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# context study

summary three\_28

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### **Description of the Site & Surrounding Land Uses**

The site is approx. 870 hectares in extent. To the south of the site are the residential suburbs of Paulshof and Sunninghill (and its commercial centre).

Witkoppen road, and the almost parallel N1 Western Bypass Highway, lies to the south of these suburbs. Kyalami Agricultural holdings, Kyalami Business Park, and the Kyalami race track and the exhibition Centre lies to the north northwest

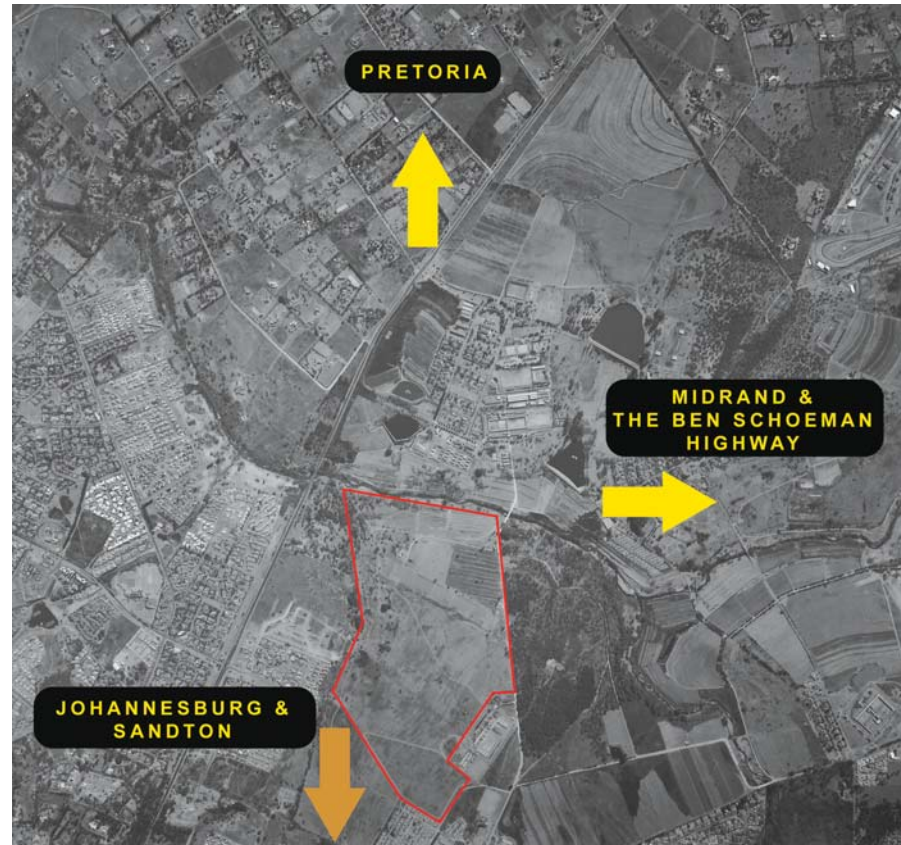
### **The site location**

The Leeuwkop prison site lies approx. 20km (as the crow flies) to the north of Johannesburg CBD and lies 10km north of the decentralised business node of Sandton. The site is situated approx. 6km southwest of Midrand and the Ben Schoeman Highway.

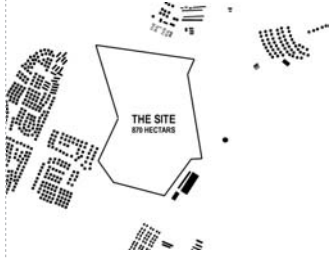


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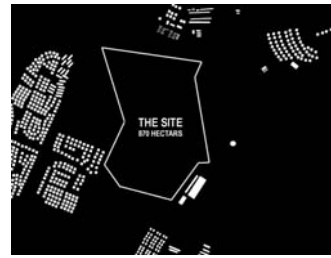
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### Description of the site and the surrounding land uses

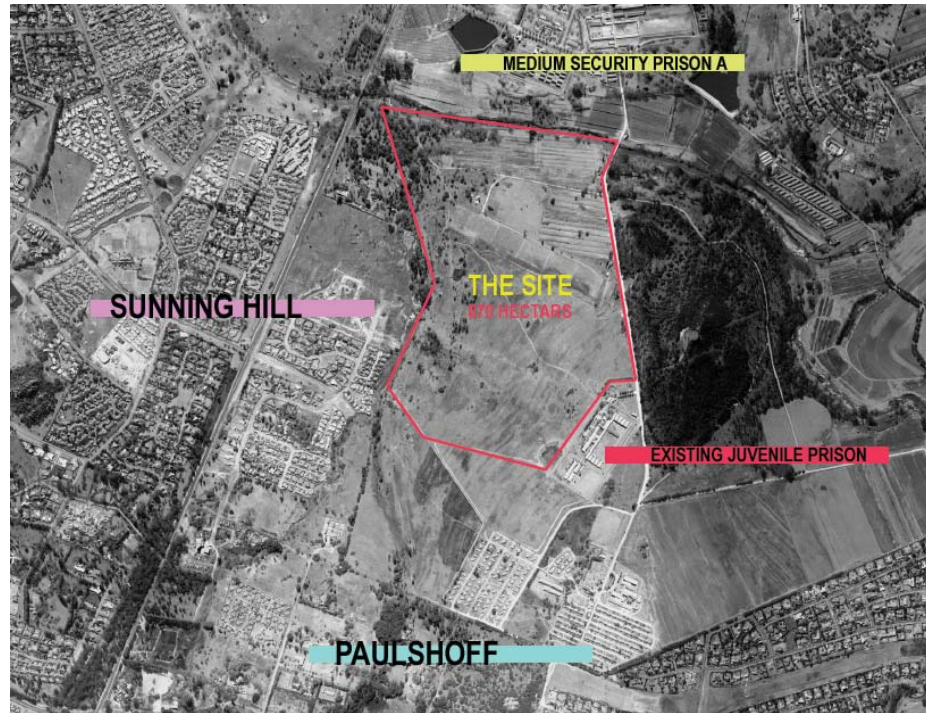
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Witkoppen road, and the almost parallel N1 Western Bypass Highway, lies to the south of these suburbs. Kyalami Agricultural holdings, Kyalami Business Park, and the Kyalami race track and the exhibition Centre lies to the north northwest and the northwest of the site respectively.

Main Road forms the eastern border of the site. Beyond the main road in a northwesterly direction lies the Glenferness Agricultural Holdings while to the immediate west of the site lies the up market single residential and cluster housing suburbs of Lonehill and further a field, Fourways (and its commercial centre) and Dainfern.

### Access to the site

The site is bordered on the western side by Main Road from which primary access to the site is gained and where the main entrance to the prison complex is located. A secondary entrance exists to the south where Leeuwkop road meets the prison site. The Local Integrated development Plan (LIDP), Region 3 seeks to promote the construction of the K60 as an alternative mobility corridor from Woodmead Drive to William Nicol Avenue. This may allow convenient access to the Leeuwkop site from the south.



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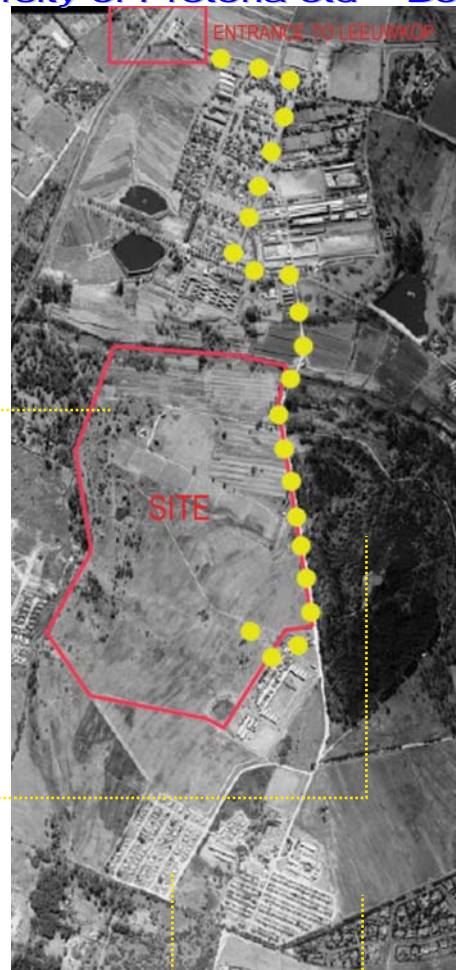
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- The site is located in the southwestern part of the Leeuwkop grounds, adjacent to the west of the existing medium B prison.
- An old shooting range borders the site from the north whilst the remaining boundaries consist of open veld.
- The site altitude varies from 1440 to 1415.
- The site slopes towards the northwest in the direction of the Jukskei river at an average gradient of 6.5%.
- The sites average altitude is about 40m higher and 700m away from the Jukskei River.
- The site consists of open veld with grass and wild vegetation covering the whole site.
- Very few rocky outcrops are visible from the surface.
- There are no agriculture structures on the site and there is no sign of standing water or dams formed on the surface.
- The site overlooks the residential area on the southern border of the Leeuwkop grounds

## City wide principles guiding development

- No tolerance toward land invasion or doubling up of settlements

- Protect and enhance the role of open space within a metropolitan open space system (MOSS)

- Promote sustainable development-development that delivers basic environmental, social and economic service to all, without threatening the viability of the natural, built and social systems upon which these services depend.

- Preserve the semi-rural lifestyle northwest of the Urban development Boundary.

- Incorporate the role of urban agriculture and peripheral land uses as secondary economic activities.

- Protect public and private investment

- Contain urban development to prevent urban sprawl through:

- The promotion of nodal development

- Balancing the mobility and activity roles of the arterial road system

### **Land use management**

To the west of the prison site are large undeveloped areas, making it subject to strong development pressures for the expansion of Diepsloot settlement, land invasion and illegal land uses. The development pressure is threatening the rural character and environmental quality of the area and is placing increasing pressure on bulk services and housing delivery.

### **Environmental management**

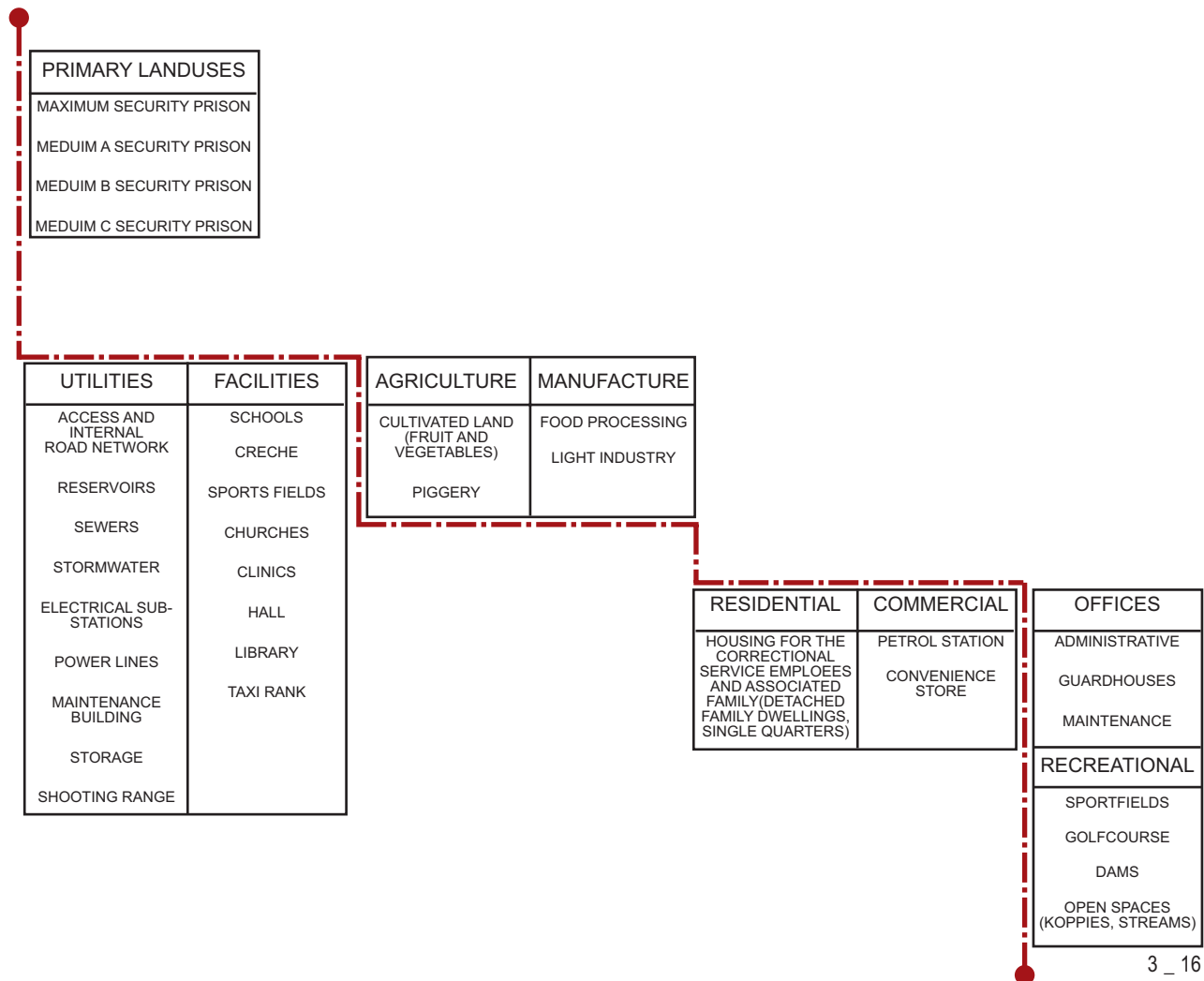
The area is more rural in character and thus has higher environmental quality. Investigations are required to determine the status of the watercourses and wetlands, fauna and flora in order for informed decisions to be made regarding environmental management. Consideration should be given to the protection, conservation and management of areas such as the Jukskei & Klein Jukskei Rivers watercourses, koppies, the Rietfontein Ridge and the vegetation and how these integrate with the Metropolitan open space System (MOSS). The open space, rivers, wetlands should form part of the MOSS in city of Johannesburg. MOSS will fulfil the following purposes: protect sensitive environmental areas, provision of recreational spaces; and assist with storm water management. No proclaimed nature reserve exists in this region.

### **Future projects**

The Intervention and Guidelines for Sub-area 3 (Kyalami Park, Leeuwkop prison), of the Local Integrated Development Plan (LIDP), Region 2, suggest that a Leeuwkop Precinct Plan is to be formulated.

The following projects have been identified for the region 3, which have an impact on the Leeuwkop Prison Site:

- The upgrade of Witkoppen road
- The promotion of the construction of the K60 as an alternative mobility corridor from Woodmead Drive to William Nicole Avenue.
- The protection and management of the Klein Jukskei as important links in the open space system.



The LIPD's for the region 2 & 3 indicate that there is sufficient bulk service capacity to service development in the area.

## Water

Water to the site if fed through two water mains to the south of the site:

- Sandton Municipal Water Main; to
- New Sandton Water Main

The Sandton Municipal Water Main supplies water to the Kyalami reservoir (Leeuwkop Reservoir) which has a capacity of 2275kl and is backed up by a stand-by reservoir with the same 2275kl capacity. A gravity fed reticulation system distributes water to the prison site. The New Sandton Water Main supplies the "New Reservoir", which has a capacity of 5170kl and at present is not fully drawn upon and thus has spare capacity. Water consumption has been reduced by means of pressure control on the water mains and leak detection of water mains. This system is implemented by Shared Energy Management and have recorded the following consumption figures. Further investigation are required to determine the adequacy of water supply and its reticulation for the new prison facility. A formal enquiry has been submitted to Johannesburg Water (see Appendix) regarding the water and sewer capacity requirement for the extension of the Leeuwkop prison

## Sewerage

The LIPD's for the region 3 raises concern regarding the capacity of the sewerage system in the vicinity. The control factor in this catchment area in the Diepsloot Outflow, which can accommodate an approximate 1 000 000 persons. The catchment is divided into five sub-catchments, each having a bulk sewer line connecting into the major outflow sewer line, viz., the Diepsloot Outflow. The sub-catchment relevant to the Leeuwkop Prison site is the Western Klein Jukskei sub-catchment. Within this area a few of the smaller bulk sewers are already near and over capacity. (LIPD, region 2 & 3, CoJ, December 2001). Johannesburg Water also mentioned that the sewers were under strain in the Leeuwkop area and that there are plans to address these problems and upgrade the sewers in the area. (Mr. E Beddington, Johannesburg Water, personal communication, 19 June 2002)

future investigations are necessary into the capacity of the sewer system to avoid potential environmental damage to the natural system. Remedial measures will be required to ensure that the sewerage is disposed of in an environmentally sustainable manner. A formal enquiry has been submitted to Johannesburg Water regarding the water and sewer capacity requirements for the extension of the Leeuwkop Prison.

## Electricity

Electricity is fed to the site via Eskom Supply Authority Substation, which lies to the North of the site. It has been mentioned, however, that Eskom seeks to upgrade this connection from the present 6600v main to a 11000v main. This may require upgrading of the present on-site system, alternatively, a transformer would be required to supply the site on the 600v system. (Rip Wyma, personal communication, 21 June 2002)

Electricity consumption has been reduced by means of load shifting from peak tariff period to off peak and standard period by means of load control geyser. This system is implemented by Shared Energy Management.

## Roads

A further enquiry has been submitted to CoJ and the Johannesburg Roads Agency (see appendix) regarding the impact of the new facility on existing future roads in the area.

## Town planning scheme

**Property description:**  
Portion 2, farm Rietfontein 2-IR

**TP Scheme:**  
Peri-urban Town Planning Scheme 1975 (previously Halfwayhouse en ClayvilleTown Planning Scheme)

**Use zone:**  
Agricultural

**Building line:**  
No standards

**Parking:**  
As per Town Planning Scheme  
restrictive conditions: None

**Coverage:**  
5%

**Density:**  
N/A

**Floor area ratio:**  
N/A

**Height zone:**  
Restricted to 2 storeys

## Town planning procedures

Currently, the land is zoned agricultural and the council has given consent for the establishment of prisons and ancillary uses (places of institution, Special buildings) Investigations are under way as to when the consent was first granted by the council and what conditions and circumstances prevailed at the time under the Peri-urban Town Planning Scheme 1975, and prior to this, the Halfwayhouse en Clayville Town Planning Scheme.

## Water

The Leeuwkop grounds are supplied from the Johannesburg water with two mains at the south borders of the site:

First point of supply:

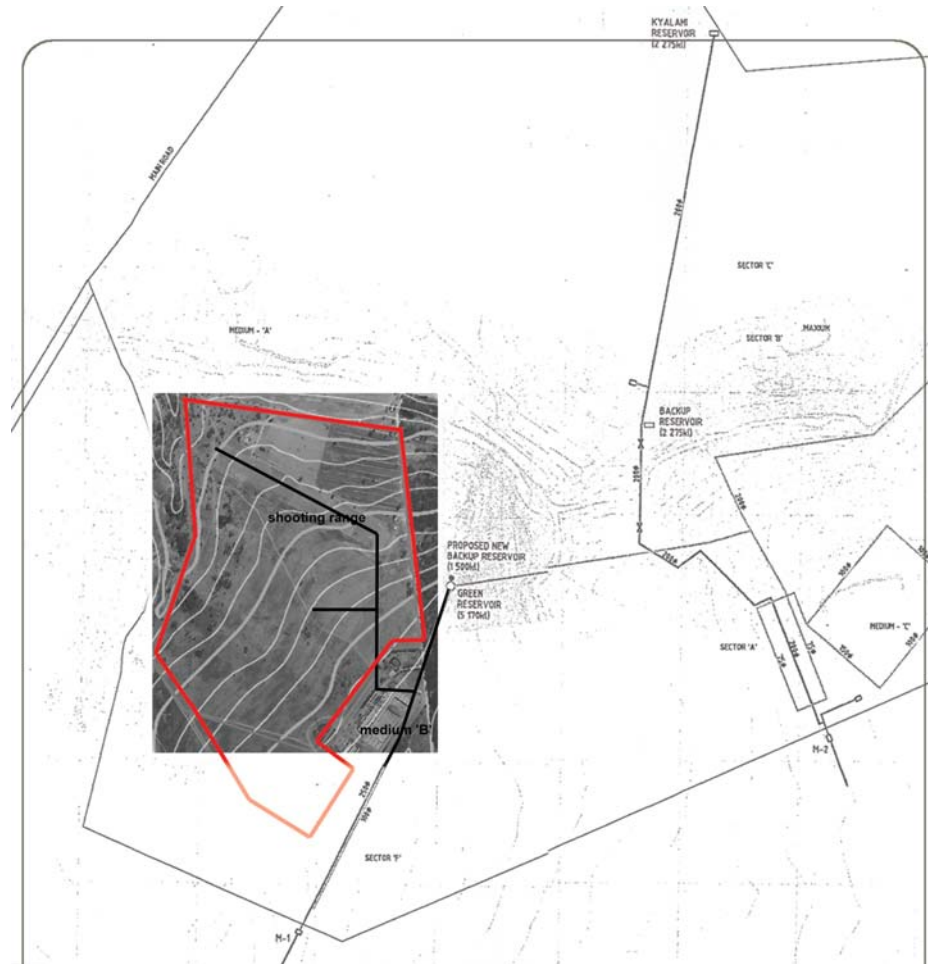
Meinecke-1 (M1):  
a 250mm concrete pipe

Second point of supply:

Meinecke-2 (M2):  
a 200mm diameter steel pipe which  
supplies the Kyalami reservoir.

The Leeuwkop site has 3 water  
reservoirs in total.

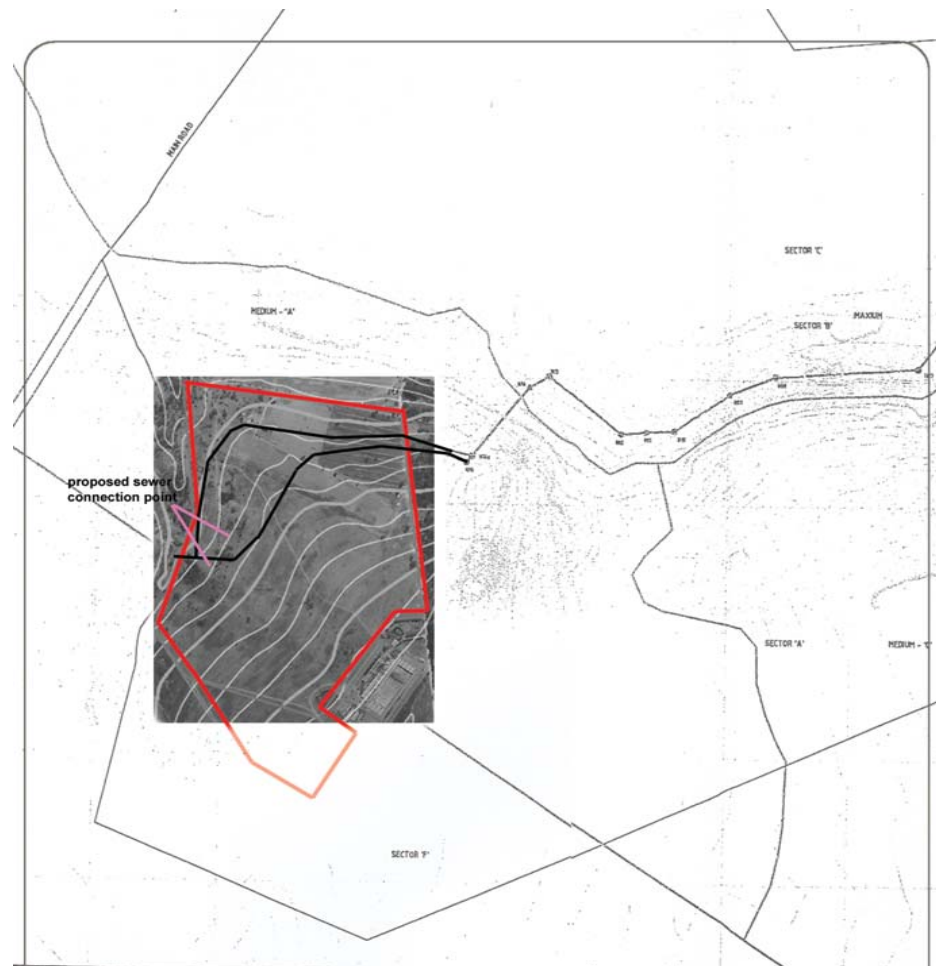
- The Kyalami reservoir with  
a capacity of 2275KL
- The Green reservoir with  
a capacity of 5170KL
- The Stand-by reservoir to  
the Kyalami reservoir with  
a capacity of 2275KL



## Sewerage

There are three sewerage lines entering the Leeuwkop grounds from different directions

- A bulk sewer which enters the grounds from the eastern border and run parallel to the Jukskei River.
- Another bulk sewer enters the grounds from the southern border in the south-northern direction and joins the first line in the vicinity of the centre of the site.
- Another outflow sewer pipe enters the site from the southern border in the east-south to north-west direction.







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- The site is located right next to Main Road.
- The main entrance is approx. 2000m from the site.
- There are speculations that new entrance might be built to replace the existing one. The new entrance is pointed out to be very close to the site, about 600m.

### Storm water

The site has a gentle slope towards the Jukskei River as seen from the contour lines on the site.

The difference in level between the estimated lowest points of the prison to the river is about 30m over a distance of 500m, which gives the average slope of 6%.

Two options are considered

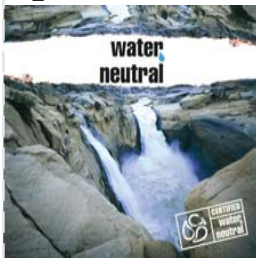
- The collection of the storm water

A proposed dam of a capacity up to 2000 cubic meters on the site, which is used for the supply of water for agriculture. But as the site investigation has pointed out several water pumps are installed directly to the main stream of the Jukskei River, making this option impractical. The expenses of building a dam while water is already available from different sources on the ground, can not be justified.

- Diverting the storm water to the Jukskei River

Concrete channels will collect the storm water from the site and discharge into the Jukskei River. This option is suitable option and relatively expensive.

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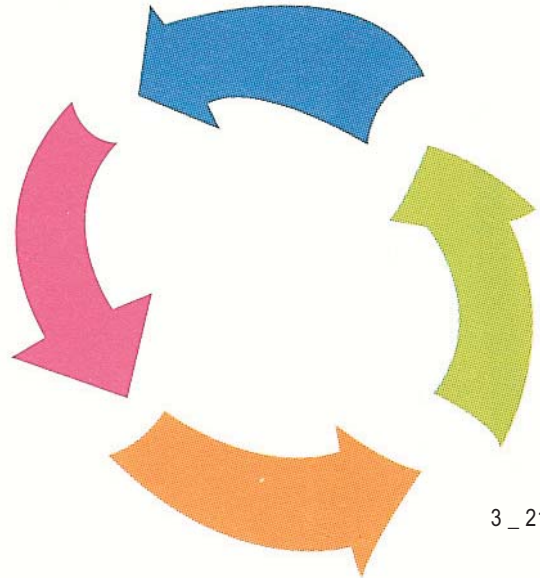
### Existing service

Presently “inter waste” render the management of the waste at the Leeuwkop site. There would be no problem in accommodating any additional waste generated by the new prison. The initial estimate for waste management for the new prison would be R 5 500 per month.

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### Alternative waste management systems

- ‘Pikitup’ could be approached for their services.
- Waste management on the site.



### Geotechnical

Rocky outcrops on the south-western side of the site, and hard materials encountered from 1.8m below the surface.

Shallow seasonal perched water table occurring during summer time.  
Granite occurs in scattered areas.

The presence of rocky outcrops and the underground water suggest that the prison should be build on different platforms as to minimize the need to deep cut of blast in rocky areas and to minimize the size of importing materials to site.

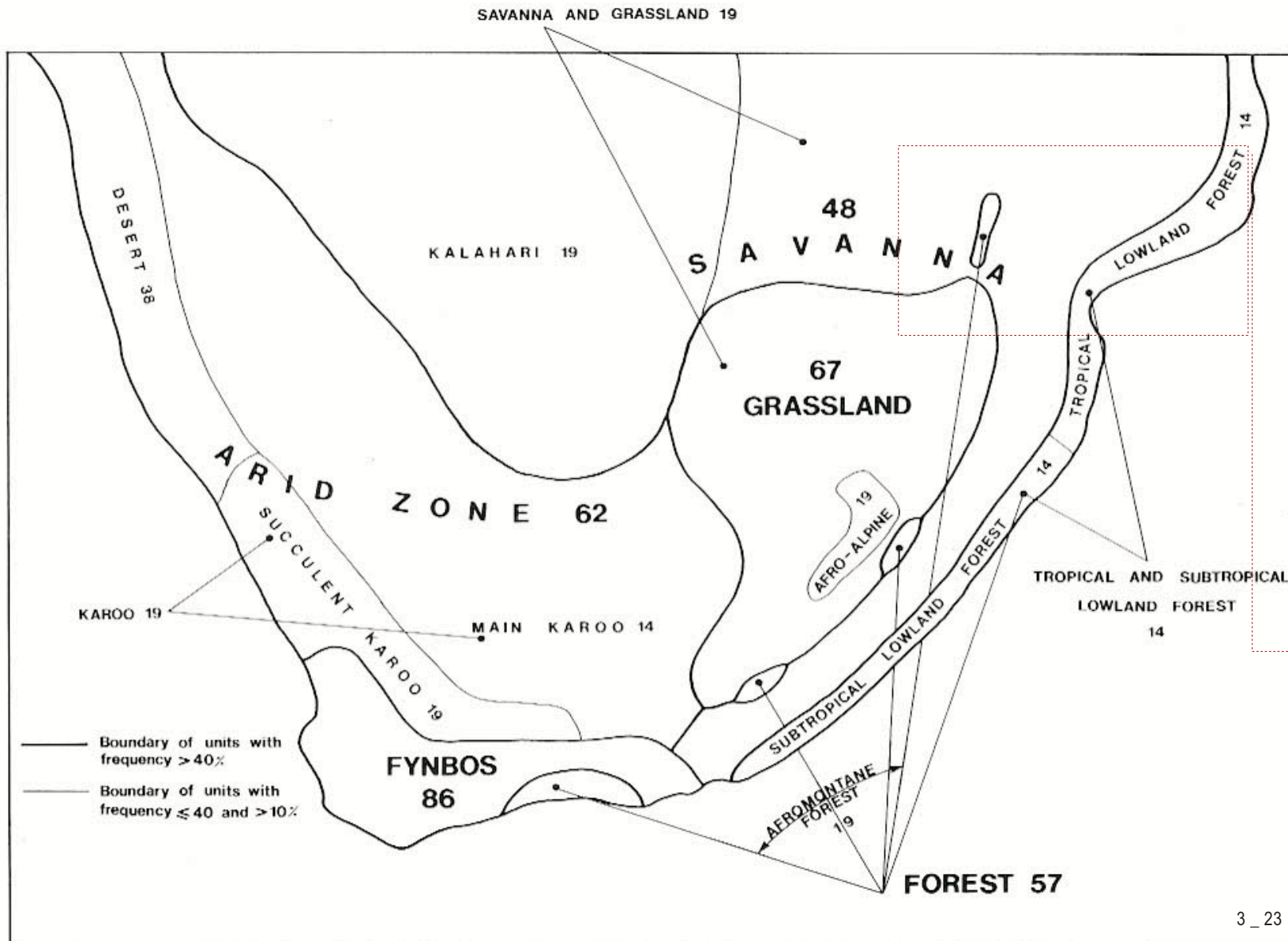


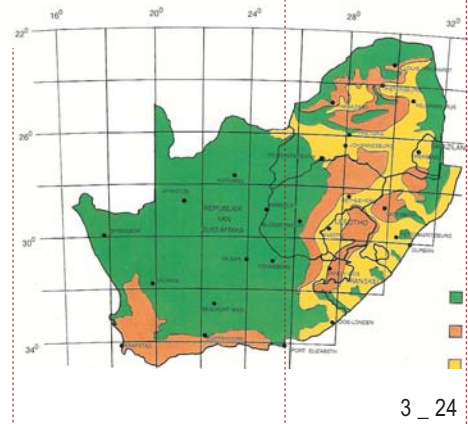
[URBAN GREEN FILE vol 7,2002.may/june]

### Recommended foundations:

- Deeps trip footing
- Soil raft/ compaction of in-situ soils.

# biophysical study



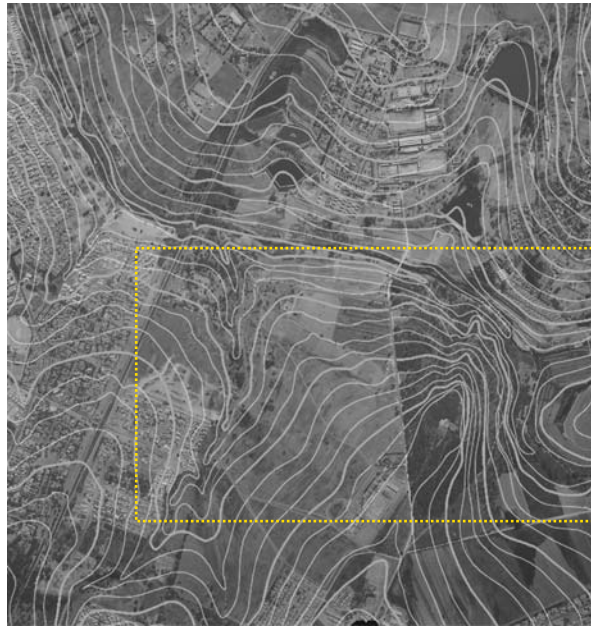


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## 2 Major grass dominate:

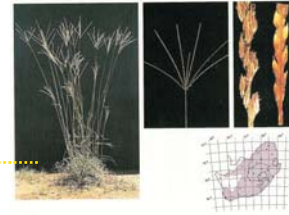
- sweet grass: lower fibre content, maintain nutrients in leaves in winter palatable to stock
- sour grass: higher fibre content, withdraw nutrients in leaves in winter unpalatable to stock

# biophysical study



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*Digitaria eriantha*  
'Finger grass'



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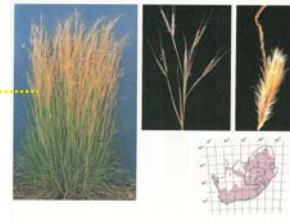
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*Hyparrhenia anamesa*  
'Bundle thatching grass'



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*Hyparrhenia hirta*  
'Common thatching grass'



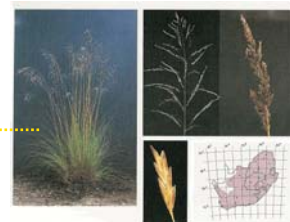
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*Pennisetum clandestinum*  
'Kikuyu'



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*Eragrotis curvula*  
'Weeping love grass'



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***Acacia karoo***

'Sweet thorn' [INDIGENOUS]

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***Acacia mearnsii***

'Blackwattle' [EXOTIC]

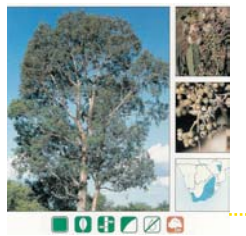
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***Celtis africana***

White Stinkwood [INDIGENOUS]

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***Eucalyptus grandis/globulus***

Blue gum [EXOTIC]

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***Grewia spp.***

Velvet rasin/ Cross-berry [INDIGENOUS]

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# biophysical study

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# climatic analysis

This analysis is guided by Dieter Holm's manual for energy conscious design document. Holm 1996

## Introduction

In order for the man-made environment to use the available natural energy to its optimum efficiency, it must be planned with consideration given to:

- Materials
- Micro climatic conditions
- Building orientation within the site
- Landscaping

An environmental responsive building should have:

- Minimal negative impact on its site
- Maximum human comfort

To economically incorporate alternative energy devices into buildings, energy conservation measures must be taken which diminish the total energy usage of the building and functions. Many different items relating to energy conservation should be considered and evaluated for possible use in buildings. Areas in which energy conservation practice can be employed, relative to the climatic zone, have been divided into the following categories.

- 1 Climate
- 2 Wind
- 3 Solar

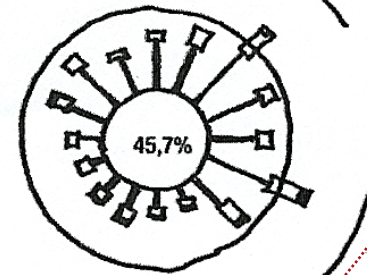
The design considerations for Johannesburg:

- 4 Peri-urban
- 5 Plan form
- 6 Possible functions
- 7 Rain protection
- 8 Mass
- 9 Insulation
- 11 Properties of materials
- 12 Lighting
- 13 Ventilation

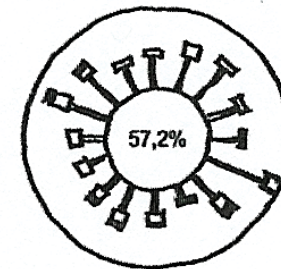
Every aspect of the building should be planned for its best utilization of all energy, including passive systems which use the natural energies from the sun, wind, water and earth.

**2 WIND**

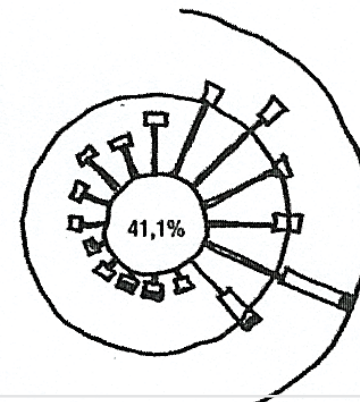
Summer winds are predominantly east-north-easterly to east-south-easterly. Winter winds are predominantly south-westerly with a fair amount originating from the north-east.



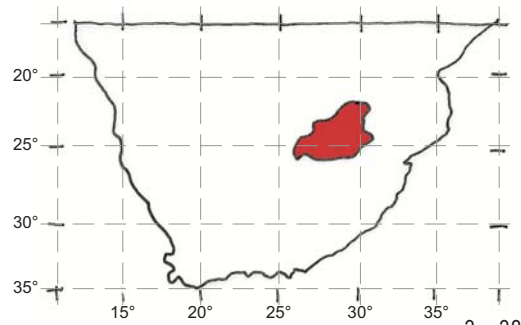
July



January



**1 Climate**



Location of climatic region: 3\_38

25,8° TO 30,7° East and 22,0° to 25,9° South.

**Description of zone climate:**

Distinct rainy and dry seasons exist with a large daily temperature variation and strong solar radiation. Humidity levels are moderate.

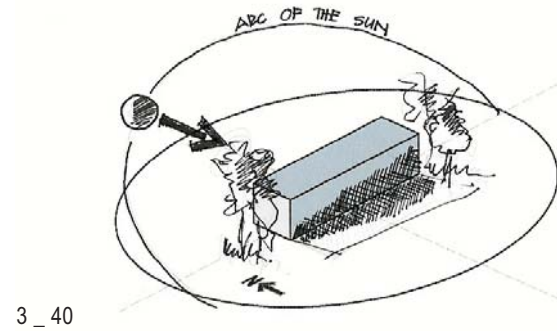
**Humidity:**

The average monthly relative humidity level is 59%.

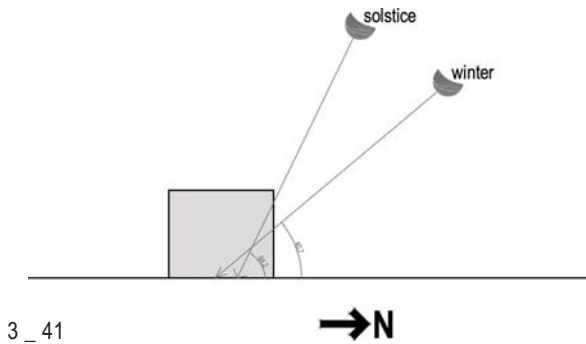
**Temperatures:**

The maximum diurnal variation occurs in July. The average monthly diurnal variation is 13K.

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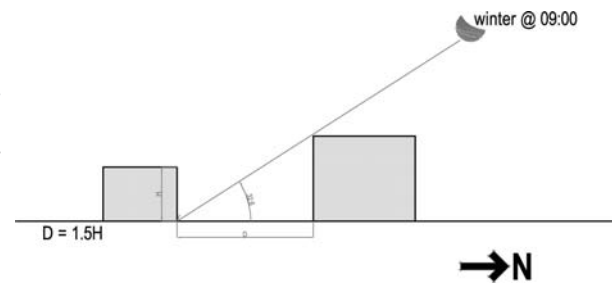
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### 3 Solar

There is a greater chance of successfully integrating solar applications if they are taken into account from the initial conceptual design stages.



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## 5 Plan form

The winter and summer requirements are different.

### The winter demands:

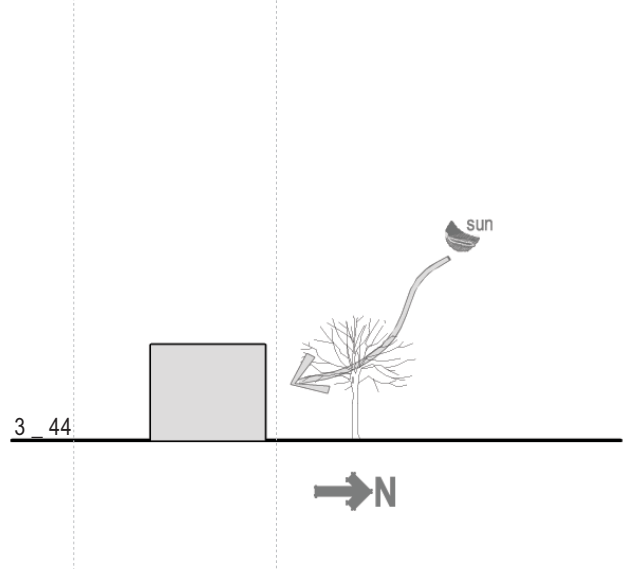
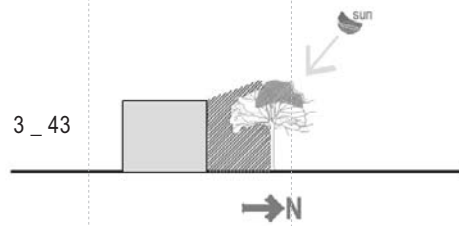
A building which has a compact form, well insulated envelope and a need for great solar gain.

### The summer demands:

A building with a free form which is well ventilated and has shading devices which control the penetration of the sun.

## 6 Possible functions

External spaces should be created forming courtyards. These spaces should provide shading for internal spaces. Louvres should be placed on the west and east facades.



## 4 Peri-urban

The urban development structure determines the quality of the built environment and open space. It also creates the possibility to use solar energy in buildings. The most important elements for achieving the optimum energy levels in an urban development plan include:

- Orientation of the facades
- Directing parts of the roof towards the south

Protection of pedestrians by tree, covered walkways, or canopies. North facades of buildings receive high radiation during summer and should be tree lined. Insulation is enhanced by a small angle of obstruction of buildings and vegetation. A larger distance between buildings reduces the angle of obstruction thus offering the greatest possibility of utilising passive solar heat.

The position of vegetation also has an effect on exposure:

The active solar application, is greatly effected by the orientation of the roof. The maximum solar incidence for active utilisation is achieved by positioning the roof structure or parts of the facade between southeast and southwest.

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### **7 Rain protection**

All entrances should be protected from rain and sudden thunderstorms.

## **8 Mass**

Thermal mass is effective for half of the under heating period of the day. In Johannesburg the thermal mass is required due to the large daily temperatures swings. It can be provided by floors, roofs, thick walls and internal partitions.

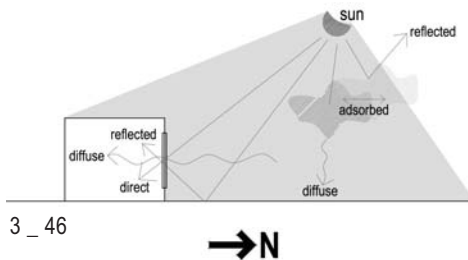
## **9 Insulation**

Light insulated roofs are feasible in this climatic region provided that the walls and the floors give thermal mass. Heavy thermal roofs are also feasible if the walls and floors are light weight.

## 10 Lighting

The right application of natural and artificial lighting is vital for good task perception and comfort within a building.

The relationship between daylight and artificial light is of importance in terms of the controllability, uniformity and colour of the light.



## 11 Ventilation

Ventilation is the provision of air to a building. One reason for ventilation is that the occupant needs oxygen to oxidize their food produce the energy in order to live. Ventilation is also required to remove pollutants, to minimize moisture, to reduce the risk of condensation and the most obvious task, to provide cooling, and is most likely to result from occupant action. For ventilation to result in useful heat loss, the ambient temperature must be lower than the maximum comfort temperatures indoors.

Different systems can be used to gain maximum ventilation levels:

- Evaporative cooling

Direct evaporative cooling is effective for most of the overheated periods of the day, but should not be used the whole time as it can add to humidity levels which could compromise human comfort levels.

- Active

air conditioning is not a necessity, but the building functions may require it.

- Mechanical

Mechanical ventilation may be necessary to achieve the required ventilation rates