Agricultural Research Council

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ARC CANNABIS & SEED MULTIPLICATION FACILITY DESIGN

SPECIFICATIONS DESIGN REPORT

FINAL REPORT REVISION 00

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EXECUTIVE SUMMARY

The Agricultural Research Council – Vegetable Industrial Crops and Medicinal Plants (ARC – VIMP) has developed a design-build specification for the design and construction of a cannabis and seed multiplication facility with auxiliary infrastructure. The envisioned facility will include a facility designed to provide a controlled environment for optimal plant growth, along with supporting infrastructure such as office space, ablution facilities, storerooms, and a drying room. The specification aims to establish the foundational requirements for the design and construction of a facility that meets operational, regulatory, and environmental standards.

The purpose of this specification report is to provide the functional requirements of the new cannabis and seed multiplication facility.

This report further details the functional specifications of the cannabis and seed multiplication facility and concept drawings of the entire facility.

The above-mentioned functional specifications are listed in the sections below:

- Section 2 – Facility Overview
- Section 3 – Architectural
- Section 4 – Mechanical
- Section 5 – Electrical
- Section 6 – Civil
- Section 7 – Environmental.

Section 2 summarises the facility overview with an accommodation schedule, including intended uses per room and the number of plants that can be expected to be housed in each of the cultivations/processing rooms.

Sections 3, 4, 5, 6 and 8 present specifications for the facility and supporting infrastructure, offering functional specifications for both the reader and the contractor. Section 7 provides the environmental items to consider as part of the development phase for a potential exemption of a basic assessment.

The following list of items should be considered/provided for all construction, designs and installations.

- Maintenance access to electrical and mechanical components where enclosed or installed in ceiling voids.
- General maintainability.
- All equipment and installations to be handed over with operating manuals where applicable.
- All installations to be accompanied by their associated guarantees and warranties and to be handed over to the client during close-out.
- Close-out also to include final copies of as-built plans and submitted approved building plans in soft copy, hard copy and electronic DWG.

- Where applicable standards override the needs of specifications, the regulations will take president.
- Similar finishes/installations can be proposed as long as the functionality takes president. This is encouraged where cost savings on maintenance or capital expenditure can be achieved.
- All legislative compliance certificates to be issued and provided to the client upon close-out.

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GLOSSARY OF TERMS AND ABBREVIATIONS

AHU	Air Handling Unit
ARC	Agricultural Research Council
ARC-VIMP	Agricultural Research Council – Vegetable Industrial Crops and Medicinal Plants
BMS	Building Management System
CO_2	Carbon Dioxide
DB	Distribution Board
DX	Direct Expansion
HVAC	Heating, Ventilation & Air Conditioning
ICT	Information and Communication Technologies
LDV	Light Delivery Vehicle
LED	Light Emitting Diode
MSL	Mean Sea Level
PVC	Polyvinyl Chloride

uPVC	Unplasticized Polyvinyl Chloride
UV	Ultraviolet

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1 INTRODUCTION

1.1 BACKGROUND

The Agricultural Research Council – Vegetable Industrial Crops and Medicinal Plants (ARC – VIMP) has developed a design-build specification for the design and construction of a cannabis and seed multiplication facility with auxiliary infrastructure. The envisioned facility will include a facility designed to provide a controlled environment for optimal plant growth, along with supporting infrastructure such as office space, ablution facilities, storerooms, and a drying room. The specification aims to establish the foundational requirements for the design and construction of a facility that meets operational, regulatory, and environmental standards.

1.2 PROJECT OBJECTIVES

The project objectives can be summarised in the bullet points below:

- Controlled Cannabis Cultivation: The cannabis facility aims to provide an optimally controlled environment replicating natural outdoor conditions. The facility will need to regulate temperature, humidity, and lighting to enhance plant health and maximize yield and offer protection against adverse weather, pests, and external threats to ensure consistent hemp production.
- Seed Multiplication Facility: The seed multiplication aspect of the facility will focus on ensuring a high-quality, consistent, and contaminant-free seed production. The facility should support the controlled cultivation of plants for seed production.
- Auxiliary Infrastructure: The facility must include adequate support structures, such as office space, ablution facilities, storerooms, and drying rooms. This infrastructure should meet operational needs to ensure efficient production and research.

1.3 PROJECT LOCATION

The project is situated at the Vegetable Industrial and Medicinal Plants Institute of the Agricultural Research Council (ARC-VIMP) located on the R573 KwaMhlanga/Moloto Road near Roodeplaat in Pretoria, South Africa.

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Figure 1-1: ARC-VIMP Location

Figure 1-2: Specific Site Location

1.4 PURPOSE OF REPORT

The purpose of this specification report is to provide the functional requirements of the new cannabis and seed multiplication facility in order for a design-build specification to be developed and implemented.

1.5 STRUCTURE OF REPORT

The report comprises the following sections:

- Section 2: Facility Overview

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- Section 3: Architectural
- Section 4: Mechanical
- Section 5: Electrical
- Section 6: Civil
- Section 7: Environmental
- Section 8: Furniture and Fixtures
- Section 9: Optional Extras
- Section 10: Closing Considerations
- Appendices.

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2 FACILITY OVERVIEW

To provide an overview of the required facility to be designed and constructed, the conceptual floor layout below is presented for the cannabis facility. The fully exported drawing can be found in Appendix A: Conceptual Floor Layout.

Figure 2-1: Cannabis Facility Conceptual Floor Layout

Tabled below is a summary of the facility's room schedule to provide an overview description of the areas required to be designed and constructed as part of the cannabis facility.

Table 2-1: Accommodation Schedule

ROOM	AREA (m^2)	DESCRIPTION
Male Bathroom	9 m^2	Ablution area designated for male gender inclusive of a urinal, wash basin and wash closet.
Female Bathroom	12 m^2	Ablution area designated for female gender inclusive of a wash basin and two wash closets.
PWD Bathroom	3 m^2	Ablution area designated for people with disability inclusive of a wash basin and a wash closet.
Office 1	10 m^2	Office space designated for a single occupant
Office 2	10 m^2	Office space designated for a single occupant
Lab	18 m^2	Area designated for testing, sampling and research equipment, including work benches and a wash basin with hot and cold water.
Fertiliser Store	32 m^2	Storage room to accommodate fertiliser stored on pallets with a motorised access door from the outside to accommodate forklift movements during deliveries.
Growth Medium Store	45 m^2	Storage room to accommodate growth medium stored on pallets with a motorised access door from the outside to accommodate forklift movements during deliveries.
Pot Store	45 m^2	Storage room with shelving to accommodate both types of pots as well as seedling/cloning trays to accommodate about 30% spares of total pots in use.
Seed Storage Room 1	32 m^2	Storage room for bags of seed optimised to store 5 to 10 litres (honey jars) & 10 , 15 and 20 kg bags of seed with manual handling shelving configuration.

Seed Storage Room 2	43 m^2	Storage room for bags of seed optimised to store 50kg bags and manual handling shelving configuration.
Mother Room	138 m^2	Production room for housing 220 plants in a permanent vegetative state arranged in 50cm pots on the floor.
Cutting/ Clones Room	118 m^2	Production room for 30 000 cuttings/clones arranged in trays on tables.
Seedling Room	118 m^2	Production room for 15 600 seedlings arranged in trays on tables.

ROOM	AREA (m^2)	DESCRIPTION
Vegetative Room	185 m^2	Production room for housing 204 plants in the vegetative state arranged in 50cm pots on the floor.
Flowering Room 1	111 m^2	Production room for housing 120 plants in the flowering state arranged in 30cm pots on tables.
Flowering Room 2	111 m^2	Production room for housing 120 plants in the flowering state arranged in 30cm pots on tables.
Tent Room	136 m^2	Research room arranged with 128 plants in 32 tents arranged in 50cm pots with four (4x) plants per tent configuration.
Drying Room	95 m^2	Production room installed with drying lines capable of accommodating 4 plants per position and a total of 576.
Work Room	76 m^2	Work room designated with benches and two wash bays to decontaminate used pots or mixing growth medium during prep stages.
Seed Multiplication Room 1	201 m^2	Large-scale seed production room to house 50cm pots arranged on the floor to accommodate 340 plants.
Seed Multiplication Room 2A	79 m^2	Large-scale seed production room to house 50cm pots arranged on the floor to accommodate 136 plants.
Seed Multiplication Room 2B	80 m^2	Large-scale seed production room to house 50cm pots arranged on the floor to accommodate 136 plants.

Seed Multiplication Room 3	201 m^2	Large-scale seed production room to house 50cm pots arranged on the floor to accommodate 340 plants.
Climate Control Room 1	112 m^2	Research room to study the effects of varying environmental conditions for different stages of growth arranged to house 30cm pots arranged on tables to accommodate 194 plants.
Climate Control Room 2	112 m^2	Research room to study the effects of varying environmental conditions for different stages of growth arranged to house 30cm pots arranged on tables to accommodate 194 plants.
ROOM	**AREA (m^2)**	**DESCRIPTION**
Climate Control Room 3	112 m^2	Research room to study the effects of varying environmental conditions for different stages of growth arranged to house 30cm pots arranged on tables to accommodate 194 plants.
Climate Control Room 4	112 m^2	Research room to study the effects of varying environmental conditions for different stages of growth arranged to house 30cm pots arranged on tables to accommodate 194 plants.
Total	2 356 m^2	Cannabis facility with external parking area, loading zone, fertigation storage tanks around the facility, as well as HVAC plant rooms where individual climate controlling units are required for different growth stages separated into rooms. The facility needs an adequate waste storage area, water supply, stormwater and sewer management based on internal operations.

3 ARCHITECTURAL

The following architectural areas are discussed:

- Floor
- Doors
- Walls
- Ceiling
- Roof
- Windows

3.1 FLOOR

3.1.1 FLOOR STRUCTURE

The base structure of all floors is to be concrete, with a slight slope to allow for effective drainage.

3.1.2 FLOOR FINISH

The flooring throughout the facility must be constructed using a non-slip material that is non-porous and can withstand regular cleaning, such as epoxy flooring or similar. The floor should be designed and constructed with a slight slope towards floor drains (see section 4.2.2).

The flooring must be durable and resistant to chemicals commonly used in cleaning and sterilisation processes. It should withstand regular washing, minor impacts, and general wear and tear to maintain functionality and appearance over time.

3.1.3 REQUIREMENTS SUMMARY

The table below summarises the floor finish and structure for each room.

Table 3-1: Floor Requirements Summary

ROOM	STRUCTURE	FINISH
Male Bathroom	Concrete Flooring	Floor should be non-slippery with a slight slope.
Female Bathroom	Concrete Flooring	Floor should be non-slippery with a slight slope.
PWD Bathroom	Concrete Flooring	Floor should be non-slippery with a slight slope.
Passage	Concrete Flooring	Floor should be non-slippery with a slight slope.

Office 1	Concrete Flooring	Floor should be non-slippery with a slight slope.

ROOM	STRUCTURE	FINISH
Office 2	Concrete Flooring	Floor should be non-slippery with a slight slope.
Lab	Concrete Flooring	Floor should be non-slippery with a slight slope.
Work Room	Concrete Flooring	Floor should be non-slippery with a slight slope.
Seed Storage Room 1	Concrete Flooring	Floor should be non-slippery with a slight slope.
Seed Storage Room 2	Concrete Flooring	Floor should be non-slippery with a slight slope.
Fertiliser Store	Concrete Flooring	Floor should be non-slippery with a slight slope.
Growth Medium Store	Concrete Flooring	Floor should be non-slippery with a slight slope.
Pot Store	Concrete Flooring	Floor should be non-slippery with a slight slope.
Mother Room	Concrete Flooring	Floor should be non-slippery with a slight slope.
Cutting/ Clones Room	Concrete Flooring	Floor should be non-slippery with a slight slope.
Seedling Room	Concrete Flooring	Floor should be non-slippery with a slight slope.
Vegetative Room	Concrete Flooring	Floor should be non-slippery with a slight slope.
Flowering Room 1	Concrete Flooring	Floor should be non-slippery with a slight slope.
Flowering Room 2	Concrete Flooring	Floor should be non-slippery with a slight slope.

Tent Room	Concrete Flooring	Floor should be non-slippery with a slight slope.
Drying Room	Concrete Flooring	Floor should be non-slippery with a slight slope.
Seed Multiplication Room 1	Concrete Flooring	Floor should be non-slippery with a slight slope.
Seed Multiplication Room 2A	Concrete Flooring	Floor should be non-slippery with a slight slope.
ROOM	**STRUCTURE**	**FINISH**
Seed Multiplication Room 2B	Concrete Flooring	Floor should be non-slippery with a slight slope.
Seed Multiplication Room 3	Concrete Flooring	Floor should be non-slippery with a slight slope.
Climate Control Room 1	Concrete Flooring	Floor should be non-slippery with a slight slope.
Climate Control Room 2	Concrete Flooring	Floor should be non-slippery with a slight slope.
Climate Control Room 3	Concrete Flooring	Floor should be non-slippery with a slight slope.
Climate Control Room 4	Concrete Flooring	Floor should be non-slippery with a slight slope.

3.2 DOORS

3.2.1 INTERNAL DOORS

All internal doors to processing, cultivation and growth medium and fertiliser storage rooms will be sliding doors with standardised double-width dimensions with aluminium, insulating leaf panels such as IsoBoard or similar cold room insulating panel functionality. These doors will be fitted with an access-controlled locking mechanism and automatic closing. See section 3.2.4: Access Control.

The offices and lab must be equipped with single-swing aluminium doors, while the workroom, seed storage and pot storage should be equipped with double-leaf doors of standard dimensions. The seed and pot storage should also be access controlled as per section 3.2.4: Access Control.

The ablution doors, including the cubicle doors, should be enamel-cladded single swing doors or similar fit for purpose with standard dimensions.

Door finishes should match the proposed internal look and feel.

3.2.2 External Doors

All external doors are to be double door standard dimensions, equipped with quick release mechanisms and labelled as fire escapes to comply with emergency regulations. The external doors should be single swing with external egress to account for fire safety requirements of the facility.

- Main entrance (Eastern Door) – To be constructed to be main door for pedestrian access and fire escape.
- Storage door (Northern Door) – To be used as a fire escape only
- Western Door – Fire escape only.

3.2.3 Loading Bay Doors

Loading bay doors should be constructed for both fertiliser and growth medium storerooms.

- Motorised steel roller shutter doors, fit for purpose, corrosion resistant, low maintenance and minimum 2.4m wide and 3m high to accommodate pallet delivery by common forklift, internally mounted for security including a ramp to accommodate a forklift.
- Locking mechanism for coded access from the exterior.
- Look and feel to match the external and internal properties of the facility.

3.2.4 Access Control

All internal doors will be equipped with RFID readers for access control, except for the ablution and office doors. The access system must be compatible with the existing ARC (SoftCon) system.

External fire doors will be equipped with a push bar quick release, the main entrance door with an RFID access mechanism on the outside and an internal emergency fire release mechanism. The loading bay roller shutter doors will be equipped with a pin pad access mechanism or similar for external access. Internal access to be quick release, e.g. push pad or similar situated inside the storage room.

3.2.5 REQUIREMENTS SUMMARY

A summary of the above has been tabled to provide an overview of the requirements for each room's doors.

Table 3-2: Doors and Access Control Requirements Summary

ROOM	DESCRIPTION	ACCESS CONTROL
Male Bathroom	Both the entrance and cubicle doors will be enamel-cladded single swing doors with standard dimensions.	N/A
Female Bathroom	Both the entrance and cubicle doors will be enamel-cladded single swing doors with standard dimensions.	N/A
PWD Bathroom	Entrance door will be enamel-cladded single swing doors with standard dimensions.	N/A
Passage	External fire doors will be equipped with a push bar quick release, and the main entrance door with an RFID unlockable mechanism on the outside and an internal emergency fire release mechanism	Push Bar Quick Release System for exiting the facility while entering the facility will be done with the use of an RFID system.
Office 1	Standard dimension single swing doors, aluminium framed.	N/A
Office 2	Standard dimension single swing doors, aluminium framed.	N/A
Lab	Standard dimension single swing doors, aluminium framed.	RFID System
Work Room	Doors will be standard dimension aluminium framed double leaf swing doors.	RFID System
Seed Storage Room 1	Doors will be standard dimension aluminium framed double leaf swing doors.	RFID System
Seed Storage Room 2	Doors will be standard dimension aluminium framed double leaf swing doors.	RFID System

Fertiliser Store	Internal doors will be sliding. External doors will be roller shutter doors for delivery of fertiliser with dimensions of 2.4m (W) x 3m (H) to accommodate a forklift.	Internal Doors - RFID System. External Doors - Pin Pad Access System.
Growth Medium Store	Internal doors will be sliding. External doors will be roller shutter doors for delivery of growth medium with dimensions of 2.4m (W) x 3m (H) to accommodate a forklift.	Internal Doors - RFID System. External Doors - Pin Pad Access System.
Pot Store	Doors will be standard dimension aluminium framed double leaf swing doors.	RFID System
Mother Room	Standard dimension, double width, insulating panel sliding door.	RFID System
Cutting/ Clones Room	Standard dimension, double width, insulating panel sliding door.	RFID System
Seedling Room	Standard dimension, double width, insulating panel sliding door.	RFID System
Vegetative Room	Standard dimension, double width, insulating panel sliding door.	RFID System
Flowering Room 1	Standard dimension, double width, insulating panel sliding door.	RFID System
Flowering Room 2	Standard dimension, double width, insulating panel sliding door.	RFID System
ROOM	**DESCRIPTION**	**ACCESS CONTROL**
Tent Room	Standard dimension, double width, insulating panel sliding door.	RFID System
Drying Room	Standard dimension, double width, insulating panel sliding door.	RFID System
Seed Multiplication Room 1	Standard dimension, double width, insulating panel sliding door.	RFID System

Seed Multiplication Room 2A	Standard dimension, double width, insulating panel sliding door.	RFID System
Seed Multiplication Room 2B	Standard dimension, double width, insulating panel sliding door.	RFID System
Seed Multiplication Room 3	Standard dimension, double width, insulating panel sliding door.	RFID System
Climate Control Room 1	Standard dimension, double width, insulating panel sliding door.	RFID System
Climate Control Room 2	Standard dimension, double width, insulating panel sliding door.	RFID System
Climate Control Room 3	Standard dimension, double width, insulating panel sliding door.	RFID System
Climate Control Room 4	Standard dimension, double width, insulating panel sliding door.	RFID System

3.3 WALLS

3.3.1 INTERIOR WALLS

All interior walls should be non-porous, both moisture and microbial-resistant. These walls should be constructed with the use of IsoBoard or similar cold room insulating panel functionality for cultivation/processing rooms and fit for use where applicable. The exception is that cubicle partitioning should match the cubicle door construction where applicable.

- Excellent thermal insulation, ideal for maintaining controlled environments in cultivation and processing areas.
- Thermal conductivity, ideal to sustain climate conditions and consider external influencing factors.
- Walls should be rigid and able to withstand external forces

3.3.2 EXTERIOR WALLS

All exterior walls should be durable and weather-resistant, while providing insulation and structural stability for the facility.

- Masonry wall with double face brick skin on exterior up to eaves height of minimum 3 metres to accommodate ceiling functionality.

- The internal skin cladding should match the internal partitioning walls to secure thermal insulating properties.

3.4 CEILING

The height of the ceiling for the bathrooms and offices should be at an industry standard of 2.4 – 2.5m, while the height of the ceilings should be 3m for all storage, cultivation and processing rooms.

The ceiling is to match the construction of the internal partitioning walls to secure the thermal conductivity of the specific room's climate requirements. The ceiling material is to be moisture resistant.

3.4.1 REQUIREMENTS SUMMARY

A summary of the above has been tabled to provide an overview of the requirements for each room's ceiling. **Table 3-3: Ceiling Requirements Summary**

ROOM	DESCRIPTION	HEIGHT (FLOOR TO CEILING) (m)
Male Bathroom	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	2.4 - 2.5
Female Bathroom	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	2.4 - 2.5
PWD Bathroom	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	2.4 - 2.5
Passage	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Office 1	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	2.4 - 2.5
Office 2	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	2.4 - 2.5

ROOM	DESCRIPTION	HEIGHT (FLOOR TO CEILING) (m)

Lab	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Work Room	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Seed Storage Room 1	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Seed Storage Room 2	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Fertiliser Store	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Growth Medium Store	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Pot Store	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Mother Room	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Cutting/ Clones Room	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Seedling Room	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Vegetative Room	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Flowering Room 1	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Flowering Room 2	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3

Tent Room	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
ROOM	**DESCRIPTION**	**HEIGHT (FLOOR TO CEILING) (m)**
Drying Room	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Seed Multiplication Room 1	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Seed Multiplication Room 2A	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Seed Multiplication Room 2B	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Seed Multiplication Room 3	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Climate Control Room 1	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Climate Control Room 2	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Climate Control Room 3	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3
Climate Control Room 4	Ceiling is to match the construction of the internal partitioning walls. The material is to be moisture resistant.	3

3.5 ROOF

3.5.1 ROOF COVER

The roof covering is to be low-maintenance and energy efficient.

- High-quality steel sheeting with corrosion-resistant coating.
- Concealed fixing installation.

- To match with the ARC campus's aesthetic.

3.5.2 ROOF STRUCTURE

The roof structure is to be constructed with a steel portal frame or prefabricated steel trusses compatible with steel sheeting covering. Selection should be based on structural requirements to support roof sheeting and HVAC requirements.

3.6 WINDOWS

It is required for there to be windows in the bathrooms, laboratory and offices that have a corrosion-resistant aluminium frame, or similar that is suitable for high erosion environments. These windows should be non-opening with non-corrosive burglar bars situated on the inside. Windows to match the look and feel of the internal doors and finishes.

3.6.1 REQUIREMENTS SUMMARY

A summary of the above has been tabled to provide an overview of the requirements for each room's windows. **Table 3-4: Windows Requirements Summary**

ROOM	FRAME	OPENABLE/UNOPENABLE
Male Bathroom	Aluminium	Unopenable
Female Bathroom	Aluminium	Unopenable
PWD Bathroom	Aluminium	Unopenable
Passage	N/A	N/A
Office 1	Aluminium	Unopenable
Office 2	Aluminium	Unopenable
Lab	N/A	N/A
Work Room	N/A	N/A
Seed Storage Room 1	N/A	N/A
Seed Storage Room 2	N/A	N/A
Fertiliser Store	N/A	N/A
Growth Medium Store	N/A	N/A
Pot Store	N/A	N/A
Mother Room	N/A	N/A

Cutting/ Clones Room	N/A	N/A
Seedling Room	N/A	N/A
Vegetative Room	N/A	N/A
Flowering Room 1	N/A	N/A
Flowering Room 2	N/A	N/A
Tent Room	N/A	N/A
Drying Room	N/A	N/A
Seed Multiplication Room 1	N/A	N/A
ROOM	**FRAME**	**OPENABLE/UNOPENABLE**
Seed Multiplication Room 2A	N/A	N/A
Seed Multiplication Room 2B	N/A	N/A
Seed Multiplication Room 3	N/A	N/A
Climate Control Room 1	N/A	N/A
Climate Control Room 2	N/A	N/A
Climate Control Room 3	N/A	N/A
Climate Control Room 4	N/A	N/A

4 MECHANICAL

The following mechanical sections are discussed:

- Climate Control
- Wet Services
- Fire Protection and Detection.

4.1 CLIMATE CONTROL

The climate control will be specified in the following sections:

- HVAC and Humidity Requirements
- CO_2 Enriching Equipment
- Internal Circulation
- Monitoring System
- Requirements Summary

4.1.1 HVAC AND HUMIDITY REQUIREMENTS

- HVAC systems will be required to ensure the adequate temperature and humidity of the specific rooms.
- Each system must be able to control the heating and cooling independently; they should be able to achieve between 15 and 35°C, suitable for the specific location, independent of external climate conditions and factors and adjacent rooms.
- Sufficient ventilation to be installed for the general work and circulation areas where fresh air is required.
- Please refer to Section 2 for room sizing or Appendix A: Conceptual Floor Layout for design purposes.

Each climate room that requires temperature and humidity control should be installed with a dedicated air handling unit (AHU) that will provide the following functionality:

- Air must move through the room, with limited disturbance to plants and limited hot spots.
- Most suitable humidification system depending on the required humidity levels.

The contractor is encouraged to optimise the design for cost and performance within the provided parameters.

The table below provides the individual HVAC needs to be installed for each room based on plant growth stage requirements.

Table 4-1: HVAC and Humidity Summary Requirements

ROOM	HVAC NEEDS	TEMPERATURE RANGE (°C)	HUMIDITY RANGE (%)	ACH (AIR CHANGES PER HOUR)
Male Bathroom	Appropriate Ventilation	21 – 26	N/A	10
Female Bathroom	Appropriate Ventilation	21 – 26	N/A	10
PWD Bathroom	Appropriate Ventilation	21 – 26	N/A	10
Passage	Appropriate Ventilation	21 – 26	N/A	1
Office 1	Appropriate Ventilation with Air Conditioning	21 – 26	N/A	2
Office 2	Appropriate Ventilation with Air Conditioning	21 – 26	N/A	2
Lab	Appropriate Ventilation with Air Conditioning	20 – 25	N/A	6
Work Room	Appropriate Ventilation with Air Conditioning	20 – 22	N/A	1
Seed Storage Room 1	Appropriate Ventilation	21 – 26	20	1
Seed Storage Room 2	Appropriate Ventilation	4-10	20	1
Fertiliser Store	Appropriate Ventilation	21 – 26	N/A	10
Growth Medium Store	Appropriate Ventilation	21 – 26	N/A	1
Pot Store	Appropriate Ventilation	21 – 26	N/A	1
Mother Room	Designated AHU Air filtration required is	25 – 30	40 – 60	1

Cutting/ Clones Room	Designated AHU	25 – 30	80 – 95	1
Seedling Room	Designated AHU	25 – 30	60 – 70	1
Vegetative Room	Designated AHU	25 -30	50 – 70	1
Flowering Room 1	Designated AHU	25 – 30	40 – 50	1
ROOM	**HVAC NEEDS**	**TEMPERATURE RANGE (°C)**	**HUMIDITY RANGE (%)**	**ACH (AIR CHANGES PER HOUR)**
Flowering Room 2	Designated AHU	25 – 30	40 – 50	1
Tent Room	Designated AHU	25 – 30	40 – 50	1
Drying Room	Designated AHU	15 - 40	20 – 50	1
Seed Multiplication Room 1	Designated AHU	21 – 30	55 – 65	1
Seed Multiplication Room 2A	Designated AHU	21 – 30	55 – 65	1
Seed Multiplication Room 2B	Designated AHU	21 – 30	55 – 65	1
Seed Multiplication Room 3	Designated AHU	21 – 30	55 – 65	1
Climate Control Room 1	Designated AHU	15 – 40	20 – 95	1
Climate Control Room 2	Designated AHU	15 – 40	20 – 95	1
Climate Control Room 3	Designated AHU	15 – 40	20 – 95	1
Climate Control Room 4	Designated AHU	15 – 40	20 – 95	1

4.1.1.1 HVAC Plant Room Requirements

The externally constructed plant rooms to house external components require the following functionality:

- Enclosed with clear view type fencing
- Based on extended concrete apron
- Covered canopy similar to roof covering.

4.1.2 CO_2 ENRICHING EQUIPMENT

The carbon dioxide enrichment levels required for the different rooms in the facility are provided in parts per million (ppm). These levels are to be acquired with the use of a CO_2 system to evenly distribute CO_2 throughout each required room. The system needs to accurately regulate the desired flow rates from an input of CO_2 canisters or similar.

Please refer to the following table for system parameters for which the CO_2 enrichment system must be able to accomplish.

Table 4-2: CO_2 Enrichment Summary Requirements

ROOM	CO_2 NEEDS	CO_2 RANGE (ppm)
Male Bathroom	N/A	N/A
Female Bathroom	N/A	N/A
PWD Bathroom	N/A	N/A
Passage	N/A	N/A
Office 1	N/A	N/A
Office 2	N/A	N/A
Lab	N/A	N/A
Work Room	N/A	N/A
Seed Storage Room 1	N/A	N/A
Seed Storage Room 2	N/A	N/A
Fertiliser Store	N/A	N/A
Growth Medium Store	N/A	N/A
Pot Store	N/A	N/A
Mother Room	Enrichment System with CO_2 canister/bottle supply	400 – 500

Cutting/ Clones Room	Enrichment System with CO_2 canister/bottle supply	500 – 1000
Seedling Room	Enrichment System with CO_2 canister/bottle supply	400 – 500
Vegetative Room	Enrichment System with CO_2 canister/bottle supply	800 – 1000
Flowering Room 1	Enrichment System with CO_2 canister/bottle supply	800 – 1000
Flowering Room 2	Enrichment System with CO_2 canister/bottle supply	800 – 1000
Tent Room	Enrichment System with CO_2 canister/bottle supply	800 – 1000
Drying Room	N/A	N/A
Seed Multiplication Room 1	N/A	N/A
Seed Multiplication Room 2A	N/A	N/A
Seed Multiplication Room 2B	N/A	N/A
Seed Multiplication Room 3	N/A	N/A
Climate Control Room 1	Enrichment System with CO_2 canister/bottle supply	200 – 1000
Climate Control Room 2	Enrichment System with CO_2 canister/bottle supply	200 – 1000
ROOM	**CO_2 NEEDS**	**CO_2 RANGE (ppm)**
Climate Control Room 3	Enrichment System with CO_2 canister/bottle supply	200 – 1000
Climate Control Room 4	Enrichment System with CO_2 canister/bottle supply	200 – 1000

The number and size of CO_2 canisters required monthly cannot be determined at this stage. Therefore, the tenderer shall design and specify the appropriate quantity and size of CO_2 canisters based on the operational requirements of the facility.

The design must ensure CO_2 levels is maintained at full occupancy.

4.1.3 INTERNAL CIRCULATION

Cultivation rooms are to be equipped with horizontal or vertical airflow fans (HAF/VAF) or similar to provide a natural environment for plant movement feel and to boost growth performance.

4.1.4 MONITORING SYSTEM

For each room that requires monitoring of temperature, humidity, CO_2 and lights, a monitoring system with alarm functions be installed with an adequate number of sensors to ensure accurate readings. The system should be able to integrate with the facility's ICT to allow for remote and on-site monitoring.

A control system should be able to adjust the lighting settings, humidity, temperature and CO_2 levels from an access-controlled centralised system.

The objective should be to allow all staff the availability to view the status of each room's parameters, but the controlling or changing of settings should be access controlled.

4.1.5 REQUIREMENTS SUMMARY

A summary of the above has been tabled to provide an overview of the mechanical requirements for each room.

Table 4-3: Needs Summary per Room

ROOM	HVAC NEEDS	CIRCULATION	MONITORING SYSTEM NEEDS	CONTROL SYSTEM NEEDS	CO_2 NEEDS	TEMPERATURE RANGE (°C)	HUMIDITY RANGE (%)	CO2 RANGE (ppm)
Male Bathroom	Appropriate Ventilation	N/A	N/A	N/A	N/A	21 – 26	N/A	N/A
Female Bathroom	Appropriate Ventilation	N/A	N/A	N/A	N/A	21 – 26	N/A	N/A
PWD Bathroom	Appropriate Ventilation	N/A	N/A	N/A	N/A	21 – 26	N/A	N/A
Passage	Appropriate Ventilation	N/A	N/A	N/A	N/A	21 – 26	N/A	N/A
Office 1	Appropriate Ventilation with Air Conditioning	N/A	N/A	N/A	N/A	21 – 26	N/A	N/A
Office 2	Appropriate Ventilation with Air Conditioning	N/A	N/A	N/A	N/A	21 – 26	N/A	N/A
Lab	Appropriate Ventilation with Air Conditioning	N/A	N/A	N/A	N/A	20 – 25	N/A	N/A
Work Room	Appropriate Ventilation with Air Conditioning	N/A	N/A	N/A	N/A	20 – 22	N/A	N/A
Seed Storage Room 1	Appropriate Ventilation	N/A	N/A	N/A	N/A	21 – 26	N/A	N/A

Seed Storage Room 2	Appropriate Ventilation	N/A	N/A	N/A	N/A	21 – 26	N/A	N/A
Fertiliser Store	Appropriate Ventilation	N/A	N/A	N/A	N/A	21 – 26	N/A	N/A

ROOM	HVAC NEEDS	CIRCULATION	MONITORING SYSTEM NEEDS	CONTROL SYSTEM NEEDS	CO_2 NEEDS	TEMPERATURE RANGE (°C)	HUMIDITY RANGE (%)	CO2 RANGE (ppm)
Growth Medium Store	Appropriate Ventilation	N/A	N/A	N/A	N/A	21 – 26	N/A	N/A
Pot Store	Appropriate Ventilation	N/A	N/A	N/A	N/A	21 – 26	N/A	N/A
Mother Room	Designated AHU	Adequate air movement	Centralised monitoring of temperature, humidity and CO2.	Centralised controls for temperature, humidity, lights and CO2.	Enrichment System with CO2 canister/bottle supply	25 – 30	40 – 60	400 – 500
Cutting/ Clones Room	Designated AHU	N/A	Centralised monitoring of temperature, humidity and CO2.	Centralised controls for temperature, humidity, lights and CO2.	Enrichment System with CO2 canister/bottle supply	25 – 30	80 – 95	500 – 1000

Seedling Room	Designated AHU	N/A	Centralised monitoring of temperature, humidity and CO2.	Centralised controls for temperature, humidity, lights and CO2.	Enrichment System with CO2 canister/bottle supply	25 – 27	60 – 70	400 – 500
Vegetative Room	Designated AHU	Adequate air movement	Centralised monitoring of temperature, humidity and CO2.	Centralised controls for temperature, humidity, lights and CO2.	Enrichment System with CO2 canister/bottle supply	28 – 35	50 – 70	800 – 1000

ROOM	HVAC NEEDS	CIRCULATION	MONITORING SYSTEM NEEDS	CONTROL SYSTEM NEEDS	CO_2 NEEDS	TEMPERATURE RANGE (°C)	HUMIDITY RANGE (%)	CO2 RANGE (ppm)
Flowering Room 1	Designated AHU	Adequate air movement	Centralised monitoring of temperature, humidity and CO2.	Centralised controls for temperature, humidity, lights and CO2.	Enrichment System with CO2 canister/bottle supply	25 – 30	40 – 50	800 – 1000
Flowering Room 2	Designated AHU	Adequate air movement	Centralised monitoring of temperature, humidity and CO2.	Centralised controls for temperature, humidity, lights and CO2.	Enrichment System with CO2 canister/bottle supply	25 – 30	40 – 50	800 – 1000
Tent Room	Designated AHU	N/A	Centralised monitoring of temperature, humidity and CO2.	Centralised controls for temperature, humidity, lights and CO2.	Enrichment System with CO2 canister/bottle supply	25 – 30	40 – 50	800 – 1000

Drying Room	Designated AHU	N/A	Centralised of monitoring temperature, humidity.	Centralised controls for temperature, humidity and lights.	N/A	15 – 21	20 – 50	N/A
Seed Multiplication Room 1	Designated AHU	Adequate air movement	Centralised of monitoring temperature, humidity.	Centralised controls for temperature, humidity and lights.	N/A	21 – 26	55 – 65	N/A
Seed Multiplication Room 2A	Designated AHU	Adequate air movement	Centralised of monitoring temperature, humidity.	Centralised controls for temperature, humidity and lights.	N/A	21 – 26	55 – 65	N/A
ROOM	**HVAC NEEDS**	**CIRCULATION**	**MONITORING SYSTEM NEEDS**	**CONTROL SYSTEM NEEDS**	**CO_2 NEEDS**	**TEMPERATURE RANGE (°C)**	**HUMIDITY RANGE (%)**	**CO2 RANGE (ppm)**
Seed Multiplication Room 2B	Designated AHU	Adequate air movement	Centralised of monitoring temperature, humidity.	Centralised controls for temperature, humidity and lights.	N/A	21 – 26	55 – 65	N/A
Seed Multiplication Room 3	Designated AHU	Adequate air movement	Centralised of monitoring temperature, humidity.	Centralised controls for temperature, humidity and lights.	N/A	21 – 26	55 – 65	N/A
Climate Control Room 1	Designated AHU	Adequate air movement	Centralised monitoring temperature, of humidity and CO2.	Centralised controls for temperature, humidity, lights and CO2.	Enrichment System with CO2 canister/bottle supply	15 – 35	20 – 95	200 – 1000

Climate Control Room 2	Designated AHU	air Adequate movement	Centralised monitoring of temperature, humidity and CO2.	Centralised controls for temperature, humidity, lights and CO2.	Enrichment System with CO2 canister/bottle supply	15 – 35	20 – 95	200 – 1000
Climate Control Room 3	Designated AHU	air Adequate movement	Centralised monitoring of temperature, humidity and CO2.	Centralised controls for temperature, humidity, lights and CO2.	Enrichment System with CO2 canister/bottle supply	15 – 35	20 – 95	200 – 1000
Climate Control Room 4	Designated AHU	air Adequate movement	Centralised monitoring of temperature, humidity and CO2.	Centralised controls for temperature, humidity, lights and CO2.	Enrichment System with CO2 canister/bottle supply	15 – 35	20 – 95	200 – 1000

4.2 WET SERVICES

The Wet Services specifications are provided in the following sections:

- Water Supply and Distribution
- Wastewater and Drainage
- Irrigation Systems
- Hot Water Supply
- Requirements Summary.

4.2.1 WATER SUPPLY AND DISTRIBUTION

4.2.1.1 Supply

The following general supply requirements are to be incorporated that feed the fertigation and irrigation systems:

- Neatly concealed reticulation supply lines
- SABS approved
- Inline filtration to fertigation/irrigation tanks
- Main pressure regulating valves
- An adequately sized water tank is required to supply the facility's irrigation tanks.
    - Expected water usage approx. 5 000 Litres per day.
- The water storage tank will also be required to have an additional storage contingency built-in of the following: ○ An operational buffer of 100% to supply the irrigation tanks with five day's water requirements. (25 kl storage tank)
    - See section 2 to review the plant growth stage and number of plants to be accounted for in each room connected to each irrigation tank.

The supply tank is to be fed from the general domestic supply. Additionally, general domestic supply should be installed at each wash basin in the facility, as well as faucets in each cultivation room for primarily cleaning purposes. This is elaborated on below.

4.2.1.2 Administrative Areas and Ablutions, Lab and Workroom

Standard domestic water supply lines are required to service office areas and restrooms, providing sufficient water pressure and flow for everyday use.

4.2.1.3 Cultivations/Research Areas

Standard domestic water supply to be installed for each cultivation/processing area, separate from the fertigation/irrigation system. See Section 4.2.3: Irrigation Supply.

To summarise the above supply and distribution requirements, see the table below for the needs per room.

Table 4-4: Water Supply and Tap Points Requirements Summary

ROOM	SUPPLY ORIGIN	TAP
Male Bathroom	Domestic Supply	1 - Wash hand basin provided.
Female Bathroom	Domestic Supply	1 - Washbasin provided.
PWD Bathroom	Domestic Supply	1 - Washbasin provided.
Passage	N/A	N/A
Office 1	N/A	N/A
Office 2	N/A	N/A
Lab	Domestic Supply	1 – Washbasin
Work Room	Domestic Supply	2 - Washbasins
Seed Storage Room 1	N/A	N/A
Seed Storage Room 2	N/A	N/A
Fertiliser Store	N/A	1
Growth Medium Store	N/A	1
Pot Store	N/A	N/A
Mother Room	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply
Cutting/ Clones Room	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply
Seedling Room	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply
Vegetative Room	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply
Flowering Room 1	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply
Flowering Room 2	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply
Tent Room	Domestic Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply
Drying Room	Domestic Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply

Seed Multiplication Room 1	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply
ROOM	**SUPPLY ORIGIN**	**TAP**
Seed Multiplication Room 2A	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply
Seed Multiplication Room 2B	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply
Seed Multiplication Room 3	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply
Climate Control Room 1	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply
Climate Control Room 2	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply
Climate Control Room 3	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply
Climate Control Room 4	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply

4.2.2 WASTEWATER AND DRAINAGE

The following requirements for the facility areas need to be incorporated for the wastewater and drainage systems:

- All drainage piping should consist of vented uPVC piping sized according to the ablution stack and vented at the main drainage line.
- All discharge branches should be back vented to ensure no loss of water seals occurs due to pressure differences.
- Cultivation Drainage ○ Cultivation areas to be fitted with floor drains that channel excess water and nutrient run-off safely to the wastewater system. Each drain to include filtration screens to prevent plant material and solid debris from entering the wastewater lines.
- General Drainage ○ Restrooms and administrative areas to feature standard drainage systems to manage water from sinks, restrooms, and handwashing stations. These systems are to tie into the facility's overall wastewater infrastructure for effective wastewater management. See Section 6.2:

Water, Sewer and Stormwater

4.2.3 IRRIGATION SUPPLY

4.2.3.1 Distribution

Individual water storage tanks are required for the different rooms of the facility.

4.2.3.2 Fertigation

Each individual tank will be manually fertigated based on the plant requirements within the specific rooms, noting that different fertigation mixtures will be needed for different plant growth stages or research needs.

4.2.3.3 Automated Irrigation

The automated irrigation systems are to be installed to reduce manual labour and should include:

- Timing controls
- Flow controls
- Valve open/close controls

The following irrigation systems are required to be designed and installed by an irrigation specialist based on the designated processing/cultivation area and their respective layouts:

- Micro-Sprinkler System for the cutting/clones and seedling rooms
- Dripper System for the mother room, seedling room, vegetative room, flowering rooms, climate control rooms and seed multiplication rooms.

4.2.3.4 Manual Irrigation

- Plants grown in the tent room will require both manual fertigation and irrigation.

4.2.4 HOT WATER SUPPLY

- Hot water to be supplied to areas requiring sanitation and cleaning, such as restrooms, work room and the laboratory.
- A tankless or an on-demand water heater to be used to minimise energy consumption and ensure an uninterrupted hot water supply when needed.

4.2.5 REQUIREMENTS SUMMARY

The tabled summary below provides the requirements for water supply, irrigation and hot water needs per room.

Table 4-5: Wet Services Requirements Summary

ROOM	SUPPLY ORIGIN	TAP	HOT WATER	IRRIGATION
Male Bathroom	Domestic Supply	1 - Wash hand basin provided.	1 - Tankless/ on-demand water heater	N/A
Female Bathroom	Domestic Supply	1 - Wash hand basin provided.	1 - Tankless/ on-demand water heater	N/A
PWD Bathroom	Domestic Supply	1 - Wash hand basin provided.	1 - Tankless/ on-demand water heater	N/A
Passage	N/A	N/A	N/A	N/A
Office 1	N/A	N/A	N/A	N/A
Office 2	N/A	N/A	N/A	N/A
Lab	Domestic Supply	1 - Sink	1 - Tankless/ on-demand water heater	N/A
Work Room	Domestic Supply	2 - Sinks	2 - Tankless/ on-demand water heaters	N/A
Seed Storage Room 1	N/A	N/A	N/A	N/A
Seed Storage Room 2	N/A	N/A	N/A	N/A
Fertiliser Store	N/A	1	N/A	N/A

Growth Medium Store	N/A	1	N/A	N/A
Pot Store	N/A	N/A	N/A	N/A
Mother Room	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply	N/A	220 Dripper Systems - Water supplied from irrigation tank filled from the water storage tank.

ROOM	SUPPLY ORIGIN	TAP	HOT WATER	IRRIGATION
Cutting/ Clones Room	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply	N/A	Micro-Sprinkler System that is capable of supplying approximately 30 000 cuttings with water - Water supplied from irrigation tank filled from the water storage tank.
Seedling Room	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply	N/A	Micro-Sprinkler System that is capable of supplying approximately 15 600 plants with water - Water supplied from irrigation tank filled from the water storage tank.
Vegetative Room	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply	N/A	204 Dripper Systems - Water supplied from irrigation tank filled from the water storage tank.

Flowering Room 1	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply	N/A	120 Dripper Systems - Water supplied from irrigation tank filled from the water storage tank.
Flowering Room 2	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply	N/A	120 Dripper Systems - Water supplied from irrigation tank filled from the water storage tank.
Tent Room	Domestic Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply	N/A	128 Plants to be manually irrigated.

ROOM	SUPPLY ORIGIN	TAP	HOT WATER	IRRIGATION
Drying Room	Domestic Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply	N/A	N/A
Seed Multiplication Room 1	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply	N/A	340 Dripper Systems - Water supplied from irrigation tank filled from the water storage tank.

Seed Multiplication Room 2A	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply	N/A	136 Dripper Systems - Water supplied from irrigation tank filled from the water storage tank.
Seed Multiplication Room 2B	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply	N/A	136 Dripper Systems - Water supplied from irrigation tank filled from the water storage tank.
Seed Multiplication Room 3	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply	N/A	340 Dripper Systems - Water supplied from irrigation tank filled from the water storage tank.
Climate Control Room 1	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply	N/A	194 Dripper Systems - Water supplied from irrigation tank filled from the water storage tank.
Climate Control Room 2	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply	N/A	194 Dripper Systems - Water supplied from irrigation tank filled from the water storage tank.
ROOM	**SUPPLY ORIGIN**	**TAP**	**HOT WATER**	**IRRIGATION**
Climate Control Room 3	Water Storage Tank and Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply	N/A	194 Dripper Systems - Water supplied from irrigation tank filled from the water storage tank.

Climate Control Room 4	and Water Storage Tank Domestic Water Supply	1 - Tap provided in room for cleaning purposes supplied from domestic supply	N/A	194 Dripper Systems - Water supplied from irrigation tank filled from the water storage tank.

4.3 FIRE PROTECTION AND DETECTION

4.3.1 GENERAL METHODOLOGY

Active and passive fire protection systems are to be implemented to ensure compliance with local regulations. These systems should be developed based on the final detail design of the facility.

5 ELECTRICAL

Firstly, prior to construction, the appointed contractor is to relocate the existing overhead electrical line to a suitable position in compliance with regulatory standards.

The following electrical sections were detailed:

- Electrical Installation
- Electronic Installation.

5.1 ELECTRICAL INSTALLATION

5.1.1 ELECTRICAL SUPPLY

5.1.1.1 Municipal Supply

- Based on the designed and supplied equipment, this supply needs to be derived from the detail design.

5.1.1.2 Standby Generator & UPS

- A standby diesel generator is required to supply full backup power to the entire facility, and no-load splitting should be applied, rated equal to the required municipal supply. ○ It is estimated that a 1000 kVA standby-rated generator is required.
  - ○ Sufficient diesel storage must be provided to support 7 days of operation at 30% load capacity.
- It is critical that lighting in the grow rooms remains uninterrupted during load shedding or power outages; therefore, a UPS system will be required to support the lighting infrastructure.

5.1.1.3 Distribution Boards

- Surface-mounted distribution boards (DB) are required for the even distribution of power.
- DBs must be appropriately in colour with internal cover plates.
- Circuit labelling must be manufactured from permanently engraved and securely fixed to the panels of the DB.
- DBs must be sufficiently specified based on moisture and dust resistance required for the room environment where positioned.

5.1.2 METERING

A metering device must be installed for the main distribution board of the building to monitor/log the overall electricity usage. The meter needs to be installed in a

sufficiently dust and moisture resistant enclosure. Additionally, it must be able to provide the following information on its display, including but not limited to:

- Active, reactive, and apparent power
- Line to line voltage
- Line to neutral voltage
- Line current
- Neutral current
- Power factor
- Energy usage.

5.1.3 LIGHTING

The lighting requirements are provided in the table below for each area. The light intensity levels provided are to be used to determine each area's lighting layout. Programmable timers are required in the majority of the cultivation/processing rooms to regulate the number of hours lights should be on/off and should be linked to the building management system where centralised control of the climate and environment is managed.

Table 5-1: Room Lighting Requirements

ROOM	TYPE	LUX/PPFD	CONTROL SYSTEM
Male Bathroom	Standard LED Lights	100 - 200 Lux	N/A
Female Bathroom	Standard LED Lights	100 - 200 Lux	N/A
PWD Bathroom	Standard LED Lights	100 - 200 Lux	N/A
Passage	Standard LED Lights		
Office 1	Standard LED Lights	300 - 500 Lux	N/A
Office 2	Standard LED Lights	300 - 500 Lux	N/A
Lab	Standard LED Lights	300 - 500 Lux	N/A
Work Room	Standard LED Lights	300 - 500 Lux	N/A
Seed Storage Room 1	Standard LED Lights	100 - 200 Lux	N/A
Seed Storage Room 2	Standard LED Lights	100 - 200 Lux	N/A
Fertiliser Store	Standard LED Lights	100 - 200 Lux	N/A
Growth Medium Store	Standard LED Lights	100 - 200 Lux	N/A

Pot Store	Standard LED Lights	100 - 200 Lux	N/A
Mother Room	Full-Spectrum LED Lights	800 – 1500 PPFD	Programmable
Cutting/Clones Room	Low-Intensity LED Lights	100 – 200 Lux	Programmable
Seedling Room	Low-Intensity LED Lights	100 – 200 Lux	Programmable
ROOM	**TYPE**	**LUX/PPFD**	**CONTROL SYSTEM**
Vegetative Room	Full-Spectrum LED Lights	800 – 1500 PPFD	Programmable
Flowering Room 1	UV Lights and Infrared spectrum LEDs	400 – 800 PPFD	Programmable
Flowering Room 2	UV Lights and Infrared spectrum LEDs	400 – 800 PPFD	Programmable
Tent Room	Standard LED Lights	100 – 200 Lux	Programmable
Drying Room	Dimmable Low-Intensity LED	≤ 200 PPFD	N/A
Seed Multiplication Room 1	LED Full-Spectrum Lights	800 – 1500 PPFD	Programmable
Seed Multiplication Room 2A	LED Full-Spectrum Lights	800 – 1500 PPFD	Programmable
Seed Multiplication Room 2B	LED Full-Spectrum Lights	800 – 1500 PPFD	Programmable
Seed Multiplication Room 3	LED Full-Spectrum Lights	800 – 1500 PPFD	Programmable
Climate Control Room 1	Full spectrum, dimmable LED Lights	800 – 1500 PPFD	Programmable
Climate Control Room 2	Full spectrum, dimmable LED Lights	800 – 1500 PPFD	Programmable
Climate Control Room 3	Full spectrum, dimmable LED Lights	800 – 1500 PPFD	Programmable

Climate Control Room 4	Full spectrum, dimmable LED Lights	800 – 1500 PPFD	Programmable

The specified lights should, as far as possible, be LED type to assist with energy efficiency in the facility, but the required LUX or PPFD will take president. Lights are to be installed to appropriately distribute the lighting level evenly throughout the room. Where dimmable, full spectrum and UV and infrared light spectrums are required, alternative lighting types need to achieve the same fit-for-purpose functionality.

5.1.4 SOCKET OUTLETS

In general, the electrical socket and power design must include the following or similar:

- 16A, 3-pin single-phase switched socket outlets for
  - Office equipment. ○
    Cleaning equipment ○
    Laboratory equipment
- Waterproof 16A, 3-pin 'new style' single-phase switched socket outlets for production rooms

Each socket outlet point installed in recessed wall boxes, power skirting, recessed wall utility boxes and under-floor boxes to consist of the following, similar to the below:

- 1x 16A 'old style' SANS 164-1 socket outlet (3-pin)
- 2x 16A 'new style' SANS 164-2 socket outlet (3-pin).

The table below summarises the socket needs of each room's installations.

Table 5-2: Electrical Socket Outlets Requirements Summary

ROOM	DESCRIPTION	NUMBER	OUTLET POINT
Male Bathroom	Extraction fans should be fed from either 32A or 63A isolators installed in ceiling voids or surface-mounted	N/A	N/A
Female Bathroom	Extraction fans should be fed from either 32A or 63A isolators installed in ceiling voids or surface-mounted	N/A	N/A
PWD Bathroom	Extraction fans should be fed from either 32A or 63A isolators installed in ceiling voids or surface-mounted	N/A	N/A
Passage	1x 16A 'old style' SANS 164-1 socket outlet (3pin) and 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Power should be fed from either 32A or 63A isolators.	8	8 surface-mounted plugs

Office 1	1x 16A 'old style' SANS 164-1 socket outlet (3pin) and 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Power should be fed from either 32A or 63A isolators.	1	Power skirting with 4 plugs.
Office 2	1x 16A 'old style' SANS 164-1 socket outlet (3pin) and 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Power should be fed from either 32A or 63A isolators.	1	Power skirting with 4 plugs.
Lab	1x 16A 'old style' SANS 164-1 socket outlet (3pin) and 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Power should be fed from either 32A or 63A isolators.	4	Power skirting with 4 plugs at work bench level
Work Room	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Power should be fed from either 32A or 63A isolators.	8	Power skirting with 4 plugs at work bench level.

ROOM	DESCRIPTION	NUMBER	OUTLET POINT
Seed Storage Room 1	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Power should be fed from either 32A or 63A isolators.	1	1 surface-mounted plugs
Seed Storage Room 2	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Power should be fed from either 32A or 63A isolators.	4	3 surface-mounted plugs and 1 recessed wall box
Fertiliser Store	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Power should be fed from either 32A or 63A isolators.	1	1 surface-mounted plugs
Growth Medium Store	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Power should be fed from either 32A or 63A isolators.	1	1 surface-mounted plugs
Pot Store	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Power should be fed from either 32A or 63A isolators.	1	1 surface-mounted plugs

Mother Room	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Plant should be fed via a 3-phase weatherproof, rotary lockable isolator.	4	4 surface-mounted plugs
Cutting/ Clones Room	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Plant should be fed via a 3-phase weatherproof, rotary lockable isolator.	4	4 surface-mounted plugs
Seedling Room	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Plant should be fed via a 3-phase weatherproof, rotary lockable isolator.	4	4 surface-mounted plugs
Vegetative Room	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Plant should be fed via a 3-phase weatherproof, rotary lockable isolator.	4	4 surface-mounted plugs

ROOM	DESCRIPTION	NUMBER	OUTLET POINT
Flowering Room 1	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Plant should be fed via a 3-phase weatherproof, rotary lockable isolator.	4	4 surface-mounted plugs
Flowering Room 2	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Plant should be fed via a 3-phase weatherproof, rotary lockable isolator.	4	4 surface-mounted plugs
Tent Room	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Plant should be fed via a 3-phase weatherproof, rotary lockable isolator.	32	2 surface-mounted plugs per tent. Overhead connection points shall be installed no more than 2 meters from the tents.
Drying Room	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Plant should be fed via a 3-phase weatherproof, rotary lockable isolator.	4	4 surface-mounted plugs

Seed Multiplication Room 1	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Plant should be fed via a 3-phase weatherproof, rotary lockable isolator.	4	2 surface-mounted plugs and 2 recessed wall boxes
Seed Multiplication Room 2A	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Plant should be fed via a 3-phase weatherproof, rotary lockable isolator.	4	2 surface-mounted plugs and 2 recessed wall boxes
Seed Multiplication Room 2B	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Plant should be fed via a 3-phase weatherproof, rotary lockable isolator.	4	2 surface-mounted plugs and 2 recessed wall boxes
Seed Multiplication Room 3	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Plant should be fed via a 3-phase weatherproof, rotary lockable isolator.	4	2 surface-mounted plugs and 2 recessed wall boxes
Climate Control Room 1	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Plant should be fed via a 3-phase weatherproof, rotary lockable isolator.	4	4 surface-mounted plugs
ROOM	**DESCRIPTION**	**NUMBER**	**OUTLET POINT**
Climate Control Room 2	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Plant should be fed via a 3-phase weatherproof, rotary lockable isolator.	4	4 surface-mounted plugs
Climate Control Room 3	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Plant should be fed via a 3-phase weatherproof, rotary lockable isolator.	4	4 surface-mounted plugs
Climate Control Room 4	Waterproof 1x 16A 'old style' SANS 164-1 socket outlet (3-pin) and waterproof 2x 16A 'new style' SANS 164-2 socket outlet (3-pin). Plant should be fed via a 3-phase weatherproof, rotary lockable isolator.	4	4 surface-mounted plugs

5.1.5 POWER SUPPLY TO HVAC EQUIPMENT

5.1.5.1 Indoor Units

- Indoor units should be fed from either 32A or 63A isolators installed within 1.5 m of the unit within ceiling voids unless otherwise required by the detail design.

5.1.5.2 Outdoor Units

- Outdoor units should be supplied by single or three-phase weather-proof, rotary lockable isolators. These isolators are to be installed within 1.5 m of the unit.

5.1.5.3 Extraction Fans

- Extraction fans should be fed from either 32A or 63A isolators installed in ceiling voids or surface-mounted within 1.5 m of the unit within ceiling voids or unless otherwise required by the detail design.

5.1.5.4 Production Areas

- Each plant area should be fed via one 3 Phase weather-proof, rotary lockable isolator. These isolators are to be installed within the various production area plant rooms.

5.1.6 WIREWAYS

5.1.6.1 Power Reticulation

- Cable ladders or similar should be used for distribution cables between distribution boards in the facility and situated within ceiling voids.

5.1.6.2 Internal Building Reticulation

- Large multi-core distribution cables or similar should be installed in perforated cable trays within ceiling voids and in areas.
- Single core PVC-insulated conductors to be installed inside cable trunking (P8000 or P9000, or similar).
- Note that all wireways, cables and cable joints utilized are to be sufficiently weather-proof and corrosion-proof.

5.1.7 EARTHING AND LIGHTING PROTECTION

- The building should be provided with an earthing and lighting protection system.

5.2 ELECTRONIC INSTALLATIONS

5.2.1 BUILDING MANAGEMENT SYSTEM (BMS)

A building management unit should be installed individually for each respective plant room to monitor each production area in isolation. See section 4.1.4: Monitoring System.

The associated internal cabling and/or management equipment is to be included in order to tie into the supplied fibre network that will be provided by ARC - VIMP is to be designed and implemented by the contractor.

The following functionality is required from the BMS:

- Sensors in each room to measure temperature, humidity, light levels and CO_2 levels accurately.
- Actuators to adjust temperature, humidity, light and CO_2
- Associated software, hardware and controllers.
- User interface dashboard accessible from computers and mobile devices to monitor and control levels, alerts and statuses.
- Remote access.
- System must be able to connect remotely to computers and phones.

6 CIVIL

This section provides the parameters of the design-build specifications for the following:

- Road and Parking Layer Works Design • Water, Sewer and Stormwater
- Waste Management.

6.1 ROAD AND PARKING LAYER WORKS DESIGN

The road and parking layer works design guide is provided in the following lines:

- Design Parameters
- Design Traffic
- Pavement Design.

6.1.1 DESIGN PARAMETERS

- The pavement needs to be structurally constructed for the appropriate traffic loads.

6.1.2 DESIGN TRAFFIC

- A design for a pavement class should be constructed to cater for low volume traffic with very few heavy vehicles utilising the pavement. Pavements will primarily be used by personnel with passenger vehicles and light delivery vehicles.

6.1.3 PAVEMENT DESIGN

The geotechnical investigations determined that the in-situ material quality is suitable for use as roadbed material. Considering maintenance requirements, functionality, aesthetics and structural capacity, it is required that the parking be constructed with 60 mm interlocking pavers or similar with ring beams to secure structural integrity.

The following requirements have been determined for the parking layout linked to the facility:

- Normal parking bays: 10 (min. 2.5m x 5m)
- Disabled parking bays: 2 (min. 3.6m x 5 m)
- Loading bays: 2 (min. 3.4m x 5.8m)

Normal and disabled parking bays to accommodate passenger and/or light delivery vehicles (LDV). Loading bays to accommodate single units (For example, 8-tonne trucks).
The contractor is encouraged to optimise the design for cost and performance within the provided parameters. The parking cover should be constructed using corrugated iron sheeting to align with the overall aesthetic of the campus.

The table below summarises the above requirements.

Table 6-1: Pavement Requirements Summary

PARKING	PAVEMENT	DIMENSION (m x m)
10 x Normal Parking	60mm Interlocking	2.5m x 5m
2 x Disabled Parking	60mm Interlocking	3.6m x 5m
2 x Bays	60mm Interlocking	3.4m x 5.8m

6.2 PLATFORM EARTHWORKS

The ARC Cannabis & Seed Multiplication Facility Design Geotechnical Investigation Report (REV00, February 2025) should be referred to for the platform earthworks, apron and foundation designs.

The geotechnical study found the whole site to be underlain by a uniform dark red clayey sand, classified as soft excavation to a depth of 2.7m where the investigation ended.

The following standards should be applied during the design and construction of the earthworks:

- South African National Standards – SANS1200
  - SANS1200C – Site Clearance
  - SANS1200D – Earthworks
  - SANS1200DA – Earthworks (Small Works)

The recommendations following hereafter are adopted from the geotechnical report.

6.2.1 Site Preparation

It is recommended to clear the site of any vegetation and topsoil at 0.15 m deep before commencing construction activities. This will facilitate the preparation of the site for further work.

6.2.2 Temporary Works (Construction Platform, Trenches, Excavations, and Stockpiles)

These temporary structures should be erected in accordance with the findings of this report and per the national standards and building regulations, particularly considering the slope stability, excavatability, and erodibility of the soil on-site.

Trenches and open excavations beyond 1.2m deep should be sufficiently shored or laterally supported to mitigate the risk of collapse.

6.2.3 Material Usage

The in-situ material on-site is suitable for use as general bulk fill in platforms beneath structures.

6.2.4 Settlement

The expected settlement is low, posing minimal risk to property and human safety.

6.2.5 Groundwater Management

The water table is expected to be very low, below 3 metres, based on the findings. Therefore, no additional groundwater management plan is thought to be necessary. It should be noted that the investigation was conducted in the dry winter season, and the water table depth could be shallower during the rainy months.

6.2.6 SEISMIC RISK

The site is not located in an active seismic zone, indicating a low risk for seismic damage. Consequently, no additional design requirements are necessary based on seismic risk.

6.2.7 FOUNDATIONS

The geotechnical investigation identified that the site's soil profile predominantly consists of dark red clayey sand, with relatively uniform characteristics across different layers and test pits. The laboratory tests, including Atterberg limits, sieve analysis, and foundation indicators, classify the soil as low-expansive, which is favourable for foundation design. The soil demonstrates low plasticity, moderate bearing capacity and low heave potential, making it generally stable for construction without excessive risk of settlement or swelling.

Based on these findings, a typical shallow strip footing is recommended as a suitable foundation type for this site for typical single-storey structures.

These recommendations are provided to guide the design and construction process, ensuring that the project proceeds smoothly while mitigating potential risks identified in this geotechnical investigation. It is recommended that a geotechnical engineer review the building/infrastructure plans prior to construction taking place on the site.

6.3 WATER, SEWER AND STORMWATER

This section provides the design parameters of the following design components:

- Water
- Stormwater Management • Sewer Management.

6.3.1 WATER

Water reticulation is available in the surrounding area with unknown capacity. The contractor is to survey and identify the appropriate access points from where to tie in from the existing network to supply sufficient pressure to the new proposed facility.

Due to the surrounding facility usages consisting of similar greenhouses and ablution facilities, it can be assumed the bulk supply has been designed for similar usages of the new proposed facility.

The contractor is encouraged to optimise the design for cost and performance within the provided parameters.

6.3.2 STORMWATER MANAGEMENT

The stormwater management designs need to consider the site contours as determined by the topography survey. These contours can be seen in Figure 6-1 below.

Figure 6-1: Contour elevation of facility

The purpose of stormwater management is to ensure roof and surface drainage is installed to direct water away from the building and parking areas and to reduce the risk of water accumulation and structural damage.

The following can be considered as analysed from the topography survey:

- The stormwater management needs to be designed and constructed to manage the expected stormwater adequately.
- The stormwater management should be installed for easy maintainability and fit for purpose.
- The concrete apron around the building should allow for a minimum of 1.5m maintenance zone around the building.

The contractor is encouraged to optimise the design for cost and performance within the provided parameters.

6.3.3 SEWER MANAGEMENT

The sewer network and additional wastewater outflow need to be constructed with the following considerations:

- From the survey information received and subsequent site visits, it is confirmed that the ARC Roodeplaat site has an existing sewage system to which the proposed facility's sewer network can be connected.
- The sewage outflow from the proposed facility shall be designed to tie into the ARC Roodeplaat's existing sewage system.
- A detailed study of the existing sewer management infrastructure should be undertaken to identify the appropriate tie-in points.
- The design of the sewer system should ensure compliance with all relevant municipal and environmental regulations governing wastewater management.
- The sewer network should be designed to handle both the wastewater from the ablution facilities and any additional wastewater generated by cultivation activities within the facility.

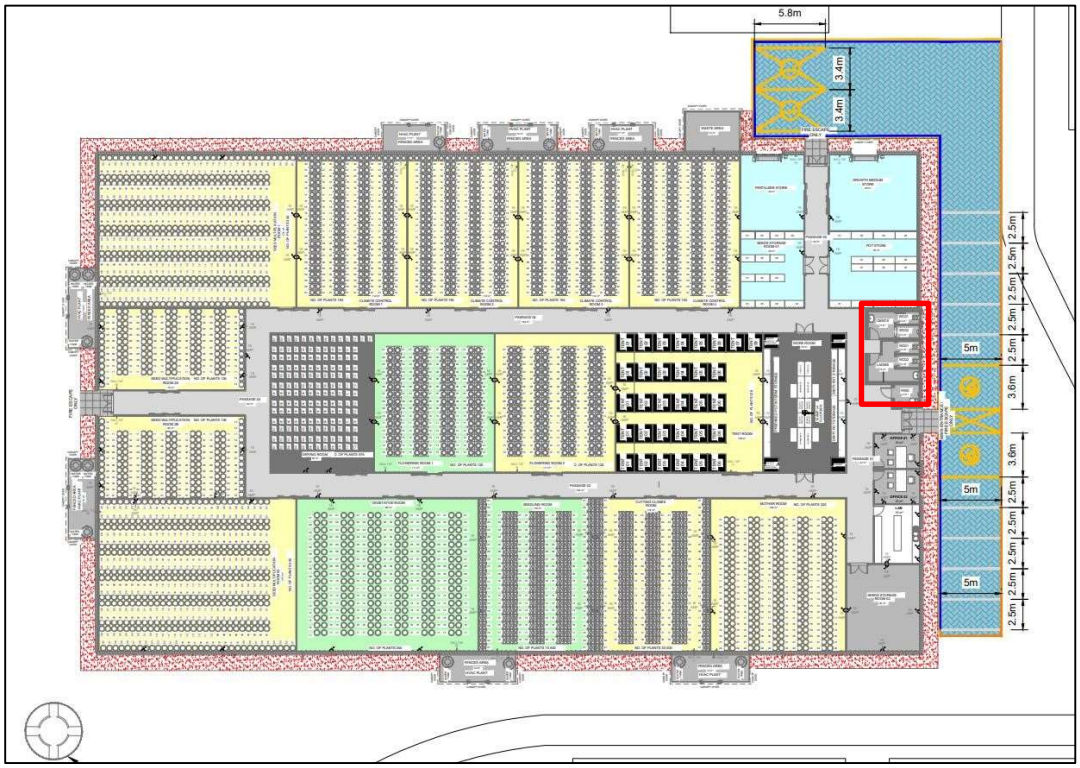

Figure 6-2: Location of Ablution Facilities

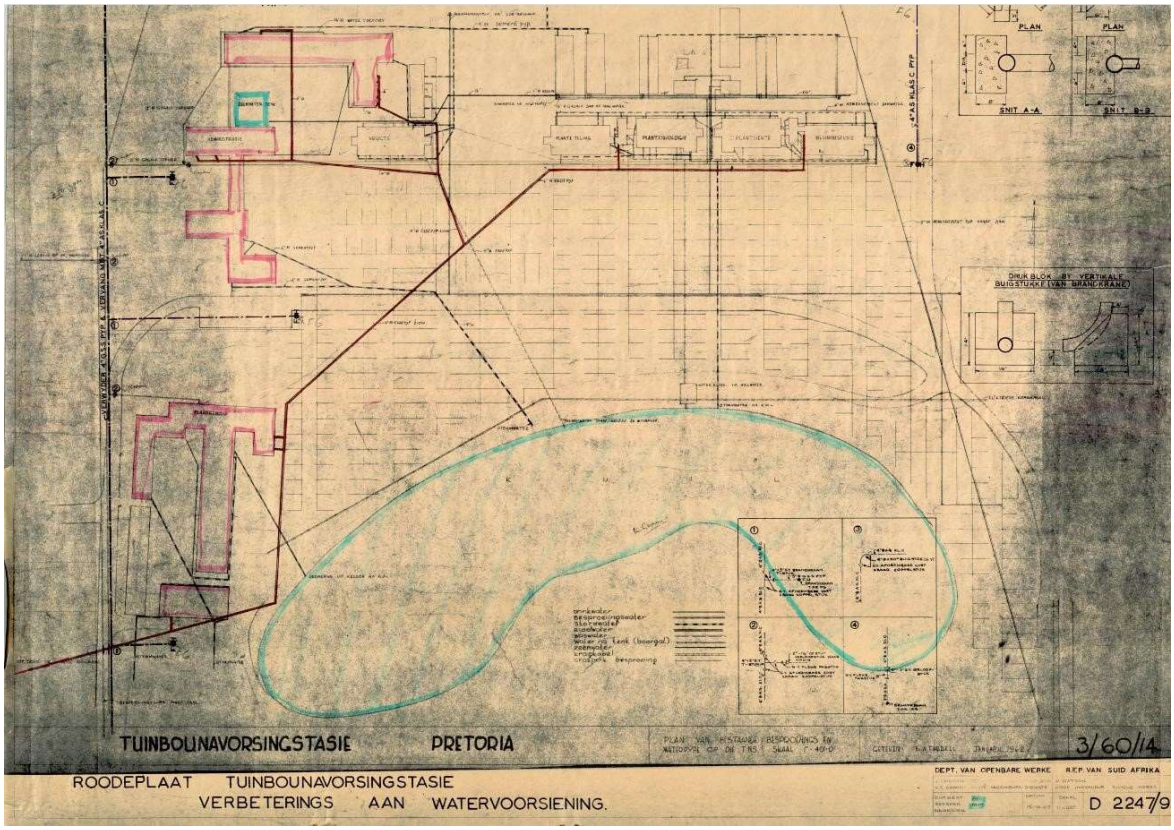

Figure 6-3: ARC Roodeplaat Sewer Management System

The contractor is encouraged to optimise the design for cost and performance within the provided considerations.

6.4 WASTE MANAGEMENT

The facility requires a functional and sized waste storage facility situated adjacent to the building. It is expected that growth medium contaminated waste, as well as general packaging and organic waste, needs to be accommodated.

The facility will be required to be covered, bunded and surfaced within the regulation to mitigate contamination of groundwater run-off. Indicated in red in Figure 6-4 is the location of the waste facility.

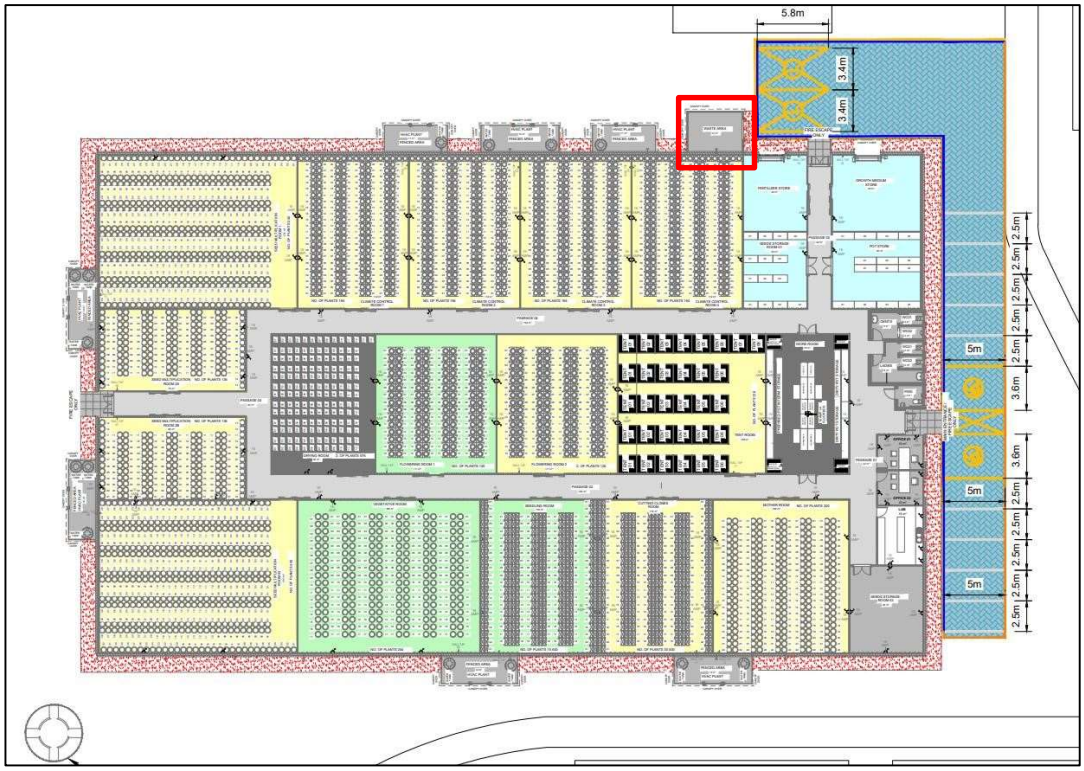

Figure 6-4: Location of Waste Facility

7 ENVIRONMENTAL

An enquiry letter was sent to the Gauteng Department of Environment on 07 February 2025.

The proposal entails a development of a 70m x 36m new structure, including a seed multiplication structure of 36m x 15m with auxiliary infrastructure within Agricultural Research Council. The proposed research facility will consist of operations such as sewer infrastructure, electrical infrastructure, water infrastructure, platforms, stormwater management, buildings, and equipment. The site is transformed, and the total development footprint is 2600 m² in extent. In terms of Departmental C-Plan Version 3.3 the site falls outside Geographic Areas as identified in Listing Notice 3 and within urban built-up areas.

Based on the above and the information submitted, the activity is not listed in terms of Listing Notice 1, 2 and 3 of Environmental Impact Assessment Regulations, 2014, (As amended) published under the National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998, as amended) and therefore does not legally require Environmental Authorisation from the Department.

Although authorisation, in terms of NEMA, is not required for this activity, all relevant legislation and requirements of other government departments (i.e., National, Provincial and Local) must still be complied with.

8 FURNITURE AND FIXTURES

The following items related to the internal moveable components are discussed:

- Furniture
- Pots
- Trays
- Tables
- Shelving/Benches
- Drying lines
- Requirements Summary.

8.1 FURNITURE

The following rooms need to be equipped with free-standing furniture:

- Offices - 1 ○ 1 x Desk ○ 3 x Office Chairs
- Offices - 2 ○ 1 x Desk ○ 3 x Office Chairs

8.2 POTS

The Mother Room, Vegetative Rooms, Tent Room and Seed Multiplication Rooms will consist of plastic pots or similar fit-for-purpose lightweight and stackable storage with a diameter of 50 cm situated on the floor.

Both the Flowering Room and Climate Control Rooms will need to consist of steel tables whereby plastic pots or similar fit-for-purpose lightweight and stackable storage with a diameter of 30 cm will be situated.

8.3 TRAYS

The supply of plastic growing trays or similar fit-for-purpose lightweight and stackable storage with dimensions 60cm (L) x 30cm (W) is required that will be situated on the steel tables and used in the cutting/clone room and the seedling room.

8.4 TABLES

The table requirements are detailed below:

- Typical table dimensions are 1.2m (L) x 0.6m (W) x 0.6m (H); however, final dimensions can be optimised by the contractor as long as the room can accommodate the needed number of plants and a 1m circulation zone is maintained between rows.
- Table material: Galvanised mild steel tables with mesh surface able to carry heavy pots.

8.5 SHELVING/BENCHES

The following rooms require permanently installed and fixed shelving:

- Seed Storage Room 2
- Pot Store
- Work Room • Laboratory.

8.5.1 SEED STORAGE ROOM 2

A fixed shelving installation is to be installed with the following functional parameters:

- The room will feature shelving that is 0.6 metres deep, 0.45 metres high, and 1.2 metres long, optimised for storing seed containers and 50 kg bags.
- The shelves should be positioned at 10 cm and 80 cm off the ground, making it easier to store and access bags or containers, ensuring seeds are kept at an optimal height for handling and storing.

- A 1 m wide walkway between shelving rows.
- Material: Galvanised mild steel with mesh surface
- 1 Shelf should be installed with enclosing sides and doors to provide a lockable unit for poisonous substances.

8.5.2 POT STORE

A fixed shelving installation is to be installed with the following functional parameters:

- The room will feature shelving that is 0.6 metres deep, 0.7 metres high, and 1.2 metres long, optimised for storing pots stacked 25 high.
- The shelves should be positioned at 10 cm off the ground up to 1.8m top shelf to ensure manual picking can be performed, making it easier to store and access containers. (pots to be stored laying on their sides)
- A 1 m wide walkway between shelving rows.
- Material: Galvanised expanded metal shelving for pot store, allowing airflow.
- A separate lockable unit is required for the storage of hazardous substances.

8.5.3 WORKROOM

The workroom should be equipped with the following fixed installations:

- Worktable in the centre of the room with a 1.2 m deep table to provide ample workspace for handling pots, plants, and other equipment.
- Benches:
  - Dirty Benches: For handling pots and tools that need to be cleaned or are in contact with soil and plant waste.
  - Clean Benches: For tasks that require sanitised surfaces, such as preparing pots for planting or organising clean tools and equipment.
  - Benches should span the length of the room on each side.
- Material: Benches and worktable to be constructed from galvanised mild steel.

8.5.4 LABORATORY

The laboratory should be constructed with a galvanised mild steel workbench in the centre, eastern wall and western wall. Benches on the wall should be mounted. The bench in the centre should be movable. The eastern wall bench should contain a wash basin. The benches should be appropriately dimensioned for standing work.

8.6 DRYING LINES

The drying system that will be used in the Drying Room will be done with the use of a drying line. The drying line system should be installed to ensure positional

availability for 576 plants and 1 m circulation between rows. The drying line structure can allow for vertical stacking.

8.7 REQUIREMENTS SUMMARY

The following table summarises the requirements on a room level to detail each room's furniture and fixture needs.

Table 8-1: Furniture and Fixtures Requirements Summary

ROOM	FURNITURE	POTS	TRAYS	TABLES	SHELVING/BENCHING	DRYING LINES
Male Bathroom	N/A	N/A	N/A	N/A	N/A	N/A
Female Bathroom	N/A	N/A	N/A	N/A	N/A	N/A
PWD Bathroom	N/A	N/A	N/A	N/A	N/A	N/A
Passage	N/A	N/A	N/A	N/A	N/A	N/A
Office 1	1x Desk and 3 x Office Chairs	N/A	N/A	N/A	N/A	N/A
Office 2	1x Desk and 3 x Office Chairs	N/A	N/A	N/A	N/A	N/A
Lab	N/A	N/A	N/A	N/A	Centre steel galvanised wcmild th of 1.2m.	N/A

Work Room	N/A	N/A	N/A	N/A	Centre galvanised mild steel worktable with a depth of 1.2m. 1 x galvanised mild steel benches to be included on the right of the workroom for dirty pots and another to be included on the left for the clean pots spanning the room length.	N/A

ROOM	FURNITURE	POTS	TRAYS	TABLES	SHELVING/BENCHING	DRYING LINES
Seed Storage Room 1	N/A	N/A	N/A	N/A	Galvanised mild steel shelving with dimensions 1.2m (L) x 0.6m (W) x 0.45m (H) and be able to withstand the weight of seed containers and 50kg bags will be used. The shelves should be positioned 10 - 80 cm off the ground. 1 shelf should have enclosing sides and doors.	N/A
Seed Storage Room 2	N/A	N/A	N/A	N/A	N/A	N/A
Fertiliser Store	N/A	N/A	N/A	N/A	N/A	N/A
Growth Medium Store	N/A	N/A	N/A	N/A	N/A	N/A

Pot Store	N/A	N/A	N/A	N/A	Galvanised mild steel shelving with dimensions 1.2m (L) x 0.6m (W) x 0.7m (H) and be able to store 25 pots in height. The shelves should be positioned 10 cm off the ground, with the top shelf at 1.8m. 1 shelf should have enclosing sides and doors.	N/A
Mother Room	N/A	Plastic pots or something similar with a diameter of 50cm	N/A	N/A	N/A	N/A

ROOM	FURNITURE	POTS	TRAYS	TABLES	SHELVING/BENCHING	DRYING LINES

Cutting/Clones Room	N/A	N/A	Plastic growing trays or similar with dimension 60cm (L) x 30cm (W).	Galvanised mild steel tables that are able to carry heavy pots with dimensions 1.2m (L) x 0.6m (W) x 0.6m (H). Tables dimensions can be optimised by the contractor as long as the room can accommodate the needed number of plants with a 1m circulation zone between rows.	N/A	N/A

ROOM	FURNITURE	POTS	TRAYS	TABLES	SHELVING/BENCHING	DRYING LINES

Seedling Room	N/A	N/A	Plastic growing trays or similar with dimension 60cm (L) x 30cm (W).	Galvanised mild steel tables that are able to carry heavy pots with dimensions 1.2m (L) x 0.6m (W) x 0.6m (H). Tables dimensions can be optimised by the contractor as long as the room can accommodate the needed number of plants with a 1m circulation zone between rows.	N/A	N/A
Vegetative Room	N/A	Plastic pots or something similar with a diameter of 50cm	N/A	N/A	N/A	N/A

ROOM	FURNITURE	POTS	TRAYS	TABLES	SHELVING/BENCHING	DRYING LINES

Flowering Room 1	N/A	Plastic pots or something similar with a diameter of 30cm	N/A	Galvanised mild steel tables that are able to carry heavy pots with dimensions 1.2m (L) x 0.6m (W) x 0.6m (H). Tables dimensions can be optimised by the contractor as long as the room can accommodate the needed number of plants with a 1m circulation zone between rows.	N/A	N/A

ROOM	FURNITURE	POTS	TRAYS	TABLES	SHELVING/BENCHING	DRYING LINES

Flowering Room 2	N/A	Plastic pots or something similar with a diameter of 30cm	N/A	Galvanised mild steel tables that are able to carry heavy pots with dimensions 1.2m (L) x 0.6m (W) x 0.6m (H). Tables dimensions can be optimised by the contractor as long as the room can accommodate the needed number of plants with a 1m circulation zone between rows.	N/A	N/A
Tent Room	N/A	Plastic pots or something similar with a diameter of 50cm	N/A	N/A	N/A	N/A

ROOM	FURNITURE	POTS	TRAYS	TABLES	SHELVING/BENCHING	DRYING LINES

Drying Room	N/A	N/A	N/A	N/A	N/A	Drying line to be installed to ensure positional availability for 576 plants with 1m circulation between rows. The line structure should allow for vertical stacking.
Seed Multiplication Room 1	N/A	Plastic pots or something similar with a diameter of 50cm	N/A	N/A	N/A	N/A
Seed Multiplication Room 2A	N/A	Plastic pots or something similar with a diameter of 50cm	N/A	N/A	N/A	N/A
Seed Multiplication Room 2B	N/A	Plastic pots or something similar with a diameter of 50cm	N/A	N/A	N/A	N/A

ROOM	FURNITURE	POTS	TRAYS	TABLES	SHELVING/BENCHING	DRYING LINES
Seed Multiplication Room 3	N/A	Plastic pots or something similar with a diameter of 50cm	N/A	N/A	N/A	N/A
Climate Control Room 1	N/A	Plastic pots or something similar with a diameter of 30cm	N/A	Galvanised mild steel tables that are able to carry heavy pots with dimensions 1.2m (L) x 0.6m (W) x 0.6m (H). Tables dimensions can be optimised by the contractor as long as the room can accommodate the needed number of plants with a 1m circulation zone between rows.	N/A	N/A

ROOM	FURNITURE	POTS	TRAYS	TABLES	SHELVING/BENCHING	DRYING LINES

Climate Control Room 2	N/A	Plastic pots or something similar with a diameter of 30cm	N/A	Galvanised mild steel tables that are able to carry heavy pots with dimensions 1.2m (L) x 0.6m (W) x 0.6m (H). Tables dimensions can be optimised by the contractor as long as the room can accommodate the needed number of plants with a 1m circulation zone between rows.	N/A	N/A

ROOM	FURNITURE	POTS	TRAYS	TABLES	SHELVING/BENCHING	DRYING LINES

Climate Control Room 3	N/A	Plastic pots or something similar with a diameter of 30cm	N/A	Galvanised mild steel tables that are able to carry heavy pots with dimensions 1.2m (L) x 0.6m (W) x 0.6m (H). Tables dimensions can be optimised by the contractor as long as the room can accommodate the needed number of plants with a 1m circulation zone between rows.	N/A	N/A
ROOM	**FURNITURE**	**POTS**	**TRAYS**	**TABLES**	**SHELVING/BENCHING**	**DRYING LINES**

Climate Control Room 4	N/A	Plastic pots or something similar with a diameter of 30cm	N/A	Galvanised mild steel tables that are able to carry heavy pots with dimensions 1.2m (L) x 0.6m (W) x 0.6m (H). Tables dimensions can be optimised by the contractor as long as the room can accommodate the needed number of plants with a 1m circulation zone between rows.	N/A	N/A

9 OPTIONAL EXTRAS

The following specifications are provided optional extra's

- **Fencing:** ClearVu fencing enclosing the facility.
- **Additional Tar Road Connection:** An optional extension of the existing road network with a tarred access route to the facility.

10 CLOSING CONSIDERATIONS

The following list of items should be considered for all construction, designs and installations.

- Maintenance access to electrical and mechanical components where enclosed or installed in ceiling voids.
- General maintainability.
- All equipment and installations to be handed over with operating manuals where applicable.
- All installations to be accompanied by their associated guarantees and warranties and be handed over to the client during close-out.
- Close-out is also to include final copies of as-built plans and submitted approved building plans in soft copy, hard copy and electronic DWG.
- Where applicable standards override the needs of specifications, the regulations will take president.
- Similar finishes/installations can be proposed as long as the functionality takes president. This is encouraged where cost savings on maintenance or capital expenditure can be achieved.
- All legislative compliance certificates to be issued and provided to the client upon close-out.

APPENDIX A: CONCEPTUAL FLOOR LAYOUT

APPENDIX B: PRICING SCHEDULE

Item No.	Description	Unit	Quantity	Rate (R)	Amount (R)
1	Earthworks				
	The earthworks shall be designed and executed to establish a stable and level platform suitable for the proposed building construction. This includes comprehensive site preparation, precise excavation, controlled grading, compaction, etc. all tailored to the specific requirements of the building project. The design and construction processes must adhere to all relevant regulations, standards, and best practices, ensuring the platform's structural integrity, load-bearing capacity, and long-term durability. Additionally, appropriate drainage solutions and erosion control measures must be implemented to maintain the platform's stability and functionality over time.				
1.1	Platform	Sum	1		
2	Building Structure				
	This refers to the overall building structure, inclusive of external walls, foundations, floors, roof, and all other building components required to adequately house each of the rooms and associated infrastructure.				
2.1	Overall Building Structure	Sum	1		
3	Internal Rooms				
	Design and build rooms to meet South African regulations, inclusive of general wet services, electrical and electronic installations, HVAC, lighting, fire protection and detection, floor finishes, doors, windows, ceilings, etc. as detailed the specification document. Production related installations are included elsewhere in the pricing schedule, this item refers to the building elements specifically				
3.1	Male Bathroom	Sum	1		
3.2	Female Bathroom	Sum	1		
3.3	PWD Bathroom	Sum	1		
3.4	Passages	Sum	1		
3.5	Office 1	Sum	1		
3.6	Office 2	Sum	1		
3.7	Lab	Sum	1		
3.8	Work Room	Sum	1		
3.9	Seed Storage Room 1	Sum	1		
3.10	Seed Storage Room 2	Sum	1		
3.11	Fertilizer Store	Sum	1		
3.12	Growth Medium Store	Sum	1		
3.13	Pot Store	Sum	1		

3.14	Mother Room	Sum	1		
3.15	Cutting/ Clones Room	Sum	1		
3.16	Seedling Room	Sum	1		
3.17	Vegetative Room	Sum	1		
3.18	Flowering Room 1	Sum	1		
3.19	Flowering Room 2	Sum	1		
3.20	Tent Room	Sum	1		
3.21	Drying Room	Sum	1		
3.22	Seed Multiplication Room 1	Sum	1		
3.23	Seed Multiplication Room 2A	Sum	1		
3.24	Seed Multiplication Room 2B	Sum	1		
3.25	Seed Multiplication Room 3	Sum	1		
3.26	Climate Control Room 1	Sum	1		
3.27	Climate Control Room 2	Sum	1		
3.28	Climate Control Room 3	Sum	1		
3.29	Climate Control Room 4	Sum	1		
4	Production Infrastructure				
	Appropriate climate control systems, irrigation& fertigation system and lighting to achieve production requirements				
4.1	HVAC (Production Related)				

Item No.	Description	Unit	Quantity	Rate (R)	Amount (R)
	Appropriate climate control system to be installed at the relevant production areas. All required infrastructure associated with the climate control system to be included. Electrical connection to each system to be included.				
4.1.1	Mother Room	Sum	1		
4.1.2	Cutting/ Clones Room	Sum	1		
4.1.3	Seedling Room	Sum	1		
4.1.4	Vegetative Room	Sum	1		
4.1.5	Flowering Room 1	Sum	1		
4.1.6	Flowering Room 2	Sum	1		
4.1.7	Tent Room	Sum	1		

4.1.8	Drying Room	Sum	1			
4.1.9	Seed Multiplication Room 1	Sum	1			
4.1.10	Seed Multiplication Room 2A	Sum	1			
4.1.11	Seed Multiplication Room 2B	Sum	1			
4.1.12	Seed Multiplication Room 3	Sum	1			
4.1.13	Climate Control Room 1	Sum	1			
4.1.14	Climate Control Room 2	Sum	1			
4.1.15	Climate Control Room 3	Sum	1			
4.1.16	Climate Control Room 4	Sum	1			
4.2	Irrigation and fertigation System (Production Related) This includes the irrigation and fertigation set-up as detailed in the specification document (inclusive of tanks, irrigation system, control system, valves, reticulation etc.)					
4.2.1	Mother Room	Sum	1			
4.2.2	Cutting/ Clones Room	Sum	1			
4.2.3	Seedling Room	Sum	1			
4.2.4	Vegetative Room	Sum	1			
4.2.5	Flowering Room 1	Sum	1			
4.2.6	Flowering Room 2	Sum	1			
4.2.7	Seed Multiplication Room 1	Sum	1			
4.2.8	Seed Multiplication Room 2A	Sum	1			
4.2.9	Seed Multiplication Room 2B	Sum	1			
4.2.10	Seed Multiplication Room 3	Sum	1			
4.2.11	Climate Control Room 1	Sum	1			
4.2.12	Climate Control Room 2	Sum	1			
4.2.13	Climate Control Room 3	Sum	1			
4.2.14	Climate Control Room 4	Sum	1			
4.3	Electrical - Lights (Production Related) All lighting requirements related to the growing of plants					
4.3.1	Mother Room					
4.3.2	Cutting/ Clones Room	Sum	1			
4.3.3	Seedling Room	Sum	1			
4.3.4	Vegetative Room	Sum	1			

4.3.5	Flowering Room 1	Sum	1		
4.3.6	Flowering Room 2	Sum	1		
4.3.7	Drying Room	Sum	1		
4.3.8	Seed Multiplication Room 1	Sum	1		
4.3.9	Seed Multiplication Room 2A	Sum	1		
4.3.10	Seed Multiplication Room 2B	Sum	1		
4.3.11	Seed Multiplication Room 3	Sum	1		
4.3.12	Climate Control Room 1	Sum	1		
4.3.13	Climate Control Room 2	Sum	1		
4.3.14	Climate Control Room 3	Sum	1		
4.3.15	Climate Control Room 4	Sum	1		
5	Electrical - Supply				
	Based on the designed and supplied equipment, this supply needs to be derived from the detail design.				
5.1	Municipal Supply	Sum	1		

Item No.	Description	Unit	Quantity	Rate (R)	Amount (R)
	Connection of the facility to the municipal supply				
5.2	Standby Generator and UPS	Sum	1		
	A standby diesel generator is required to supply full backup power to the entire facility, no-load splitting should be applied, rated equal to the required municipal supply.				
	Diesel Storage tank				
	UPS required for the grow lights in the production facilities				
5.3	Metering	Sum	1		
	A metering device must be installed for the main distribution board of the building to monitor/log the overall electricity usage.				
6	Electronic				
	A building management unit should be installed individually for each respective plant room to monitor each production area in isolation. Access control should be installed for each access point as detailed in the specification document				
6.1	Building Management System	Sum	1		
6.2	Access Control	Sum	1		
7	Furniture				
	Applicable furniture, trays, tables, shelving, drying lines, etc. as detailed in the specification document				
7.1	Office 1	Sum	1		

7.2	Office 2	Sum	1		
7.3	Lab	Sum	1		
7.4	Work Room	Sum	1		
7.5	Seed Storage Room 1	Sum	1		
7.6	Seed Storage Room 2	Sum	1		
7.7	Fertilizer Store	Sum	1		
7.8	Growth Medium Store	Sum	1		
7.9	Pot Store	Sum	1		
7.10	Mother Room	Sum	1		
7.11	Cutting/ Clones Room	Sum	1		
7.12	Seedling Room	Sum	1		
7.13	Vegetative Room	Sum	1		
7.14	Flowering Room 1	Sum	1		
7.15	Flowering Room 2	Sum	1		
7.16	Tent Room	Sum	1		
7.17	Drying Room	Sum	1		
7.18	Seed Multiplication Room 1	Sum	1		
7.19	Seed Multiplication Room 2A	Sum	1		
7.20	Seed Multiplication Room 2B	Sum	1		
7.21	Seed Multiplication Room 3	Sum	1		
7.22	Climate Control Room 1	Sum	1		
7.23	Climate Control Room 2	Sum	1		
7.24	Climate Control Room 3	Sum	1		
7.25	Climate Control Room 4	Sum	1		
8	Equipment				
	Additional equipment as detailed in the specification document or deemed necessary for the operation of the facility by the contractor				
8.1	Pots	Sum	1		
8.2	Tents Provision of tents to be housed in the tent room. Tents to be supplied with all supporting equipment (HVAC, lighting, electrical, etc.) to ensure that once installed it will perform their required functions	Sum	1		

9	External				
	As per details in Section 6.1.3.				
9.1	Pavements	Sum	1		

Item No.	Description	Unit	Quantity	Rate (R)	Amount (R)
	Pavements connecting the various parking bays as shown in the facility layout, all paving should be adequately designed and constructed to handle the movements and parking LDVs and HDVs. Inclusive of at least 10 LDV parking bays, 2 disabled parking bays and 2 HDV parking bays				
9.2	Water Supply and Distribution Water storage and supply for the entire facility, inclusive of back-up supply, reticulation, etc.	Sum	1		
9.3	Building Apron The building apron shall be constructed around the entire facility to provide a stable and durable platform for maintenance access and operational activities. It will also serve as a base for any externally constructed items. The design and construction of the apron must ensure adequate load-bearing capacity, durability, and proper drainage to support long-term functionality.	Sum	1		
9.4	Stormwater The stormwater management system shall be designed and constructed in compliance with all applicable regulations, standards, and best practices to ensure effective performance, durability, and environmental sustainability.	Sum	1		
9.5	Sewer The sewer system shall be designed and constructed in compliance with all applicable regulations, standards, and best practices to ensure efficient wastewater collection, conveyance, and disposal.	Sum	1		
9.6	Waste Area The facility requires a functional and sized waste storage facility situated adjacent to the building. It is expected that growth medium contaminated waste, as well as general packaging, organic waste, etc. needs to be accommodated.	Sum	1		
10	Optional Extras				
	Optional extras included in the pricing schedule for consideration by the client.				
10.1	Road Extending tarred road from the existing tarred road to the newly constructed pavements for the parking access	Sum	1		
10.2	Perimeter Perimeter fence to enclose facility inclusive of a pedestrian access gate and vehicle access gate. This should allow adequate circulation around the facility.	Sum	1		
11	Other				
	Any other items deemed necessary by the service provider to be detailed in an annexure to the pricing schedule.				
11.1	Please specify in annexure	Sum	1		

TOTALS		
1	Room Schedule	

2	HVAC (Production Related)	
3	Irrigation and fertigation System	
4	Electrical - Lights (Production Related)	
5	Electrical - Supply	
6	Electronic	
7	External	
8	Earthworks	
9	Furniture	
10	Equipment	
11	Optional Extras	
12	Other	
13	P&G's	
14	Contingencies	
	GRAND TOTAL	