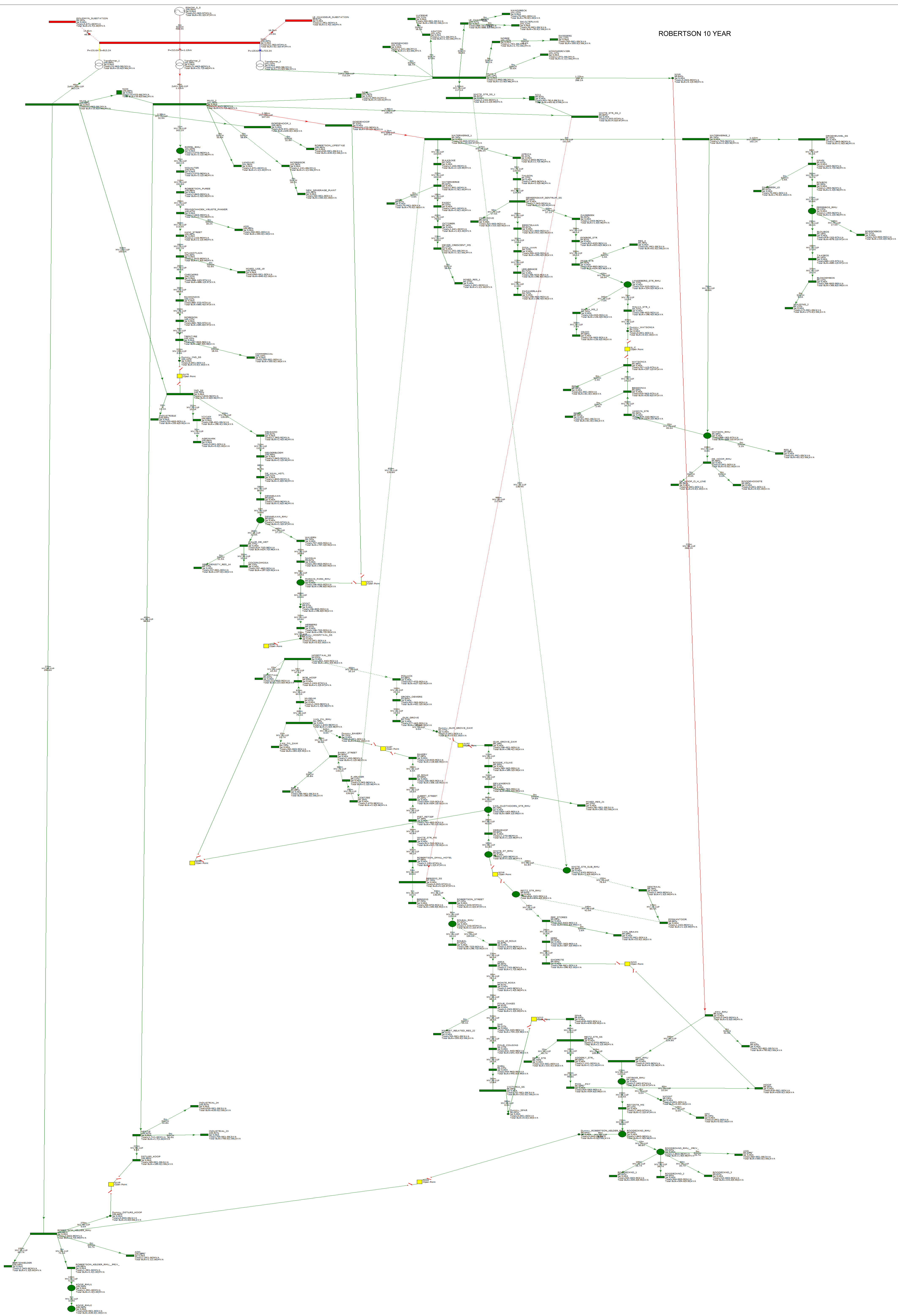
|              |       |
|--------------|-------|
| INDUSTRIELE  | 4.15% |
| DSTLLRS_KOOP | 3.91% |

**LANGEBERG MUNICIPALITY**

**ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY**

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## **APPENDIX 21 – 10-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS**



**LANGEBERG MUNICIPALITY**

**ELECTRICITY MASTERPLAN - ROBERTSON AREA OF SUPPLY**

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## **APPENDIX 22 – 10-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS – VOLTAGE LEVEL STUDY**

## Robertson 10 Year Voltage Level Study

| Node Name                    | Min Voltage | Difference |
|------------------------------|-------------|------------|
| MUIS_1                       | 100.88%     |            |
| N224                         | 100.88%     | 0.00%      |
| IND_SS                       | 100.70%     | 0.18%      |
| INDUSTRIELE                  | 100.69%     | 0.19%      |
| ROBERTSON_KELDER_RMU         | 100.68%     | 0.20%      |
| VIVIAN                       | 100.68%     | 0.20%      |
| ROBERTSON_KELDER_RMU__PRIV__ | 100.68%     | 0.20%      |
| Dummy_DSTLLRS_KOOP           | 100.68%     | 0.20%      |
| ADD_                         | 100.68%     | 0.20%      |
| ADD_____                     | 100.68%     | 0.20%      |
| FRANSCHHOEK_VRUGTE_PAKKER    | 100.67%     | 0.21%      |
| AGRIMARK                     | 100.66%     | 0.22%      |
| DELGADO                      | 100.61%     | 0.27%      |
| RBRTSNKELDER                 | 100.59%     | 0.29%      |
| KOOP_RMU1                    | 100.59%     | 0.29%      |
| KOOP_RMU2                    | 100.58%     | 0.30%      |
| GELDERBLOEM                  | 100.49%     | 0.39%      |
| HANI_STREET                  | 100.46%     | 0.42%      |
| GOEDEHOOP_1                  | 100.46%     | 0.42%      |
| ROBERTSON_LIFESTYLE          | 100.46%     | 0.42%      |
| MIXED_USE_19                 | 100.40%     | 0.48%      |
| NTLAKOTLAZA                  | 100.36%     | 0.52%      |
| CHECKERS                     | 100.32%     | 0.56%      |
| RAIMONDIS                    | 100.21%     | 0.67%      |
| DE_WAAL_HSTL                 | 100.12%     | 0.76%      |
| MORESON                      | 100.12%     | 0.76%      |
| TRENTYRE                     | 100.10%     | 0.78%      |
| Dummy_IND_SS                 | 100.10%     | 0.78%      |
| COMMERCIAL                   | 100.10%     | 0.78%      |
| N161                         | 100.00%     | 0.88%      |
| WHITE_STR_SS_1               | 99.92%      | 0.96%      |
| N211                         | 99.92%      | 0.96%      |
| WHITE_STR_SUB_RMU            | 99.89%      | 0.99%      |
| DENNELAAN                    | 99.86%      | 1.02%      |
| DENNELAAN_RMU                | 99.85%      | 1.03%      |
| WHITE_ST_RMU                 | 99.85%      | 1.03%      |
| MERWEHOF                     | 99.80%      | 1.08%      |
| WHITE_STR_SS_2               | 99.80%      | 1.08%      |
| SENTRAAL                     | 99.78%      | 1.10%      |
| CALLIE_DE_WET                | 99.77%      | 1.11%      |
| MED_DENSITY_RES_14           | 99.77%      | 1.11%      |
| VAN_OUDTHOORN_STR_RMU        | 99.75%      | 1.13%      |
| COCSPLOMOSA                  | 99.73%      | 1.15%      |

|                            |        |       |
|----------------------------|--------|-------|
| WAVERN                     | 99.70% | 1.18% |
| POSKANTOOR                 | 99.68% | 1.20% |
| LE_CHASSEUR_SUBSTATION     | 99.67% | 1.21% |
| REITZ_STR_RMU              | 99.65% | 1.23% |
| N219                       | 99.64% | 1.24% |
| NASSUA                     | 99.61% | 1.27% |
| MARAIS_PARK_RMU            | 99.60% | 1.28% |
| PEP_STORES                 | 99.59% | 1.29% |
| VAN_GRAAN                  | 99.59% | 1.29% |
| JOINT                      | 99.57% | 1.31% |
| HERBERG                    | 99.51% | 1.37% |
| Dummy_HOSPITAAL_SS         | 99.51% | 1.37% |
| KERK                       | 99.50% | 1.38% |
| _KWV_RMU                   | 99.42% | 1.46% |
| KWV_                       | 99.42% | 1.46% |
| SHOPRITE                   | 99.40% | 1.48% |
| GEVANGENIS                 | 99.37% | 1.51% |
| MIXED_RES_21               | 99.37% | 1.51% |
| GOUDMYN_SUBSTATION         | 99.35% | 1.53% |
| ROODE_VILLAS               | 99.30% | 1.58% |
| GUM_GROVE_DAM              | 99.29% | 1.59% |
| KWV_RMU                    | 99.25% | 1.63% |
| VRTRKKR_RMU                | 99.19% | 1.69% |
| KFC                        | 99.19% | 1.69% |
| NJOINT                     | 99.19% | 1.69% |
| REITZSTR_MS                | 99.12% | 1.76% |
| ROODEZAND_RMU              | 99.04% | 1.84% |
| Dummy_ROBERTSON_KELDER_RMU | 99.04% | 1.84% |
| ROODEZAND_RMU_PRIV_        | 99.03% | 1.85% |
| ADD_                       | 99.03% | 1.85% |
| ROODEZAND_3                | 99.02% | 1.86% |
| ROODEZAND_1                | 99.00% | 1.88% |
| ROODEZAND_2                | 99.00% | 1.88% |
| REITZ_STR_SS               | 98.80% | 2.08% |
| REITZ_STR                  | 98.79% | 2.09% |
| ADDERLY_STR_               | 98.68% | 2.20% |
| SPAR                       | 98.64% | 2.24% |
| PICK__PAY                  | 98.58% | 2.30% |
| HOOP                       | 98.56% | 2.32% |
| BERGSIG                    | 97.70% | 3.18% |
| BERGSIG_SS                 | 97.70% | 3.18% |
| ROBERTSON_SMALL_HOTEL      | 97.68% | 3.20% |
| GOEDEHOOP                  | 97.53% | 3.35% |
| WHITE_STR_MS               | 97.43% | 3.45% |
| PIET_RETIEF                | 97.36% | 3.52% |
| ALBERT_STREET              | 97.20% | 3.68% |
| ROBERTSON_STREET           | 97.13% | 3.75% |

|                       |        |       |
|-----------------------|--------|-------|
| LE_ROUX               | 97.09% | 3.79% |
| BAKERY                | 97.08% | 3.80% |
| ROLBAL_RMU            | 97.02% | 3.86% |
| ROLBAL                | 97.02% | 3.86% |
| HUIS_LE_ROUX          | 96.87% | 4.01% |
| ABSA                  | 96.66% | 4.22% |
| MONTE_ROSA            | 96.61% | 4.27% |
| FOUR_OAKES            | 96.41% | 4.47% |
| MARKET_RELATED_RES_22 | 96.41% | 4.47% |
| SAP                   | 96.21% | 4.67% |
| FOUR_COUSINS          | 96.17% | 4.71% |
| SHELL                 | 96.13% | 4.75% |
| VICTORIA_SS           | 96.09% | 4.79% |
| Dummy_SPAR            | 96.09% | 4.79% |
| WATERWERKE_1          | 95.76% | 5.12% |
| WATERWERKE_2          | 95.76% | 5.12% |
| PLAASLIKE             | 95.74% | 5.14% |
| WATERWERKE            | 95.62% | 5.26% |
| ADD                   | 95.62% | 5.26% |
| JASMYN_STR            | 95.58% | 5.30% |
| WATSON_RMU            | 95.58% | 5.30% |
| DE_HOOP_RMU           | 95.58% | 5.30% |
| DE_HOOP_O_H_LINE      | 95.58% | 5.30% |
| ROODEHOOGTE           | 95.58% | 5.30% |
| RES_6                 | 95.58% | 5.30% |
| PADDY                 | 95.53% | 5.35% |
| BEGGONIA              | 95.50% | 5.38% |
| RES_5                 | 95.50% | 5.38% |
| WATSONIA              | 95.48% | 5.40% |
| RES_7                 | 95.48% | 5.40% |
| DROEHEUWEL_SS         | 95.45% | 5.43% |
| HAHN                  | 95.42% | 5.46% |
| DAGBREEK_LS           | 95.42% | 5.46% |
| AFRICA                | 95.41% | 5.47% |
| THUSON                | 95.37% | 5.51% |
| OCTOBER               | 95.36% | 5.52% |
| COETZEE               | 95.30% | 5.58% |
| ROLBOS                | 95.30% | 5.58% |
| MEYER_CRESCENT_MS     | 95.27% | 5.61% |
| MIXED_RES_1           | 95.27% | 5.61% |
| PEPERBOS_RMU          | 95.23% | 5.65% |
| BOEGOEBOS             | 95.21% | 5.67% |
| BLOUBOS               | 95.18% | 5.70% |
| TAAIBOS               | 95.16% | 5.72% |
| BLOKOEMBOS            | 95.12% | 5.76% |
| HOUSING_2             | 95.12% | 5.76% |
| P_KRUGER              | 95.11% | 5.77% |

|                       |        |       |
|-----------------------|--------|-------|
| GEMEENSKAP_SENTRUM_SS | 95.05% | 5.83% |
| COSYCOVE              | 95.05% | 5.83% |
| DAGBREEK              | 94.91% | 5.97% |
| BARRY_STREET          | 94.90% | 5.98% |
| RES_9                 | 94.89% | 5.99% |
| GOERGE_STR            | 94.82% | 6.06% |
| EERSTELAAN            | 94.81% | 6.07% |
| IRISS_STR             | 94.76% | 6.12% |
| RES_4                 | 94.76% | 6.12% |
| VAN_ZYL_RMU           | 94.75% | 6.13% |
| VAN_ZYL_DAM           | 94.75% | 6.13% |
| Dummy_BAKERY          | 94.75% | 6.13% |
| DISA_LAAN             | 94.72% | 6.16% |
| LANGEBERG_STR_RMU     | 94.72% | 6.16% |
| MALVA_STR_1           | 94.72% | 6.16% |
| Dummy_WATSONIA        | 94.72% | 6.16% |
| LEEUBEKKIE            | 94.71% | 6.17% |
| PAPAWERLAAN           | 94.70% | 6.18% |
| MALVA_MS_2            | 94.70% | 6.18% |
| IGLOO                 | 94.68% | 6.20% |
| MUSEUM                | 94.42% | 6.46% |
| HOSPITAAL_SS          | 94.03% | 6.85% |
| HOSPITAAL             | 94.03% | 6.85% |
| ROB_HOSP              | 94.03% | 6.85% |
| POLLACK               | 93.88% | 7.00% |
| GROEN_OEWERS          | 93.84% | 7.04% |
| _GUM_GROVE            | 93.77% | 7.11% |

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## **APPENDIX 23 – 10-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS – CONDUCTOR THERMAL CAPACITY STUDY**

### Robertson 10 Year Feeder Loading

| Feeder to                 | Feeder % Loading |
|---------------------------|------------------|
| GOEDEHOOP                 | 179.35%          |
| WATERWERKE_1              | 179.35%          |
| BERGSIG_SS                | 155.43%          |
| Transformer_2             | 142.82%          |
| MUIS_2                    | 130.74%          |
| _KWV_RMU                  | 115.72%          |
| Transformer_1             | 103.29%          |
| WHITE_STR_SUB_RMU         | 98.83%           |
| KWV_RMU                   | 97.78%           |
| ROBERTSON_STREET          | 97.13%           |
| MUIS_1                    | 94.56%           |
| Transformer_3             | 91.87%           |
| ROLBAL_RMU                | 85.69%           |
| MUIS_3                    | 84.10%           |
| ROBERTSON_KELDER_RMU      | 82.88%           |
| RIPPEL_RMU                | 81.08%           |
| WOLHUTER                  | 81.08%           |
| WHITE_STR_SS_2            | 78.44%           |
| REITZ_STR_SS              | 78.39%           |
| N219                      | 77.60%           |
| ROBERTSON_PUREE           | 75.89%           |
| WATERWERKE_2              | 75.48%           |
| HUIS_LE_ROUX              | 74.28%           |
| AFRICA                    | 73.15%           |
| FRANSCHHOEK_VRUGTE_PAKKER | 70.71%           |
| ROODEZAND_RMU__PRIV_      | 70.55%           |
| COETZEE                   | 67.92%           |
| THUSON                    | 67.70%           |
| ABSA                      | 67.11%           |
| DELGADO                   | 63.39%           |
| P_KRUGER                  | 62.99%           |
| GEMEENSKAP_SENTRUM_SS     | 62.47%           |
| WHITE_STR_SS_1            | 58.56%           |
| BARRY_STREET              | 58.06%           |
| PLAASLIKE                 | 57.50%           |
| HANI_STREET               | 56.51%           |
| MONTE_ROSA                | 55.78%           |
| GELDERBLOEM               | 55.08%           |
| SENTRAAL                  | 54.72%           |
| MUSEUM                    | 53.74%           |
| WATERWERKE                | 52.18%           |
| KOOP_RMU1                 | 51.66%           |
| NTLAKOTLAZA               | 51.36%           |
| VRTRKKR_RMU               | 50.17%           |
| REITZSTR_MS               | 50.17%           |
| IND_SS                    | 49.19%           |

|                             |        |
|-----------------------------|--------|
| FOUR_OAKES                  | 48.67% |
| RBRTSNKELDER                | 46.96% |
| ROBERTSON_SMALL_HOTEL       | 46.80% |
| ROB_HOSP                    | 46.04% |
| HAHN                        | 45.65% |
| VAN_ZYL_RMU                 | 45.41% |
| PADDY                       | 44.97% |
| DENNELAAN                   | 43.24% |
| POSKANTOOR                  | 43.14% |
| ADDERLY_STR_                | 43.05% |
| ROODEZAND_RMU               | 42.95% |
| OCTOBER                     | 39.70% |
| NESTLE                      | 38.64% |
| ROLBOS                      | 38.34% |
| EERSTELAAN                  | 36.02% |
| PICK_PAY                    | 35.54% |
| WHITE_STR_MS                | 35.16% |
| DENNELAAN_RMU               | 34.99% |
| MEYER_CRESCENT_MS           | 34.47% |
| HOSPITAAL_SS                | 33.95% |
| DROEHEUWEL_SS               | 33.51% |
| DE_WAAL_HSTL                | 33.17% |
| PEPERBOS_RMU                | 32.88% |
| GEVANGENIS                  | 32.47% |
| ROBERTSON_KELDER_RMU__PRIV_ | 31.44% |
| PEP_STORES                  | 31.38% |
| PIET_RETIEF                 | 30.55% |
| DAGBREEK                    | 28.56% |
| SAP                         | 27.44% |
| MERWEHOF                    | 26.86% |
| WHITE_ST_RMU                | 26.86% |
| WAVERN                      | 26.60% |
| POLLACK                     | 25.06% |
| FOUR_COUSINS                | 25.00% |
| CHECKERS                    | 24.51% |
| RAIMONDIS                   | 24.51% |
| WATSON_RMU                  | 24.39% |
| BLOUBOS                     | 24.21% |
| HOOP                        | 23.96% |
| SPAR                        | 23.94% |
| KOOP_RMU2                   | 23.48% |
| CALLIE_DE_WET               | 23.47% |
| ALBERT_STREET               | 23.30% |
| GOERGE_STR                  | 23.07% |
| JASMYN_STR                  | 22.77% |
| KERK                        | 22.12% |
| VAN_OUDTHOORN_STR_RMU       | 19.76% |
| MORESON                     | 19.34% |
| REITZ_STR_RMU               | 19.10% |
| ROODEZAND_1                 | 19.09% |

|                        |        |
|------------------------|--------|
| ROODEZAND_2            | 19.09% |
| TAAIBOS                | 18.76% |
| GROEN_OEWERS           | 18.07% |
| IRISS_STR              | 17.58% |
| SHELL                  | 17.35% |
| BEGGONIA               | 17.33% |
| GOUDMYN_SUBSTATION     | 16.64% |
| DISA_LAAN              | 16.50% |
| GOEDEHOOP_1            | 16.46% |
| SHOPRITE               | 14.97% |
| NASSUA                 | 14.82% |
| ROODE_VILLAS           | 14.70% |
| TRENTYRE               | 14.22% |
| REITZ_STR              | 11.95% |
| ROODEZAND_3            | 11.93% |
| LE_ROUX                | 11.82% |
| BERGSIG                | 11.55% |
| ROLBAL                 | 11.47% |
| VAN_ZYL_DAM            | 11.20% |
| _GUM_GROVE             | 11.08% |
| LEEUBEKKIE             | 11.00% |
| BLOKOEMBOS             | 10.12% |
| VICTORIA_SS            | 9.83%  |
| N161                   | 9.17%  |
| LANGEBERG_STR_RMU      | 8.99%  |
| HOSPITAAL              | 8.89%  |
| COSYCOVE               | 8.70%  |
| BOEGOEBOS              | 8.68%  |
| GUM_GROVE_DAM          | 7.49%  |
| COCSPLOMOSA            | 7.42%  |
| MARAIS_PARK_RMU        | 7.41%  |
| HERBERG                | 7.41%  |
| WATSONIA               | 7.07%  |
| LE_CHASSEUR_SUBSTATION | 7.00%  |
| PAPAWERLAAN            | 5.50%  |
| MALVA_STR_1            | 5.50%  |
| JOINT                  | 5.19%  |
| VIVIAN                 | 5.17%  |
| IGLOO                  | 4.99%  |
| MALVA_MS_2             | 4.99%  |
| BAKERY                 | 4.59%  |
| INDUSTRIELE            | 4.56%  |
| DSTLLRS_KOOP           | 4.27%  |
| NOREE                  | 1.80%  |
| GOEDEMOED              | 1.37%  |
| ASHTON                 | 1.36%  |
| MCGREGOR               | 1.18%  |
| MIXED_RES_1            | 1.16%  |
| LANGVLEI               | 1.11%  |
| KONINGSRIVIER          | 1.11%  |

|                            |       |
|----------------------------|-------|
| ADD_                       | 1.09% |
| LE_CHASSEUR                | 0.92% |
| MIXED_USE_19               | 0.88% |
| KWV_                       | 0.84% |
| INDUSTRIAL_23              | 0.73% |
| ROBERTSON_LIFESTYLE        | 0.66% |
| INDUSTRIAL_24              | 0.66% |
| ADD_                       | 0.59% |
| MARKET_RELATED_RES_22      | 0.39% |
| COMMERCIAL                 | 0.37% |
| LUCERNE                    | 0.36% |
| SWIEGERS                   | 0.36% |
| NEW_SEWERAGE_PLANT         | 0.36% |
| ADD_                       | 0.36% |
| RES_9                      | 0.32% |
| MIXED_RES_21               | 0.30% |
| MED_DENSITY_RES_14         | 0.25% |
| HOUSING_2                  | 0.19% |
| DAGBREEK_LS                | 0.08% |
| ADD                        | 0.08% |
| WANDSBECK                  | 0.07% |
| RES_6                      | 0.07% |
| RES_4                      | 0.07% |
| RES_7                      | 0.07% |
| RES_5                      | 0.07% |
| VAN_GRAAN                  | 0.06% |
| SKUILTEPLAAS               | 0.04% |
| AGRIMARK                   | 0.00% |
| DE_HOOP_RMU                | 0.00% |
| DE_HOOP_O_H_LINE           | 0.00% |
| ROODEHOOGTE                | 0.00% |
| KFC                        | 0.00% |
| NJOINT                     | 0.00% |
| Dummy_WATSONIA             | 0.00% |
| Dummy_IND_SS               | 0.00% |
| Dummy_BAKERY               | 0.00% |
| Dummy_HOSPITAAL_SS         | 0.00% |
| Dummy_GUM_GROVE_DAM        | 0.00% |
| Dummy_DSTLLRS_KOOP         | 0.00% |
| Dummy_ROBERTSON_KELDER_RMU | 0.00% |
| Dummy_SPAR                 | 0.00% |

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## **APPENDIX 24 – RECOMMENDED CAPITAL UPGRADES**

Langeberg Municipality Electrical Engineering Services Infrastructure: Capital Projects - Robertson

| Priority                      | Suburb | Ward | Project Description                                                                                                                                                                                                                                                  | Budget<br>2022/23 | Budget<br>2023/24 | Budget<br>2024/25 | Budget<br>2025/26 | Budget<br>2026/27 | Budget<br>2027/28 | Budget<br>2028/29 | Budget<br>2029/30 | Budget<br>2030/31 | Budget<br>2031/32 | Project<br>Total |
|-------------------------------|--------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------------------|
| ROBERTSON                     |        |      |                                                                                                                                                                                                                                                                      |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   | R0,00            |
| 1. CAPITAL PROJECTS           |        |      |                                                                                                                                                                                                                                                                      |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   |                  |
| 1,1                           |        |      | Replacement of Prepaid Meters (PLC)                                                                                                                                                                                                                                  |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   |                  |
| 1,2                           |        |      | Increase in NMD (from 36MVA to 38MVA)                                                                                                                                                                                                                                | R5 625 456,67     |                   |                   |                   |                   |                   |                   |                   |                   |                   | R5 625 456,67    |
| 1,3                           |        |      | Upgrade Ashton (Robertson) 11 kV line Phase 1: from Smuts Bros (Klipboslaagte) to Rietvallei Cellar - 3 km (Existing Copper line) and Phase 2 from Rietvallei Cellar to Ashton Cellar - 5,4 km (Existing Copper line)                                                | R1 400 000,00     | R1 700 000,00     |                   |                   |                   |                   |                   |                   |                   |                   | R3 100 000,00    |
| 1,4                           |        |      | Upgrade Mc Gregor 11 kV line at Klipdrift, Robertson _2,9 km (Existing Copper line)                                                                                                                                                                                  |                   | R850 000,00       |                   |                   |                   |                   |                   |                   |                   |                   | R850 000,00      |
| 1,5                           |        |      | Upgrade Koningsrivier 11 kV line from Muiskraalskop substation to Galgeberg, Mc Gregor. Phase 1: From Muiskraalskop substation to Paul Marais farm - 6,5 km. Phase 2: From Zewenbergen farm to Hennie Hugo - 15 km and Phase 3 From Lords Winery to Galgeberg - 8 km |                   | R2 500 000,00     | R4 500 000,00     | R3 000 000,00     |                   |                   |                   |                   |                   |                   | R10 000 000,00   |
| 1,6                           |        |      | Upgrade 11 kV cable feeders between Muiskraalskop and White Street substations. Install 185 mm² 11 kV cable and Solkor cable.                                                                                                                                        | R5 300 000,00     |                   |                   |                   |                   |                   |                   |                   |                   |                   | R5 300 000,00    |
| 1,7                           |        |      | Install 11 kV cable feeder from Droëheuwel substation to Dassiehoek/Keurkloof 11 kV line                                                                                                                                                                             |                   | R350 000,00       |                   |                   |                   |                   |                   |                   |                   |                   | R350 000,00      |
| 1,8                           |        |      | Replace 7 (8) x 11 kV oil switches, install 1 x new additional Incomer, 1 x new additional Feeder panel and extend building at Waterwerke substation                                                                                                                 |                   |                   | R3 500 000,00     |                   |                   |                   |                   |                   |                   |                   | R3 500 000,00    |
| 1,9                           |        |      | Replace 9 (10) x 11 kV oil switches, extend building, install fire walls between transformers and building at Goudmyn substation                                                                                                                                     |                   |                   | R4 200 000,00     |                   |                   |                   |                   |                   |                   |                   | R4 200 000,00    |
| 1,10                          |        |      | Install 11 kV 70 mm cable between Meyer Street MS to Gemeenskapsentrum SS and install RMU (CCV) at Gemeenskapsentrum SS                                                                                                                                              | R720 000,00       |                   |                   |                   |                   |                   |                   |                   |                   |                   | R720 000,00      |
| 1,11                          |        |      | Replace Malva Street No 2 MS                                                                                                                                                                                                                                         |                   | R536 000,00       |                   |                   |                   |                   |                   |                   |                   |                   | R536 000,00      |
| 1,12                          |        |      | Replace Watsonia RMU (CCV)                                                                                                                                                                                                                                           | R300 000,00       |                   | R300 000,00       |                   |                   |                   |                   |                   |                   |                   | R600 000,00      |
| 1,13                          |        |      | Install Robertson Koop 11 kV Switchgear                                                                                                                                                                                                                              | R60 000,00        |                   |                   |                   |                   |                   |                   |                   |                   |                   | R60 000,00       |
| 1,14                          |        |      | Install 95 mm Cable from Reitz Street RMU to new Telkom MS                                                                                                                                                                                                           |                   |                   | R250 000,00       |                   |                   |                   |                   |                   |                   |                   | R250 000,00      |
| 1,15                          |        |      | Install 95 mm Cable from Telkom MS to Sentraal RMU                                                                                                                                                                                                                   |                   | R290 000,00       |                   |                   |                   |                   |                   |                   |                   |                   | R290 000,00      |
| 1,16                          |        |      | Install 95 mm cable from Sentraal RMU to White Street SS                                                                                                                                                                                                             |                   | R240 000,00       |                   |                   |                   |                   |                   |                   |                   |                   | R240 000,00      |
| 1,17                          |        |      | Install new 10 A Battery Charger and batteries at Muiskraalskop SS                                                                                                                                                                                                   | R280 000,00       |                   |                   |                   |                   |                   |                   |                   |                   |                   | R280 000,00      |
| 1,18                          |        |      | Replace 110 volt batteries Le Chasseur SS                                                                                                                                                                                                                            | R85 000,00        |                   |                   |                   |                   |                   |                   |                   |                   |                   | R85 000,00       |
| 1,19                          |        |      | Replace Protection Relays (SEL 851) on 2 x Trf panels 11 kV and 66 kV at Le Chasseur SS                                                                                                                                                                              | R75 000,00        |                   |                   |                   |                   |                   |                   |                   |                   |                   | R75 000,00       |
| 1,20                          |        |      | Goedemoed 11 kV (Mc Gregor Boesmansrivier funds R1 400 000)                                                                                                                                                                                                          | R1 400 000,00     |                   |                   |                   | R1 400 000,00     |                   |                   |                   |                   |                   | R2 800 000,00    |
| 1,21                          |        |      | Replace Le Roux Street 315 kVA miniature substation                                                                                                                                                                                                                  |                   | R450 000,00       |                   |                   |                   |                   |                   |                   |                   |                   | R450 000,00      |
| 1,22                          |        |      | New fence around Muiskraalskop Substation en Workshop                                                                                                                                                                                                                |                   |                   |                   | R960 000,00       |                   |                   |                   |                   |                   |                   | R960 000,00      |
| 1,23                          |        |      | Replace Ripple Controller at Muiskraalskop Workshop                                                                                                                                                                                                                  |                   | R950 000,00       |                   |                   |                   |                   |                   |                   |                   |                   | R950 000,00      |
| 1,24                          |        |      | Replace perimeter fence at Waterworks SS and Bergsig SS                                                                                                                                                                                                              |                   |                   |                   |                   | R400 000,00       |                   |                   |                   |                   |                   | R400 000,00      |
| 1,25                          |        |      | Repair Le Chasseur SS building                                                                                                                                                                                                                                       |                   |                   |                   |                   |                   | R300 000,00       |                   |                   |                   |                   | R300 000,00      |
| 1,26                          |        |      | Install 11kV capacitors                                                                                                                                                                                                                                              |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   | R0,00            |
| 1,27                          |        |      | Upgrade Pep Stores Miniature Substation                                                                                                                                                                                                                              |                   |                   |                   |                   |                   | R750 000,00       |                   |                   |                   |                   | R750 000,00      |
| 1,28                          |        |      | Upgrade Wakkerstroom West 11 kV line from River Cabins to Pieter van der Westhuizen - 3 km                                                                                                                                                                           |                   |                   |                   |                   |                   |                   | R1 000 000,00     |                   |                   |                   | R1 000 000,00    |
| 1,29                          |        |      | Upgrade Goedemoed 11 kV line from Guest House to farm Schoemanshoek - 3 km                                                                                                                                                                                           |                   |                   |                   |                   |                   |                   | R1 200 000,00     |                   |                   |                   | R1 200 000,00    |
| 1,30                          |        |      | Install 11kV Cable feeder from Droëheuwel substation to RMU on c/o Bloekombos and Dassiehoek Road and then via RMU on Keurkloof 11 kV line - 620 m 95 mm 11 kV cable. From RMU to Bloekombos Miniature substation                                                    |                   |                   |                   |                   |                   |                   | R800,000,00       |                   |                   |                   | R0,00            |
| 1,31                          |        |      | Upgrade Agter-Vinkrivier 11 kV line from Noree Booster to Cape Lime and from T-off to Saggy Stone - 11 km                                                                                                                                                            |                   |                   |                   |                   |                   | R1 400 000,00     | R1 400 000,00     | R800 000,00       |                   |                   | R3 600 000,00    |
| 1,32                          |        |      | Upgrade De Hoop 3,3 kV Line to 11 kV from Step-down in De Hoop to Gerhard Burger farm and replace 22 transformers - 3,8 km                                                                                                                                           |                   |                   |                   |                   |                   | R1 400 000,00     | R700 000,00       | R700 000,00       |                   |                   | R2 800 000,00    |
| 1,33                          |        |      | Upgrade Noree 11 kV line from Noree Booster to Orange Grove - 2,2 km                                                                                                                                                                                                 |                   |                   |                   |                   |                   |                   | R700 000,00       |                   |                   |                   | R700 000,00      |
| 1,34                          |        |      | Extend Waterworks substation, install 11 kV cable from Goedehooplaan substation to Waterworks substation and install 11 kV switchgear at Water works substation - 1,7 km x 185 mm 11 kV cable                                                                        |                   |                   |                   |                   |                   |                   |                   | R3 000 000,00     |                   |                   | R3 000 000,00    |
| 1,35                          |        |      | Upgrade Keurkloof 11 kV line from Almond burry farm to Greek Church, _1,6 km                                                                                                                                                                                         |                   |                   |                   |                   |                   |                   |                   | R500 000,00       |                   |                   | R500 000,00      |
| 1,36                          |        |      | Upgrade 11 kV line to farm Sunshine in Uitnood - 800 m includes river crossing                                                                                                                                                                                       |                   |                   |                   |                   |                   |                   |                   | R300 000,00       |                   |                   | R300 000,00      |
| 1,37                          |        |      | Install 730 m 11 kV line from Keurkloof 11 kV line to Freecia Ave and from there 200 m 70 mm 11 kV cable to Papawer Ave miniature substation.                                                                                                                        |                   |                   |                   |                   |                   | R500 000,00       |                   |                   |                   |                   | R500 000,00      |
| 1,38                          |        |      | Replace existing street lights with LED street lights                                                                                                                                                                                                                |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   | R0,00            |
| 1,39                          |        |      | Install new 1,4 km x 95 mm 11 kV cable and switchgear for development at old KVV site Robertson                                                                                                                                                                      |                   |                   |                   |                   |                   | R1 800 000,00     |                   |                   |                   |                   | R1 800 000,00    |
| 1,40                          |        |      | Upgrade Eilandia 11 kV line from Boetie Cilliers to Guest Farm near Eilandia Primary School - 1,3 km                                                                                                                                                                 |                   |                   |                   |                   |                   | R450 000,00       |                   |                   |                   |                   | R450 000,00      |
| 1,41                          |        |      | Upgrade Klaasvoogds 11 kV line from Klaasvoogds Primary School to farm Buitensorg and from Klaasvoogds Primary School to Farm Bergsig                                                                                                                                |                   |                   |                   |                   |                   |                   | R2 000 000,00     | R1 000 000,00     |                   |                   | R3 000 000,00    |
| 1,42                          |        |      | Upgrade Retreat 11 kV line along Agterkliphoopte Retreat road, 3,3 km (replacing existing 11 kV line (Cu) in thorn trees and river) and upgrade 11 kV line (Cu) from Kasra to Dieter Steyn - 1,9 km                                                                  |                   |                   |                   |                   |                   |                   | R1 000 000,00     | R500 000,00       |                   |                   | R1 500 000,00    |
| 1,43                          |        |      | Upgrade 11 kV line to farm Johannes van Zyl's in Uitnood - 3,5 km includes river crossing                                                                                                                                                                            |                   |                   |                   |                   |                   |                   | R1 000 000,00     |                   |                   |                   | R1 000 000,00    |
| 1,44                          |        |      | Upgrade Wansbeck 11 kV line from Danie Erasmus to Philbert Lourens, _2,8 km (Existing Copper line)                                                                                                                                                                   |                   |                   |                   |                   |                   |                   |                   | R900 000,00       |                   |                   | R900 000,00      |
| 1,45                          |        |      | Upgrade Agterkliphoopte 11 kV line from Wansbeck Wine Cellar to Farm De Hoek - 8,6 km                                                                                                                                                                                |                   |                   |                   |                   |                   |                   | R2 400 000,00     |                   |                   |                   | R2 400 000,00    |
| 1,46                          |        |      | Replace 6 x 11 kV oil switches at Le Chasseur substation                                                                                                                                                                                                             |                   |                   |                   |                   |                   |                   | R2 400 000,00     | R2 400 000,00     |                   |                   | R4 800 000,00    |
| 1,47                          |        |      | New Primary Substation Building with 11 kV Switchgear and 11 kV cable feeder at Erf 3, Robertson.                                                                                                                                                                    |                   |                   |                   |                   |                   |                   |                   | R2 500 000,00     | R2 500 000,00     |                   | R5 000 000,00    |
| 1,48                          |        |      | Replace Denne Avenue RMU (CVV)                                                                                                                                                                                                                                       |                   |                   |                   |                   |                   |                   |                   |                   | R320 000,00       |                   | R320 000,00      |
| 1,49                          |        |      | Repair old workshop building at Muiskraalskop                                                                                                                                                                                                                        |                   |                   |                   |                   |                   |                   |                   |                   |                   | R250 000,00       | R250 000,00      |
| 1,50                          |        |      | Repair and paint Noree SS building and fence                                                                                                                                                                                                                         |                   |                   |                   |                   |                   |                   |                   |                   |                   | R100 000,00       | R100 000,00      |
|                               |        |      |                                                                                                                                                                                                                                                                      |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   | R0,00            |
| 2. MASTERPLAN RECOMMENDATIONS |        |      |                                                                                                                                                                                                                                                                      |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   |                  |
| 2,1                           |        |      | Replace HV substation switchgear (Muiskraalskop)                                                                                                                                                                                                                     | R1 627 000,00     |                   |                   |                   |                   |                   |                   |                   |                   |                   | R1 627 000,00    |
| 2,2                           |        |      | Replace transformers 1 & 2 at Muiskraalskop substation                                                                                                                                                                                                               |                   | R13 000 000,00    |                   |                   |                   |                   |                   |                   |                   |                   | R13 000 000,00   |
| 2,3                           |        |      | Upgrade 11kV underground cable from White Str SS to Bergsig Str SS (95mm²) 700m                                                                                                                                                                                      |                   |                   | R950 000,00       |                   |                   |                   |                   |                   |                   |                   | R950 000,00      |
| 2,4                           |        |      | Replace 11kV switchgear in Sentraal SS                                                                                                                                                                                                                               |                   |                   | R2 000 000,00     |                   |                   |                   |                   |                   |                   |                   | R2 000 000,00    |
| 2,5                           |        |      | Replace 11kV switchgear in White Str SS                                                                                                                                                                                                                              |                   |                   |                   |                   | R3 600 000,00     |                   |                   |                   |                   |                   | R3 600 000,00    |
| 2,6                           |        |      | Replace miniature substations                                                                                                                                                                                                                                        | R525 000,00       |                   | R525 000,00       | R2 675 000,00     | R2 100 000,00     | R525 000,00       |                   |                   | R525 000,00       | R525 000,00       | R7 400 000,00    |
| 2,7                           |        |      | Replace transformers                                                                                                                                                                                                                                                 | 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       | R300 000,00       | R3 000 000,00    |
| 2,8                           |        |      | Upgrade 11kV feeder to KVV RMU (220m)                                                                                                                                                                                                                                |                   |                   |                   |                   |                   |                   |                   |                   |                   | R400 000,00       | R400 000,00      |
|                               |        |      |                                                                                                                                                                                                                                                                      |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   | R0,00            |
|                               |        |      | Total                                                                                                                                                                                                                                                                | R17 697 456,67    | R21 166 000,00    | R16 525 000,00    | R6 935 000,00     | R7 800 000,00     | R7 425 000,00     | R14 100 000,00    | R12 900 000,00    | R3 645 000,00     | R1 575 000,00     | R109 768 456,67  |