 Eskom	<b>Scope of Work</b>	<b>Technology</b>
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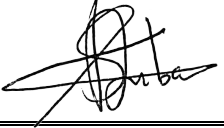


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## 1. INTRODUCTION

This document is to give detailed scope of work for construction of 35 m tower at Nonyane Substation (SS) [coordinate 25°24'46.40"S, 27°59'43.10"E]. The tower is to be used to provide telecommunication network for purpose of SCADA RTU and Telephone lines.

## 2. SCOPE OF WORK

The document covers the general Scope of work needed to be done at Nonyane SS. It gives the guideline of the scope of work to be covered by appointed contractor for construction of 35 m Tower i.e. Supply, delivery and erection of 35 m Tower at Nonyane SS in the North west operating unit (OU).

### 2.1 PHASE 1: PRODUCTION OF MANUFACTURING DRAWINGS

Eskom will provide

### 2.2 PHASE 2: DESIGN OF TOWER FOUNDATION

The construction of the foundation shall be in accordance with the following drawing:

*“0.53/Nonyane: Nonyane 35m Microwave Tower Raft Foundation Layout and Details”*

Should the soil conditions be unfavourable for the installation of this design, the contractor shall inform Eskom.

### 2.3 PHASE 3: MANUFACTURING AND TOWER CONSTRUCTION

#### 2.3.1 Material Quality

The following material grades shall be utilized:

Steel Sections	S355JR
Plates (less than 19mm thick)	S355JR
Plates (greater than 19mm thick)	S355J0 (for better workability)
Bolts	Grade 8.8 to ISO 898
Nuts	Grade 8
Washers and Packers	S275JR

Impact properties in the longitudinal direction of all structural materials shall be determined for grade S355JR material greater than 19mm in thickness in accordance with the Charpy V-notch test. Charpy V-notch requirements at a minimum, shall meet the requirements of 27 J absorbed energy at room temperature (21° Celsius)

Silicon and Phosphorous content of steel is limited as follows:

“Aluminium Killed Steel”: Silicon (Si) = 0.01 to 0.04%, Phosphorous (P) < 0.015% max

“Silicon Killed Steel” : Silicon (Si) = 0.15 to 0.25%, Phosphorous (P) < 0.02% max

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### **2.3.2 Tower fabrication**

Tower fabrication must be done as per general tower specification, 240-59967638

The supplier and his manufacturing facility shall employ a production process that has an integrated Quality Management System (QMS). The Quality Management System employed shall be based on the framework of SABS /ISO 9001 standards for Quality Management Systems or be an equivalent recognised system approved by Eskom Quality Assurance Division. Details of the QMS shall be provided.

### **2.3.3 Quality inspection of the supplied steel**

The contractor to send an inspection notification to Eskom 7 days in advance for the inspection of the steel to be used in order for Eskom to verify the quality of the steel provided.

### **2.3.4 Prototype Assembly**

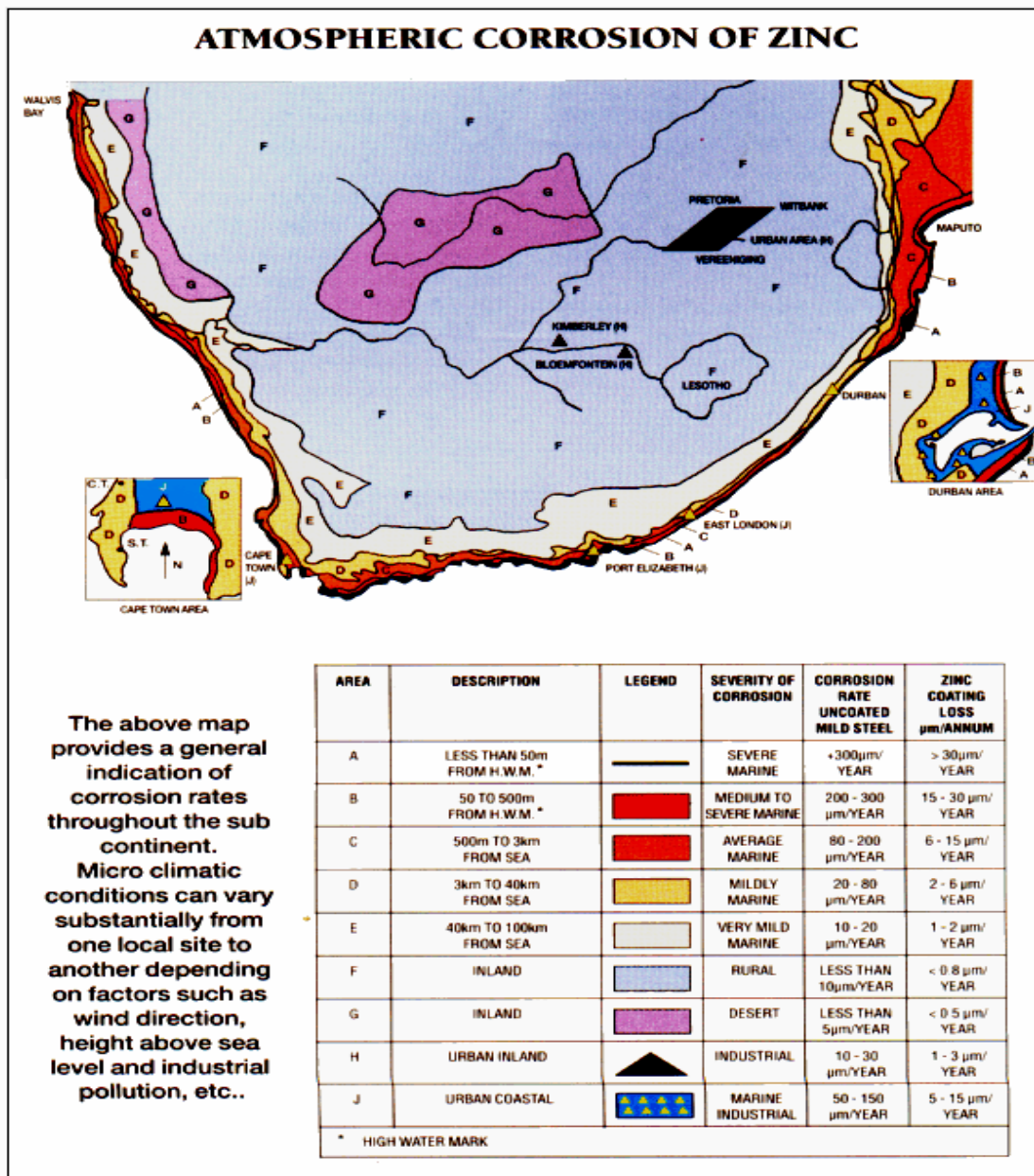
- a) All structures shall be test assembled in the shop to the extent necessary to ensure accurate fit in the field. Prototype assembly shall include all structure components and accessories. Assembly procedure shall demonstrate that each section fits the adjacent section.
- b) A Prototype Assembly Report shall summarize the findings of the prototype assembly and all necessary modifications to the members.
- c) The prototype structure shall be assembled with the correct fasteners and bolts tightened to the correct torque.

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### 2.3.5 Corrosion levels

The position of the tower is about located in the North West which falls under the rural inland category as per **Figure 2.1**. The expected corrosion level in the region is less than 10  $\mu\text{m}/\text{year}$ . Therefore, standard galvanizing is specified with a thickness of 85 $\mu\text{m}$  in order to cater for rate of corrosion on the tower steel.



**FIGURE 2.1: CORROSION LEVELS EXPERIENCED IN REGIONS OF SOUTH AFRICA**

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### **2.3.6 Other pre-construction activities**

The contractor to supply the following documents to Eskom for review and acceptance before construction commences:

- a) All the Safe Work Procedures to be used detailing step by step methodology that will be used by the contractor during construction to ensure that the tower is safely constructed.
- b) The contractor to note that ORVHS authorization is required for all the sites that are located within the substation yard
- c) The contractor to provide Eskom with a quality, inspection and test plan (QITP) for acceptance before any construction can take place. An example of this will be provided to the contractor once the contract has been awarded

### **2.3.7 Construction activities**

The construction of the tower must be done in accordance to the Eskom standard 240 – 59967638.

### **2.3.8 Geo-Technical information**

Eskom will provide the report (5027-10- Nonyane SS *Geotech Report*)

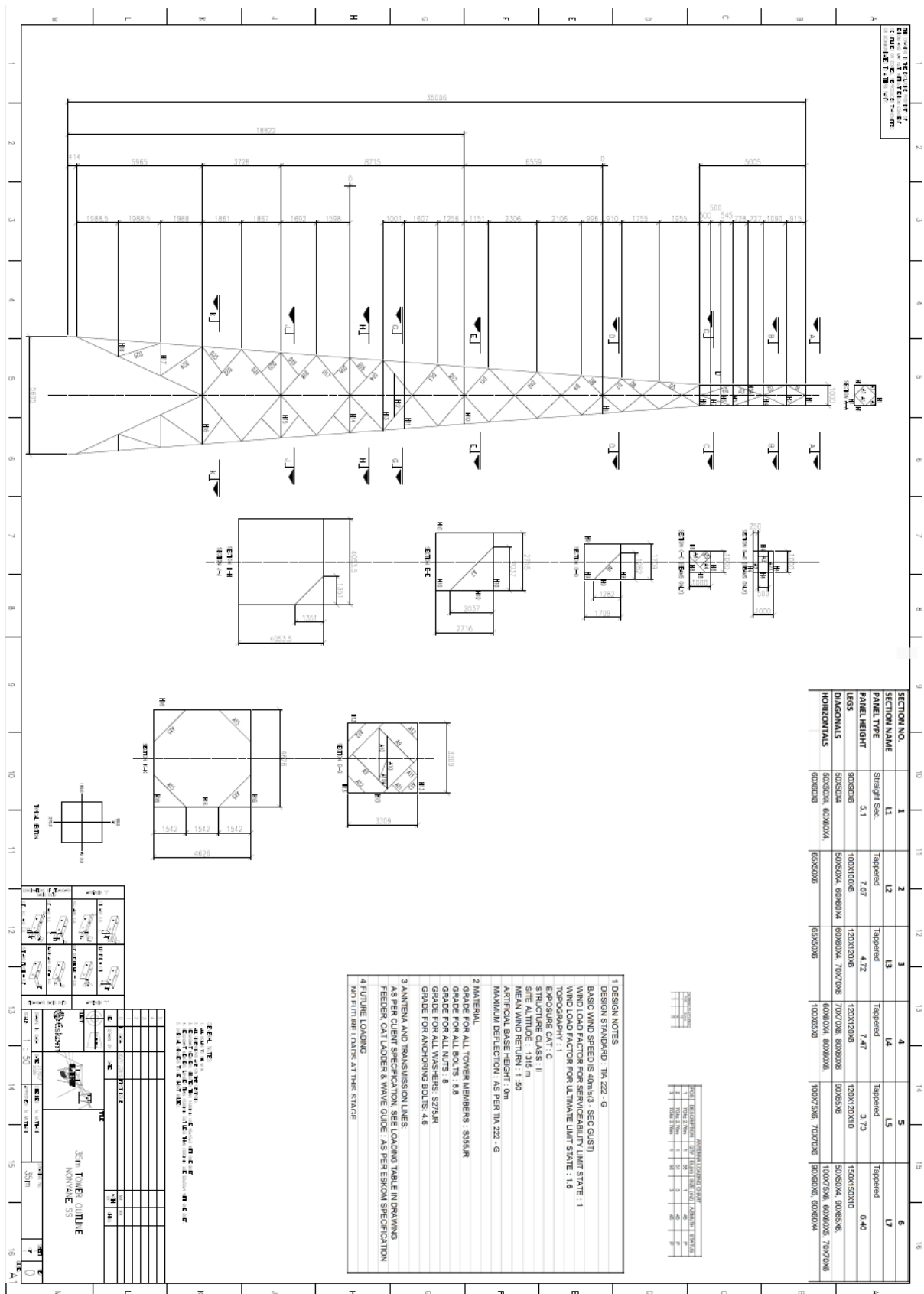
### **2.3.9 Total tower mass**

The total tower steel mass including the plates, bolts platforms, and ladders = **6938 kg. This should be used when costing as well.**

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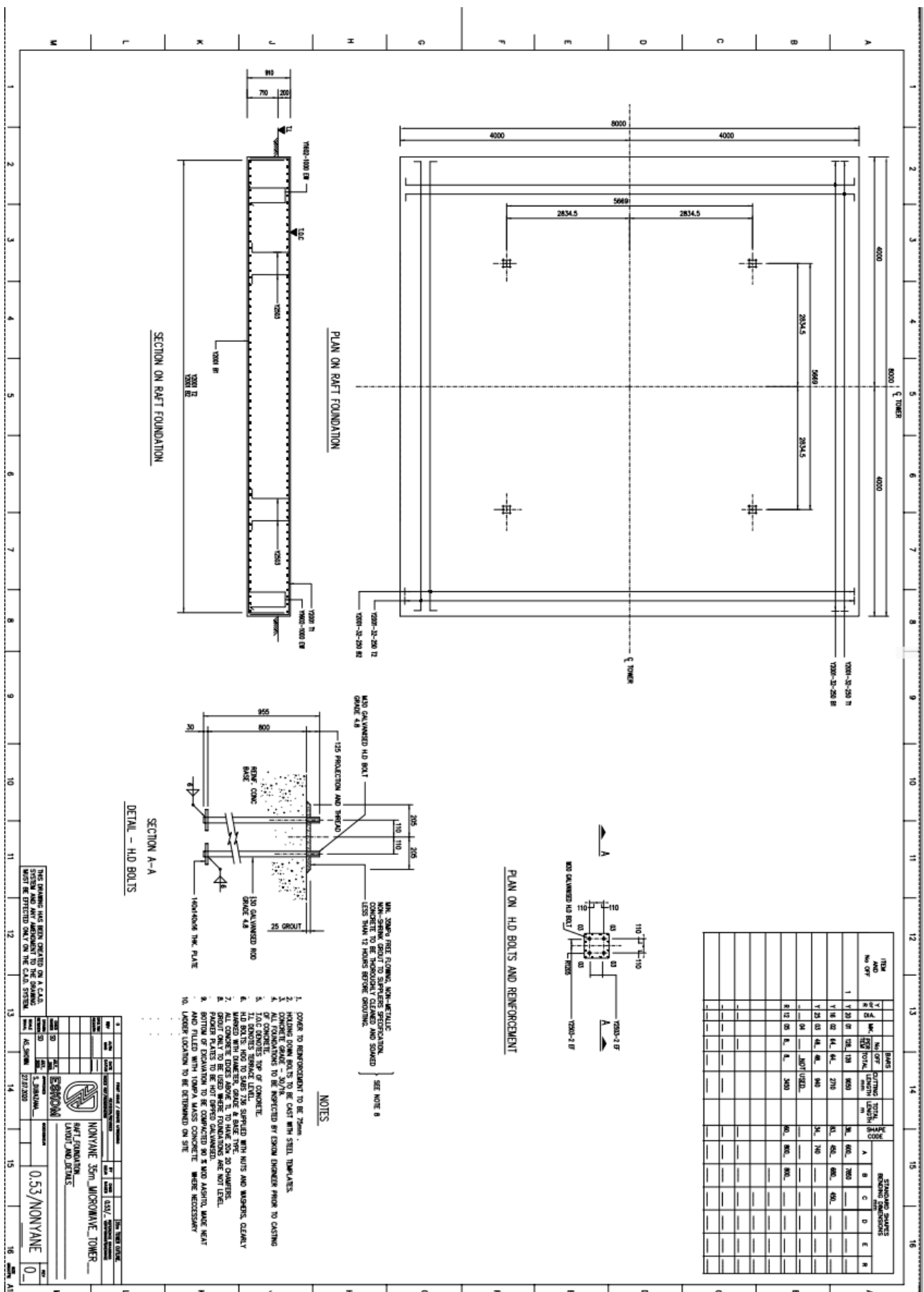
## 2.4 TOWER DRAWINGS



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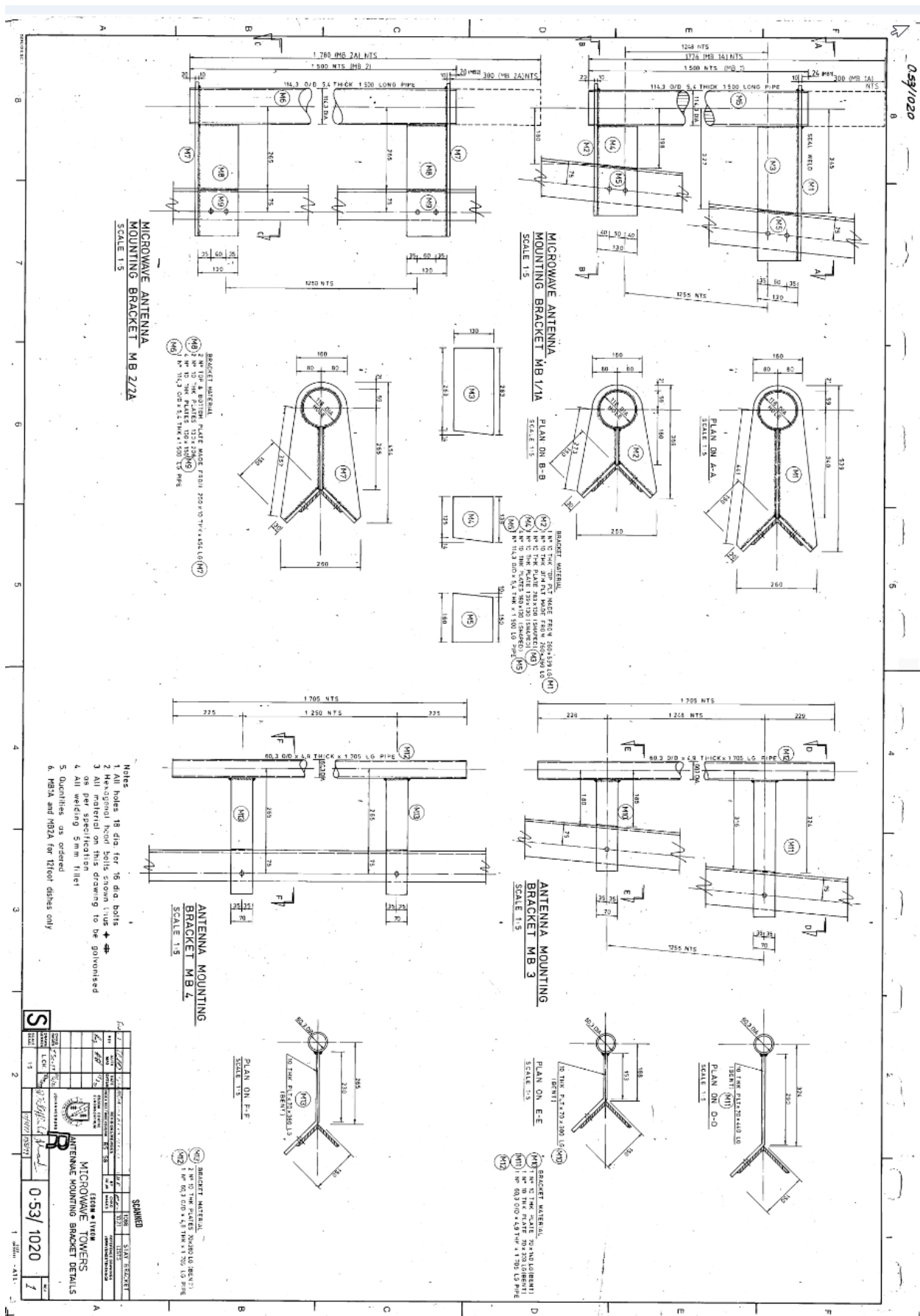
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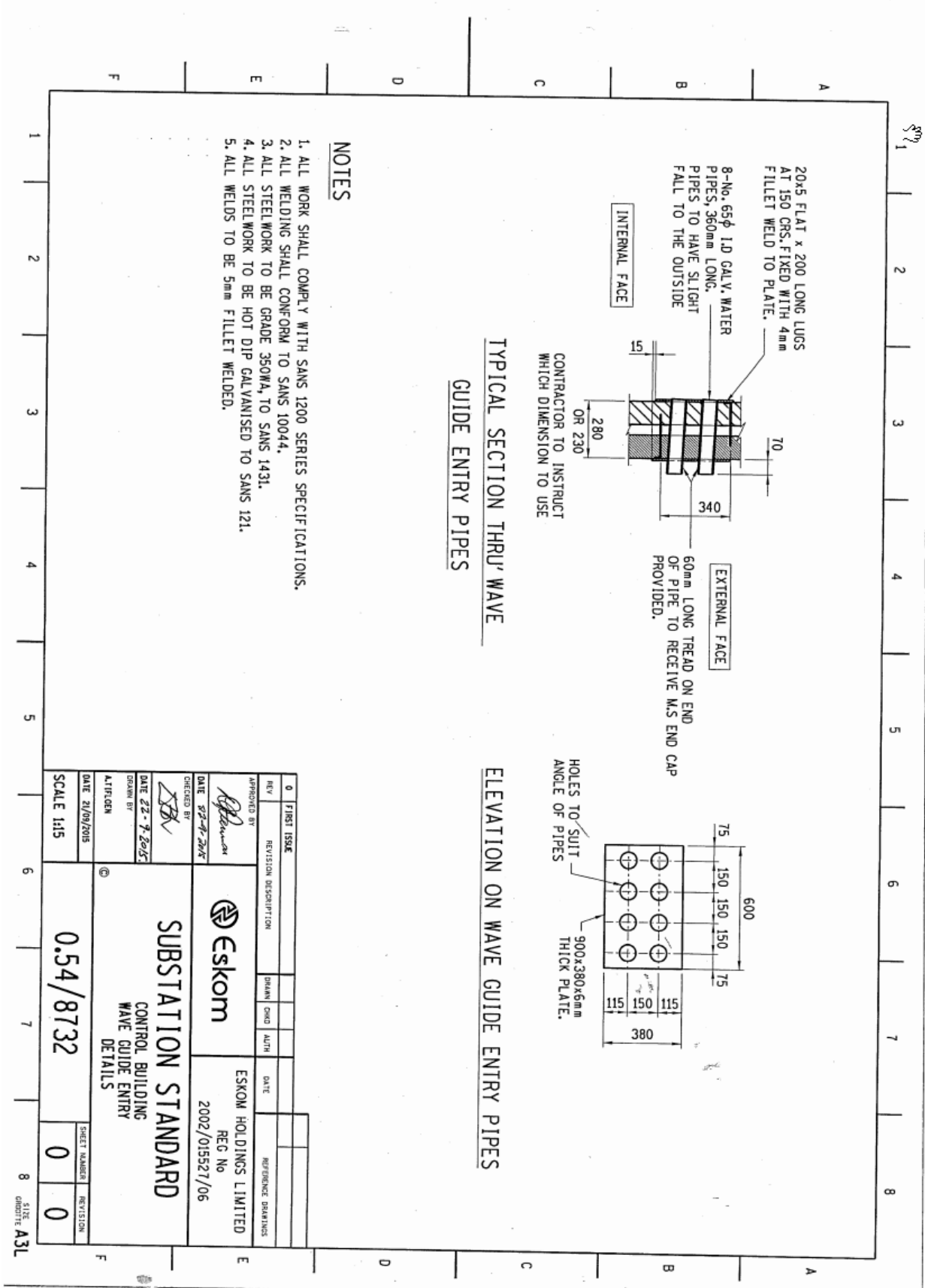


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## 2.5 OTHER USER DEFINED REQUIREMENTS

1. The contractor shall provide As-built document such as engineering Certificate signed off by contractor professional engineer to declare that tower is safe, earth test certificate, site drawing and any other documents that deemed applicable by them and Eskom telecommunication and/or Provide documentation related to 35 m tower.
2. The tower shall have platform (full landing zone) with trap doors as per the provided manufacturing drawings.

### Notes:

- Trap door should be lockable on open and closed position.
  - Ensure kick plates are minimum 150 mm x 2.5 mm thick.
  - Ensure resting stations or platforms do not interfere with the direct routing paths of the feeder ladder
  - Provide earthing terminal plates at each landing with brass bolts for terminating equipment earthing leads. This must be bonded to main tower down earth or structural steel if a down conductor was nor required.
3. Tower shall have cat ladder to its full length with guard rails as per Eskom standard.
  4. Provide earthing terminal plates with brass bolts as per *Eskom Telecommunications General Tower Specification (240-59967638)* and *Radio station Earthing and Bonding standard (240-56872313)* for terminating equipment earthing leads. This must be bonded to main tower earthing system.
  5. The contractor must supply and Install universal microwave antenna brackets (**see drawing no 0.53/1020**) per Table 2-1: Antenna Mounting Brackets Schedule**Table 2-1**

Note: The Supplier is allowed to submit alternative antenna mounting brackets to ESKOM for review and approval were necessary

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**Table 2-1: Antenna Mounting Brackets Schedule**

Attachment level	Bracket Type	Quantity
4 x @Working platform #3 (33 m level)	MB 2/2A	4
4 x @Working platform #2 (30 m level)	MB 2/2A	4
4 x @Working platform #1 (15 m level)	MB 1/1A	4
No required	MB 3	0
No required	MB 4	0

**6. Tower Cable Tray /Feeder entry panel:**

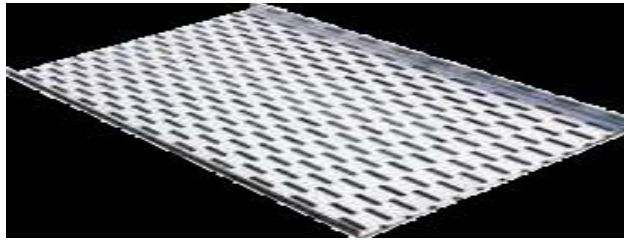
- Contractor to install a 6 m **horizontal cable tray/racking** from the tower to the wall of control room.
- The cable tray must be installed upside down to prevent feeder cable from hail damage.
- The cable tray shall be a **heavy-duty** cable tray pre galvanised standard finish and the splicing method must be overlap with M6 gutter bolts and square nuts. Where bends are required it shall be of horizontal bend (**see example** of horizontal cable tray and horizontal bend below)



Horizontal bend

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Straight cable tray heavy duty pre-Galvanised.

**Table 2-2: Additional criteria for cable Tray**

Width (mm)	304
Height (mm)	19
Finish fasteners	Electro - Galvanised
Number of Gutter bolts and square nuts per joint	3

**7. Wave guide plate details**

Waveguide entry plate shall be installed as per drawing no “0.54/8732 Control building wave guide entry details”

**8. Fence around the Tower**

Fencing requirements are listed as per below

- No fence is required as the tower is within the SS fence

**2.6 SITE INFORMATION**

The tower is to be constructed at the existing Nonyane SS, which is located in North West OU.

GPS Coordinate: **25°24'46.40"S, 27°59'43.10"E**

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**2.7 BILL OF MATERIALS (BOM)**

The table below shows high level bill of material required for the tower and not meant to nullify other items that are specified on the Eskom standard 240 – 59967638.

**Table 2-3: Nonyane SS BOM**

Item	Description	Unit	Qty.	Labour rate	Total
<b>1</b>	<b>Foundation (all 4 legs)- See drawing no 0.53/Nonyane Raft_foundation_layout_and_details</b>				
1.1	Reinforcement steel weight	kg	3150.25		
1.2	Concrete volume	m <sup>3</sup>	58.44		
1.3	Excavation volume	m <sup>3</sup>	45.44		
1.4	Formwork Surface	m <sup>2</sup>	29.12		
1.5	Backfill	m <sup>3</sup>	0		
1.6	35Mpa Non-Metallic No shrink grout	m <sup>3</sup>	0.0212		
1.7	M30 GRADE 4.8 GALVANIZED H.D BOLTS WITH 160 x160x16 THK PLATES	n/a	16 x 955 mm LONG		
<b>2</b>	<b>Main tower - See drawing no 35 m Tower outline – Nonyane SS</b>				
2.1	Supply steel – <b>including</b> plates, cat ladder, working platforms galvanised at 85 µm	kg	6244		
2.2	Supply bolts	kg	693		
2.3	Tower Assembly	hr	24		
2.4	Tower Erection	hr	12		
<b>3</b>	<b>Working/resting platforms - supply and install</b>				
3.1	Already included under 2.2				
<b>4</b>	<b>Antenna Mounting Brackets - Supply and install</b>				
4.1	8 x Antenna Mounting brackets <b>MB 1/1A</b>	Unit	8		
4.2	4 x Antenna Mounting brackets <b>MB 2/2A</b>	Unit	4		
<b>5</b>	<b>Miscellaneous - Supply and install</b>				
5.1	Cat ladder and cage – covered under section 2.2				
5.2	Earthing terminating plates	Unit	1		

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5.3	Horizontal cable tray/racking-heavy duty including supports	m	6		
<b>5.4</b>	<b>Tower lights as per Eskom standard 240-138048594</b>				
5.4.1	Double low intensity lights at tower top – Type B(32cd)	Unit	2		
5.5	Tower painting as per CAA requirements – (red and white, equal spacing with red band on top)	m <sup>2</sup>	212		
5.6	Supply and install waveguide entry plate – 600 x 380 x mm THK plate see drawing no “0.54/8732 Control building wave guide entry details”	n/a	1		
<b>6</b>	<b>Equipment - hire</b>				
6.1	Use of specialized equipment i.e. Crane	hr	12		
<b>7</b>	<b>Fencing –Supply and Install</b>				
7.1	No fencing required	m <sup>3</sup>	N/A		
<b>8</b>	<b>Dismantling work</b>				
8.1	No dismantling is required	Rate	N/A		

## 2.8 APPLICABLE STANDARDS

Mast/Tower must comply with Eskom Telecommunication specification as listed.

*240-59967638 General Tower Specification*

*240-56872313 ET Radio Station Earthing and Bonding*

*240-103616544 Aviation requirements Towers rev 1*

*240-138048594 LED Aircraft Warning Light for Eskom Telecommunication Towers*

Informative references

*SANS 10160-3 Basis of structural design and actions for buildings*

*and industrial structures Part 3 Wind actions*

*ETSP 0459 ET Tower Lights Specification\_rev1*

*SCSASACF6 Power lines and telecommunications tower Aviation regulations*

*The civil Aviation Act relating to Obstacles (RSA)*

*ETPN 1490 Environmental Impact Assessment principles*

*Documents available on request or at <http://dt.eskom.co.za/> or Hyperwave*

*Latest revision must always be applied.*

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## **2.9 DEFINITIONS**

### **2.9.1 Disclosure Classification**

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