South African Site Information & Instructions : SKA_MID: Part A – Site Information

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1 Introduction

The Square Kilometre Array (SKA) project is an international effort to build the world's largest radio telescope. The scale of the SKA represents a huge leap forward in both engineering and research & development towards building and delivering a unique instrument. As one of the largest scientific endeavours in history, the SKA will bring together a wealth of the world's finest scientists, engineers and policy makers to bring the project to fruition.

The Square Kilometre Array Observatory (SKAO) is one observatory, with two telescopes - one in Australia and the other in South Africa. The Headquarters of the SKAO is at Jodrell Bank, near Manchester, UK.

The South African Radio Astronomy Observatory (SARAO) is a National Facility of the National Research Foundation (NRF). The NRF has acquired land (through acquisition or servitude agreement) for the SKAO and is the license holder of all construction licenses. The MeerKAT Radio Telescope and its extension is an asset of SARAO until it is incorporated with SKA_Mid and handed over to the SKAO. The SKAO is responsible for construction of SKA_Mid in South Africa and shall comply with all South African legislation and SARAO Policies described in Section 6 as well as the SKAO's policies, procedures and management plans.

The Karoo region of South Africa provides the perfect radio-quiet backdrop for the high and medium frequency arrays that will form a critical part of the SKAO's ground-breaking continent-wide telescope.

South Africa is already host to KAT 7, MeerKAT, HERA AND HIRAX radio telescopes on the site, with MeerKAT and HERA serving as precursors to the SKA radio telescope.

The MeerKAT radio telescope commenced with scientific observations in 2019 and in its expanded form will be integrated during the latter part of construction of SKA_Mid. The scope of SKA_Mid includes the addition of up to 133 dishes and associated infrastructure with construction commencing in 2021. The SKA telescope is expected to operate for 50 years.

The SKA_Mid Project will conduct observations in many exciting areas of science, such as gravitational waves, pulsars, and will search for signatures of life in the galaxy. It will provide a jump in capability, providing 4 times more resolution and 5 times more sensitivity than the JVLA, the current best telescope as similar frequencies. Additionally, it will be able to map the sky 60 times faster.

1.1 Purpose of the Document

The purpose of this document is to provide Site Information (Part A) and Site Instructions (Part B) for the SKA_Mid Project. To do so, the document has been prepared in two parts:

SKA-TEL-SKO-0001040: Part A: Site Information

Part A is intended to provide an overview and general site information for all who travel to the site in South Africa to work or as a Visitor which includes Contractors.

This is also an introductory document for individuals, companies and organisations seeking to participate in procurement processes implemented for the SKA_Mid project and those who have secured contracts to provide products and services for the SKA_Mid project.

SKA-TEL-SKO-0001040: Part B: Site Instructions

Part B has been prepared to provide more detailed and specific information on obligations, requirements and instructions for Tenderers, Contractors and service providers working on site.

Part A and Part B are intended to be read together and be mutually explanatory.

SKAO and its Contractors shall comply with all relevant South African legislation.

1.2 Scope of the Document

The scope of this document is to provide information on:

- The location of the site in South Africa, main access routes to the site and transportation routes from major urban centres, airports and ports in South Africa (Part A).
- The environmental conditions that can be expected for people visiting or working at the site which includes detailed weather data, geotechnical, geohydrological, environmental, topographical and heritage information (Part A).
- The obligations, requirements, policies and procedures that must be understood and complied with when travelling to, visiting or involved in construction or operational activities at the site (Section 6 of Part A & Part B).

1.3 Interpretation: "Visitor" and "Contractor"

The NRF is the owner of the land. SARAO is a National Facility of the NRF and its staff are responsible for the operation of the existing site and associated infrastructure. SARAO are not defined as Visitors or Contractors.

Pursuant to the 'Memorandum of Understanding on Collaboration between the SKAO and the NRF regarding Principles of Collaboration on SKA-MID', and the 'Host Country Agreement between the SKAO and the Department of Science and Innovation', SKA-Mid Project Personnel shall be afforded rights of access to SARAO properties and resources consistent with their needs and requirements to carry out the SKA project in South Africa.

The word "Visitor" may be used within this document to mean a person visiting the site in a non-working capacity but more often it is used as an all-encompassing term to mean anyone travelling to or present on the site in either a working or non-working capacity. For the sake of clarity, "Visitor" shall be understood to include:

- SKAO Visitors
- SKAO Project Consultants and Contractor personnel
- Guest Instrument Personnel and Visitors
- Guest Instrument Project Consultants and Contractor personnel
- Transport operators, service providers and others associated with the SKA_Mid Project or Guest Instruments.

"Contractor" has been used within this document to mean a company or person who is present on the site in a working capacity or providing a service associated with construction of the SKA_Mid Project or other Guest Instruments being constructed on site and who are not SKAO or SARAO Personnel. For the sake of clarity, "Contractor" where used shall be understood to include:

- Project Consultants and Contractor personnel
- People arriving at the site for the specific purpose of visiting a Contractor
- Transport operators (including bus charter companies, forklifts, cherry pickers, mobile cranes and any vehicles with on-board integrated lifting equipment)
- Suppliers, couriers and carriers delivering materials, goods and equipment
- Air charter companies/operators.

1.4 Limitation of Use

Before confirming arrangements and embarking on travel to the site for any purpose, Visitors, service providers, Contractors and personnel are advised to refer to this document and understand access protocols and to undertake their own investigations when seeking to understand travel, transportation and environmental conditions, regulations, policies, procedures, protocols and constraints that could have an impact on them or others for whom they may have a responsibility.

A References

A.1 Applicable Documents

The following documents are applicable to the extent stated herein. In the event of conflict between the contents of the applicable documents and this document, **the applicable documents** shall take precedence.

[AD 1]	SKA_MID Physical Configuration Coordinates, SKA.TEL-INSA-0000537;
[AD 2]	Astronomy Geographic Area Advantage Act, Act No. 21 of 2007 & its Regulations
[AD 3]	National Environmental Management: Protected Areas Act, Act No. 57 of 2003
[AD 4]	SKA Organisation Health, Safety & Environmental Management Plan, SKA-TEL-SKO-0000740, J. Kerr
[AD 5]	SKA SA (SARAO) Health & Safety Policy, SSA-0008A-001
[AD 6]	Integrated Environmental Management Plan (IEMP) for SKA Phase 1 mid-frequency array (SKA1_MID) in South Africa, CSIR, 2017 and Rev1 version updated in 2018 and prepared by Gaea Enviro (Pty) Ltd;
[AD 7]	Occupational Health and Safety Act, Act No 29 of 1996 and its Regulations
[AD 8]	Mine Health and Safety Act, Act 29 of 1996 and its Regulations
[AD 9]	Compensation for Occupational Injuries and Diseases Act (Act 75 of 1997)
[AD 10]	South African Construction Regulations, 2014
[AD 11]	Road Traffic Act, Act No 29 of 1989
[AD 12]	Disaster Management Act, Act. No 57 of 2002
[AD 13]	National Environmental Management Act, Act. No 107 of 1998
[AD 14]	The South African Radio Astronomy Observatory Heritage Impact Assessment & Conservation Management Plan Project, Conservation Management Plan, Digby Wells Environmental, July 2018
[AD 15]	SKA EMI/EMC Standards, Related Procedures & Guidelines, SKA-TEL-SKO-0000202;
[AD 16]	SARAO Visitor Policy, SSA-0006A-001;
[AD 17]	SARAO Visitor Access Procedures: Johannesburg, HartRAO, Cape Town, Klerefontein Offices, SSA-0006B-002;
[AD 18]	Karoo Site Tour/Visitor Checklist, SSA-0006B-003;
[AD 19]	SARAO On-Site Rules & Procedures, SSA-0006A-001;
[AD 20]	SARAO Transport Policy, SSA-0000-0000-001;
[AD 21]	SARAO Procedure for Alcohol & Substance Abuse Control, SSA-0008B-003;
[AD 22]	SARAO Emergency Response Plan, SSA-0008C-002;
[AD 23]	SARAO Disaster Management Plan, SSA-0008C-007;
[AD 24]	SARAO Radio Frequency Interference Karoo Site Procedures, SSA-0008B-02464;

[AD 25] SARAO RFI Zone Definitions for MeerKAT and SKA1, SSA-0008N-01A-001;
[AD 26] Applying Telescope Protection Levels to Measurement Data, SSA-0008A-038;
[AD 27] SARAO Guest Instrument Policy, SSA4100-0000-001
[AD 28] SKAO HSE policy, SKA-GOV-0000063-01
[AD 29] SSA-0018H-0C-01C-001 to SSA-0018H-0C-01C-038 - Boundaries of the site – NRF owned land
[AD 30] SKA-GOV-0000014 ISMS Acceptable Use Policy For Users

A.2 Reference Documents

The following documents are referenced in this document. In the event of conflict between the contents of the referenced documents and this document, **this document** shall take precedence.

[RD 1] GCS, Hydrogeological Investigation – Square Kilometre Array South Africa, Northern Cape, SKA-TEL-INSA-0010014 Rev 1;

[RD 2] GCS, SKA1_MID Borrow Pits Investigation Report, SKA-TEL-INSA-0010009 Rev 1;

[RD 3] LiDAR Survey Report, SGP2015_37, Rev 1;

[RD 4] GCS, Flood Line Assessment Update for the Square Kilometre Array (SKA1) Project, Northern Cape, South Africa, SKA-TEL-INSA-0010013 Rev 4;

[RD 5] GCS, Stormwater Management Plan & Water Balance for the South African Mid-Frequency Array SKA Phase 1 (Core), Ver 2, 10 May 2019;

[RD 6] GCS, Factual Report for the Antenna Foundations for the Extension of the SKA1_MID Project, Northern Cape Province: Final, April 2018;

[RD 7] Environmental Conditions for the SKA 1 Site South Africa document, 301-000000-009 Rev 02, H. Niehaus, A Peens-Hough

[RD8] Screening Major Hazard Installation Risk Assessment of the Proposed Square Kilometre Array Site Complex near Carnarvon, Northern Cape, CSIR, Report Number R/16/CSIR-01 Rev 1, 7 August 2016

[RD9] Critical Design Report (CDR) for the Water & Sanitation Sub-element, SKA-TEL-INSA-0004021 Rev 5, H. Hurter, 23 February 2021 and Water & Waste Water Design Demand, SKA-TEL-INSA-0004026 Rev 4, H. Hurter, 3 August 2021;

[RD10] GCS, Stormwater Management Plan & Water Plan for the Visserskloof Contractor Camp, Ver 1, 30 June 2021

[RD11] Antenna Foundation Sub-Element Detailed Design Report, DVP5: MeerKAT Extension 20 Dishes, 406-000003-GG-501-DDR – Zutari, June 2021 (Appendix B – Percussion Borehole logs & Appendix C – CSW test data results from additional investigations undertaken in May 2021)

LIST OF ABBREVIATIONS

AA0.5	SKA Array Assembly 0.5 (SKA early production array)
AAA	Astronomy Advantage Area
AD	Applicable Document
AGA Act	Astronomy Geographic Area Advantage Act, Act No. 21 of 2007
AGIS	Agricultural Geo-referencing Information System
CFP	Chance Find Protocol
CPF	Central Processing Facility
COC	Certificate of Compliance
COIDA	Compensation for Occupational Injuries and Diseases Act
COVID-19	'Severe Acute Respiratory Syndrome Coronavirus 2' (SARS-CoV-2): causative agent of 'Coronavirus Disease 2019'
CMP	Conservation Management Plan
CS	Cultural Significance
DMP	Disaster Management Plan
DMR	Department of Mineral Resources
DMPC	Disaster Management Planning Committee
DRA	Disaster Risk Assessment
DSI	Department of Science and Innovation
DSTI	Daily Safe Task Instruction
DWS	Department of Water & Sanitation
ECC	Emergency Control Centre
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EMPr	Environmental Management Plan
EMT	Emergency Management Team

EMS	Emergency Medical Services
EOC	Engineering Operations Centre
ERAP	Emergency Response Action Plan
ERP	Emergency Response Plan EOC
ESD	Electro Static Discharge
EWT	Endangered Wildlife Trust
HERA	Hydrogen Epoch of Reiniozation Array
HSE	Health, Safety, Environment
HSMP	Health & Safety Management Plan
IDP	Integrated Development Plan
IEC	International Environmental Conditions
ISMS	Information Security Management System
IUCN	International Union for Conservation of Nature
IWWMP	Integrated Water and Waste Management Plan
KAPB	Karoo Array Processor Building
KAT7	Karoo Array Telescope 7 (engineering prototype for MeerKAT)
KPI	Key Performance Indicator
LNA	Low Noise Amplifier
LTIFR	Lost Time Injury Frequency Rate
MeerKAT	MeerKAT Radio Telescope
MeerKAT+	MeerKAT Radio Telescope expansion – 16 dishes and infrastructure
MRS	Mobile Radio System
MSP	Managed Service Provider
NEMPAA	National Environmental Management Protected Areas Act, Act No. 57 of 2003
NKP	National Key Point
NRF	National Research Foundation
ODF	Optic Distribution Fibre

PDMC	Provincial Disaster Management Committee
PICC	Presidential Infrastructure Coordinating Committee
POP	Point of Presence
PORTNET	South African Ports Authority
PPE	Personal Protective Equipment
PrDP	Public Drivers Permit
PSIRSA	Private Security Industry Regulatory Authority
PTO	Planned Task Observations
RD	Reference Document
RFI	Radio Frequency Interference
RMF	Regional Maximum Flood
RSA	Republic of South Africa
RQM	Risk Quartile Matrix
RQZ	Radio Quiet Zone
SAHRA	South African Heritage Resource Authority
SANAS	South African National Accreditation System
SAPS	South African Police Service
SANParks	South African National Parks appointed by the National Research Foundation to manage the land owned by the NRF
SARAO	South African Radio Astronomy Observatory, a National Facility of the NRF who is responsible for the construction, operation and maintenance of the MeerKAT radio telescope prior to handover to the SKAO
SARAS	South African Radio Astronomy Standards
SAWS	South African Weather Service
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
SIP	Strategic Integrated Project
SKA	Square Kilometre Array

SKA_Mid Project	SKA Phase 1 to be constructed in South Africa
SKAO	Square Kilometre Array Observatory (the Client)
SOC	Science Operations Centre (not on site)
SOP	Standard Operating Procedure
SPOT	Satellite for Earth Observation (Satellite Pour l'Observation de la Terre)
SPC	Science Processing Centre (not on site)
SRC	Science Regional Centre (not on site)
SSA	State Security Agency
SWMP	Stormwater Management Plan
TBC	To be Confirmed
TBD	To Be Determined
TMP	Traffic Management Plan
TNA	Training Needs Analysis
UK	United Kingdom

DOCUMENT HISTORY

Revision	Date Of Issue	Engineering Change Number	Comments
A	2019-09-13	N/A	First draft for review
B	2020-07-15	N/A	Update based on OAR comments and release of draft Construction Proposal
01	2020-09-21	N/A	Update based on OAR comments received from 2nd review
02	2021-09-15		Update based on working scenarios, corrections and updated SARAO policies issued (Annexures)

DOCUMENT SOFTWARE

	Package	Version	Filename
Word processor	MS Word	Office 365	SKA-TEL-SKO-0001040 Rev 2 South African Site Information & Instructions: Part A – Site Information
Block diagrams			
Other			

ORGANISATION DETAILS

Name	SKA Observatory
Registered Address	Jodrell Bank Lower Withington Macclesfield Cheshire, SK11 9FT, UK
Fax	+44 (0)161 306 9600
Website	www.skao.int

PART A: SITE INFORMATION

1 SKA_MID PROJECT: SOUTH AFRICA

The site in the Karoo was established in 2007. The KAT 7, MeerKAT, HERA (http://reionization.org/) radio telescopes are located on the farms Meysdam and Losberg. More information about KAT 7, MeerKAT and the South African Radio Astronomy Observatory can be found at https://www.sarao.ac.za/. HIRAX is a guest instrument which is located on the Swartfontein farm (Further information can be found at https://hirax.ukzn.ac.za/). Meysdam and Losberg have been declared as the Core Astronomy Advantage Area in terms of the Astronomy Geographic Advantage Act, 2007 (Act No. 21 of 2007) (Government Gazette Notice 33462, 20 August 2010) [AD2].

The site was expanded in 2017 to host the SKA radio telescope. This expansion includes the acquisition of an additional 36 land portions in the Karoo; taking the total land size up to 135,000 hectares. This land is owned by the National Research Foundation (NRF). The NRF entered into a Management Agreement with SANParks who undertakes the land management responsibility for the NRF-owned land. The Department of Environment, Forestry & Fisheries declared the NRF-owned land the Meerkat National Park in terms of the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003).

The 3 SKA_Mid spiral arms are located on 72 land portions secured through Servitude Agreements with 59 landowners. These servitudes are being secured by SARAO. This equates to approximately 1200 hectares of land to accommodate access roads, overhead and buried optic fibre cable, standalone photovoltaic plants, transformers and buried electrical cable, antenna foundations and the surrounding platform at each antenna location.

The Klerefontein Support Base serves as the Engineering Operations Centre (EOC) and is located approximately 75km from the site and 10km from Carnarvon. The EOC also forms part of the site.

The SKA_Mid Project in South Africa includes the following:

1) Up to 133 dishes and associated infrastructure, power and fibre. The 64 dish MeerKAT radio telescope which includes MeerKAT+ will be incorporated to form part of the SKA_Mid Project. There shall be a total of 197 dishes;
2) Telescope Monitoring and Control;
3) Science Data Processor and Correlator located in Cape Town;
4) SKA Engineering Operations Centre located at Klerefontein on the site;
5) SKA Science Operations Centre located in Cape Town.

The MeerKAT radio telescope will be expanded (“MeerKAT+”) prior to the commencement of SKA1 construction. The scope of MeerKAT+ includes:

1) Installation of 16 SKA dishes which form part of the MeerKAT+ project
2) The SKAO Dish Contractor will be responsible for the manufacturing and installation of 4 x AA0.5 dishes as early production dishes for SKA_Mid;
3) Power, fibre and antenna foundations for 24 dishes will be delivered by the MeerKAT+ infrastructure contract.

A detailed breakdown of the geographic spread of MeerKAT, MeerKAT+, SKA_Mid AA0.5 and the remainder of the SKA_Mid array is illustrated in Figure 1 and Table 1 of the site. A total of 176 dishes are located on the NRF-owned land (Meerkat National Park) and 21 dishes on servitudes secured with landowners.

The frequency range for SKA_Mid is 350MHz to 15.4 GHz.

The site is zoned as a Special Zone in terms of the construction and operation of the SKA_Mid radio telescope and guest instruments located on the site.

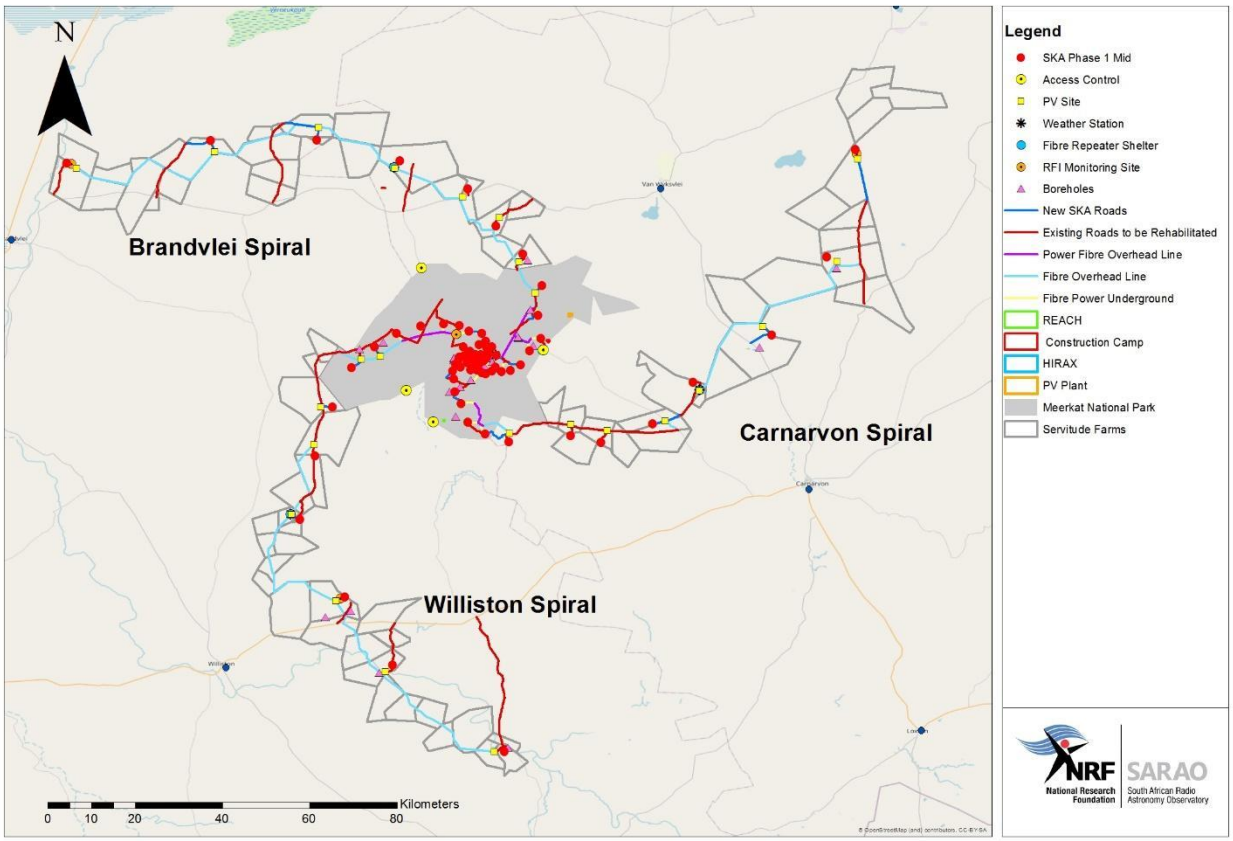

Figure 1: SKA_Mid site in the Karoo, South Africa

Reference can be made to the NEC4 Contract Data which specifies the boundaries of the site for each construction contract.

Table 1: Geographic Distribution of MeerKAT, MeerKAT+ & SKA_Mid dishes on site

Geographic Location	Description
MeerKAT/SKA core – 5km diameter on Meysdam and Losberg farms (Figure 3)	91 SKA1_Mid dishes - 74 SKA_Mid dishes - 4 SKA_Mid dishes (AA0.5) - 13 SKA_Mid dishes (MeerKAT+) 64 MeerKAT dishes **SUB TOTAL**: **155 dishes** (77% of array)
NRF-owned land (Meerkat National Park) – 135,000 hectares (Figure 4)	21 SKA_Mid dishes - 18 SKA_Mid dishes - 3 SKA_Mid dishes (MeerKAT+) **SUB TOTAL**: **21 dishes** (89% of array)
3 Spiral Arms (up to 120km baseline from SKA core) – 1200 hectares in extent (Figure 5)	21 SKA_Mid dishes **SUBTOTAL: 21 dishes** (100% of array)
TOTAL	**197 dishes**

2 PROJECT LOCATION

2.1 Physical Location of the site

The site is located in the Northern Cape Province of South Africa. The site is surrounded by four local towns: Carnarvon, Williston, VanWyskvlei and Brandvlei. The site is located 643km from Cape Town and 1118km from Johannesburg (Figure 2). Carnarvon is the closest town to the site (85km).

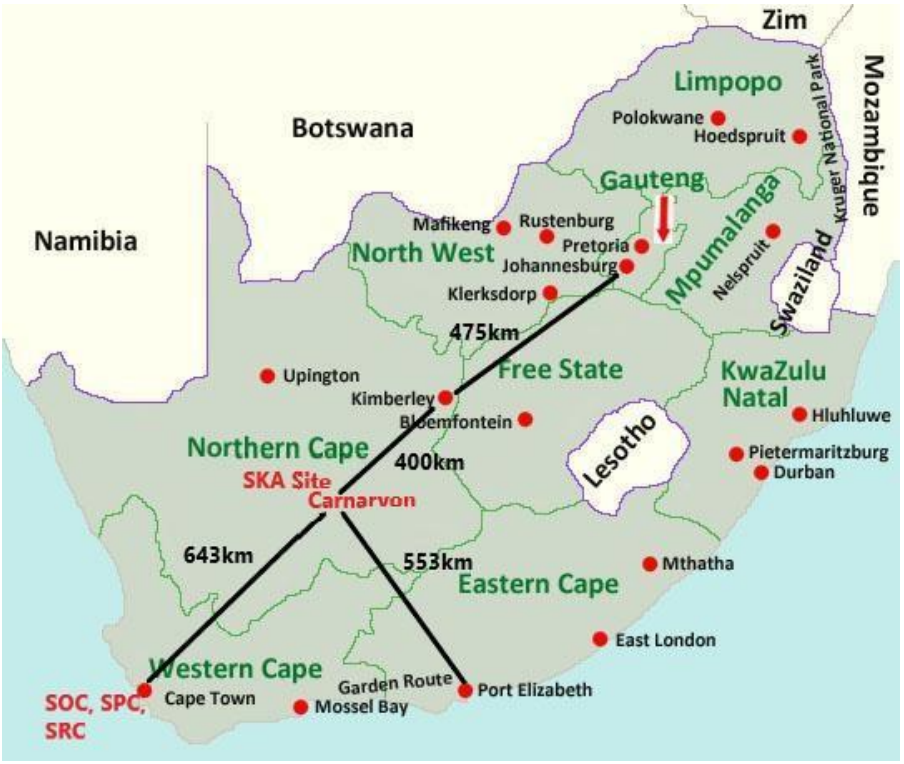

Figure 2: Map of South Africa, 9 Provinces and distances to site from Urban Areas

2.2 Definition of the site

The term "site" shall mean the SKA_Mid area where construction will be undertaken. The site is indicated in Figure 5 which is divided into the three geographic areas:

1) **Meysdam and Losberg farms – NRF-owned land** (Figure 3)
   - These farms are owned by the NRF;
   - This is defined as a Very High Risk RFI area in terms of the MeerKAT Science and SKA Construction Interferences Management Plan and Risk Register;
   - Meysdam and Losberg have also been declared a Core Astronomy Area in terms of Section 7 of the Astronomy Geographic Area Advantage Act, 2007;
   - The higher elevation of this area is 1054m above sea level;
   - This area includes the following instruments, facilities and infrastructure:

     - ***SKA Site Complex*** which includes the Karoo Array Processor Building, Dish and Pedestal shed, SKA Power facility and staff accommodation
       - [Coordinates: 30°45’13.00” S; 21°25’52.65” E]

     - ***KAT 7 radio telescope*** (engineering prototype for MeerKAT)
       - [Coordinates: 30°43’17.62” S; 21°24’38.85” E]

     - ***MeerKAT radio telescope centre***
       - [Coordinates: 30°42’46.65” S; 21°26’34.84” E]

     - ***HERA Guest Instrument***
       - [Coordinates: 30°43’17.17” S; 21°25’41.32” E]

     - ***SKA1_Mid radio telescope centre*** (co-located with MeerKAT)
       - [Coordinates: 30°42’46.65” S; 21°26’34.84” E]

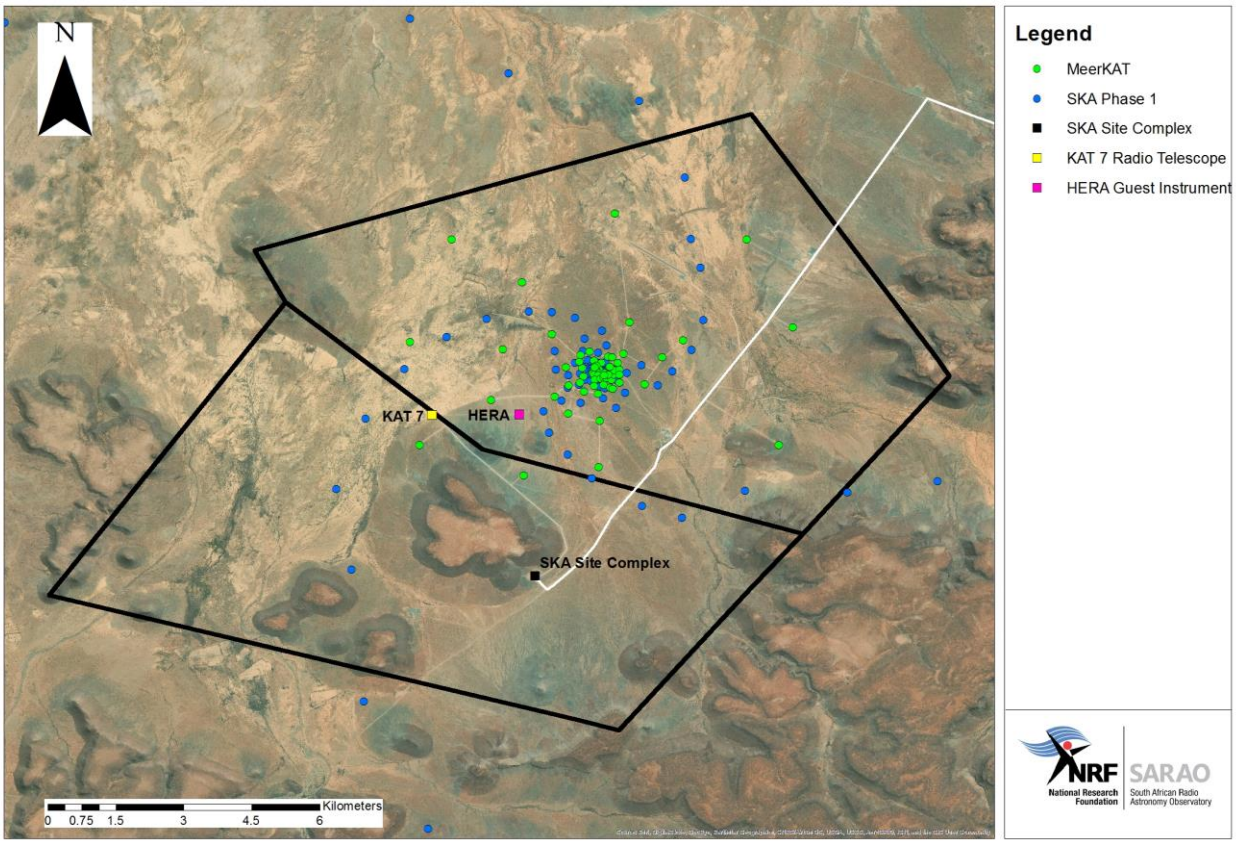

Figure 3: Meysdam and Losberg farms (NRF-owned land) – Very High Risk RFI zone

2) **Remainder of the NRF-owned land** which has been declared a **National Park** (Figure 4)
   - This area is owned by the NRF and is declared as a National Park (which also includes Meys Dam and Losberg farms) in terms of the National Environmental Areas Protected Act. This land is managed by SANParks;
   - This area is a High Risk RFI area in terms of the MeerKAT Science and SKA Construction Interferences Management Plan and Risk Register;
   - This area falls within the Karoo Core Astronomy Advantage Area and the Karoo Central Radio Astronomy Advantage Area (KCAAA3) – refer to Figure 11.
   - Apart from the instruments, facilities and infrastructure located on Meysdam and Losberg, additional facilities and infrastructure located within this area are:

- ***Bergsig Environmental Research farmhouse*** (SAEON and other researchers)
    - [Coordinates: 30°40’00.16” S; 21°31’46.03” E]

- ***SANParks offices – Swartfontein farmhouse and outbuildings***
    - [Coordinates: 30°41’01.92” S; 21°33’31.21” E]

- ***HIRAX Guest Instrument at Swartfontein***
    - [Coordinates: 30°41’21.47” S; 21°33’23.97” E]

- ***Visserkloof Construction Camp Area***
    - [Coordinates: 30°40'24.17"S; 21°35'22.47" E]

- ***A number of SKA_Mid antennas on the spiral arms.***

  Coordinates listed in the SKA1_Mid Physical Configuration coordinates [AD1].

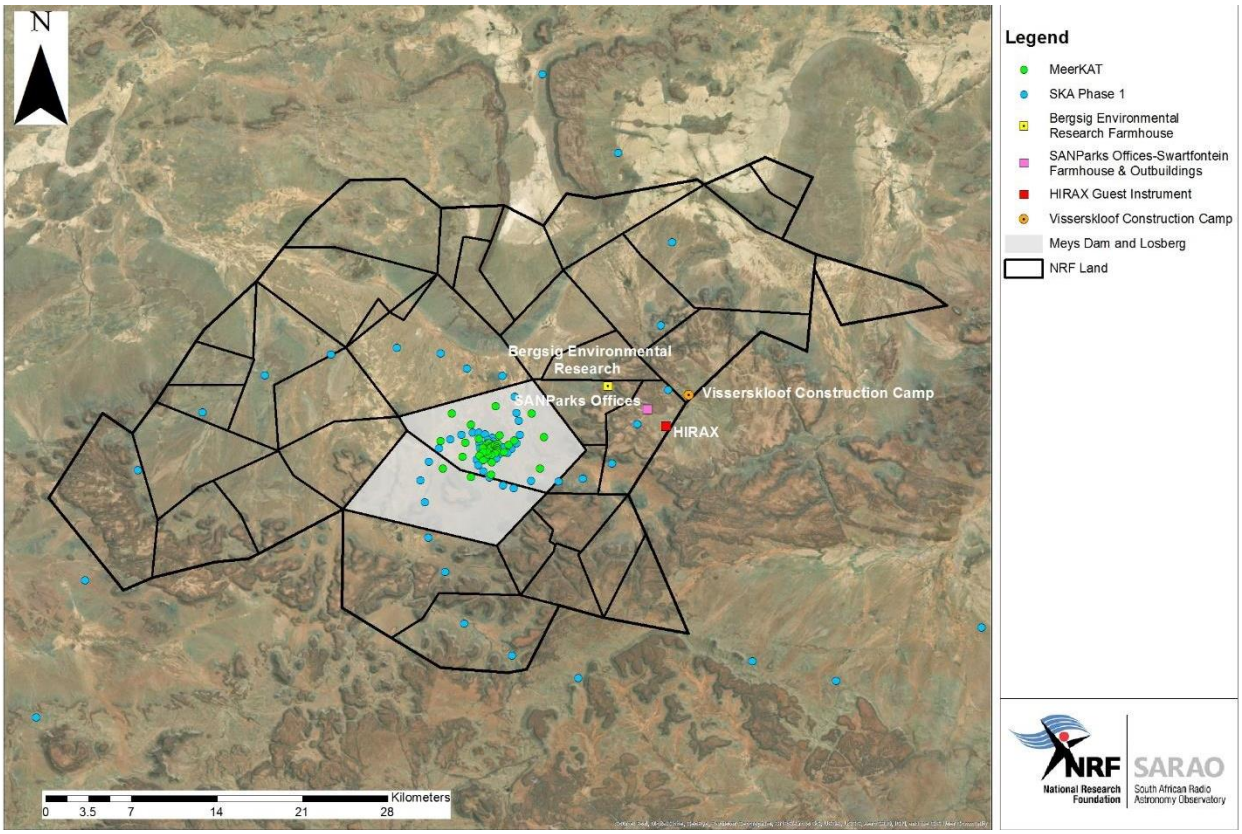

Figure 4: Remainder of the NRF-owned land (High Risk RFI zone) and remainder of the site (Low Risk RFI zone)

3) **3 SKA_Mid Spiral Arms, Klerefontein Engineering Operations Centre and Carnarvon POP Station** (Figure 5)

- **3 Spiral Arms**
  - This is defined as a Low Risk RFI area in terms of the MeerKAT Science and SKA Construction Interferences Management Plan and Risk Register;
  - There are 3 spiral arms, namely the Carnarvon Spiral Arm, Brandvlei Spiral Arm and the Williston Spiral Arm which extends from Meysdam and Losberg over the NRF-owned land to approximately 120km from the SKA_Mid Core Area;
  - Each spiral arm shall be secured by the NRF through a Servitude Agreement. The width of the servitudes is indicated in Table 2.

Table 2: Summary of Servitude widths for SKA infrastructure

Infrastructure Element	Width / Size
SKA_Mid Base Station	100 x 100 m (1 hectare)
Weather Station	10 x 10 m
SaDT Fibre Repeater Stations[1]	20 x 20 m
PV Plant	100 x 100 m (1 hectare)
Overhead Power and Optic Fibre line	30 m wide
Overhead Optic Fibre line	22 m wide
Underground Power, Optic Fibre line link to Base Station	5 m wide
Access Roads	10 m wide

  - There are 8 dishes located on the Carnarvon Spiral Arm; 6 dishes on the Williston spiral arm and 7 dishes on the Brandvlei Spiral Arm;
  - Dishes on each spiral arm include associated infrastructure comprising of overhead and trenched powerlines, overhead and trenched optic fibre lines, access roads, optic fibre repeater stations, security perimeter fencing around each base station and standalone photovoltaic plants supplying the last five to 7 dishes in each spiral arm;
  - The Carnarvon and Brandvlei Spiral Arms fall within the Karoo Central Radio Astronomy Advantage Area 3 (KCAAA3) and the Williston Spiral arms falls with the Karoo Central Radio Astronomy Advantage Area 3 (KCAAA3) and 2 (KCAAA2) (Refer to Figure 6);

[1] SaDT Repeater Station must be situated outside the servitude provided for overhead power line and fibre optic due regulatory and safety requirements.

- **Klerefontein Support Base - SKA Engineering Operations Centre** (Figure 4 & 5)
- This is a Medium Risk RFI area in terms of the MeerKAT Science and SKA Construction Interferences Management Plan and Risk Register;
- The Klerefontein Support Base is located approximately 10km from the town of Carnarvon and 75km from the SKA Site Complex;
- The coordinates are:
  - Latitude: 30°58'24.28"S; Longitude: 21°59'43.21"E
  - The Klerefontein Support Base is where the SKA Engineering Operations Centre where the Site and Telescope operations and maintenance staff are located. Reference can be made to Figure 5.

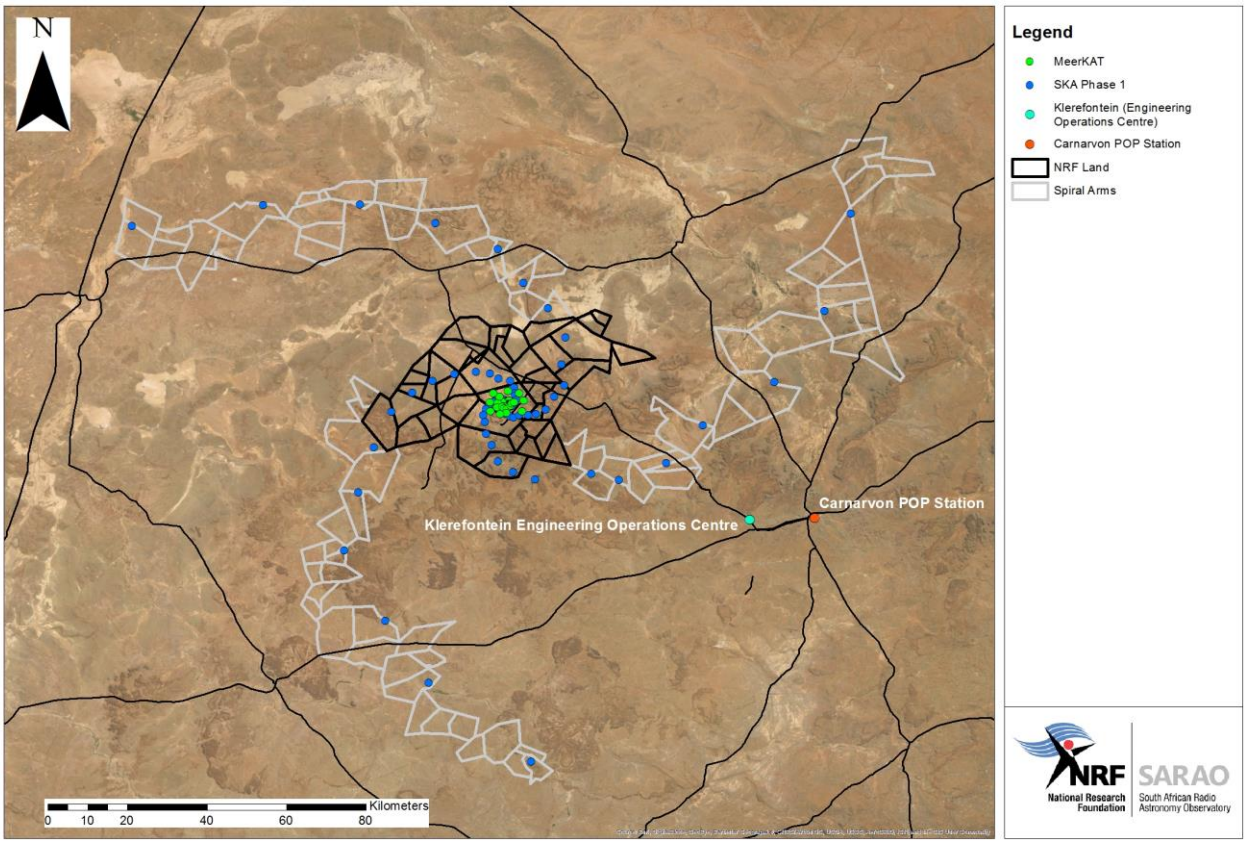

Figure 5: Site overview

2.3 SKA_Mid Physical Configuration Coordinates

The SKA_Mid geodetic coordinates are listed in [AD2]. The document also includes the MeerKAT geodetic coordinates. The Geodetic datum used is WGS84 with longitude and latitude expressed in decimal degrees.

3 BOUNDARIES OF THE SITE

Reference can be made to the NEC4 Contract Data which specifies the boundaries of the site for each construction contract.

4 ACCESS TO THE SITE

The site is located approximately 85km from the town of Carnarvon in the Karoo, Northern Cape Province, South Africa. Access to the site from:

1. International and Domestic Airports;
2. Major Ports;
3. Road Access from Major Urban Centres
4. On-site All-weather Landing Strip and gravel landing strip in Carnarvon

is included in **Annexure A** of this document. Access to the site shall be in accordance with SARAO policies described in Section 5.

There are a number of service centres (providing fuel or support services) on the direct road routes from Major Urban Centres to the site. Some of the smaller towns fuelling facilities are closed on a Sunday.

5 SOUTH AFRICAN LEGISLATION, REGULATIONS & SARAO POLICIES

The SKA_Mid radio telescope is located on NRF-owned land, either through ownership or a servitude. The South African MeerKAT radio telescope is fully operational and will continue to observe whilst MeerKAT+ and SKA_Mid are being constructed. There are other Guest Instruments located on the NRF-owned land which are either under construction or already observing.

5.1 Astronomy Geographic Area Advantage Act & Regulations

To ensure protection of the site, the South African Government passed the Astronomy Geographic Advantage (AGA) Act in 2007 [AD2]. The AGA Act and associated Regulations have implications for people living within an Astronomy Advantage Area (AAA).

The AGA Act provides for a wide range of requirements for the advancement and protection of astronomy including the development of skills, capabilities and expertise; the identification and protection of areas in which astronomy projects can be undertaken; the provision of a framework for the establishment, protection, preservation and maintenance of a national system of Astronomy Advantage Areas highly suitable for astronomy; and the regulation of activities which cause or could cause interference.

To date, the following AAAs (Figure 6) has been declared by the Minister of Higher Education, Science and Innovation (previously Science and Technology):

- The Northern Cape Province excluding Sol Plaatje Municipality;
- Karoo Core AAA (Meysdam and Losberg);
- Karoo Central AAAs (remaining SKA_Mid site and surrounding areas).

5.1.1 Karoo Core Astronomy Advantage Area

A Karoo Core Astronomy Advantage Area (AAA) was declared in 2010 and consists of 13 406 hectares of land (Meysdam and Losberg) owned by the National Research Foundation (NRF) about 85 km north of Carnarvon.

The Karoo Core AAA hosts the KAT 7, HERA, MeerKAT, HIRAX and SKA radio telescopes. The Karoo Core AAA is under a co-management agreement between the Astronomy Management Authority (Department of Higher Education, Science & Innovation) and the NRF, in terms of Section 18 of the AGA Act. Duties of the NRF, as an organ of state, are prescribed in Section 47 of the AGA Act.

The Karoo Core AAA is subject to the "regulations restricting or prohibiting certain activities in the core astronomy advantage areas declared for radio astronomy purposes" as prescribed in Government Notice (GN) Regulation (R) 465 published on 22 June 2012. The regulations further prohibit any of the activities listed in section 23(1) of the AGA Act relevant to radio astronomy unless it is required for

radio astronomy purposes. Access to the Karoo Core AAA is governed by section 20 of the AGA Act.

5.1.2 Karoo Central Astronomy Advantage Area

In 2014, following a public participation process undertaken in terms of Section 42 of the AGA Act, read with the Promotion of Administrative Justice Act, the Minister of Science and Technology declared the Karoo Central AAA 1, 2 and 3 for radio astronomy and related scientific endeavours:

- Karoo Central AAA 1 extent includes approximately 123 456 square kilometres (km^2),
- Karoo Central AAA 2 extent includes approximately 79 963 km^2 and
- Karoo Central AAA 3 extent includes approximately 44 602 km^2.

The Karoo Central AAA 1 is the largest of the Karoo Central AAA's and includes four District Municipalities: Namakwa District Municipality, Pixley Ka Seme District Municipality, Siyanda District Municipality, and Central Karoo District Municipality.

In 2017, the Minister of Science and Technology published a Central AAA Regulations to protect a Central AAA from radio interference. Karoo Central AAA regulations prescribe specific protection measures for the use of the radio frequency spectrum and prescribe standards and conditions that must be complied with in conducting activities declared in terms of subsections 23(1) (b), (i) and (k) of the AGA Act (Figure 6).

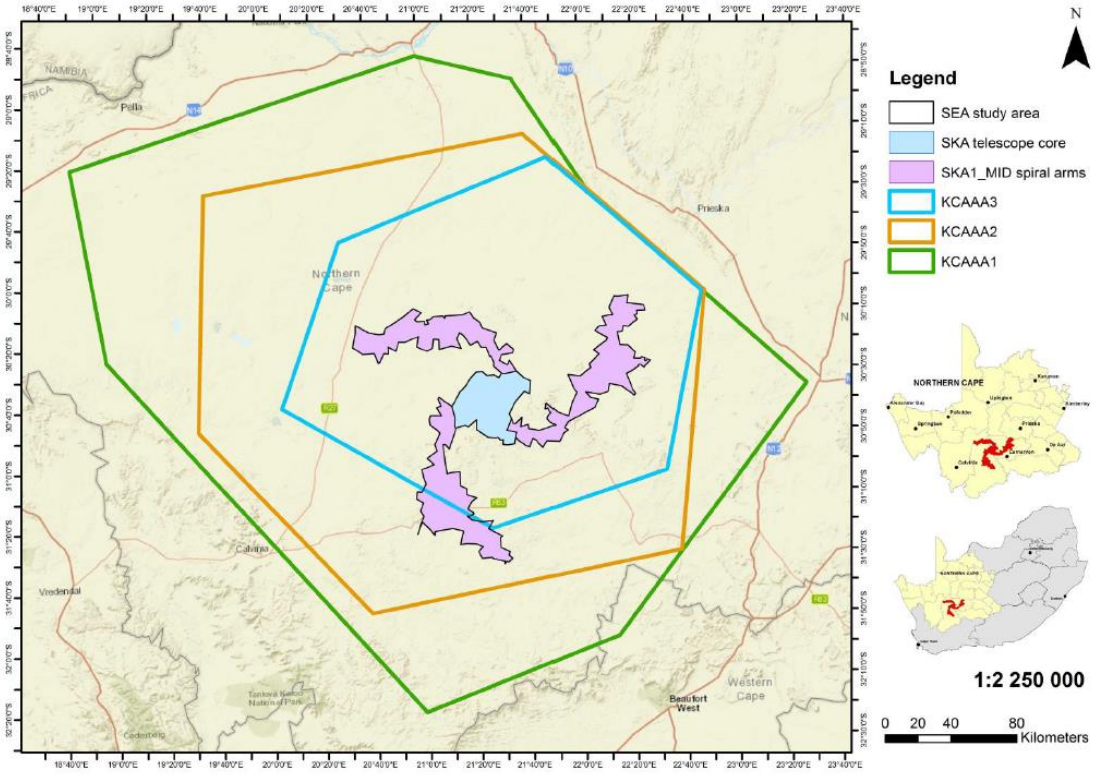

Figure 6: South African site in relation to the Karoo Astronomy Advantage Areas

5.2 SARAO Site Policies Applicable to Contractors and Visitors

As the NRF is the owner of the land and has operational radio telescopes on the site, all Visitors including Contractors are required to comply with the following SARAO Policies, Procedures and Standards listed below.

5.2.1 SARAO Visitors Policy

Reference can be made to **Annexure B**. This policy prescribes the conditions upon which any person that is not a SARAO employee shall be classified as a SARAO Visitor including Contractors (and SARAO staff employees contracted by the SKAO), and therefore be granted access, with or without condition to the NRF properties and resources.

Unless otherwise agreed by the SARAO Managing Director, non-compliance with any provision of this Policy shall result in the immediate rescindment of recognition as an SARAO Visitor, and all associated obligations, rights and privileges.

Pursuant to the 'Memorandum of Understanding on Collaboration between the SKAO and the NRF regarding Principles of Collaboration on SKA-MID', and the 'Host Country Agreement between the SKAO and the Department of Science and Innovation', SKAO Personnel shall be afforded rights of access to SARAO properties and resources consistent with their needs and requirements to carry out the SKA project in South Africa.

The policy must be read in conjunction with the SARAO Visitors access procedures [**Annexure W**]. Visitors must at all times display their Visitors Site Access Card and signing of the Visitor Register shall be deemed as acceptance of all the relevant applicable SARAO policies, codes of conduct and rules. Visitors will be required to abide by general codes of conduct and health and safety regulations.

5.2.2 SARAO Karoo On-Site Rules & Procedures

Reference can be made to **Annexure C**. This set of rules applies to all Visitors including Contractors accessing land under the direct management and control of SARAO. The rules include:

i. Site Security
ii. Site Access
iii. Accommodation
iv. Health, Safety, Security, Quality and Environment
v. Radio Frequency Interference
vi. Vehicles
vii. Alcohol, Narcotic Drugs, Firearms

viii. House Rules and Signage
ix. Delegation of Authority.

5.3 SARAO Health & Safety Policy & Plan

Reference can be made to **Annexure D and Annexure K**. Visitors including Contractors may be subject to this policy through separate agreement to access any premises under the direct management and control of SARAO.

5.4 SARAO Transport Policy

Reference can be made to **Annexure E**. This policy provides a framework for the management of all vehicles (whether owned or leased) and the use of charter flights by SARAO staff, Visitors including Contractors to the site. The policy applies only to transportation requirements to and from the site –

i. Flights between Carnarvon and the on-site landing strip, Lanseria and Cape Town;
ii. Ground transportation between Carnarvon (including Klerefontein Engineering Operations Centre) and the site;
iii. Ground transportation between Cape Town, Johannesburg and the site.

5.5 SARAO Procedure for Alcohol & Substance Abuse Control

Reference can be made to **Annexure F**. This procedure implements the policy provisions outlined in the SARAO Health & Safety Policy and prescribes the manner in which alcohol and substance abuse testing shall be undertaken at the site. The procedure is applicable to all Personnel, Visitors including Contractors who wish to enter the site, as well as drivers of official company vehicles.

5.6 SARAO Emergency Response and Disaster Management Plan

Reference can be made to **Annexure G**. The Emergency Response Plan (ERP) is based on a Disaster Risk Assessment (DRA) undertaken of the site and the possible consequences of an emergency occurring as a result of those hazards.

The ERP defines the protocols and procedures for the safe and effective management of an emergency event occurring or threatening to occur on the site. All Personnel, Visitors including Contractors are required to follow the protocols and procedures outlined in the plan to maintain essential business services and operations during an incident or emergency situation, while providing for the protection of life, health and safety for all Personnel and Visitors including Contractors to the site. The plan includes the following site Emergency Actions:

i. Emergency evacuation procedures;
ii. Procedures to account for Personnel and Visitors including Contractors after evacuation has been completed;
iii. Search and Rescue and medical duties for those Personnel who are to perform them;
iv. Procedures for reporting and responding to incidents / emergencies relating to identified hazards;
v. Flood mitigation and response measures due to blocked drain lines or deluges;
vi. Procedures for the restoration of power during a power failure; and
vii. Procedures for the management of incidents.

5.7 SARAO Radio Frequency Interference Policies, Karoo Site Procedures, RFI Zones and Standards

The MeerKAT radio telescope and Guest Instruments located on the site are operational and undertaking scientific observations and routine maintenance. Reference can be made to the, SARAO RFI Policy - **Annexure X**; SARAO RFI Controls Policy - **Annexure Y** and the Karoo Site Procedures - **Annexure H**.

The SARAO RFI Controls Policy explains the permitting and Certificate of Compliance process, and the SARAO RFI Policy authorizes the SARAO RFI Control Officer to enforce the RFI Controls Policy.

The Karoo Site Procedure prescribes rules and procedures to support the management of RFI at the site. This Site Procedure applies to all Personnel and Visitors including Contractors to the site.

The Site Procedure includes:

i. General RFI Controls;
ii. Site Access and Induction Procedure;
iii. Use of on-site Communication Devices;
iv. Site Equipment and Notebook/laptop stowage and usage;
v. Pre-maintenance procedures;
vi. Procedures for aircraft using the on-site landing strip;
vii. RFI Policy and Procedure Notification to Personnel and Visitors including Contractors;
viii. Enforcement.

Radio frequency interference (RFI) zones have been defined for the site. Reference can be made to **Annexure I**. The RFI zone definitions are used when SARAO issues RFI Controls such as Permits or Certificates of Conformance (CoC) to manage where and when RFI culprits can be utilized on the site in terms of time

and frequency. These RFI zones have been defined based on radio propagation properties from which minimum separation distances are derived.

5.8 SARAO Guest Instrument Policy

This policy provides guidance in determining whether or not to allow the use of land under the direct management and control of SARAO for Guest Instruments. The availability of land and resources will vary on an ongoing basis, but includes key infrastructure such as grid power, data networks and connectivity, access roads and support buildings. The following guest instruments are located on the site:

i. HERA
ii. REACH
iii. HIRAX
iv. CBASS
v. SKA prototype dish

6 SITE ENVIRONMENTAL CONDITIONS

6.1 Site Characterisation Studies

There are various site investigations that were undertaken, the information analysed and interpreted in order to inform the reference design of the infrastructure for the SKA_Mid Project. The investigations undertaken are listed below:

a. Topographical Survey (LIDAR) [RD3]
b. Borrowpit Investigation [RD2];
c. Flood line analysis [RD4];
d. Geotechnical Investigations [RD6];
e. Geohydrological Study [RD1];
f. Stone Quarry Investigation [RD2].

6.1.1 Topographical (LIDAR) Survey

A topographical survey (LIDAR) [RD3] was undertaken covering the footprint of the site based on the 2015 dish configuration for the geometric design of the roads. Prior to the LIDAR survey nine (9) additional survey beacons were installed on the site in addition to the three (3) existing MeerKAT beacons. There are therefore a total of 12 survey beacons that were used as reference points for the LIDAR survey as shown in Figure 7. Further survey work has been undertaken by the MeerKAT+ infrastructure contractor and this data shall be made available if requested.

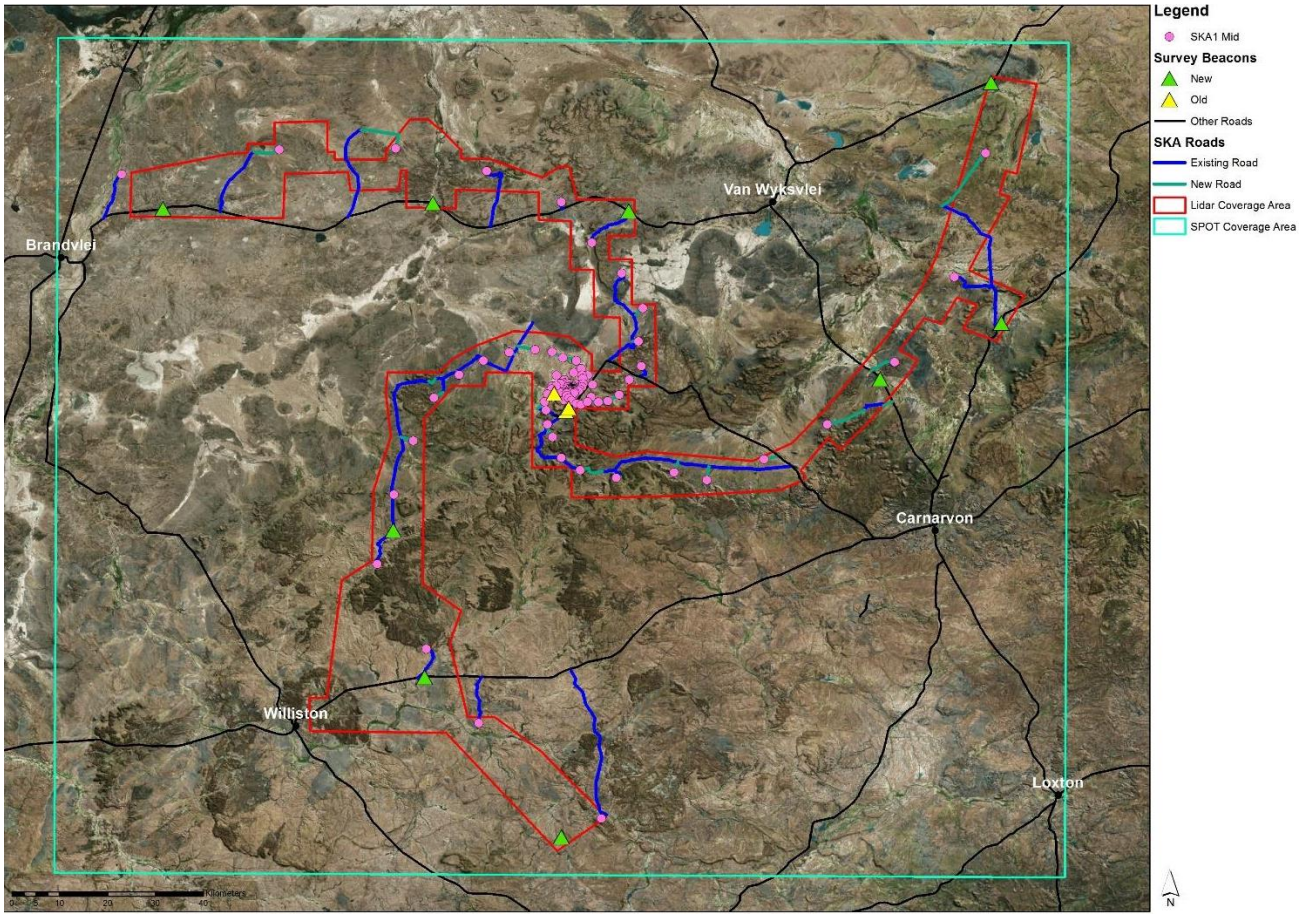

Figure 7: LIDAR Survey and SPOT Coverage Areas

It was anticipated that the 2015 configuration may change therefore as a contingency; a data set from the Satellites For Earth Observation (SPOT) was procured for the LIDAR survey area and beyond. Some of the roads fall outside the LIDAR area but are within the SPOT coverage area which is acceptable for this design as most of the roads are still within the LIDAR area.

The LIDAR survey coverage area is shown in red, SPOT is the green box and the survey beacons are shown in green (new) and Yellow (existing). The survey beacons will be used as benchmarks for establishment of additional benchmarks and for construction of the roads. Reference can be made to [RD3] for the LIDAR survey and the survey beacons report. This report and the associated GIS data is available on the SKAO ALIM system and shall be made available to Contractors. Should Contractors be required to resurvey areas, this should be included in their costs.

6.1.2 Borrowpit Investigation (geotechnical investigation)

The borrow pits investigation was undertaken to determine the quantity and quality of the material within the SKA_Mid Project footprint that could be sourced to upgrade existing roads and construct new access roads to the dish locations. All reports and further results undertaken by the MeerKAT+ infrastructure contractor will be made available to Contracotrs on SKAO ALIM.

A total of fifteen (15) borrow pits were physically investigated while borrow pits towards Brandvlei, along the Carnarvon-Williston Road and along the access road to the south-most dish were limited to visual inspections. Four (4) of the fifteen (15) investigated borrow pits are existing MeerKAT borrow pits. The intention was to use as many of the existing borrow pits as possible in an effort to minimise the environmental impact and aid negotiations with the land owners.

Based on the borrow pits investigation results and visual inspections, there is sufficient material from the borrow pits for the construction of SKA_Mid Project access roads. Reference can be made to [RD2] for the Borrow Pits investigation report which provides the location of the borrowpits and stone quarries and the results from the investigation. This report is available on the SKAO ALIM system and shall be made available to Contractors.

Any additional / changes to borrowpit positions and the extent of borrowpits required shall be accepted by the SKAO prior to commencement of any work. SAHRA shall also be notified of these changes.

6.1.3 Flood line Analysis

A Flood line Analysis [RD4] was undertaken of the site to assess the flood risk associated with the proposed development. The purpose of the analysis was also to facilitate a safe environment and environmentally sustainable stormwater management plan for the NRF land (RD 5) and the Visserskloof Contractor Camp [**Annexure P**].

The flood lines were determined for the main rivers and streams within the study area for the 1 in 5-year, 1 in 10-year, 1 in 20-year, 1 in 50-year, 1 in 100-year storm event recurrence intervals as well as for the Regional Maximum Flood (RMF), as presented in Figure 8.

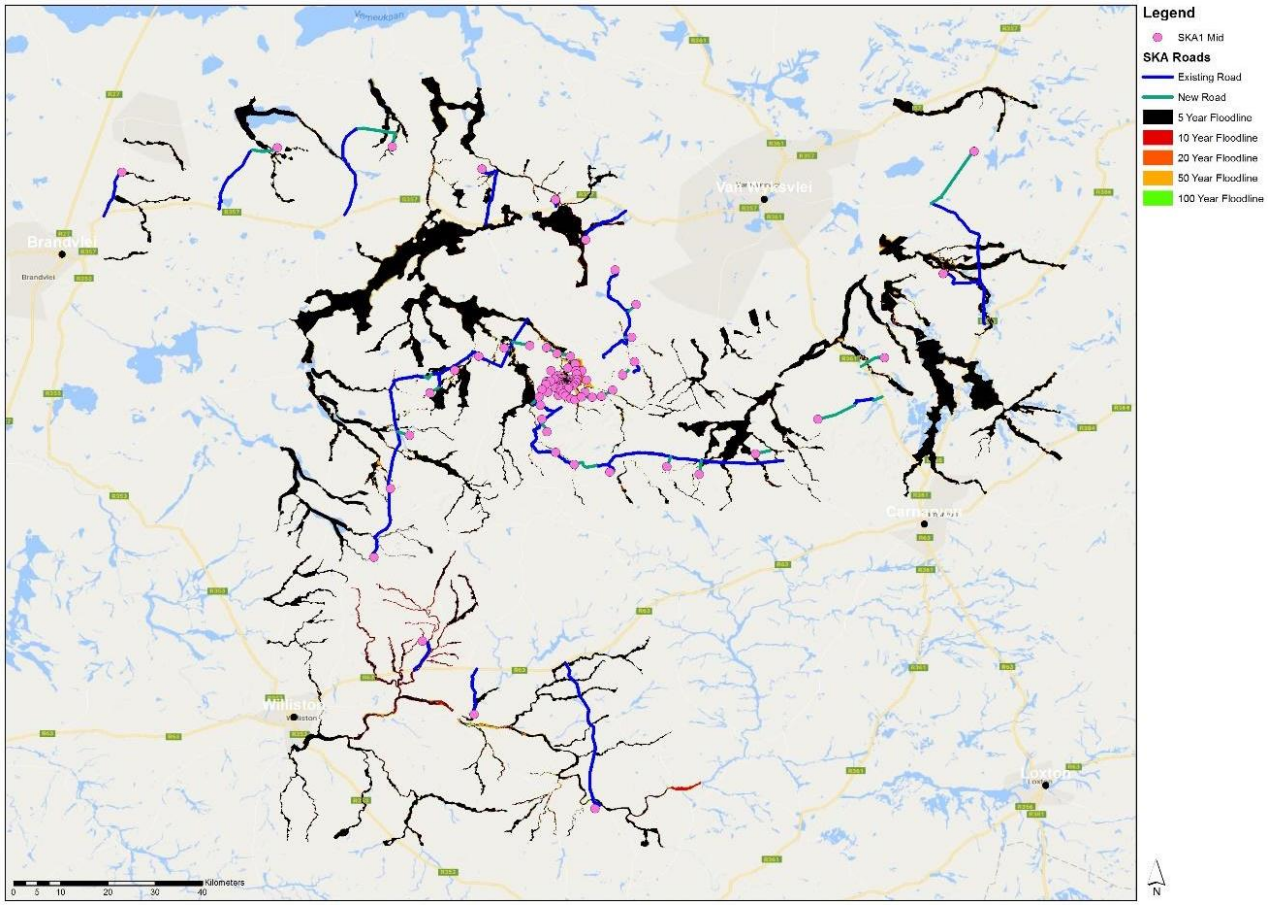

Figure 8: Flood line overview

There are also existing and new roads that cross streams and rivers on the site and the stormwater catchment flow drawings are available. Mitigation measures for both the dish locations and the road crossings are contained in the design solution for Access. Reference can be made to [RD4] for the Flood line Analysis report. This report and associated GIS data is available on the SKAO ALIM system and shall be made available to Contractors.

This report was used to apply for a General Authorization [**Annexure A1]** for all crossings (1200) from the Department of Water & Sanitation (refer to Section 21 – Construction Licenses).

6.1.4 Dish Foundation Geotechnical Investigation

This report contains the findings for the SKA_Mid Dish Foundations [RD6]. The purpose of this investigation was to determine the subsurface soil and rock conditions below the proposed dish foundation sites. The geotechnical investigation undertaken considers the determination of the allowable ground

conditions through percussion and rotary-core drilling as well as through test pits with plate load tests.

The recommendations from this report have informed the rdesign and type of dish foundations proposed for the various locations on the site. This report and the findings/test results are available on the SKAO ALIM system and shall be made available to Contractors.

Additional geotechnical work was undertaken for MeerKAT+. The results of this work is included in [RD 13].

6.1.5 Stone Quarry Investigation

The Stone Quarry Investigation (report) – [RD2] contains the findings of a materials investigation for the proposed quarry sites for the SKA_Mid Project. These quarries are required to source suitable material (quality and quantity) for the construction of the SKA_Mid Dish Foundations.

The proposed quarry sites are approximately 90 km northwest of Carnarvon. The rock quality and volumes have been evaluated by drilling thirteen boreholes to an average depth of 19 to 20 meters below existing ground level. The soils and rock cores were used to provide material for the testing of the rock quality.

The results obtained are generally very favorable suggesting that the rock can be used in applications such as concrete aggregate.

This report is available on the SKAO ALIM system and shall be made available to Contractors.

6.1.6 Geohydrological Study

A geohydrological study [RD1] was undertaken over the SKA_Mid footprint. The purpose of the study was to:

- Undertake borehole hydro census;
- Assess the groundwater capacity;
- Assess the content of the groundwater;
- Build a geohydrological model;
- Assess the impact of abstraction on the resources;
- Determine water abstraction points; and
- Use the groundwater information compiled during the investigation as input for the water-use license applications

Water abstraction boreholes for the roadworks were identified and tested to confirm the sustainable yield of each borehole.

The boreholes yield test results confirmed a total surplus of 59kl/day over the full project when comparing the total sustainable yield and the estimated demand which can almost satisfy the estimated 66kl/day per road construction area required for road construction. There are however boreholes with less than the required minimum yield (or zero yield) which will need to be supplemented by other boreholes through trucking of water and storing it in the water storage tanks. Reference can be made to the Water and Sanitation Detailed Design Report [RD11] for the breakdown of the total water demand and the yields from each borehole.

Reference can be made to the Geohydrological Study Report [RD1 and RD12]. This report and associated GIS data is available on the SKAO ALIM system and shall be made available to Contractors.

6.2 Climatic Data

6.2.1 Rainfall

The site is located in the Nama-Karoo which can be described as a semi-arid to arid environment. The climate of the Nama-Karoo is determined by:

1) the degree of latitude, in this case falling within the sub-tropical high-pressure belt that brings with it dry air and open skies;

2) the distance from the sea, meaning a moderate maritime climate is lacking (it thus has a continental-type climate); and

3) elevation and topography as it influences both rainfall and temperature.

4) historic rainfall data can be obtained from the South African Weather Service

(https://www.weathersa.co.za) with particular reference to the Vanwyksvlei Weather Station and Brandvlei Weather Station.

6.2.2 Temperature & Wind Data

The Nama-Karoo is known to be an area of great temperature extremes. A temperature difference of 25 °C between day and night is not extraordinary. Maximum temperatures range from 33 °C in summer to 16 °C in winter, and minimum temperatures from 16 °C in summer to 1 °C in winter. In extreme years it was found that the region surrounding Carnarvon can have between 120 - 150 days a year where the maximum temperature is above 30 °C.

Temperatures may also reach below freezing. Ellis (1988) predicted the Carnarvon district would lose about 3,201 mm of water through evaporation. This greatly exceeds the average annual rainfall of around 200 mm. Moreover, this area was measured as having the second highest evaporation rate, with only Pofadder to the west having higher evaporation of 3,536 mm.

Average annual wind speeds measured for the Carnarvon district between 1978 and 1994 were mostly between 5.6 and 8.7 m/s, but can reach up to 15 m/s. West and northwest winds are the most common. Winds are thus moderately strong to strong in nature, and although good for wind pumps and favouring seed distribution, it could in turn aggravate evaporation, dust generation and transport. Wind-driven dust devils are also common. In particular, strong and persisting winds in the summer rainfall season may negatively affect plant water uptake by drying out the air and thus increasing evapotranspiration. On average only 27,4 % wind still days are recorded annually. The windiest months are October to January, with wind still days dropping to 14.7 % in November.

6.2.3 Altitude

The landscape of the site comprises abrupt ridges and conical hills scattered across extensive sandy and silty plains. The altitude ranges from 1500masl (meters above sea level) the escarpment in the South (Fraserburg) to 900masl on the pans between Brandvlei and Vanwyksvlei. There is thus a gentle gradient of 0.6km over a distance of 300km.

6.2.4 Seismic Conditions

In terms of the seismic conditions on the site – natural seismic activity, excluding mining induced seismic activity – SKA_Mid is expected to have a seismic intensity level as <3.8 Richter scale.

6.2.5 Lightning Conditions

Reference can be made to **Annexure Z** for the long-term lightning data of the SKA_Mid Area.

6.3 Environmental Conditions based on the International Standard for Classification of Environmental Conditions

Based on the International Standard for Classification of Environmental Conditions, IEC 60721-3-4, the climatic conditions for SKA_Mid equipment is

stated in the Environmental Conditions for the SKA_Mid Site South Africa document – **Annexure L**. Conditions addressed include:

i. Deployment:
   - Static use in non-weather protected locations
   - Static use in weather-protected locations

ii. Storage Climatic Conditions; and
iii. Transportation Conditions.

6.4 Geology

The site consists of sedimentary deposits from the Dwyka Group, Ecca Group and Beaufort Group as illustrated in Figure 9. These three groups are part of the Karoo Supergroup. The Dwyka Group is the earliest and lowermost of the Karoo Supergroup of sedimentary deposits, it is overlaid by the Ecca Group which in turn is overlaid by the Beaufort group.

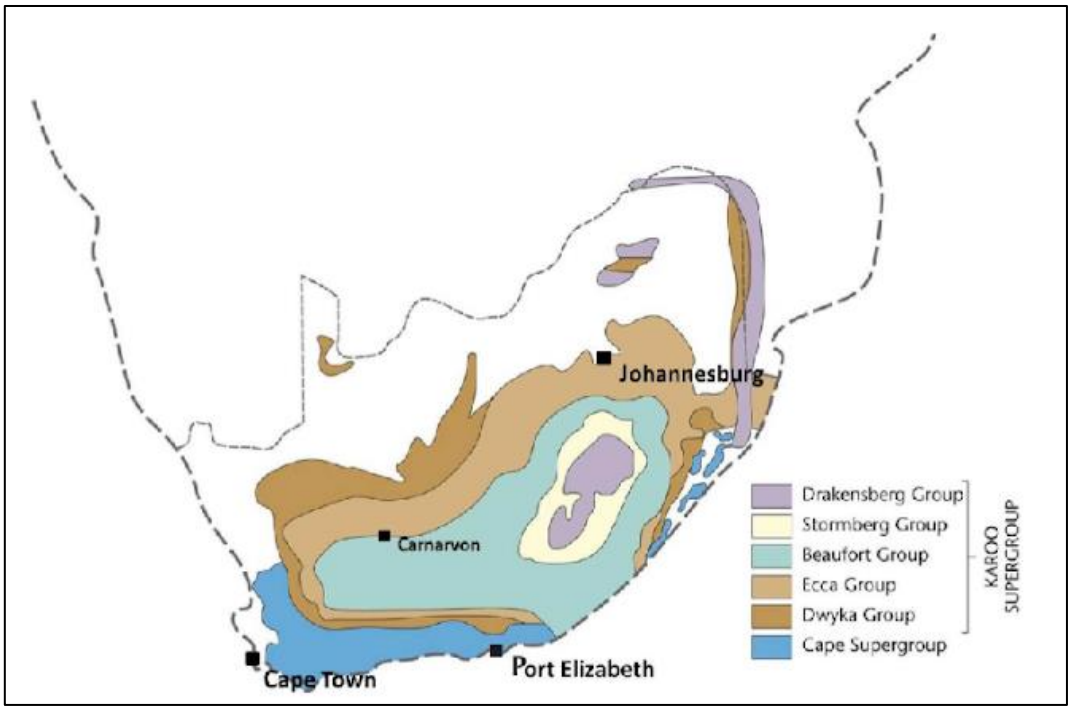

Figure 9: Karoo Supergroup sedimentary deposits

6.4.1 Surface Water Bodies and Soil Types

Drainage is mostly associated with endorheic rivers arising on the escarpment (e.g. Sakrivier) and flowing off ridges and hills. These rivers flow northwards and discharge into the pans (Brandvlei, Verneukpan, Vanwyksvlei) where the water evaporates. Although the soils of the plains are generally shallow to skeletal, wind and water-borne sediments have accumulated in parts of the landscape. In the Vanwyksvlei/Carnarvon Spiral Arm area, many stony plains are devoid of soil

whereas wind-blown sand has elsewhere accumulated to form dunes that overlie the mudstone plains and dolerite outcrops in some places.

According to the generalized soil pattern data from the Southern African Agricultural Geo-referenced Information System (AGIS), six soil types are found on the Site (Refer to Figure 10). These six soil types are usually found in the arid parts of the country and include:

- Red and yellow, well drained sandy soils with high base status[3] (AR2 on the map);
- Soils with negligible to weak profile development, usually occurring on deep alluvial deposits (FL on the map);
- Soils with minimal development, usually shallow, on hard or weathering rock, with or without intermittent diverse soils. Lime generally present in part or most of the landscape (LP2 on the map);
- Soils with a marked clay accumulation, strongly structured and a reddish colour. Prisma cutanic and/or pedocutanic diagnostic horizons dominant (PL1 on the map);
- Rock with limited soils (R on the map); and
- Strongly saline soils generally occur in relatively deep deposits in low lying arid areas (SC on the map).

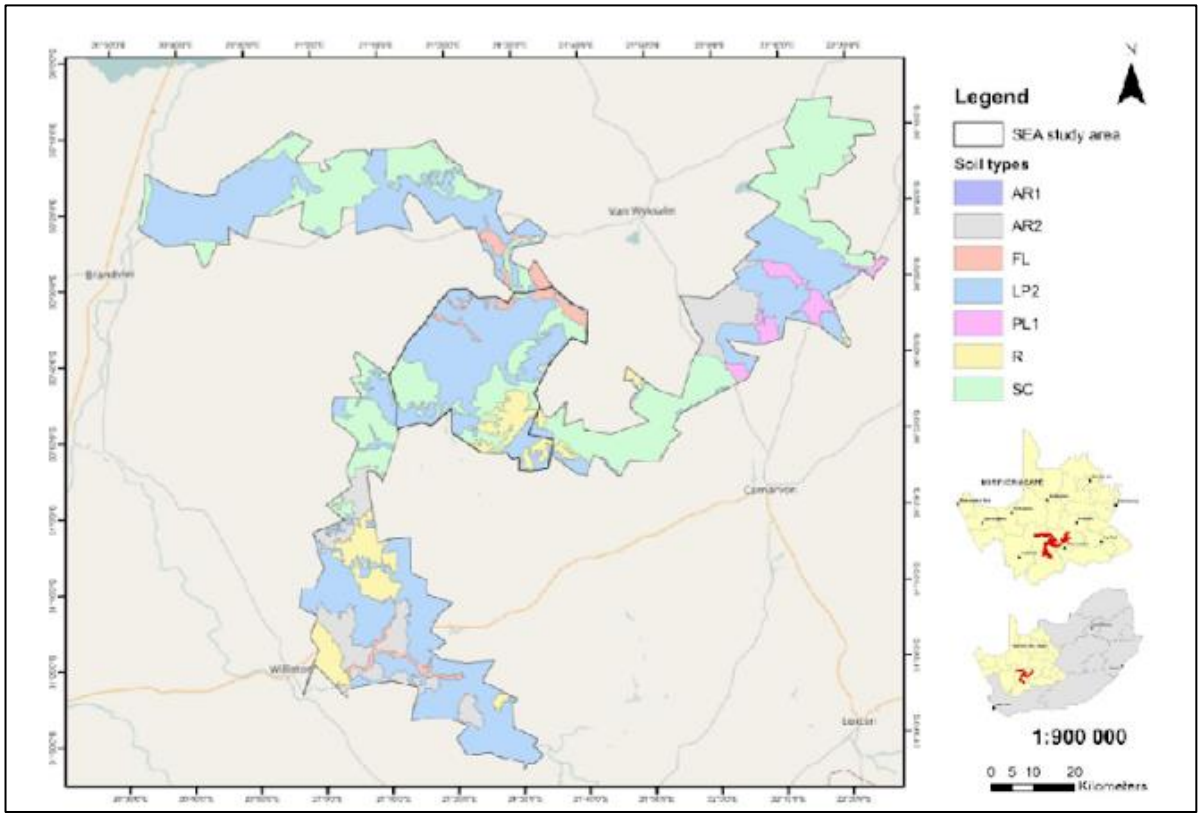

Figure 10: Soil Type found on the site

6.4.2 Vegetation

Two Biomes occur on the site, namely the Azonal Vegetation Biome (which is part of the Inland Saline Vegetation Bioregion) and the Nama-Karoo Biome (which is part of the Bushmanland Bioregion and Upper Karoo Bioregion). Each biome contains several vegetation types namely: Bushmanland Arid Grassland, Bushmanland Basin Shrubland, Bushmanland Sandy Grassland, Bushmanland Vloere, Northern Upper Karoo, Upper Karoo Hardeveld and Western Upper Karoo. Refer to Figure 11 for the extent of the different vegetation types.

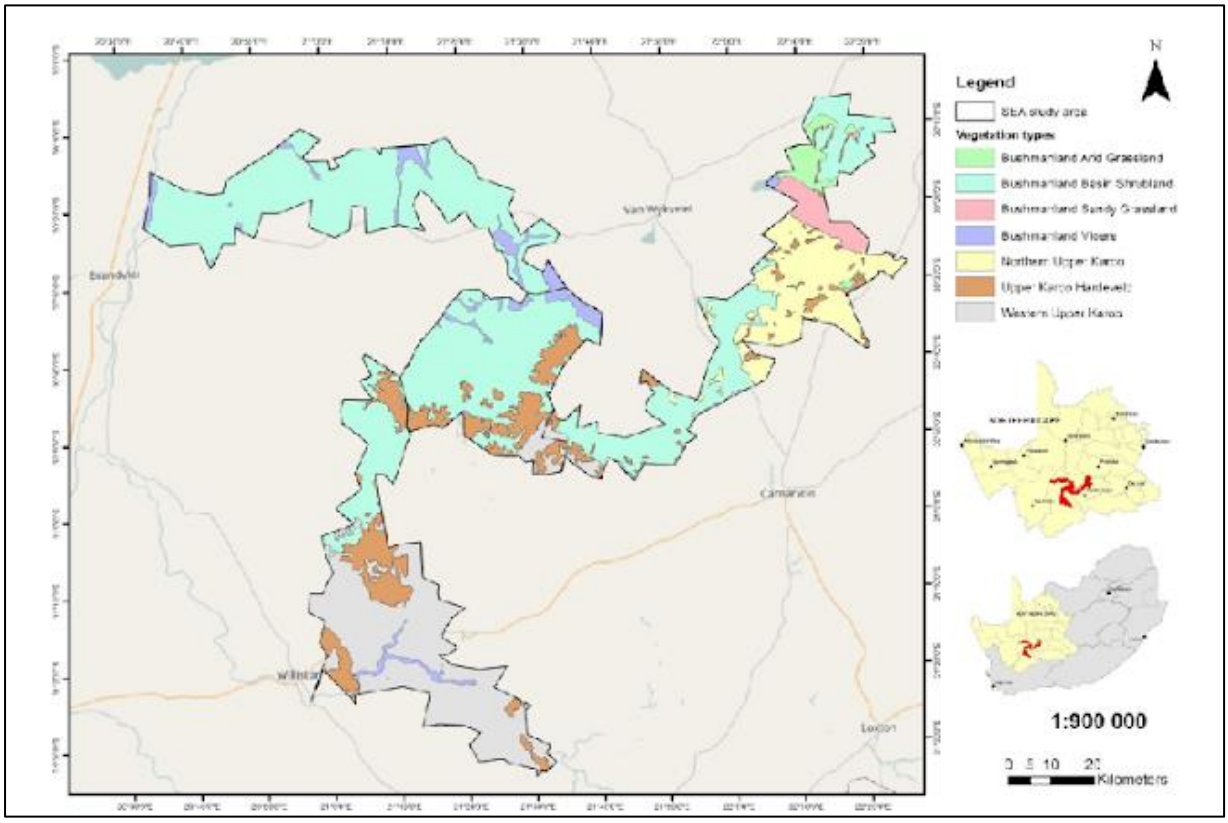

Figure 11: Vegetation Types

Amongst the vegetation types described above, 89 records of 47 plant species of conservation concern were recorded on site. The plant families with the most species of conservation concern are Iridaceae, Amaryllidaceae and Apocyaceae. These three plant families are geophytes or small shade succulents and difficult to detect in field surveys during dry periods. Three plant species of conservation concern occur on the site:

- *Aloe dichotoma* (vulnerable);
- *Hoodia gordonii* (data deficient, declining); and
- *Acacia erioloba* (declining).

The following plant species defined in the Northern Cape Nature Conservation Act as specially protected and protected, are also present on the site:

- slow-growing trees (*Boscia* species, *Acacia erioloba*),
- geophytes in the Amarayllidaceae, Hyacinthaceae, Iridaceae, Oxalidaceae plant families,
- succulents in the Apocynaceae, Asphodelaceae, Crassulaceae, Euphorbiaceae, Geraniaceae, Portulacaceae plant families, and
- certain medicinal plant species (*Harpagophytum sp., Sutherlandia sp.*).

6.4.3 Mammals

The site supports a high diversity of mammal species, particularly rich in small carnivores and rodents. Most of the species are widespread and not considered to be of any conservation concern. The survey conducted by the Endangered Wildlife Trust (EWT) in 2016 confirmed the presence of several small carnivores, insectivores and rodents including mongoose, caracal, black backed jackal, aardvark, steenbok, kudu and common hares on the NRF-owned land. In addition to this, the SEF survey in December 2006 recorded the presence of African wild cat (*Felis silvestris lybica*), steenbok (*Raphicerus campestris*), striped mouse (*Rhabdomys pumilio*) and Karoo Bush Rat (*Otomys unisulcatus*) on Meysdam and Losberg. Furthermore, a survey was conducted by the EWT in May and June 2016 to confirm that the Riverine Rabbit (*Bunolagus monticularis*), which has a critically endangered status on the International Union for Conservation and Nature (IUCN) Red List of Threatened Species, does not occur within the study area.

6.4.4 Reptiles

The site is fairly rich in tortoises and lizards, but snake diversity is low in comparison with higher rainfall areas. The only species of conservation concern is the Karoo padloper (*Homopus boulengeri*) tortoise which occurs in the south of the site and is Near-Threatened according to the assessment by Bates et al. (2014). The Fisk's House Snake (*Lamprophis fiskii*) which could occur on the site is listed as Vulnerable.

6.4.5 Birds

The dolerite sills and rock faces provide breeding, roosting and foraging habitat for a number of bird species, most notably threatened species such as Verreaux's Eagles (*Aquila verreauxii*), the "Near-Threatened" Lanner Falcon (*Falco biarmicus*) and the endemic Jackal Buzzard (*Buteo rufofuscus*). The grey shale pediments also provide an ideal nesting platform for the near-endemic Sclater's Lark (*Spizocorys sclateri*). An avifauna specialist study was conducted on the farm Meysdam and Losberg in 2007, indicating that 189 bird species are expected to occur in the study area of which 33 were confirmed during the SEA survey period. During this study, 13 Red Data birds with distribution ranges sympatric to the study area were identified, of which 4 species were allocated low probabilities of occurrence and considered vagrants in the study area. The remaining nine Red Data birds are the Martial Eagle (*Polemaetus bellicosus*); Lesser Kestrel (*Falco naumanni*); Kori Bustard (*Ardeotis kori*); Ludwig's Bustard (*Neotis ludwigii*); Red Lark (*Certhilauda burra*); Black Stork (*Ciconia nigra*); Secretary Bird (*Sagittarius serpentarius*); Lanner Falcon (*Falco biarmicus*); and Sclater's Lark (*Spizocorys sclateri*). In 2016, an avifauna sensitivity study was prepared as part of this SEA. The number of species recorded within the SEA study area is 264, of which only 152 species can be considered resident, and the remainder are breeding migrants (19 species), non-breeding migrants (32 species), nomads (37 species) and vagrants (15 species).

The highest priority resident species within the study area is the Red Lark (*Certhilauda burra*). For this species, protection of the remaining habitat is especially urgent. The highest priority endemic and nomadic species in the Karoo is the Sclater's Lark (*Spizocorys sclateri*) which is characterised as Near-threatened by BirdLife South Africa. A third priority species, the endemic and resident Cinnamon-breasted Warbler (*Euryptila subcinnamomea)* is confined to inselbergs and rocky ridges in the Succulent and Nama Karoo.

For further detailed explanation of the environmental conditions of the site, reference can be made to Chapter 3 of the IEMP [**Annexure M**].

7 ACCESS TO EXISTING FACILITIES, SERVICES, ACCOMMODATION AND PROTECTION

The farms Meys Dam and Losberg were acquired by the NRF in 2008 for the purposes of constructing the KAT 7 and MeerKAT radio telescopes and other Guest Instruments. The farms were originally used for agricultural purposes (sheep farming). All farming activities ceased in 2011. The Minister of Science and Technology declared the two farms the "Core Astronomy Protected Area" in terms of the Astronomy Geographic Advantage Area Act. Two contractor camps were established to construct MeerKAT and have since been decommissioned and so are not available to Contractors.

In 2017, the NRF acquired an additional 135,000 hectares of land which is declared a National Park. All farming activities have ceased, and previous landowners vacated from the land. There are a number of farmhouses, farm buildings and bulk infrastructure which have been identified and recorded (Figure 12) and graded (descriptively and spatially) in terms of the historical farmsteads on the NRF-owned land, including their associated outbuildings, stone walling and grave sites, as well as corbelled buildings has been initiated to determine the need for long-term conservation of historical structures and graves on the NRF-owned land.

Historical structures and graves that are older than 60 years old are automatically protected under section 34, 35 and 36 of the National Heritage Resources Act (Act No 25 of 1999) as they form part of the National Estate (section 3 of the National Heritage Resources Act). In consultation with the SAHRA and the NCHRA, a grading process has been undertaken to earmark buildings worthy of conservation; and to identify which buildings can be converted to offices and storage areas for use by SANParks and other environmental researchers on the NRF-owned land. The Heritage Conservation Management Plan [**Annexure O**] will guide the ongoing management of heritage resources on the site including maintenance of significant structures and maintenance and access to burial grounds and graves. The potential impact of accessibility restriction to the public on preservation efforts for such heritage sites has been addressed in the Heritage Conservation Management Plan.

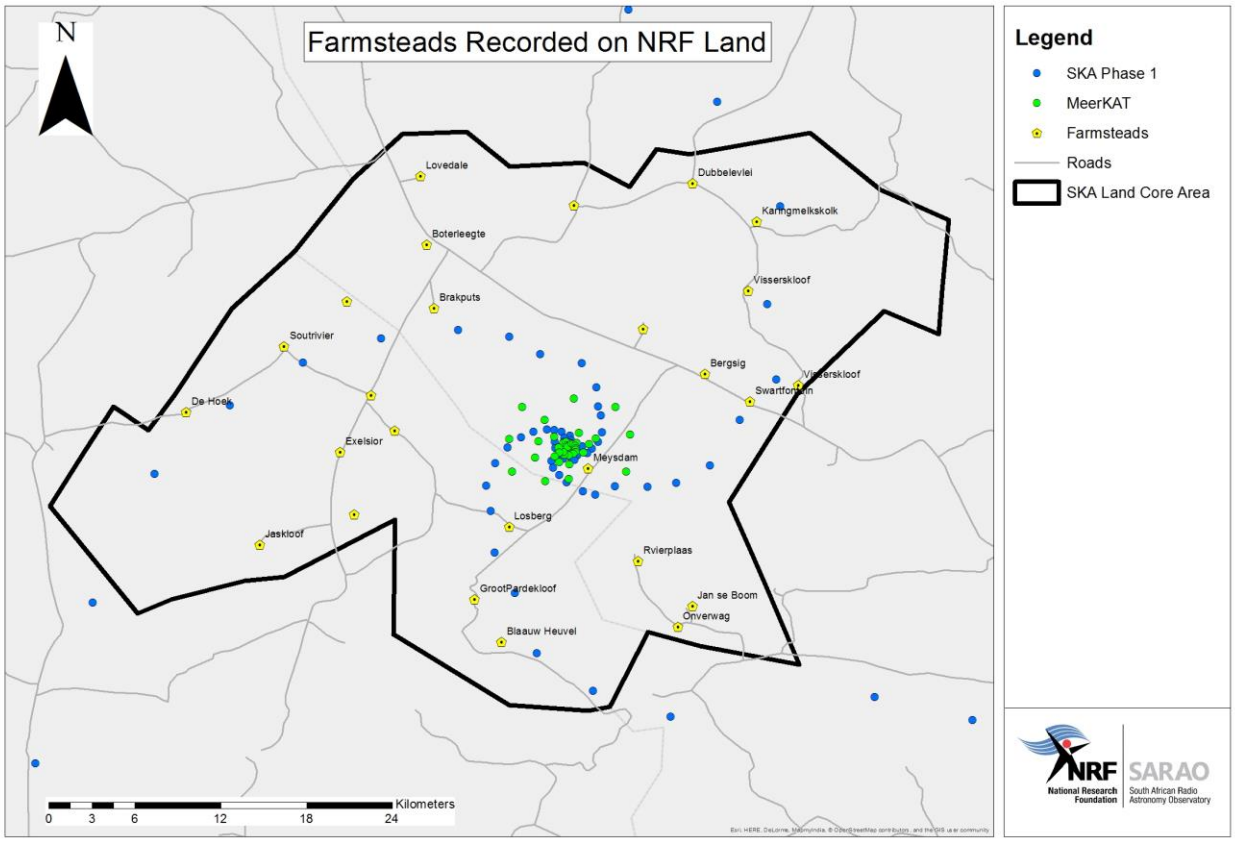

Figure 12: Farmsteads recorded on NRF Land

All internal farm fences on the NRF-owned land in the National Park will be removed. SANParks will be reintroducing wildlife (different buck species) during SKA construction. A 2.4m game fence will be erected to secure the National Park.

In addition, there are existing facilities and infrastructure established for KAT 7, MeerKAT and HERA. Some of these facilities will be upgraded for SKA_Mid. Instructions related to Access to these facilities for the purposes of SKA1 construction are described in detail in Part B Section 4 of this document.

Personnel, Visitors including Contractors shall respect the environment, heritage buildings and heritage findings on the site. Personnel, Visitors including Contractors shall remain within areas and corridors specified in construction documents and nominated in induction processes. No one will be allowed to visit, venture into, explore, interfere with or use existing facilities without prior approval by the SKAO Site Manager.

Visitors, including Contractors, may only use demarcated roads into a construction area or corridor and for accessing adjacent construction areas or corridors. These

demarcated roads will be indicated to Contractors by the SKAO Site Manager. The SKA1_Mid core area with the highest density of dishes is co-located with the MeerKAT radio telescope core. Common access roads will be utilised for the purposes of accessing MeerKAT, SKA_Mid and HERA (to an extent).

The existing accommodation at the SKA Site Complex and at the Klerefontein Engineering Operations Centre is not available for use by Contractors.

The NRF is securing servitudes along the Williston, Brandvlei and Carnarvon Spiral Arms where dishes and associated infrastructure will be located. Instructions related to Access to the Spiral Arms are described in detail in Part B Section 3.1.1.5. of this document.

8 SITE BULK INFRASTRUCTURE

8.1 Water

Reference can be made to Part A & B: Section 19.1 regarding access to water. The SKAO will not be held responsible or liable if there is insufficient availability of water on the site.

SARAO (NRF) has obtained water-use licenses on behalf of the SKAO for the abstraction and treatment of water for construction and operational purposes [**Annexure A1**] for the NRF-owned land. These licenses shall be made available to Contractors who require water for construction and/or operations purposes (refer to Part A & B: Section 19.1 for further information on the Integrated Water & Waste Management licenses).

The NRF shall apply for general authorization/s from the Department of Water & Sanitation for river crossings in the 3 spiral arms once consent is obtained from landowners.

8.2 Electric Power & Temporary Power during Construction

Reference can be made to Part B: Section 10.1 for site instructions related to electric and temporary power.

8.3 Temporary Sanitary Facilities

Reference can be made to Part B: Section 10.1 for site instructions related to temporary sanitary facilities.

9 CONTRACTOR CAMP AREA

A new Contractor Camp Area has been established by the MeerKAT+ infrastructure contractor. The Contractor Camp Area is located on the Visserkloof farm (farm portion 69/3) which falls within 15km of the SKA core. A locality plan of the Contractor Camp Area is indicated in Figure 13. The SKAO Site Management Team will be responsible for the allocation of each Contractor's individual camp and for general liaison between Contractors in the Contractor Camp area. Contractors can request dispensation from the NEC4 Project Manager in consultation with the SKAO Site Management Team should they wish to not utilise the Contractor Camp Area.

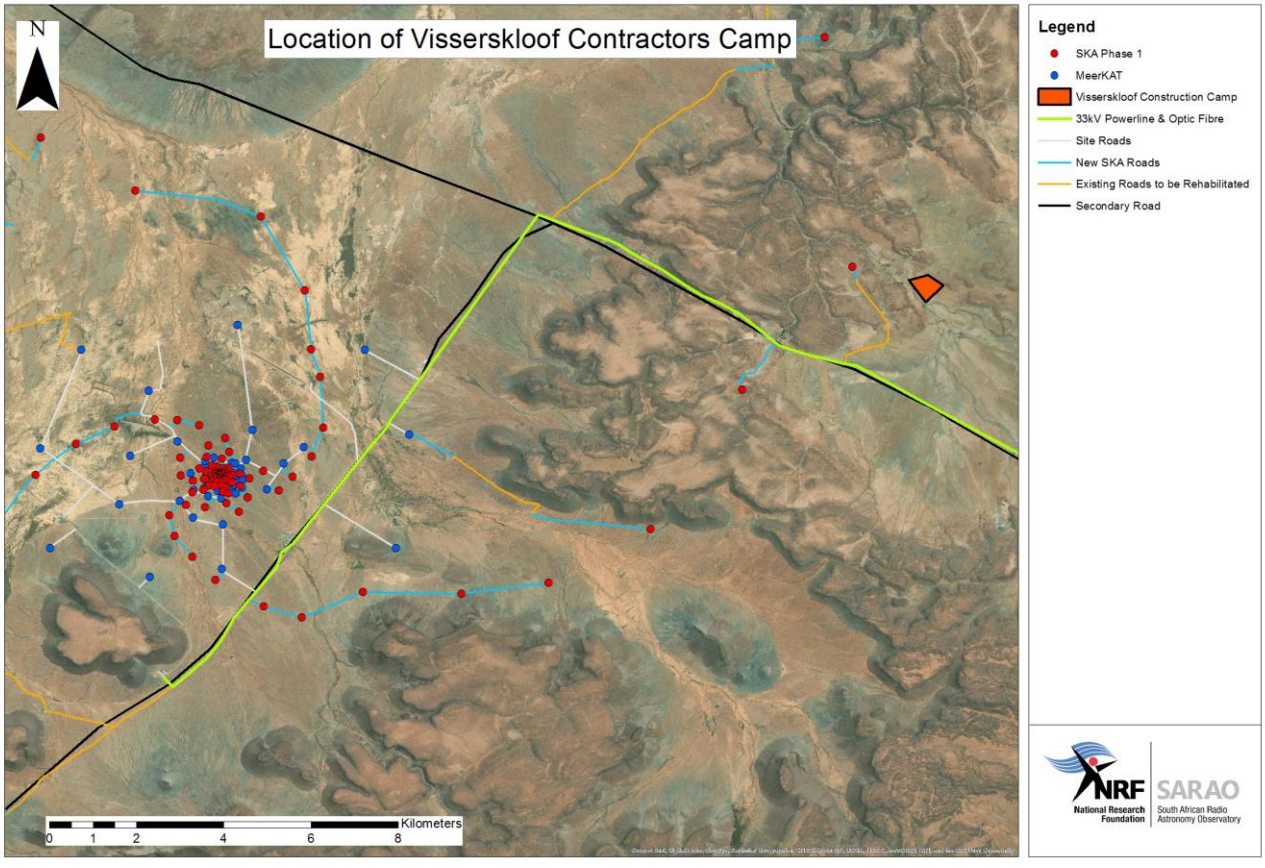

Figure 13: Location of Visserskloof Contractor Camp Area

The Visserskloof Contractor Camp Area services layout can be found in **Annexure P**.

The Contractor Camp Area location was selected for the following reasons:

- the farm has been purchased as part of the SKA land acquisition programme;
- the farm is located along a proclaimed road and is within 3 km from the access road to the site (provincial road "P02996"), which was upgraded (sealed) and completed in November 2017;
- the Camp Area is located at least 15 km from the SKA land core area; and
- The Camp Area is located within 2.5 km from the 33kV powerline to the site.

The Contractor Camp Area has been established on existing natural substrate where possible to:

- reduce the disturbance of the land to a minimum,
- limit the introduction of foreign gravel material to a minimum, and
- facilitate the rehabilitation of the site at the time of decommissioning.

The camp area is secured with perimeter fencing.

The power supply to the camp area is provided from the existing 33kV power line. A mini-substation is located on site and connected to one or two distribution kiosks within the camp area. An allowance has been ~~will be~~ made for new diesel generators for provision of power to the water and sanitation pumps in the event of a mains failure. The provision of back-up power will be in accordance with SARAO RFI Policies and Procedures.

The Visserskloof Contractor Camp Area has following bulk infrastructure:

- Bulk services, including water supply, sanitation, power supply, and fibre optic connection;
- Water and sanitation infrastructure including one earth dam (evaporation dam) and one waste water treatment plant at the Contractor Camp Area;
- Stormwater management system;
- Space for Offices – the offices however have to be provided by individual Contractors;
- Space for Dining facilities and recreational facilities (facilities to be provided by individual Contractors)
- Space for Materials laboratory area which Contractors must establish;
- Contractors to provide own waste management facilities;
- Space for a concrete batching plant area (batching plant to be provided by Contractors) and
- Perimeter fencing, access roads and access gates.

9.1.1 Water Connection

A bulk reticulation layout is provided for the Contractor Camp Area. It will be the responsibility of each Contractor to determine the specific point/s of connection to the bulk services. Water consumption by the site personnel has been included under water consumed at the Contractor Camp Area.

Potable water will be treated to conform to the regulated drinking water quality requirements of South Africa. Whilst the non-potable water for use within the camp site will be disinfected. Allowance will be made to supply potable water to the following within the camp site: 1. A common dining facility 2. Bulk supply point(s) for modular accommodation units housing in total 250 people 3. Communal ablution facilities 4. A recreational facility.

9.1.2 Sewer Connection

The sewer system at the Contractor Camp Area comprises a bulk sewer network that discharges into a sump with a pump that pumps the sewer into a package treatment plant. The treated effluent thereafter gravitates into a lined evaporation pond. The treatment facility will have water conservancy tanks installed upstream of the evaporation pond to conserve as much water as possible.

Bulk sewer lines will be installed within the Contractor Camp Area with sufficient manholes to allow Contractors to connect the camp's ablution and other facilities. The bulk reticulation and the connections, which may be modified with acceptance by the SKAO and shall be based on the layout of the Contractor Camp Area.

Similar to the water reticulation, bulk sewer lines will be installed around the Contractor Camp Area, with sufficient manholes to allow Contractors to connect the areas being serviced.

9.1.3 Electricity

The bulk electrical supply to the Contractor Camp Area has been provided by the MeerKAT+ infrastructure contractor. All Contractors wishing to utilise the Contractor Camp Area shall make their own arrangements to supply their individual camp within the larger Contractor Camp Area from the bulk power supply. Electrical Certificates of Compliance (COCs) shall be issued by each Contractor to the SKAO Site Manager. No guarantee can be given that electricity will be available at all times as unavoidable electricity cuts may occur, thus Contractors shall make their own arrangements for their electrical supply at this time. RFI-compliant diesel generators will provide back-up power to the water and waste treatment plants.

9.2 Housing & Ablutions

Contractors are responsible for erecting their own temporary housing units ("porta-cabins") and shall arrange for fencing and security for their allocated area in the Contractor Camp Area.

General Living Facilities: Contractors must ensure there is a good standard of living facilities to avoid safety hazards and to protect workers from diseases and illness and to maintain personal dignity and morale. Living conditions for workers should be clean, safe and, at a minimum, meet the basic needs of workers.

Reference can be made to Part B: Section 4 of this document which defines the detailed requirements for housing and ablution facilities.

9.3 Offices, Laboratories, Stores, Workshops, Security

Reference can be made to Part B: Section 4 of this document which defines the detailed requirements for offices, laboratories, stores, workshops and security.

9.4 Communication

Reference can be made to Part B: Section 4 of this document which defines the detailed requirements for the provision of communication to the Contractor Camp Area.

9.5 Maintenance

Reference can be made to Part B: Section 4 of this document which defines the detailed requirements for maintenance of the Contractor Camp Area.

9.6 Parking

Reference can be made to Part B: Section 4 of this document which defines the detailed requirements for parking.

9.7 Rehabilitation / remedial work

Reference can be made to Part B: Section 4 of this document which defines the detailed requirements for rehabilitation and remedial work required at the Contractor Camp Area.

9.8 Waste Management

Reference can be made to Part B: Section 4 of this document which defines the detailed requirements for waste management at the Contractor Camp Area.

9.9 Access to Contractors Facilities & Inspections

Reference can be made to Part B: Section 4 of this document which defines the detailed requirements for access to Contractor facilities for inspections.

9.10RFI Compliance

The Visserkloof Contractor Camp Area is in close proximity to the MeerKAT/SKA core. Any equipment being utilised by Contractors in the Contractor Camp Area could have a detrimental impact on MeerKAT and Guest Instrument science observations.

Tenderers will be required to submit a detailed list of equipment and vehicles that will be used both on the site as well as at the Visserskloof Contractor Camp Area. Contractors are required to submit an EMC Control Plan for the equipment to be used in the Contractor Camp Area. These will be reviewed, accepted by SKAO/SARAO and monitored for compliance by SARAO with the respective RFI permits or CoCs issued. The SARAO RFI team will undertake RFI test/scans and communicate Contractor compliance during construction to the NEC4 Project Manager. The NEC4 Project Manager will address any non-compliances with the Contractor.

The following equipment/activities are <u>not allowed</u> at the Contractor Camp Area:

i. Any WIFI
ii. Any Bluetooth or tracking devices
iii. Any welding or grinding
iv. Any stoves, ovens and geysers unless they are fuelled by gas
v. Any microwave ovens
vi. Any radios other than those that have been planned for deployment by the SKAO (low-frequency communication network)
vii. Any private radio communication systems or DECT/cordless telephones or cell phones

The following shall be addressed in the Contractor EMC Control Plans:

viii. Inverters and charge controllers, Television screens and monitors
ix. Air conditioners, network switches, VSATs and laptops.

Should the SARAO RFI team detect non-compliant equipment or activities, the contravening Contractor will be requested under their Contract to undertake remedial action to address the non-compliant equipment or activity.

10 BULK FUEL SUPPLY & STORAGE

Contractors are responsible for providing their own bulk fuel and storage supply to and at the site. The provision and storage of fuel shall be in compliance with Chapter 5 of the IEMP – [**Annexure M**]. Diesel can be sourced from the town of Carnarvon.

A Screening Major Hazard Installation Risk Assessment [RD10] was undertaken by the CSIR as one of the specialist studies for the Strategic Environmental Assessment. The Risk Assessment focussed on the main risks on the site related to chemical components to be stored on, produced or delivered to the site and to assess:

1. Whether any materials to be stored on the site would be classified as Notifiable;
2. Development of accidental spill and fire scenarios for the facility;
3. For each incident develop, determine consequences;
4. Determine whether the facility has the potential to be classified as a Major Hazard Installation (MHI) and whether a full MHI risk assessment would be triggered.

The outcome of the screening risk assessment concluded that:

- No material to be stored on the site is listed as notifiable in terms of the General Machinery Regulation 8 and its Schedule A on notifiable substances;
- No jet fires were predicted from the simulations;
- No flash fires were predicted from the simulations;
- No explosions were predicted for the storage of diesel;
- No boiling liquid expanding vapour explosions were predicted from the simulations;
- The worst-case (maximum distance) 10 kilowatt per m^2 thermal radiation isopleths, representing a 1% fatality, for diesel would no extend beyond the site boundary that could involve people in a major incident; and
- The scope of application of the Major Hazard Installation Regulations would not apply and the facility would not be considered a major hazardous installation.

11 SECURITY

11.1 Physical Site Security

SARAO is responsible for the provision of physical security on the NRF-owned land and at Klerefontein. There are currently five security guard huts located at:

(i) Klerefontein Support Base (EOC);
(ii) Meysdam (provincial road),
(iii) Boundary of the Losberg farm on provincial road
(iv) Two security guard huts at the SKA Site Complex (entrance to SKA Site Complex and exit to MeerKAT and SKA core).

Four new security guard huts will be added as part of the MeerKAT+ project. The position of these security control points is illustrated in Figure 14.

As indicated in Figure 14, the land is owned by the NRF. Provincial and district (public) access roads transverse the NRF-owned land which cannot be closed as there are local farmers traveling in the area to access their farms.

To ensure proper access control to the site, specific access control points have been identified based on entry/exit points to and from the NRF-owned land.

The security access control point coordinates are indicated in Table 3. The implementation of this access control will facilitate the management of vehicles entering and exiting the site.

Table 3: Security Access Control Point Coordinates for the site

Access Control Point	X_cord	Y_cord
1	21.3283844000	-30.5257720000
2	21.5783659600	-30.6926045000
3	21.2977199800	-30.7766276000
4	21.3529177400	-30.8414684000

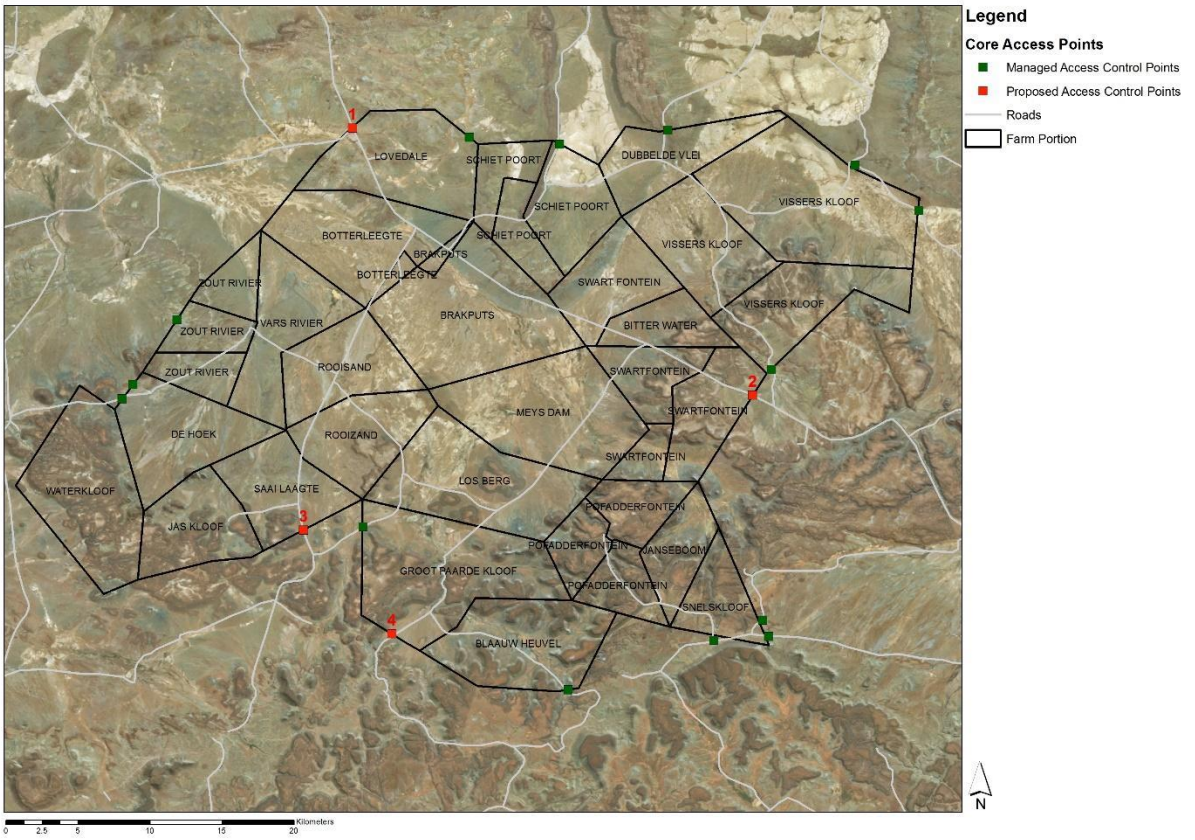

Figure 14: Security Access Control Points where SKA security guard huts are located

Servitudes are being secured on 72 farms in the 3 spiral arms for the establishment of SKA_Mid infrastructure. The width and size of the servitudes is indicated in Section 4.2 of this document.

Security perimeter fencing will be provided by SKAO Contractors for the following products:

- 21 SKA_Mid Dish Base Stations
- 4 SaDT Fibre Repeater Stations
- 3 SKA_MID Weather Monitoring Stations
- 21 local PV power stations on the spiral arms

SARAO-appointed security personnel are responsible for controlling (recording via register) everyone accessing the site. They are also responsible for undertaking alcohol and drug testing at security access control points.

11.2 National Key Point requirements

The SKA Site Complex has been declared a National Key Point (NKP) in terms of the National Key Point Act, Act 102 of 1980. The National Key Point registration number is 0134700.

A Joint Planning Coordinating Committee (JPCC) has been established in terms of the relevant legislation and is chaired by the National Department Higher Education, Science and Innovation and comprises of the following security departments:

a. South African Police Service (SAPS);
    - Local Police Station Commander
    - Provincial National Key Point Command
    - Provincial Crime Intelligence
b. State Security Agency (SSA);
c. Department of Higher Education, Science and Innovation (DSI);
d. South African Radio Astronomy Observatory (SARAO);
e. District services including Emergency Medical Services (EMS), Traffic Control and Disaster management.

SARAO works with the SAPS Key Points Division to find a balance between the security requirements as stated in the National Key Point Act and to ensure compliance with the requirement for Radio Frequency Interference (RFI) for the site.

The following South African legislation is used during the execution of duties by SARAO Security Officers.

- National Key Point Act (Act 102 of 1980) and NKP Regulations
- Criminal Procedure Act (Act 51 of 1977)
- Control of Access to Public Premises and Vehicles Act (Act 53 of 1985)

The South African Police Service has an operation station in Carnarvon. Due to the strategic importance of the SARAO and SKAO facilities, the Carnarvon SAPS conducts regular visits to the site to confirm that no incidents have occurred and / or to assist with any security-related matters. SARAO and the SAPS have a good working relationship and consequently any security-related matters that necessitate support from SAPS are addressed speedily and efficiently.

11.2.1 Roles & Responsibilities

11.2.1.1 SARAO Chief Security Officer (National Key Point)

- Coordinate and integrate all security-related matters for the site which includes the National Key Point

- Co-ordinate and Submit monthly/quarterly reports to the South African Police Service (SAPS)
- Ongoing liaison with local SAPS

11.2.1.2 External Security Provider

- SARAO utilises an external service provider to render security services on the site. The same approach will be undertaken for the SKA_Mid Project.
- The appointed service provider must be a registered security service provider with the Private Security Industry Regulatory Authority (PSIRA)
- The service provider is responsible for:
    - Compilation of weekly, monthly and quarterly reports of incidents on the site
    - Daily inspection of the site access control points
    - Coordination with the local SAPS in relation to security aspects
    - Mobilize response to security incidents
    - Monthly inspection of NKP security service provider compliance re training and equipment compliance
    - Ensure access and egress control to the site
    - Ensure that the provided register is duly completed by Personnel and Visitors including Contractors entering and exiting the site
    - All persons accessing or exiting the site must wear the issued Visitor/personnel identification card, in a clear and visible manner on his/her person
    - Report any non-compliance of individuals during entry or exit to the Security Provider control room at the SKA Site Complex and record details of the non-compliance in the relevant register. The Security control room office reports incidents to the SARAO Chief Security Officer.
- The service provider is also required to be a registered NKP service provider with the South African Police Service;
- A two-shift system of 12 hours each (24-hour security) is implemented with deployment of qualified security guards per shift (day and night) at the following stipulated points:
    - Guardhouse at Klerefontein (Support Base)
    - Guardhouse 1 Site Complex Central Processing Facility
    - Guardhouse 2 Site Complex Central Processing Facility
    - Access Boom gate Meys Dam Farm
    - Access Boom gate Groot Paardekloof Farm.
    - Access Boom gate Swartfontein Farm
    - Access Boom gate Lovedale Farm
- The Number of deployed guards is determined by the NKP Joint Planning Committee.

11.3 Baggage Checks / People Searches

All vehicles and baggage may be searched to ensure that no unauthorised equipment enters or leaves the site. SKAO personnel (IGO-employed staff) are subject to Privileges and Immunities and staff will be guided by SKAO Human Resources Policies and Procedures regarding Checks and Searches.

In terms of the Section 20 and 23 of the South African Criminal Procedure Act (Act 51 of 1977), security guards appointed to a designated National Key Point may execute searches of vehicles and persons to designated facilities if required in terms of the risk and threat assessment of the facility. The SARAO Site Manager / SARAO Chief Security Officer may instruct security guards to execute such searches as may be required of vehicles to detect any illegal goods, materials etc. entering or exiting the site.

11.4 Valuables

Lockable electronic safes are provided at the Security Control Point at Klerefontein Support Base and at the Security Control Point at the SKA Site Complex. Any person visiting the site with electronic equipment such as laptops, cell phones, tablets, smartwatches etc, will be required to switch off the equipment and lock it in the custody area for the duration of their stay on the site. The use of laptops is permitted only in the RFI-shielded control room in the Karoo Array Processor Building.

A safe custody facility is available to full time staff at the Security Control Point Klerefontein Support Base to secure electronic equipment prior to departure to the site.

SARAO or the SKAO will not take any responsibility for the loss of or damage to equipment or valuables on the site. Reference can be made to Part B: Section 6 which provides further detail on Contractor laydown areas and storage.

11.5 Information Security

SKA Observatory networks and services are provided for business use only and are subject to the agreement of the ISMS Acceptable Use Policy for Users document [AD32].

Internet access is provided for business and personal use and is subject to the conditions defined below.

All Visitors, service providers, Contractors, and Personnel must:

- Conduct themselves in a manner where their actions do not negatively impact, or potentially negatively impact, the security, reputation, or operation of the SKA Observatory
- Not circumvent security protocols or jeopardise system security through prohibited activities
- Not disclose any information which could put the security of SKA Observatory users, networks, and information systems at risk
- Not use the internet to transmit, receive, or store any communication or data that could be considered as criminal activity, sexually explicit, profane, threatening, of a gambling nature, or otherwise offensive or illegal
- Not violate copyright legislation (e.g. through the use, download, or distribution of music, video, or e-books)

Information security incidents must be reported immediately to the SKAO Site Manager.

12 OTHER INSTRUMENTS/3rd PARTIES ON THE SKA_MID SITE

12.1 Radio Telescopes

The MeerKAT radio telescope has been constructed and operated by SARAO on the farms Meysdam and Losberg in Zone 0 and 1. MeerKAT is operational whilst SKA construction is undertaken. In addition to MeerKAT, the HERA instrument is also located in Zone 1 and will be constructed and operated whilst SKA construction is undertaken. HIRAX will be located in Zone 2 on the farm Swartfontein. Both instruments are temporary with HERA completing science in March 2023 and HIRAX when there is no longer sufficient grid power available on site to power HIRAX. Reference can be made to Figure 15 which indicates the location of both guest instruments and the MeerKAT core.

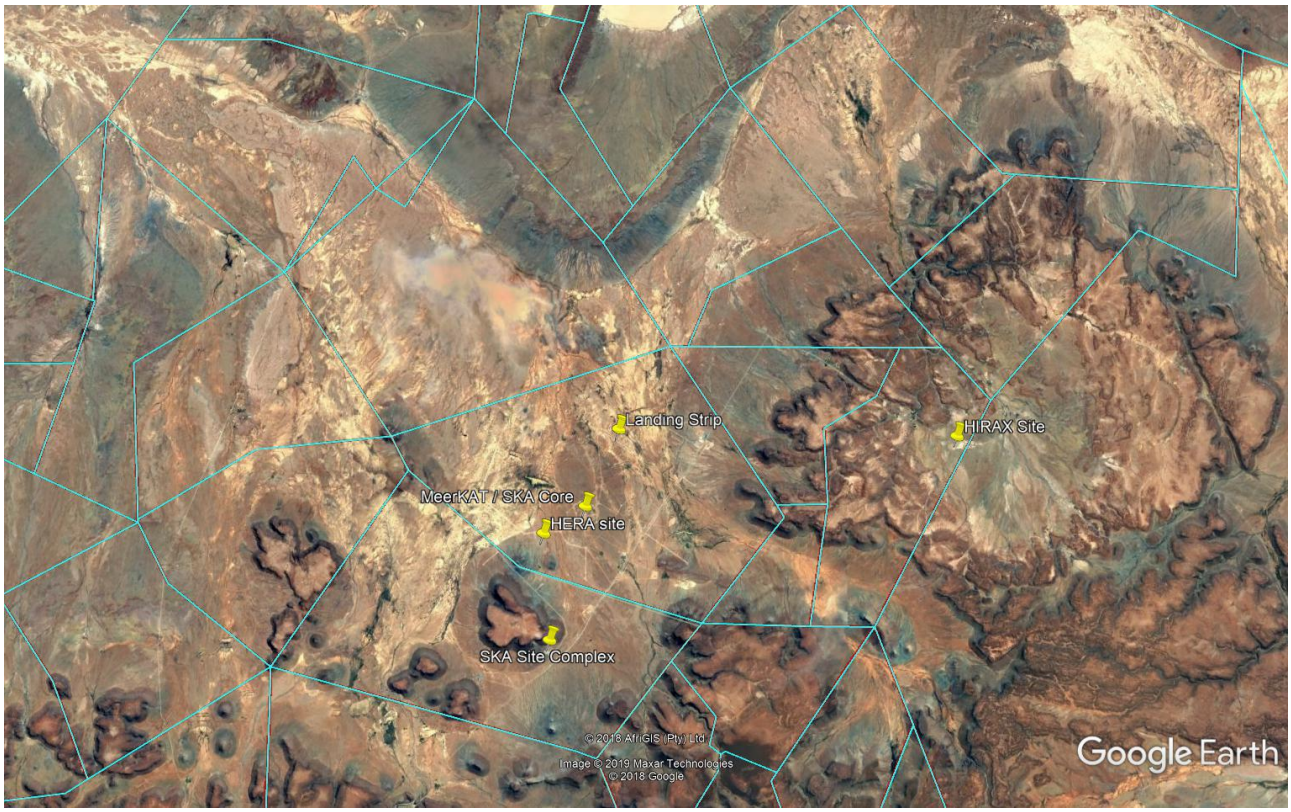

Figure 15: Location of MeerKAT, HERA & HIRAX on site

12.2 Land Management Authority

The NRF has appointed SANParks as the Land Management Authority to ensure the environmental protection of the newly established National Park. SANParks responsibilities include:

i. Development and implementation of the Park Management Plan

ii. Implementing some of the Management Outcomes defined in the Integrated Environmental Management Plan [**Annexure M**]. These include:
- Human/wildlife conflict
- Working for Water Programme
- Boundary patrol of game fence
- Biodiversity and ecosystem management
- Indigenous Plant Specie management
- Ecosystem Fire Management
- Erosion Management

The SANParks office is located at the farmstead located on the farm Swartfontein which is at the entrance to the National Park. SANParks staff can be identified through their green game-ranger uniforms. All SANParks vehicles are branded with the SANParks logo. Any queries related to SANParks activities and operations must be directed to the SKAO Site Manager who will address this with the SARAO Site Manager.

12.3 Research Organisations

There are a number of research organisations undertaking environmental research in the National Park. These include the South African Arid Areas Network (SAEON) and tertiary institutions. These organisations/institutions are subject to the same policies to protect the site. Any queries related to research organisations/institutions must be directed to the SKAO Site Manager who will address this with the SARAO Site Manager.

12.4 Northern Cape Department of Agriculture and Land Reform

The farm at the Klerefontein Engineering Operations Centre is managed by the Northern Cape Department of Agriculture and Land Reform. The farm is an active agricultural research station with their office also co-located with the EOC and SARAO accommodation facilities. Any queries related to research organisations/institutions must be directed to the SKAO Site Manager who will address this with the SARAO Site Manager.

12.5 Local Municipalities

The site is located within the Kareeberg, Karoo Hoogland and Hantam Local Municipalities.

Each local municipality is required in terms of the Spatial Planning and Land Use Management Act, Act 16 of 2013 to develop an Integrated Development Plan (IDP) for their respective municipalities which is aligned with the

broader Spatial Development Framework (SDF). All three municipalities have included the SKA radio telescope in their development and integrated planning frameworks and implementation plans. Further information is available at the following links:

12.5.1 Hantam Municipality

SDF: Not published

IDP: https://www.hantam.gov.za/2020/06/04/integrated-development-plan-idp-2020-2021-final/

12.5.2 Kareeberg Municipality

SDF and IDP: http://www.kareeberg.co.za/corp.htm

12.5.3 Karoo Hoogland Municipality

SDF: http://www.karoohoogland.gov.za/category/annually-updated-documents/spatial-development-framework/

IDP: http://www.karoohoogland.gov.za/idp/

The three municipalities have provided support in terms of obtaining rezoning and development approval for the SKA1_Mid project.

12.6 Public

The general public do not have right of access to the site apart from the Provincial road which passes through the NRF-owned land. In all cases where members of the public seek access, they are required to obtain prior consent from SARAO (NRF) as the owner of the land. Visitors, including Contractors, suppliers, transport operators etc. do not have a right to access any part of the site other than the areas prescribed in the SKA_Mid contract documentation.

SANParks is allowed access in compliance with SARAO policies and procedures within all parts of the NRF-owned land which has been declared the Meerkat National Park to fulfil their duties and obligations.

13 TRANSPORT MANAGEMENT

13.1 Traffic Management Plan

The site is surrounded by privately owned property where livestock farming is undertaken. The security and protection of the farmers' livestock and lifestyle is of primary importance to both the project and the farming community.

One of the management outcomes of the IEMP [**Annexure M**] is for Contractors who are constructing on site (but excluding delivery of telescope equipment within the KAPB) to develop a Traffic Management Plan (TMP) for construction. Reference can be made to Part B: Section 10 of this document which provides an outline of the requirements with Contractors shall comply with – however this summary must be read in conjunction with the management outcomes listed described in the IEMP [**Annexure M**].

13.2 Transport Policy

Reference can be made to the SARAO Transport Policy for the site – **Annexure E**.

13.3 Radio Frequency Interference

All transport operators providing support services to the site and SKA_Mid Project are required to assist SARAO in preserving the radio-quietness of the site. Reference can be made to the following SARAO Policies protecting the site:

i. SARAO RFI Policy – **Annexure X**;
ii. SARAO RFI Controls Policy – **Annexure Y**;
iii. SARAO Radio Frequency Interference Karoo Site Procedures – **Annexure H**;
iv. SARAO Radio Frequency Interference Zones – **Annexure I**;
v. SARAO Karoo On-site Rules & Procedures – **Annexure C**;
vi. SARAO Transport Policy – **Annexure E**.

13.4 Loading & Unloading: Cranes, Forklifts etc.

The site is in a remote location and it can require considerable time and expenditure to arrange and make available unloading and loading equipment, particularly specialised equipment.

Transport operators shall ensure that enquiries have been made with the SKAO's NEC4 Project Manager or delivery recipients and suitable arrangements have been agreed and implemented for access to and use of any loading and unloading plant

that maybe based at the site or that needs to be arranged and available at the site on arrival, ready to be utilised.

Important Note: Do not arrive expecting to load or transport plant, equipment and materials to the site without first making sure and being satisfied that suitable loading/unloading arrangements have been organised and essential equipment will be available.

13.5 Fuel

There are a number of service centres (providing fuel or support services) on the direct road routes from Major Urban Centres to the site. Some of the smaller towns fuelling facilities are closed on a Sunday. Carnarvon is the closest town to the site where refuelling can be undertaken.

Check fuel volumes, volume onboard, requirements and availability before commencement of travel.

Refuelling of vehicles and equipment shall be done at a refuelling location where appropriate surfaces and bunding have been installed/provided. If refuelling of equipment or vehicles in another location is essential and cannot be avoided, a spillage protection/collection container or suitable sheet material shall be used to eliminate the risk of contamination of the ground surface. Should spillage occur, and fuel or oil finds its way onto the ground surface (sand, soil etc.) the area affected is to be remediated.

13.6 Transport route

Reference can be made to **Annexure A** which describes major transport routes to the site.

13.7 Aircraft Landing Facilities

13.7.1 Site all-weather Landing Strip

The on-site landing strip indicated in Figure 16 was completed in 2014.

The site all-weather landing strip can only be utilised for emergency purposes, unless written authorization is obtained from SARAO stating otherwise.

Reference can be made **Annexure Q** of this document with regards to arrangements and instructions for use of the landing strip if SARAO approval is granted to Visitors including Contractors to utilise the landing strip.

As MeerKAT and other guest instruments are operational, all approvals must be obtained by SARAO in writing at least two (2) weeks prior to the flight being arranged (Contact the SARAO Site Manager: Tel: 053 382 5907). No ground transport is available, and all Visitors and Contractors must make prior arrangements with regards to ground transport.

Figure 16: Site All-weather Landing Strip

The landing strip has been registered with the Civil Aviation Authority (CAA) and SARAO has insurance cover. This is acceptable due to the fact that the MTOW of the PC-12 is less than 5 700kg which is the weight at which licensing becomes compulsory. This weight restriction has to be respected by all pilots flying into the airfield since any incident at the airfield involving an aircraft with a MTOW of more than 5700kg will in all likelihood have insurance repercussions.

For the PC-12 aircraft, the Rescue and Fire-fighting category is 3, although with minimal air traffic movements (less than 700 movements in the busiest consecutive three months) – this could be reduced to category 2. The preferred extinguishing agent for this category is a foam spray meeting the minimum performance level B, as described in ICAO Airport Services Manual. A mobile trailer containing foam is available at the landing strip.

13.7.2 Carnarvon Aerodrome

The Carnarvon Aerodrome is a small airport located in Carnarvon, Northern Cape, South Africa. The aerodrome is managed by the Carnarvon Flying Club. It mainly accommodates light and ultra-light aircraft. The Carnarvon Flying Club hosts an annual Fly-In to raise funds to maintain and improve the airport.

The coordinates are as follows (Figure 17):

- ***Carnarvon Aerodrome (gravel)***

  [Coordinates: 30°59’04.37” S; 22°07’3139.99”E]

The main runway is 34/16 and is 1300m in length. There is also a 30/12 runway and a 23/05 runway. It is an unmanned aerodrome and wind direction must be determined by the pilot. Charter companies must inform the Kareeberg Municipality (Tel: 053 382 3012) of a flight in order for them to check the condition of the runway and to ensure the gate is open upon arrival and departure. Low-level inspections are recommended to ensure no wildlife is on the runway. Security remains the responsibility of the air charter company, however the South African Police Service do undertake patrols when there are overnight aeroplanes on the apron. The runway has emergency lights and the use of the emergency lights must be arranged prior.

No ground transport is available and all Visitors including Contractors must make prior arrangements with regards to ground transport.

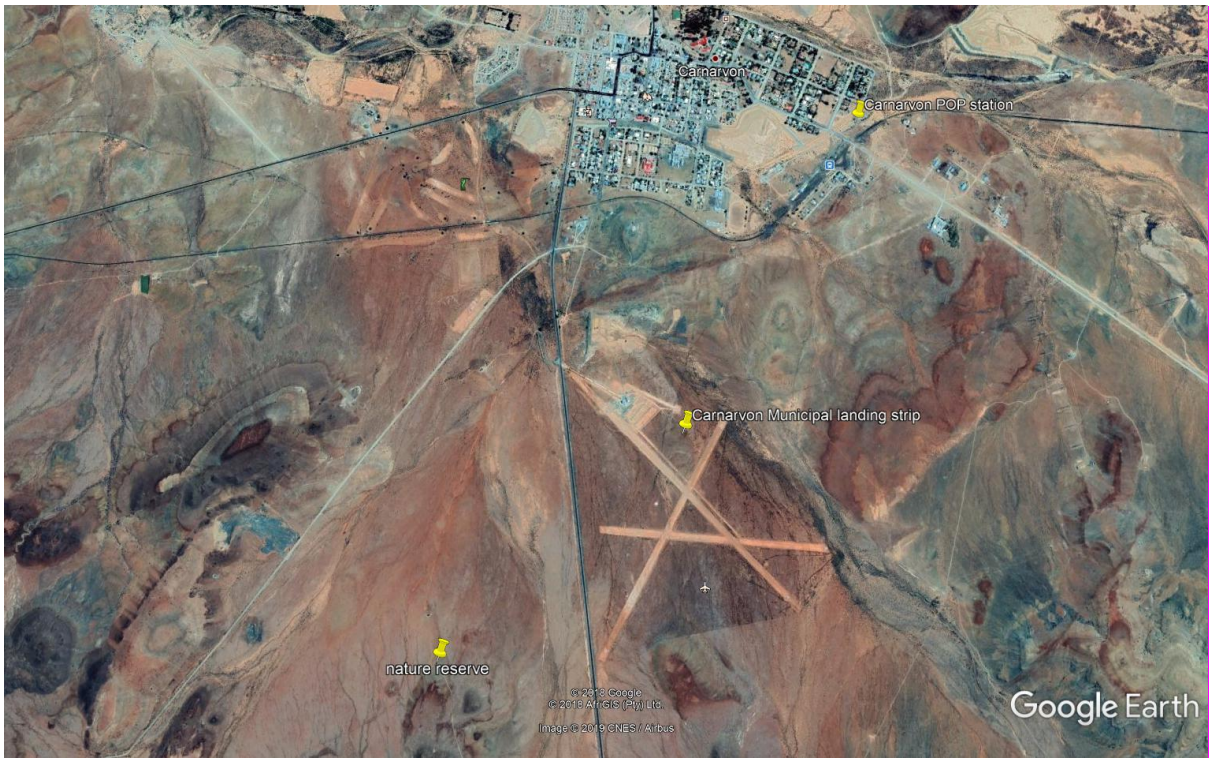

Figure 17: Carnarvon Aerodrome (gravel runway)

14 COMMUNICATION DEVICES

The Mobile Radio System (MRS) is being deployed as part of Early Works for the SKA_Mid Project. The MRS consists of vehicle mounted-, handheld- and base station radios that communicate via a network of repeaters. Remote consoles are

also provided for communications with the various operations rooms. The carrier frequency for the new MRS will be in the VHF Low Band, between 30 – 50 MHz

The operational activities on the site require the availability of an efficient MRS. Such a system is required for reasons of safety, maintenance, infrastructure operations and logistics.

Contractors will be provided with handheld and vehicle low frequency radio communication devices that do not cause interference with radio telescopes on the site. These units, for which quantities are to be determined by Contractors in the tendering phase, will be issued by the SMT as part of the Site induction.

These radio communication devices will provide coverage for the majority of the site.

VOIP communications from inside identified dishes are permitted during allocated telescope maintenance periods in order to communicate telephonically with the site/telescope maintenance management team, maintenance contractors and/or duty telescope personnel.

Communication via cell phone on the site is not allowed. Reference can be made to Part B: Section 11 of this document which provides further instructions to Contractors.

14.1 Operational Functionality

The MRS provides the following operational functionality:

- The MRS provides a homogeneous network eliminating channel switching etc.
- GPS facilities for safety-related work are inherent in radios.
- 2 Channel operation is possible on the same channel bandwidth, i.e. double capacity.
- Sophisticated configuration possibilities, e.g. grouping, priority calls, text messaging, inherent site telemetry, IP capability are built into the MRS.

14.2 Operational Restrictions

Reference can be made to Part B Section 11 of this document which describes the operational restrictions which Contractors shall comply with.

15 HEALTH & SAFETY MANAGEMENT

SARAO and the SKAO are committed to protecting personnel, Visitors including Contractors from accidental death, injury, or occupational illness and safeguarding systems, infrastructure, and property from accidental destruction, or damage while executing its engineering and science requirements.

Contractors will be required to develop Health & Safety Management Plans (HSMP) as part of their tender response to the SKAO to demonstrate their understanding of South African legislative requirements and compliance to the SKAO Health, Safety & Environmental Management Plan [**Annexure S**]. Residual design risks have been captured in a system-level Hazard Analysis which Contractors need to address during the design verification and construction phase. As the land is owned by the South African National Research Foundation (NRF) and will be operating the MeerKAT radio telescope and other Guest Instruments on the site, the SARAO Health & Safety Policy [**Annexure D**] shall also be applicable.

SKAO Health & Safety Officers (and any other person on site who deems there to be a high-risk HSE event) have the authority and responsibility to stop work if, in his/her opinion, a serious threat to or impact on safety may be caused directly from site activities.

15.1 South African Regulatory Requirements

All Contractors will be required to comply with the South African Occupational Health & Safety Act – (Act No. 29 of 1996) [AD9] and its Regulations; the Mine Health and Safety Act – (Act 29 of 1996) [AD10] and its Regulations and the Compensation for Occupational Injuries and Diseases Act (Act 75 of 1997) [AD9], contractual requirements and relevant industry standards and codes of practice.

In conjunction with the SKA SKAO Health, Safety & Environmental Management Plan [**Annexure S**], reference can be made to an example of a Health and Safety Specification in **Annexure N** which describes what Tenderers and Contractors are required to implement to comply with the South African Regulatory Requirements.

15.2 Disaster Management and Emergency Response

The NRF is the owner of the land where the site is located. In terms of Section 25 (1) of the Disaster Management Act (No 57 of 2002 as amended) (DMA), the NRF (SARAO), is responsible for the collation and management of a Disaster Management Plan (DMP) for activities on the SKA site. The implementation of this plan shall be jointly coordinated between SARAO and the SKAO Site Management Team.

The purpose of the SKA DMP [Refer to **Annexure G** and Section 6.6] is to document the institutional arrangements for disaster risk management planning, which includes the assignment of primary and secondary responsibilities for priority disaster risks posing a threat to the site. It further provides the broad framework within which the disaster risk management planning requirements of the DMA will be implemented by relevant departments and other entities included in the organisational structure of the SARAO and the SKAO.

It establishes the operational procedures for disaster risk reduction planning as well as the emergency procedures to be implemented in the event of a disaster occurring or threatening to occur on the site. It aims to facilitate an integrated and coordinated approach to disaster risk management, ensuring the SARAO and the SKAO achieves its vision for disaster risk management, which is to enhance resilience and self-reliance, and develop adequate capabilities for readiness; and effective and rapid response and recovery.

SARAO has submitted a copy of its disaster management plan to the Pixley ka Seme and Namakwa District Municipal Disaster Management Centres and the Northern Cape Provincial Disaster Management Centre (PDMC).

For the purposes of the Disaster Risk Assessment and implementation of the Disaster Management Plan, the site has been divided into 3 geographic areas:

1. SKA Site Complex (National Key Point);
2. NRF-owned land (National Park);
3. 3 SKA Spiral Arms

The following risks have been identified for the site:

SKA Site Complex

- Both **flooding** and **structural fire** are located in the 'tolerate' / 'green' zone, indicating that these risks have a low probability of occurrence, and fairly low impact should they occur. However, ongoing monitoring for both risks is necessary to ensure these risk conditions remain low, without increasing over time;
- Both **chemical spillage** and **sewage spillage** are located on the border between the 'tolerate' / 'green' and the 'treat' / 'grey' zone. This indicates that these risks have a low probability of occurrence, and a fairly moderate impact should they occur. In this case, decision-makers could choose to only employ ongoing monitoring measures for both risk types, or put in place additional mitigation measures to further reduce their probability and likely impact; and
- **Theft**, **RFI** and **power failure** are located in the 'treat' / 'grey' zone, indicating that these risks, although have a low probability of occurrence, their level of impact will be moderate to high should they occur. In light of this, it is recommended that additional mitigation measures are put in place to reduce the severity of these risks to a more tolerable level (i.e. mitigate their potential impact should they occur).

NRF-owned land and 3 Spiral Arms

- **Flooding** risk is located in the 'tolerate' / 'green' zone, indicating that this risk has a low probability of occurrence, and fairly low impact should it occur. However, ongoing monitoring for the risk of flooding is necessary to ensure it remains low, without increasing over time;
- **Structural fire** is located on the border between the 'tolerate' / 'green' and the 'treat' / 'grey' zone. This indicates that this risk has a low probability of occurrence, and a fairly moderate impact should it occur. In this case, decision-makers could choose to only employ ongoing monitoring measures for structural fire risk, or put in place additional mitigation measures to further reduce its probability and likely impact;
- **Road accidents, subversion and vandalism, RFI, power failure, strong winds and lightning** are located in the 'treat' / 'grey' zone, indicating that these risks, although have a low probability of occurrence, their level of impact will be moderate to high should they occur. In light of this, it is recommended that additional mitigation measures are put in place to reduce the severity of these risks to a more tolerable level (i.e. mitigate their potential impact should they occur).

15.3 Medical Facilities & Services

Contractors can refer to Part B: Section 12.3 of this document and **Annexure G** for further requirements.

16 RADIO FREQUENCY INTERFERENCE MANAGEMENT

16.1 Standard, Policies, Procedures & Protection Levels

The site has been selected to be as free as possible of external terrestrially generated RFI over significant bandwidths and will be maintained as such by the establishment of Radio Quiet Zones (RQZs). RQZ legislation provides the legal requirements for the limitation of levels of RFI from any source on the site over a frequency range from 100MHz to 25.5 GHz in South Africa. (Refer to Section 6 of this document).

In the context of the SKA telescope, RFI is defined as all unwanted, non-astronomical electromagnetic signals received by the telescope that are sufficiently strong to have the potential of creating false detections of astronomical signals or even influence the telescope's design. This includes licenses or unlicensed telecommunications signals and the unintentionally generated signals emitted from any electrical equipment as it operates. Equipment to be used in the SKA telescope must be designed to appropriately limit self-generated RFI that may interfere with nearby telescopes or other sensitive equipment located on the site.

A national standard specifying the protection levels for radio astronomy observations has been developed in South Africa for the frequency spectrum between 70 MHz and 25.5 GHz.

16.1.1 SKA RFI/EMC Standard [AD17]

This standard (**Annexure D1**) defines the SKA EMI/EMC requirements, applicable to all equipment within products that constitute the operational telescopes, are identified in the SKA product tree, and are operated within the observatory. It also applies to all extraneous support equipment that is used on the SKA sites whilst observations are being conducted by any telescope. For the particular case of radiated emissions, where the *SKA protection levels* will supersede commercial EMC standards, guidance on the derivation of the *emission threshold levels* is provided with the inclusion of SKA-provided software. The software derives the *emission threshold levels* without requiring complex calculations on electromagnetic propagation.

Overall, this standard is intended to be the source of the SKA system level requirements on EMC and shall be used as a reference for the derivation of any sub-level EMC requirements.

16.1.2 SKA EMC/EMI Management Plan

The SKA EMI/EMC Management Plan [**Annexure T**]:

(i) Sets the thresholds of allowable emission levels for equipment located on the site referred to the guided wave input of the telescope dishes;
(ii) Establishes procedures for the monitoring and control of EMC issues as the project progresses
(iii) Provides guidelines for the interpretation of the document, its associated procedures, and the measurement and verification requirements.

Contractors shall familiarise themselves with this document and implement the procedures defined in the document (these are generally aligned to the SARAO policies and procedures defined below).

16.1.3 SKA System EMI/EMC Control Plan for Procurement and Manufacturing Phase

The purpose of this document [**Annexure E1**] is to describe the process by which the SKAO will achieve EMC compliance of both SKA-Low and SKA-Mid through the *Procurement* and *Manufacturing* phases. A top down approach is used starting at the system level control plan, where the integration of all products will create a compliant system, followed by a description of a typical EMC control workflow diagram for a product/system describing different milestones and stakeholders involved in the process. This document also includes a section on EMC requirements, aimed to expand on the application of the SKA EMI/EMC standards and procedures document [AD 17].

The *EMC Compliance Roadmap* described in this document is based on a typical scenario, and it is possible that the implementation of the workflow, depending on the complexity and context where the equipment will be installed on site, will require tailoring for a particular product/system. The application of this roadmap shall be described in the EMC Control Plan (EMCCP) of each product/system.

16.1.4 Applying Telescope Protection Levels to Measurement Data

This standard [**Annexure J**] prescribes the application of the Square Kilometre Array Observatory (SKAO) radio telescope protection levels in the SKA EMI/EMC Standards [**Annexure D1**], for the determination of impact from radio frequency interference (RFI) on radio astronomy observations. The standard shall be applied to all RFI impact assessments, unless otherwise prescribed for a specific measurement and analysis scenario.

16.1.5 SARAO RFI Policies & Procedures

As owner of the SKA_Mid land, Contractors shall also comply with the following SARAO Policies and Procedures related to RFI:

16.1.5.1 SARAO RFI Policy

The purpose of the Radio Frequency Interference (RFI) Policy is to ensure that, as far as possible, all risk of detrimental radio interference to radio astronomy facilities under the management and control of SARAO, or radio astronomy facilities hosted on sites currently under the management and control of SARAO, is appropriately controlled and mitigated to acceptable levels.

This RFI Policy, and any rules and regulations approved to implement the objectives of this policy, applies to all SARAO employees and Visitors (which includes contractors and service providers). Non-compliance with this policy, or any RFI related rules and procedures approved, may result in disciplinary action or withdrawal of permission to enter SARAO sites, as may be relevant.

16.1.5.2 SARAO RFI Controls Policy

The purpose of the SARAO RFI Controls Policy defines how the compliance to the RFI Standards and RFI Policies will be managed on site, including verification, testing, analysis, record keeping and initiation of corrective action.

16.1.5.3 SARAO Radio Frequency Interference Karoo Site Procedures [**Annexure H**]

These procedures include the following aspects which Visitors including Contractors shall comply with:

i. Site Access and Induction Procedures
ii. Use of on-site communication devices
iii. Site Equipment and Notebook/Laptop Stowage and Usage
iv. Pre-maintenance procedures
v. Procedures for aircraft landing on the site
vi. RFI Policy & Procedure notification
    - Internal to SARAO staff
    - External to Visitors including Contractors and other Organisations
    - External – Public visits.
vii. Enforcement

No equipment is allowed on the site without having first obtained the necessary SARAO RFI Permit (temporary installation with or without conditions) or Certificate of Compliance (permanent or semi-permanent installation), in accordance with the SARAO Policy for the Control of RFI on the Karoo Site [**Annexure H**].

No equipment will be allowed on site without a RFI permit.

This includes:

1. Any electrical equipment that may produce intentional radio frequency transmissions such as mobile phones, laptops (except when being used in a RFI-shielded room), Bluetooth, satellite phones and electronic tablets;
2. Equipment that may produce unintentional electromagnetic radiation such as digital cameras, welding machines, electrical generation equipment and inverters will require RFI testing to be undertaken, and if compliant/partially compliant, a RFI permit will be issued according to the zone where the RFI Culprit is located. Equipment making use of active dishes, such as GPS, radio receivers and GPS-tracking devices are major RFI culprits and the necessary testing and permits will be required prior to allowing this equipment onto site.
3. Only vehicles that have undergone RFI qualification are allowed site access. RFI Permit Stickers will be affixed to tested and qualified vehicles. Disabling of Bluetooth and tracking devices shall be mandatory for any vehicle and for all personal Bluetooth devices, such as smart watches.

Any equipment located on the site that does not have a valid RFI Permit or Certificate of Compliance (CoC) will be issued with an RFI Notice by the designated personnel (SARAO RFI Control Officer/s) who shall provide instructions to achieve compliance with the SARAO RFI Controls Policy – **Annexure Y** within an agreed timeframe. A template RFI Permit, CoC and Notice is attached as **Annexure U** of this document. RFI Permits or CoC's will indicate what Zones the Permit or CoC has been issued for. Contractors must comply with the terms and conditions defined in the Permits and CoC's.

RFI Permits will be issued for RFI culprits that do not fully comply to the SKA EMC/EMI Standards, and where the RFI culprit will only be used on the site for a limited period. RFI permits can be issued for a short-term or longer term (i.e. Waiver) basis, but in general, will have a fixed duration of validity. The RFI Permits will be issued by the SARAO RFI Manager and co-signed by the SKAO RFI Manager. The owner of equipment that is subject to a RFI Permit must have a printed and signed copy of the permit whenever he/she uses the equipment on the site. The SARAO Site Manager or the SARAO RFI Manager, or specific personnel designated by them, can request the user of an RFI Culprit to present the RFI Permit. If the owner does not have a RFI permit, or cannot present it within a reasonable time, or is using the equipment outside the permit restrictions, he/she will be required to immediately switch off and remove the equipment from the site. All RFI Permits

issued, including the RFI Permit number, RFI test report, the validity dates and restrictions for use, will be recorded on the SARAO RFI Permit Database and made available online to delegated authorities.

RFI Certificates of Compliance (CoCs) will be issued for all permanently deployed equipment to the site that comply with the SKA EMC/EMI Management Plan – **Annexure T**, as applicable to the relevant position where the RFI Culprit is to be installed. RFI CoCs will only be issued after the equipment has been tested. Type testing can only be conducted on RFI Culprits that are more than 1,000m from an dish at the discretion of the SARAO and SKAO RFI Managers. The RFI CoCs will be issued by the SARAO RFI Manager and co-signed by the SKAO RFI Manager and owner/supplier of the equipment/hardware.

Applications for SARAO RFI Permits or CoC's shall require the relevant equipment to undergo RFI qualification through testing in a test facility that has been certified to do RFI tests to the standard required in the SKA EMC/EMI Management Plan. This implies certification of the chamber, the test equipment, the test procedures and the competency of the staff. This is similar to ISO 170025:2017 certification by the test authorities of a country (SANAS in South Africa) but not to the commercial (CISPR) standard but to the SKA EMC/EMI Standard.

Applications for SARAO RFI Permits or CoC's shall require the relevant equipment to undergo RFI qualification through testing.

The following facilities are available for use by Contractors (use of facility and resources required to do the RFI testing is for the account of the Contractor):

(i) Test facilities in member country where product is being manufactured

(ii) SARAO Reverberation Chamber, Cape Town (Operational)

(iii) Houwteq Anechoic Chamber (Operational, 80km from Cape Town)

(iv) Houwteq Reverberation Chamber

(v) ITC Anechoic Chamber, Gauteng (Operational, CISPR standards only).

(vi) SARAO Klerefontein temporary facility (operational in 2022).

Qualification shall be in accordance with approved procedures[2] and using whatever measurement resources as may be appropriate. Pending the outcome of the qualification, which shall consider the frequency range and levels of emissions, a Permit or CoC shall be issued and shall prescribe terms of use within specified Zones and specific times of day, as well as any other instructions as may be relevant. Equipment for temporary use will remain switched off when not inside authorised locations or Zones.

[2] At a minimum, compliance with relevant SARAO protection threshold limits will be tested

16.1.5.4 RFI Zone Definitions for MeerKAT and SKA_MID **[Annexure I]**

This document defines the RFI Zone definitions which are used when issuing RFI controls such as RFI Permits or Certificates of Conformance (CoC) to manage RFI culprits which shall be issued to Visitors including Contractors for all equipment, vehicles and components coming to the site.

The definition of these Zones is based on radio propagation properties, from which minimum separation distances are derived. The RFI Zone definitions are provided in Table 5.

Table 4: RFI Zones for the site

Zone ID	Zone Title	Notes
RFI Zone 0	Receptor (Dish)	100 m radius circle around each of the MeerKAT, MK+ or SKA1 telescope receptors. For SKA1 spiral arms, this will be within the 100 m x 100 m security fences.
RFI Zone 1	Inner Core	5 km radius circle around the SKA virtual core / centre: 30.71292°S, 21.44380°E [4].
RFI Zone 2	Outer Core	25 km radius around the SKA virtual core / centre: 30.71292°S, 21.44380°E [4].
RFI Zone 3	Spiral Arms	10 km corridor centred around the spiral arm telescope locations.

The attenuation range for a frequency of 500 MHz is provided in Table 6.

Table 5: Attenuation range per RFI Zone for f = 500MHz

Zone ID	Zone Title	Attenuation Range (f = 500 MHz) [min to max dB]
RFI Zone 0	Receptor (Dish)	0 dB to 64.5 dB for f = 500 MHz
RFI Zone 1	Inner Core	64.5 dB to 129 dB for f = 500 MHz
RFI Zone 2	Outer Core	64.5 dB to 176 dB for f = 500 MHz
RFI Zone 3	Spiral Arms	64.5 dB to 169 dB for f = 500 MHz

The RFI State definitions are defined in Table 7.

Table 6: RFI State definitions

RFI State	Colour	State Description	State Definition
RFI State 1	Green	Full Science Operations	This is the state with the highest RFI restrictions through RFI controls (i.e., best condition for most sensitive science observations). Only equipment with RFI CoC allowed to operate. Only staff required for critical functions allowed on site. During construction phases this will be curfewed from 17h00 to 08h00.
RFI State 2	Yellow	Restricted Science Operations	This is a slight RFI relaxation through RFI permit conditions. Where required, the responsible manager and persons shall communicate with the science operations team to co-ordinate activities start and stop times.
RFI State 3	Red	No Science Operations	In this state no science operations are possible (e.g., aircraft approaching or departing from core airstrip; critical maintenance done on power system). These periods will be promulgated by the Site Manager in consultations with science operations teams. In the case where damage to the receiver front-ends (LNA) are at risk, RFI covers are to be fitted.

In considering the impact of construction activities on the MeerKAT and Guest Instrument science programmes, the most likely interferences that could adversely affect observations are RFI and planned power outages.

Important considerations are that impacts on MeerKAT operation are strongly dependent on the distance of a given activity from a MeerKAT dish (e.g. RFI) or involve single points of failure (e.g. power systems).

The various MeerKAT observation projects have significant diversity in terms of operating frequencies, susceptibility to RFI and scheduling constraints, but in general it would be impractical to coordinate construction activities and the MeerKAT schedule to minimize RFI impact on observations. The impact of unintended or intentional RFI on MeerKAT science operations can be broadly classified as follows, in order of increasing severity:

1. RFI that is weak and/or is low cadence and/or is out of band, and has insignificant deleterious effect on the observations;
2. Low-cadence, transient RFI that can be flagged in the time domain, leading to reduced integration times and an acceptable associated loss of sensitivity, or acceptably longer observing times to account for the fraction of flagged data;

3. Weak, narrow-band RFI that does not lead to spurious spectral leakage, and that can be flagged in the frequency domain without significant scientific impact. For continuum observations this will lead to a loss of sensitivity or an increase in observing time to regain the required sensitivity. For spectral line observations the severity of the impact on science will depend on whether or not the flagged channels correspond to science target frequencies;
4. RFI that is persistent and strong enough to contaminate data to such an extent that the flagging fraction makes the observation non-viable. Observations that are not time-critical can be rescheduled, but science would be lost for time-critical observations;
5. RFI that is strong enough to cause permanent damage to the receivers.

Some occurrences of categories (1), (2) and (3) could be tolerated with acceptable impact on the scientific productivity of MeerKAT, but mitigation strategies must still be in place to prevent them (i.e. occurrences should be unintended or accidental). Categories (4) and (5) need to be avoided, and stringent mitigation strategies and procedures must be implemented to avoid occurrences. There is a real and significant opportunity cost associated with data loss and extension of observation schedules.

Besides the obvious effect of prolonging the MeerKAT science programme, power outages can have a serious impact on the science objectives of time-critical observations. Careful planning and scheduling must be done in order to minimize this deleterious impact.

Daily, weekly and monthly site meetings will be scheduled between SARAO and the SKAO Site Management and Operations teams to plan and communicate when RFI states change in order to accommodate both SKA construction and MeerKAT science observations.

17 ENVIRONMENTAL MANAGEMENT

The use of the land for the purposes of construction and operation of the SKA radio telescope is subject to the statutory terms and conditions of the Integrated Environmental Management Plan described below.

The MeerKAT and the SKA projects are one of the 18 Strategic Integrated Projects of the Presidential Infrastructure Coordinating Committee (PICC), as part of the South African National Development Plan 2030.

The South African Department of Environment, Forestry and Fisheries committed to contributing to the implementation of the National Development Plan by undertaking Strategic Environmental Assessments (SEAs) to integrate the regulatory environmental requirements for the Strategic Integrated Projects (SIPs), while safeguarding the environment.

In 2015, the Council for Scientific and Industrial Research (CSIR) was appointed by DEA (now DEFF) to undertake a Strategic Environmental Assessment (SEA) for the SKA Phase 1 Mid-Frequency Array. This study included detailed specialist studies. The SEA and specialist reports are available at https://www.sarao.ac.za/about/strategic-environmental-assessment/.

The SEA covers an area of approximately 628,200 hectares of land in the Karoo which was divided into two sub-areas: The "SEA Core Study Area" (outlined in blue in Figure 18), which consists of 38 land parcels, and covers an area of approximately 131 200 hectares; and the "SEA Spiral Arm Study Area" (outlined in purple in Figure 18), which includes 131 land parcels, and covers an area of approximately 497,000 hectares.

The overall study area falls within four local municipalities; the Kareeberg Local Municipality, the Hantam Local Municipality, the Siyathemba Local Municipality and the Karoo-Hoogland Local Municipality. The largest towns surrounding the study area are Carnarvon, Williston, Van Wyksvlei and Brandvlei.

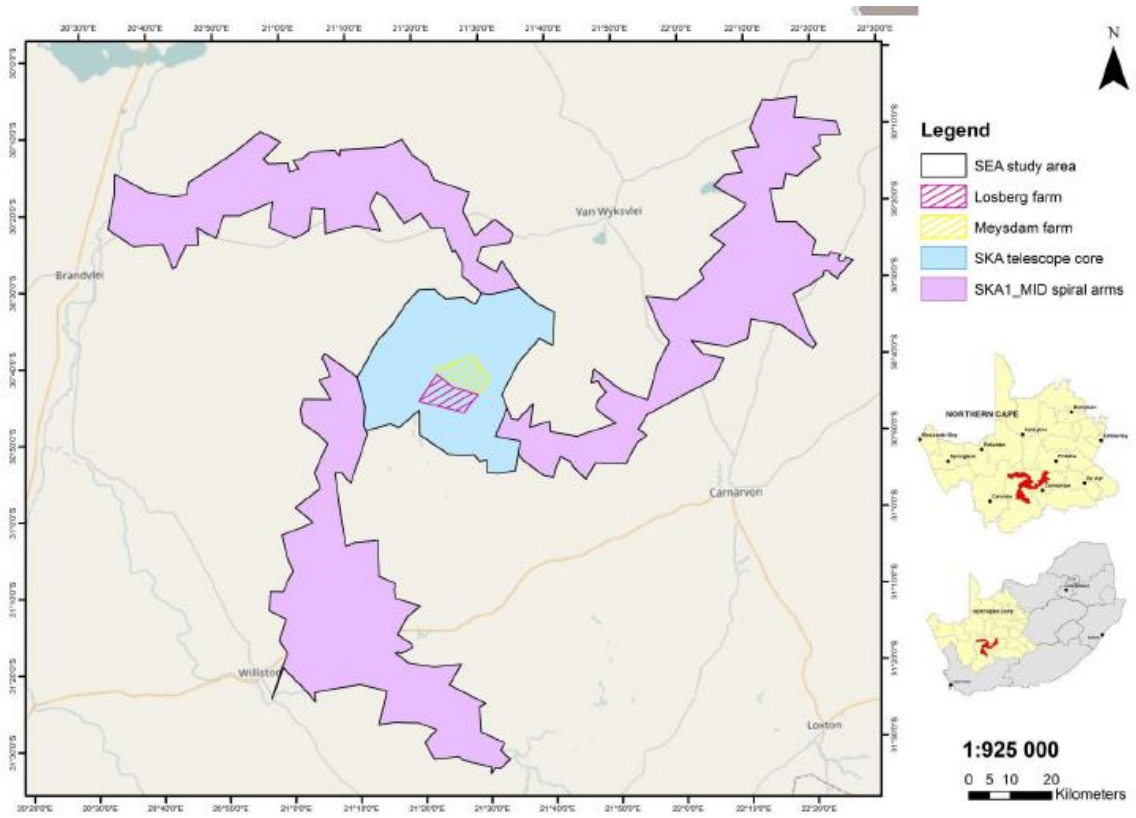

Figure 18: Strategic Environmental Assessment Area

The SEA assessed the potential impacts that the proposed activities for the construction and operation of the SKA_Mid Project may have on local agriculture, heritage (including archaeology, palaeontology, cultural heritage and visual/landscape aspects), terrestrial ecology and biodiversity, including avifauna, aquatic ecosystems, as well as socio-economic aspects. Specialist findings and recommendations were included in Chapter 3 (State of the Environment), Chapter 5 (Environmental Management Programme) and Chapter 6 (Research and Monitoring Programmes) of the Integrated Environmental Management Plan (IEMP) [**Annexure M**]. Further aspects of sensitivity in terms of aviation, defence, telecommunications, weather services, mining, water use, waste management, noise and traffic effects were also investigated in consultation with the relevant authorities and stakeholders. The specialist reports were reviewed by independent experts, who provided input and contributed to improving the scoping level.

Legal Instrument

South Africa's National Environmental Management Act (NEMA) (Act No. 107 of 1998) [AD15] promotes the integrated environmental management of activities that may have a significant effect (positive or negative) on the environment. Section 24(1) of the NEMA states that "*in order to give effect to the general objectives of integrated environmental management laid down in this Chapter, the potential impact on the environment of listed activities must be considered, investigated, assessed and reported to the competent authority charged by this Act with granting the relevant environmental authorization*." The reference to

"listed activities" in Section 24 of the NEMA relates to the Environmental Impact Assessment Regulations, 2014 and its associated Listing Notices and amendments.

This Integrated Environmental Management Plan (IEMP) [**Annexure M**] has been adopted by the Minister of Environmental Affairs (now Department of Environment, Forestry & Fisheries) as an environmental instrument. The adopted IEMP forms the basis on which an exclusion from the need to obtain an environmental authorisation for the listed and specified activities associated with the development of the SKA_Mid as identified in Chapter 2 of the IEMP was granted to the National Research Foundation on behalf of the SKAO in terms of section 24(2)(e) of the NEMA. The exclusion is subject to compliance with the content of Chapter 2 and 5 of the IEMP.

Integrated Environmental Management Plan (IEMP) [**Annexure M**]

On the 22 March 2019, the Minister of Environmental Affairs (now Minister of Environmental Affairs, Fisheries and Forestry) gazetted the adoption of the IEMP for the Square Kilometre Array Phase 1 Mid-Frequency Array (SKA1_Mid) in South Africa (Government Gazette No 42323 (Notice No. 436).

The conditions of exclusion listed in the Government Gazette include amongst others:

i. Ecological, terrestrial and heritage specialists must undertake a walkthrough of the site prior to the start of construction to confirm the final development footprint to confirm the areas unsuitable for development;
ii. Prepare a map signed off by specialists which consolidates areas for unsuitable development and overlays the final proposed development to confirm that no development will take place in these areas;
iii. Submit the consolidated map and the written notice of commencement of construction to the Department and include the map as Appendix C to Chapter 5 of the IEMP.

Failure to comply with the Management outcomes defined in Chapter 5 of the IEMP will constitute an offence in terms of Section 49(A)(1)(d) of NEMA.

Further amendments were made to the scope of SKA_Mid which resulted in updates being made to Chapter 2 and Chapter 5 of the IEMP. These scope amendments include:

i. Further RFI risk analysis was undertaken of the proposed Contractor Camps at Losberg, Bergsig and Swartfontein Contractor Camps. The outcome of this analysis indicated that the risk of establishing these camps would pose a high risk of RFI which could compromise science observations being undertaken on site;
ii. SKAO's desire to introduce further renewable energy into the mix through the establishment of a central Photovoltaic plant on/close to site;

iii. Need to construct a boundary game fence to enhance security and facilitate boundary fence inspections;
iv. The addition of 3 farms owned by the NRF;
v. To acknowledge the declaration of the NRF-owned land as the Meerkat National Park with SANParks as the appointed Land Management Authority.

On the 25 March 2021, the Minister of Environment, Forestry & Fisheries published an adoption of amended Chapter 2 and Chapter 5 of the Integrated Environmental Management Plan for Phase 1 of the Square Kilometre Array and amendment to the conditions of the exclusion listed in Government Gazette No. 44220, Notice No. 250.

The revised IEMP [**Annexure M new version**] is called the IEMP for the SKA (Phase 1) Revision 1 and replaces the IEMP as adopted in the Exclusion Notice of 2019 from 25 March 2021.

The National Research Foundation, through its national facility, the South African Radio Astronomy Observatory, and the International SKA Observatory are required to comply with the conditions contained in both Government Gazette Notices.

In terms of the conditions listed in 2.3.3., a detailed heritage, ecology and aquatic walkthrough has been completed on the site . The following Management Plans have been compiled following the walkthroughs:

i. Gap Analysis and Ecology, Bats and Aquatic Site Assessment [**Annexure V**];

ii. Conservation Management Plan [**Annexure O**] has been submitted and approved by the South African Heritage Resource Agency (SAHRA);

iii. A Revegetation and Rehabilitation Plan and a Plant Rescue and Protection Plan is also in place for the construction and operation of the SKA radio telescope in South Africa.

SKAO Environmental Officers (in emergency situations, stop work instructions shall be issued by appropriately designated person nearest the incident) have the authority and responsibility to stop work if, in his/her opinion, a serious threat to or impact on the environment may be caused directly from site.

Reference can be made to Part B: Site Instructions: Section 14.1 with regards to compliance and monitoring of the IEMP.

18 CONSTRUCTION LICENSES & EXEMPTIONS

The Contractor will obtain all the necessary permits and licenses prior to the commencement of any activities requiring such a permit or license. Such permits and/or licenses may include the operation of abnormal vehicles on public roads; storage and handling of general and hazardous waste, abstraction of water and treatment of waste and the abstraction of mineral resources for the purposes of construction. Reference can be made to the IEMP [**Annexure M**] which lists possible permits/licenses required.

All permits and licenses will be checked by the SKAO Site Management Team in conjunction with SARAO (as license-holders).

18.1 Integrated Water & Waste Management Licenses

The NRF (SARAO) has obtained water licenses for the NRF-owned land from the Department of Water & Sanitation. Contractors shall comply with the conditions stipulated in the license approval [**Annexure A1**]. Any updates that the Department of Water & Sanitation may make to the license conditions will be communicated through an Early Warning to Contractors. A Stormwater Management Plan has been compiled as part of the license application and shall be complied with by all Contractors.

A separate water license is required for the Visserskloof Contractor Camp. This has been compiled and submitted to the Department for approval. Contractors shall comply with the conditions of approval. These conditions shall be made available to Contractors once obtained.

General Authorization permit applications are underway for river crossings/listed activities in the 3 spiral arms. Contractors shall comply with the conditions of approval. These conditions shall be made available to Contractors once obtained.

The main purpose of an integrated water use licence application (WULA) is to consolidate all the various site-specific activities such as storm water management, water reuse, water conservation, waste minimization and recycling into a simple implementable management plan. The following water uses have been identified requiring authorisation in terms of Section 21 of the National Water Act (Act no. 36 of 1998):

- **Section 21(a)** (*Taking water from a water resource*) – a total of 17 applications for the abstraction of water from boreholes. A total volume of 352 009m^3/a is required for domestic and cleaning purposes.
- **Section 21(b)** (*Storing of water*) – a total of 6 applications for the storing of raw water and borehole water in various sized tanks. This stored water will be used during the construction and operational phase.

- **Section 21(c)** (*Impeding or diverting the flow of water in a watercourse*) – a total of 319 crossings were identified that occur from roads, powerlines and fibre-optic cables, these will be applied for in 20 applications.
- **Section 21(g)** (*Disposing of waste in a manner which may detrimentally impact on a water resource*) – a total of 5 applications for dams for the overflow of wash bays and treated effluent water, as well as drying of treated sewage sludge at the Visserskloof Contractor Camp.
- **Section 21(i)** (*Altering the bed, banks, course or characteristics of a watercourse*) – a total of 319 crossings were identified that occur from roads, powerlines and fibre-optic cables, these will be applied for in 20 applications.

The locality of the Section 21(a), (b), (c), (g) and (i) water uses to be licensed are provided in Figure 19.

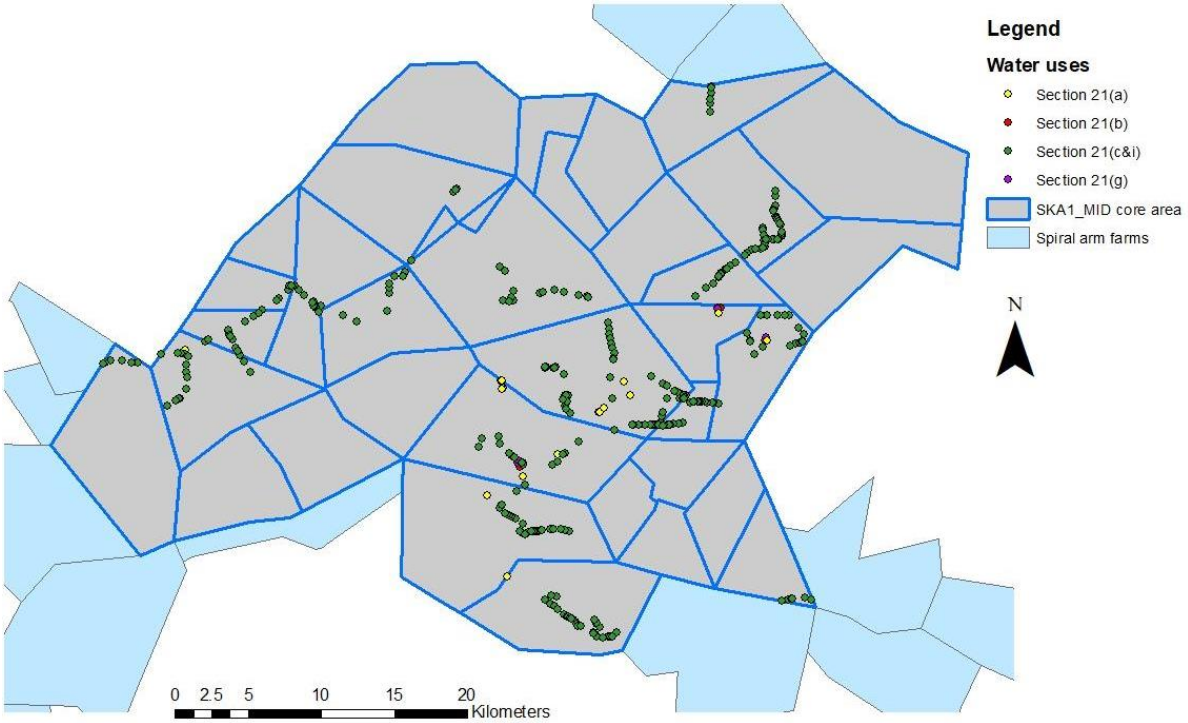

Figure 19: Location of water license applications on the NRF-owned land

These licenses will be made available to Contractors who require water for construction and/or domestic purposes; however Contractors will need to ensure that they have budgeted sufficiently to ensure compliance to the license conditions. It is envisaged that the Infrastructure Work Package 1 Contractor will be the primary user of these licenses for the purposes of the construction of the bulk civil infrastructure.

All information contained in the Integrated Water & Waste Management Plan (IWWMP) was sourced from the following:

- Specialist studies conducted for the project area which include:

- GCS – Hydrogeological Investigation Report;
- Limosella Consulting – DWS (2016) risk assessment: Overhead and underground infrastructure report;
- Dr Casparus J. Crous - Ecological Sensitivity Assessment of terrestrial and aquatic environments;
- GCS – Flood line assessment; and
- GCS – Geotechnical investigation.

- The IEMP prepared by the Council for Scientific and Industrial Research (CSIR); and
- The IWWMP for MeerKAT.

18.2 Mineral Permit Exemption for Borrowpits and Stone Quarries

14 (originally 15) borrow pits and 4 stone quarries will need to be established within and around the site to provide the required gravel and stone material required for SKA road construction and the construction of the dish foundations. It is too expensive to source this material commercially and the preference of the SKA_Mid project is to source this material locally. There is however a requirement as stipulated in the Mineral and Petroleum Resources Development Act (MPRDA) (Act No. 28 of 2002) that a mining right or permit is required for the establishment and operation of borrow pits and stone quarries depending on the extent of the operation.

The Act, however, also states that in terms of section 106(1), "the Minister may by notice in the Gazette, exempt an organ of state from the provisions of section 16, 20, 22 and 27 in respect of any activity to remove any mineral for road construction, building of dams or other purpose which may be identified in such notice". (similar to SANRAL, Department of Water Affairs, Public Works, SANParks exemption etc.). SARAO (NRF) has obtained this exemption on behalf of the SKAO from the Department of Mineral Resources and Energy. The exemption notice is included as **[Annexure B1].** Contractors sourcing material from the borrow pits and stone quarries for construction purposes are still required to compile an Environmental Management & Rehabilitation for acceptance by the SKAO.

18.3 Way leaves

SARAO shall assist the SKAO in obtaining all the wayleaves required for SKA construction. Way leaves include but are not limited to:

1) Way leave for the installation of SKA security guard huts on the provincial road to site (Application submitted by SARAO as part of MeerKAT+);
2) Way leaves for access and use of the Provincial Department of Roads & Public Works borrow pits and quarries.
3) Way leaves for the proclaimed roads to be rehabilitated.

18.4 Development Approval

The SKAO will be responsible for obtaining construction development approval from the local authorities. SARAO has submitted the development approval submission on behalf of the SKAO for SKA_Mid. Contractors shall be required to comply with any terms and conditions stipulated for the development approval. These approvals have been obtained from the Kareeberg and Karoo Hoogland Municipality. (Hantam Municipality still outstanding for the Brandvlei Spiral Arm).

19 SKAO Site Management Team and Project Management

19.1 Site Management

The roles and responsibilities on site are complicated by a range of overlapping jurisdictions and the need to acknowledge the ongoing operations of existing facilities adjacent to/overlapping with SKA construction.

The SKAO Site Management team in each country is an extension of the Telescope Delivery Teams, reporting directly to the South African and Australian Site Construction Directors respectively. The SKAO Site Manager will be on site during construction activities to support the coordination of activities and to provide necessary decision making on priorities under the dynamic situations on site. The Site Management team is composed of:

- Site Construction Director
- Site Manager
- Deputy Site Manager
- RFI/EMC Engineer [skills/capabilities provided through Mission Assurance Product Assurance staff]
- HSE Manager, HSE Officers, Environmental Officers and an Environmental Control Officer
- Administrator/Logistics

The Site Manager is tasked with realising the Project Construction schedule, coordinating the different delivering institutions to site, coordinating use of resources on site, and ensuring safe construction activities, running a daily liaison meeting at the start of each day and supporting the Site Construction Director who shall be leading the "3 month Look-ahead" meetings.

The RFI/EMC Manager performs site RFI/EMC compliance testing on the SKA-Mid construction site and performs data analysis and characterisation utilising the

SKA_Mid fixed and mobile RFI monitoring stations along with the SKA-Mid facility dishes (and potentially other host country observatory assets).

The SKAO Site Management Team shall liaise with the SARAO Site Manager for the subset of area under construction by the SKAO. The SARAO Site Manager is responsible for maintaining their compliance aspects but provides access to the SKA1 construction areas based on maintenance of the agreed upon compliance (noted in this document, the Site Information Document and the Host Agreement documents).

A Health, Safety and Environment (HSE) Manager operates in each host country to monitor the safe execution of all construction work.

They ensure that all HSE considerations are included in the Integrating Organisation construction phase HSE plan and monitor and support their implementation during construction. This role is supported by site-based Safety and Environmental Officers who support the site reviews.

These Health, Safety and Environmental positions are line managed by the Head of HSE but will report or consult, as appropriate, with the NEC4 Project Managers (and Site Manager). Specific HSE duty holder responsibilities are articulated in the SKAO HSE Plan (SKA-TEL-SKO-0000740).

19.2 Management of Contracts

The management of contracts is built upon the management model of the SKAO as the 'Client' interacting directly with the Contractor in the delivery to the observatory. These descriptions and diagrams come directly from the NEC4 "Establishing a Procurement and Contract Strategy" document. In particular, there are many Tier 1 contracts while the Computing & Software areas will require a set of contracts with each participating institution.

The basic model is:

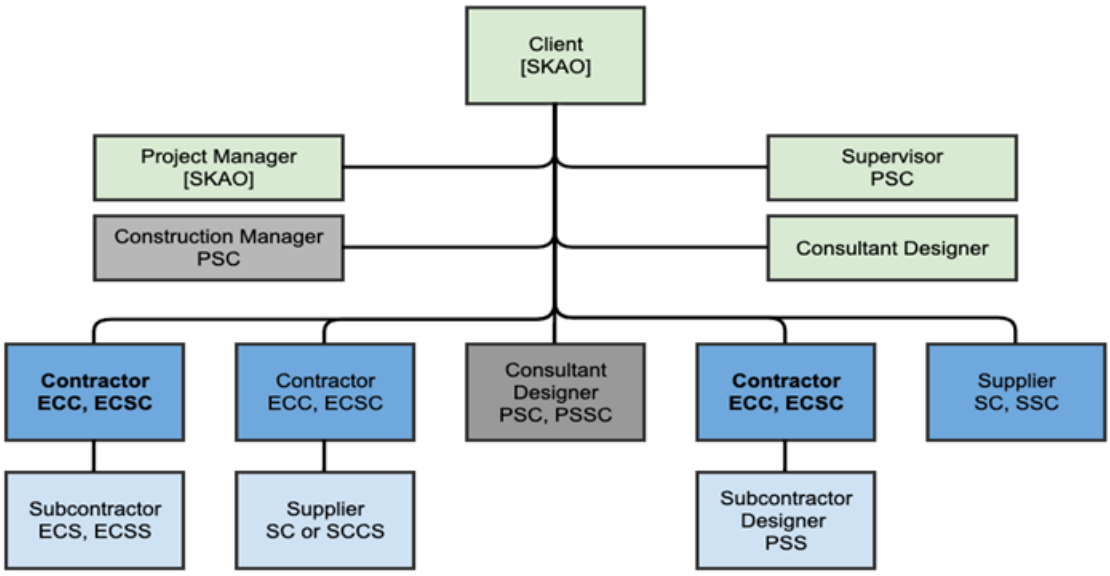

Figure 20: Basic Tier 1 contract management model for SKA1

Where the "Client" is the SKAO (SKAO roles are coloured Green), represented by the Product Delivery Team Project Manager and Domain Specialist who directly fulfil the NEC Project Manager and Supervisory roles. However, the breadth of Supervisory discipline support is fully represented by the Engineering Domain Specialists, Systems Engineers and Assurance Product Assurance staff within SKAO. The Grey boxes are those areas not anticipated to be needed in general while the Blue boxes are the Tier 1 contactors (Dark Blue) under different circumstances (e.g., working with sets of subcontractors, suppliers, etc).

In this general model, the Tier 1 deliveries are made to SKAO and are then integrated through the execution of the AIV, Commissioning and Science Verification activities which are themselves an integrated team of SKAO staff and Professional Services Contracted staff from the member countries.

In the area of infrastructure, the complex interplay of jurisdictions and compliance requires significant additional effort to achieve. The model for this is shown in the next Figure. In this model, as above, the "Client" is the SKAO represented by the Product Delivery Team, however the individual infrastructure contracts will require a different set of Supervisory disciplines not resident within SKAO (in sufficient capacity) and so an NEC4 PSC will provide that support alongside an NEC4 PSC for Project Management for each separate contract. The Product Delivery Team will manage these PSCs (PSC Project Manager) toward the realisation of the full infrastructure work scope.

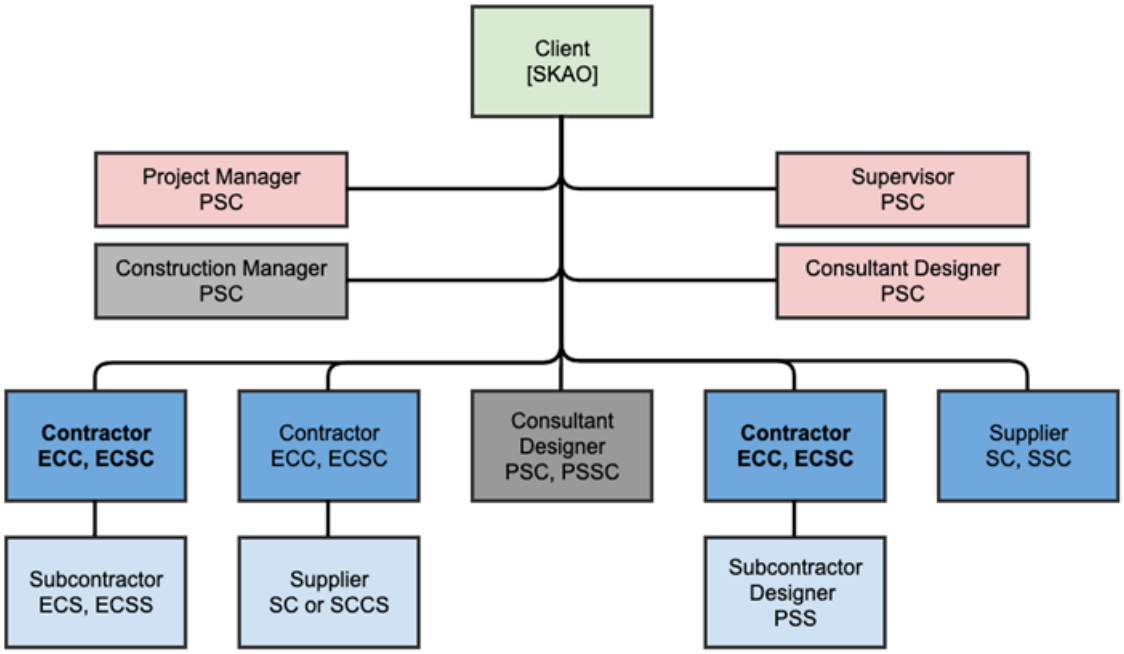

Figure 21: SKA1 NEC4 Construction Management Relationship. Green roles are fulfilled by SKAO staff. Red roles are fulfilled through PSCs and for infrastructure are expected to be CSIRO/SARAO institution & industry staff. Grey areas are those not relevant to the SKA1 construction having been completed in the Pre-construction design phase. Blue areas are potential contracts with those bolded being the most common

Overall, the SKAO manages the SKA_Mid construction through a mix of SKAO staff (e.g., SKAO Site Construction Director, SKAO Site Manager) supported by professional service providers contributing essential additional skills and effort. SKAO remains the Employer and pays invoices based on their advice. (see SKA-TEL-SKO-0000740 SKAO Health, Safety and Environmental Plan for specific HSE duties and responsibilities).

20 South African Stakeholders & Communication

The SARAO Stakeholder Manager maintains a complaint's register during all phases of the SKA project which include all complaints received from adjacent landowners, local stakeholders and local/district/provincial authorities. The register will contain a detailed description of each complaint with supporting documentation and a written response to each complaint with a description of any corrective action implemented by the SKAO, its Contractors and/or SARAO as a result of the complaint. Stakeholder Engagement will be undertaken in compliance with Chapter 4 & 5 of the IEMP [**Annexure M**].

SARAO and the SKAO Communications and Outreach teams will be jointly responsible for all Public Relations / Media related to the SKA in South Africa. Any media statements are interviews will only be undertaken by the identified representatives from both organisations. All visits to the site will be jointly agreed by the SARAO Managing Director and SKA Director General.

South African Key Stakeholders are indicated in Table 8.

Table 7: South African Key Stakeholders

Tier	Stakeholder	Key Aspects/Interests
South African National Government Departments	Department of Water & Sanitation	Water & waste management licenses, compliance
	Department of Environmental Affairs, Fisheries & Forestry	Integrated Environmental Management Plan
	Department of Higher Education, Science & Innovation	South African SKA funding
	Department of Agriculture & Land Reform	Land issues
	Department of Mineral Resources & Energy	Mineral permit exemptions for stone quarries & borrow pits. Closure inspections Coordination & regulation of Independent Power Producers
	Department of International Relations & Cooperation	Coordination of international visits to Site & meetings
	Department of Communication	Spectrum Management & regulation
	Department of Labour	Compliance to Labour, health & safety regulations
	South African Police Service	Safety & Security

	Department of Trade & Industry	Customs & Excise
	Department of Home Affairs	Visas, Privileges & Immunities
	Presidential Infrastructure Coordinating Commission	Council reporting to the President of South Africa on SIP 16 (MeerKAT & SKA)
	Department of Public Works	State owned land

Tier	Stakeholder	Key Aspects/Interests
State Owned Entities	Eskom	Grid Power State Owned Entity
	ICASA	Spectrum licenses
	NERSA	National Energy Regulator – power distribution licenses
	PortNET	South African Ports Authority
	SANParks	Land Management Authority on behalf of NRF – manages National Park
	SAHRA	South African Heritage Authority – heritage permits
Provincial Government / Authorities	Premier's Office	Coordination within the Northern Cape Province
	Department of Economic Development	SKA lead Department for Province
	Department of Environment, Nature & Conservation	Heritage approvals
	Department of Agriculture	NRF Agreement to utilise Klerefontein Support Base
	Department of Roads & Public Works	Provincial Road maintenance Way leaves for upgrade to existing public roads Way leaves for installation of security guard huts on provincial / public roads
Local Authorities	Kareeberg Municipality	Development Approval, manages Carnarvon Municipal Dump site, Land owner of Carnarvon POP station, Spatial Development Frameworks, Integrated Development Plans
	Karoo Hoogland Municipality	Development Approval, Spatial Development Frameworks, Integrated Development Plans
	Ubuntu Municipality	Development Approval, Spatial Development Frameworks, Integrated Development Plans
	SAPS	Safety & Security
	Pixley Ka Seme District Municipality	District Municipality responsible for Kareeberg, Karoo Hoogland & Ubuntu Municipalities
Local Communities	Local labour, EME's or QSE's from surrounding towns within a radius of 150km from the project site.	Achieving local participation goals as per respective Contract Data

21 LANGUAGE

The language of each contract is defined in each contract but it is noted that the predominant language in the Karoo is Afrikaans.

22 TOWN FACILITIES

22.1 Hospitality

The following hospitality facilities are located in the local towns (Carnarvon, Williston, VanWyksvlei and Brandvlei) close to the site:

i. Bed & Breakfasts
ii. Restaurants

22.2 Medical Facilities

The following medical facilities are available in Carnarvon:

i. Medical Clinic
ii. Hospital
iii. Private local doctor

22.3 Convenience Stores / General Supplies

The following convenience stores/general supplies are located in the surrounding towns:

i. Grocery stores
ii. Butcheries
iii. Clothing stores
iv. Banks & ATMs
v. Fuel filling stations
vi. Cooperatives for local supplies and building material

ANNEXURES

Annexure A General Access to the Site from Urban Areas

Annexure B SARAO Visitors Policy

Annexure C SARAO Karoo On-site Rules & Procedures

Annexure D SARAO Health & Safety Policy

Annexure E SARAO Transport Policy

Annexure F SARAO Procedure for Alcohol and Substance Abuse

Annexure G SARAO Emergency Response and Disaster Management Plan

Annexure H SARAO Radio Frequency Interference Karoo Site Procedures

Annexure I SARAO Radio Frequency Interference Zones

Annexure J Standard which prescribes the application of radio astronomy protection levels for the determination of impact from radio frequency interference (RFI) on radio astronomy observations

Annexure K SARAO Health & Safety Plan

Annexure L Environmental Conditions for the SKA1_MID Site South Africa document

Annexure M Integrated Environmental Management Plan for SKA1_MID

Annexure N SKA Health & Safety Specification

Annexure O Conservation Management Plan

Annexure P Visserskloof Contractor Camp Services Layout

Annexure Q Procedures for Landing on Site

Annexure R Access Instructions to the SKA1 Spiral Arms

Annexure S SKA Organisation Health, Safety & Environmental Management Plan

Annexure T SKAO EMC/EMI Management Plan

Annexure U Template for RFI Permits and CoCs

Annexure V Ecology, Aquatic and Bat Assessment Report and specialist reports

Annexure W SARAO Visitors Access Procedures

Annexure X SARAO RFI Policy

Annexure Y SARAO RFI Controls Policy

Annexure Z Long-term lightning data

Annexure A1 Water Licenses for NRF-owned land

Annexure B1 Mineral permit exemption for borrowpits and stone quarries

Annexure C1COVID-19 Screening Requirement

Annexure D1 SKA RFI/EMC Standard

Annexure E1 SKA EMC Control Plan for Procurement and Manufacturing Process

Annexure F1 Benefits Register Template

Annexure G1Template for Contractor sign boards