MKHONDA LODGE & EDUCATIONAL FARM

PIET RETIEF, MPUMALANGA

Creating a new vernacular

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JC
Sue, Cielja and Dee

ABSTRACT

This thesis focuses on the design of a lodge and all its components, which include accommodation, exhibition spaces, conference facilities, restaurants, public services, fishing dams and a certain amount of cottages. Regarding accommodation, the proposed lodge would be able to provide for large groups of people, but would still adhere to the more private needs of those individuals who prefer to travel alone.

Mkhonda Lodge and Educational farm is situated on farm Madola outside the town of Piet Retief, Mpumalanga. Piet Retief is integrated as part of a major tourist route that connects KwaZulu-Natal with Swaziland and the Kruger National Park. This means that a considerable amount of tourists inevitably pass through the town without adequate available accommodation or restaurants to satisfy their needs.

Sustainable building practices and appropriate technologies guide the design process in terms of the use of local materials and labour; construction techniques; and resource and waste management. Local labor plays an important role in an effort to educate the local community. All the buildings are predominantly constructed of straw bales which are used as infill between the timber pole post-and-beam roof structures. Building elements are standardized to create a modular system which adds to the idea of keeping the design simple and easy to construct.

The design strives to create spatial balance and harmony for interior and exterior spaces, environmentally friendly yet functional infrastructure and materials, low maintenance, ergonomic solutions, and respect for our environment and resources. The ideal is that visitors are educated in an informal way through experiencing unconventional construction methods and design approaches.

In essence, this thesis continuously emphasizes respect for the site, its users through generally integrating a more holistic approach.

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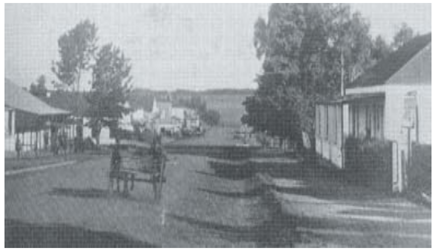

fig.01.02 Church street, ca. 1952

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01 INTRODUCTION

01.01 PROLOGUE

The emerging town of Piet Retief has been described by many as the 'Gateway to Swaziland and the KwaZulu-Natal Coast'. (Piet Retief: 75 jaar van vooruitgang 1959, p.1) It was founded in 1883 by Anton van Wielligh and named in memory and honour of the famous Voortrekker leader who was killed by the Zulu leader Dingaan in 1836 The town is situated in Mpumalanga – "place where the sun rises" - and lies on the boundaries of the beautiful and majestic Swaziland. (Figure 01.01) It is envisaged that, in future, Piet Retief will become the headquarters of the rapidly evolving industrial development in the Lowveld (Piet Retief: 75 jaar van vooruitgang 1959, p.2), as it is renowned to be at the heart of the largest wattle-bark producing area.

Tourism can be described as the movement of people who converge on an area for recreational purposes. They explore and experience the culture, the specific activities and generally enjoy all that is offered by the individual communities. Tourism is presently the main area of growth in our economy, offering many opportunities.

Piet Retief is integrated as part of a major tourist route that connects KwaZulu-Natal with Swaziland and the Kruger National Park. This means that a considerable amount of tourists inevitably pass through the town without adequate available accommodation or restaurants to satisfy their needs. Therefore, a definite market for accommodation of large tourist groups can be identified.

This thesis focuses on the design of a lodge and all its components, which include accommodation, exhibition spaces, conference facilities, restaurants, public services, fishing dams and a certain amount of cottages. Regarding accommodation, the proposed lodge would be able to provide for large groups of people, but would still adhere to the more private needs of those individuals who prefer to travel alone.

The design of the lodge will be a priority. However, it is initially necessary to include pilot or starter projects that are capable of sustaining the development financially. Adequate spaces that would be able to facilitate these starter projects and thus form an important part of the design process, are therefore a necessity. It is important to retain the cultural identity of the surroundings. Therefore, the lodge will aptly be called "Mkhonda", meaning 'Spoor' in the Zulu language. (See Appendix 08.01.1)

Within the last few years, sustainability and ecological responsibility has become a significant consideration in development, as the importance of a self-sustainable development cannot be ignored. In essence, this should guide every aspect of future designs.

Sustainable building practices and appropriate technologies guide the design process in terms of the use of local materials and labour; construction techniques; and resource and waste management. The design includes sustainable principles to create spatial balance and harmony for interior and exterior spaces, environmentally friendly yet functional infrastructure and materials, low maintenance, ergonomic solutions, and respect for our environment and resources. The ideal is that visitors are educated in an informal way through experiencing unconventional construction methods and design approaches.

In essence, this thesis will focus specifically on continuously emphasizing respect for the site, its users and generally integrating a more holistic approach.

01.02 PROBLEM STATEMENT
01.02.1 Accommodation

In the eastern parts of South Africa, a typical voyage will include a visit to the Kruger National Park, Swaziland and KwaZulu-Natal's coastline. Piet Retief can, for this very reason, be described as the perfect halfway stop. (Figure 01.10a) Whether traveling via Nelspruit or Swaziland, the route will inevitably include Piet Retief.

The area has a fragmented guesthouse industry which, over time, has had a great impact on the future of the hotel industry. Currently, only one hotel is set to accommodate a busload of 45 to 60 tourists at a time. As a sign of the changing times, large tourist groups tend to exclude this option of accommodation and would rather pass through the town to find other, more favored, exclusive hotels or lodges. Most of the time, these lodges are located in Swaziland and are situated around 100km from Piet Retief, which means added travel expenses and unnecessary time consumption. Further complications are the derelict condition of the roads and the fact that one has to pass through two borders, which often cause delays.

A definite need can be identified to provide of accommodation catering for both small and large groups of local and foreign tourists. The accommodation should attract people and provide them with a unique experience true to Piet Retief, its people and the activities that are taking place in the surrounding areas.


fig.01.05


fig.01.06


fig.01.07


fig.01.08


fig.01.09 Church street, ca. 2004

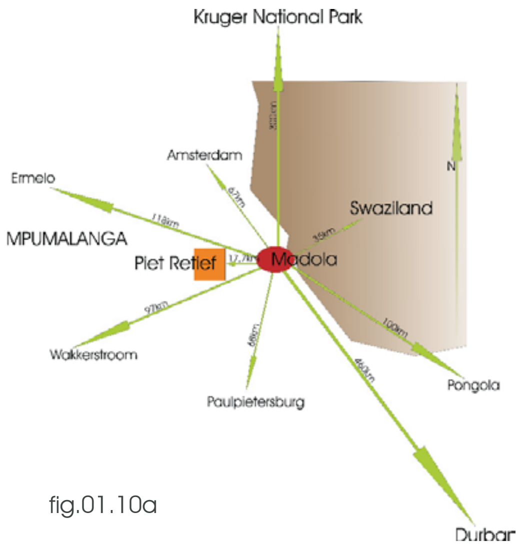


fig.01.10a

fig.01.10b

fig.01.10c

01.02.2 Road Structure

In the early and mid 1900's, Piet Retief had ample rail and transport facilities. This catered mainly for wattle bark, mining timber and tobacco exportation. (Piet Retief: 75 jaar van vooruitgang 1959, p.2) Unfortunately, the utilization of this railway line has decreased considerably, causing an increase in the current amount of heavy vehicles on the national roads in area. As a result, the road conditions deteriorate up to the point where an alternative road has been proposed. This aims to provide travelers with a convenient, well-kept road that links the Kruger National Park with KwaZulu-Natal and will pass within a range of 10km from the farm Madola, which is the proposed site. (See Appendix 08.01.7)

01.03 THE SITE

Piet Retief is situated in the south of the Mpumalanga province and lies approximately 330km south-east of Johannesburg and Pretoria. (Figure 01.10a) The proposed development site is on a farm outside Piet Retief called Madola H.T. – 154 Portion 5. The farm is about 128 hectares in size and is located 17km east outside of town on the Mahamba road towards the Mahamba border post. (Figures 01.10b&c) The farm offers various unique experiences in terms of natural plant growth, topography and water resources. It also plays host to a small indigenous forested area. (Figures 01.05 - 01.08, 01.11, 01.12)

01.04 CLIENT AND CLIENT REQUIREMENTS

CLIENT

The client, Gemsbou Beleggings CC, presently based on the farm Madola, is concerned with the production of an extensive variety of products. This includes timber (the manufacturing of poles, planks and furniture), wine, liqueur, preserves, cheese, pickled and dried mushrooms. Gemsbou Beleggings CC will supply the preliminary costs of various pilot projects. At a later stage, the project will joined by selected farmers in the area who wish to partake in such a project.

CLIENT REQUIREMENTS

The client is open to building lenient on site, but stipulates that the design should make use of natural, locally obtained materials so as to ensure a sustainable development. This is based on the principles of best practices and appropriate technologies. As much as possible, building costs should be kept to a minimum. Local labor should be utilized and the overall design should include waste management and re-use of materials. The only fixed requirement is that the design should include an area or building that is relatively close to the existing house in which pilot projects and the current production of farm products could continue.

01.05 OBJECTIVES

The main objective of this thesis is to design a lodge based on best practice design principles that focus on the use of local, value-adding. The focus should be on energy conservation, local food production, community upliftment and a new, sustainable design approach. As there are very few activities in the Piet Retief district that cater for the social needs of the local community, a place of enjoyment that can also enhance the quality of life in Piet Retief is envisaged.

01.06 FEASIBILITY & PROJECT PHASING

In order for the project to be financially viable, the development is divided into different phases. It is necessary to determine pilot projects that can sustain the development at first and, as the project starts to thrive economically, next phases will be introduced. Each phase should theoretically sustain the next one. The different phases entail the following:

Phase 1 (current activities):
1. Sawmill
2. Timber processing (timber products & timber treatment)
3. Mixed farming
    I. Berries
    II. Livestock (cows, goats, chickens)
    III. Agricultural crops
    IV. Silviculture
    V. Wild & cultivated mushroom processing

Phase 2
1. Farm Factory functions:
    I. Brewery
    II. Winery
    III. Cheese making
    IV. Captive use of farm products
    V. Retail outlet
    VI. Coffee shop
2. Manager's cottage
3. Mushroom cultivation area
    I. Spawn laboratory
    II. 3 mushroom growing rooms
    III. Solar dryer


fig.01.11


fig.01.12

Phase 3
1. Fishing dams
    I. Dam 1
    II. Dam 2
    III. Trout dam
2. 12 private cottages (Kloof)

Phase 4 (MAIN PHASE)
Lodge that includes:
1. Accommodation
    I. 6 family cottages
    II. 6 semi-private cottages
    III. 6 private cottages
2. Restaurant & Kitchen
3. Public & private swimming pool areas
4. Reception & offices
5. Lounge
6. Conference facility

    Functions:
    I. Showroom /exhibition space for local artists
    II. Conferences
    III. Showroom
    IV. Theatre
    V. Weddings, entertainment, etc
    VI. Meeting room

02 DESIGN DISCOURSE

02.01 DESIGN PHILOSOPHY

A PHENOMENOLOGICAL APPROACH

Phenomenology – *"an approach that concentrates on the study of consciousness and the object of direct experience"*
(Concise Oxford Dictionary, 1999)

Existentialism – *"philosophical theory which emphasizes the existence of the individual person as a free and responsible agent determining their own development through acts of the will"*
(GELERNTER, M. 1995 p.272)

Norberg Schultz proposed a theory of 'existential space', which describes the intimate relationship between the individual and the space he or she inhabits and experiences for him- or herself. The user then interprets it, responds to it and makes up his or her mind about the design and therefore learns from it.

The design of Mkhonda Lodge takes a phenomenological approach, where the individual is continually aware of a space and the objects within the space as he or she moves through the different buildings on site. In other words, knowledge is obtained through appearances that are perceived by the individual's experiences. The idea would be that this experience should take place in the subconscious mind of the while an overall positive impression of the site and the design is brought about. Specifically, in designing Mkhonda Lodge, this would mean that people should be able to communicate with their surroundings when in and around the buildings, through overlooking the site from within buildings and being able to look into interior spaces from the outside. At the same time, the buildings should physically relate to their immediate surroundings. These visual and sensory experiences help create a vibrant place of interaction. Progression between spaces and their interaction with each other and the site will be some of the main design requirements. The design therefore becomes a mere tool, which guides the individual in planning his or her own course through the landscape. The user determines the nature of his or her experience. This experience is further enhanced by the use of materials and good detailing within the design, which means that **buildings must express what they are made of.** Materials and building techniques must be used optimally, never using one material or method if another can do the job less expensively or more efficiently. It implies the honest use of materials and never making the material seem that which it is not. For example, windowsills should portray the unconventional thickness of straw bale walls; timber structural poles should be used in their natural state to display the inherent load bearing qualities of timber and stone walls should be used in areas where an element or building needs to blend into its surroundings and where the structural potential of stone becomes evident in the construction of retaining walls.

This phenomenological approach ultimately aids in experiencing the site and its surroundings, which informs the design when investigating possibilities of creating a new vernacular.

THE GREEN MOVEMENT

Environmental consciousness has come of age. History shows that in the hour before a paradigm shift occurs, solutions to seemingly impossible problems present themselves. Lest we commit ecological suicide, we have been forced to come up with solutions to halt global warming, decontaminate our food and drinking water and de-pollute our air. This all gave rise to the 'The Green Movement', which is an encompassing awareness that places respect for the environment and human life at the forefront of each endeavor. For too long architecture has been dragged into the inaccessibility of fine art, only obtainable by the very rich or in a poor reproduction by those less wealthy. Maybe a green approach to the built environment will succeed, not least because it can provide again an architecture for all (VALE, B. & VALE, R. 1991 p.186), including future generations. This green movement constitutes a massive shift. It is not simply a trend that will die out as modernism did. Like us, it is here to stay. (SHANTALL, L. 2004, p.117-120)

02.02 DESIGN DIRECTIVES FOR A NEW VERNACULAR

VERNACULAR *– to be connected to a place. It is the landscape, surroundings, history, traditions, people and time of a place.*

'We should relish the opportunity to create an architectural vernacular redolent of our unique landscape that set an eco-friendly example for the rest of the world'
(SHANTALL, L. 2004, p.117-120)

The design of Mkhonda strives to create a new vernacular architectural style that is regional and pragmatic in nature, based on the following four main elements as design directives:

1. sustainable design
2. implications of straw bale construction
3. cultural significance of a courtyard; and
4. mushroom cultivation

In essence, the final solution portrays an architectural style similar to designs done by the architect, Glen Murcutt, where the use of materials are honest and simple to create a domestic architecture that is non-showy works of art.

"What is missed is the fact that Africa is a humble and soulful place where we mostly still build in an age-old tradition of bricks and mortar …The intrusion of alien variants…indicates how poorly we are equipped to sense and then sell the real spirit of a place and our own rooted vernaculars to clients" – Henrie Comrie (COMRIE,H.2003,p.36)


Fig.02.01a


Fig.02.01b


Fig.02.01c

02.02.1 Sustainable building practices and appropriate technologies

Green buildings are sensitive and respond to their sites and climates, instead of imposing invasive and ecologically ineffective structures upon us. Solar water heaters, grey rainwater harvester recycling programmes, natural ventilation, walls consisting of earth, stone, straw bales and planted gardens are all part of the new architectural language. The use of balanced lighting, therapeutic colours, fresh air, water features, the use of earthy materials, mood and atmosphere, and noise reduction all aid in creating an overall holistic design.

In specifically designing Mkhonda Lodge, realistic and practical issues influenced decision making. Only local materials and labour are used and every effort is made to preserve energy resources on site. Systems used to portray sustainable practices become part of the design and the intention is that people will be informally educated through being exposed to these systems.

The design strives to simplify all elements, keeping the design modular and construction less complicated. Available local skills and techniques are adopted and modified in an appropriate way and displays the honesty of a design that has an architectural language derived from the local context.

02.02.2 Straw bale construction

The main construction material of Mkhonda Lodge is straw bales. A new set of design specifications accompanies straw bale construction, which has a significant effect on building forms and facades. The design is therefore subjected to these guidelines, which, to certain extent, determine the nature of the final product. Straw bales can be locally obtained or produced, keeping transporting costs to a minimum.

02.02.3 Cultural significance of the courtyard

COURTYARD – *"an open area enclosed by walls or buildings"*
(Concise Oxford Dictionary, 1999)

The Zulu villages in the surrounding areas are all based on a typical layout where buildings are arranged around a central and private courtyard. (Figures 02.01b,c) People are drawn from each individual unit to this central point where most of the social and daily activities take place. In effect, the courtyard plays a significant role in unifying the entire village. This function is of high value to a development such as Mkhonda. The users of the lodge and Zulu villages take part in similar activities, such, eating, leisure, relaxation and sleeping, which are all linked to one or more courtyard. In the design, the courtyard and variations thereof therefore become main features that symbolize the bringing together of a diverse group of people. Each enclosure is intimate and personal within which a high level of awareness is maintained through the use of textured materials and visual elements.

02.03 LAYOUT GENERATORS

In generating a suitable layout, the local context was analyzed, which provided Mkhonda Lodge with design essentials. The three subjects that were investigated included a study of local building typologies, the traditional courtyard and the cultural meaning of "Mkhonda". The final layout was generated through overlapping and refining these three aspects.

02.03.1 Local building typologies

Through reusing local old building methods, we are forced to relearn many of the traditions and disciplines lost to modern architecture and planning. While respecting these old traditions, the design modifies them according to the current needs and knowledge. The challenge is to synthesize the relevant pieces of the past with the progressive ideas of the present. Hence, the design demonstrates innovation in its translation and interpretation of the existing local vernaculars, which included traditional farmsteads (Figure 02.09) and local Zulu villages. (Figures 02.02 - 02.08)

Fig.02.02

Fig.02.03

Fig.02.04 - 02.08


Fig.02.09


Fig.02.10


Fig.02.11


Fig.02.12

TRADITIONAL FARMSTEADS

Through analyzing a number of existing traditional farmsteads in the area, common key elements and layout principles were identified. People recognise, relate to these elements and find comfort in them. Therefore it was important that the design incorporated these features in a creative and unconventional way. This ensures that people are able to relate to the buildings of Mkhonda Lodge and at the same time are gradually introduced to a new design solution for the area. The idea was not to create a completely unorthodox building typology, but rather to use parts of the renowned architectural style in the area to be able to come up with a better solution in terms of construction methods and the overall design approach. The key elements that were identified include:

1. Corrugated iron roofs
2. Verandahs
3. Fire places
4. Use of stone as building material
5. Gardens around houses
6. Sheds/working areas of the farm have large doors and high, small windows
7. Buildings and avenues are aligned on an axis to give focus and direction
8. There exists hierarchy between buildings
9. Buildings are modest in architecture

One of the main elements of traditional farmsteads is how the werf is divided into a working and residential area. In the same way, the development on Madola is divided into these two distinct functions, the working area being the Mushroom Cultivation Area and the Farm Factory, while the residential area is represented by the lodge and all its various functions. The two different functions are characterized through the following:

1. WORKING AREA – Highly accessible, production takes place, views do not enjoy highest priority
2. RESIDENTIAL AREA – Peaceful and tranquil atmosphere, private, parking in close vicinity, provides accommodation, captures most important views.

When designing Mkhonda Lodge, all the abovementioned elements were reinterpreted in a modern way.

ZULU VILLAGES

The architecture of Mkhonda Lodge attempts to re-instill a sense of cultural pride and building techniques that are informed by traditional Zulu space, using methods where outdoor spaces become very important and where natural plant and earth materials are used. (Figures 02.10 - 02.12) Different buildings within a village spill out onto a central space, which becomes a private enclosed area. Each village that was analyzed has a courtyard that opens up at one end to embrace the most important view (Figures 02.01a, 02.13), as well as three layers that progress from semi-public to private and eventually to a very private inner space. (Figure 02.14) The semi-public and private layers are separated by a buffer of trees planted along three sides of each village. The fourth side opens up to the view.

Initial design sketches were made using a mirrored version of the layouts of Zulu villages as a starting point for the arrangement of functions within the main development area. (Figures 02.15 - 02.18a,b)

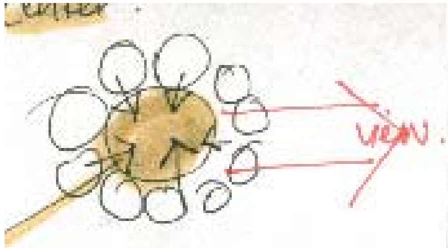


Fig.02.13

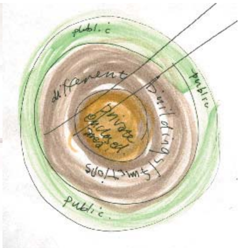
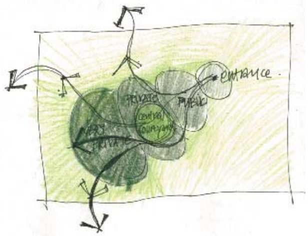


Fig.02.14



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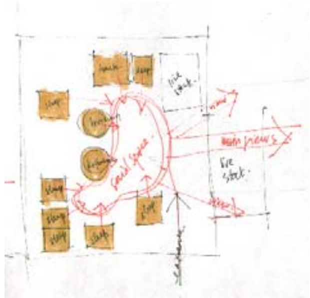

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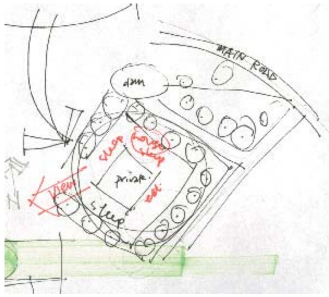

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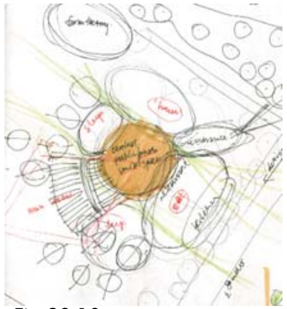


Fig.02.18a

02.03.2 Significance of courtyard

A courtyard is significant in that it has the ability to gather people and provide opportunity for social interaction. The arrangement of buildings around a central courtyard was an integral design consideration and influenced various layout proposals from the outset of the project. In terms of layout, the main courtyard, with a formal and clearly defined circular arrangement, becomes the central focus in generating an appropriate plan. (Figure 02.18a,b) As one begins to move away from this central point, different courtyards or enclosed spaces are created, which are less formal until they eventually spill out to become less defined, leaving only a hint of its origin – the perfect circle.

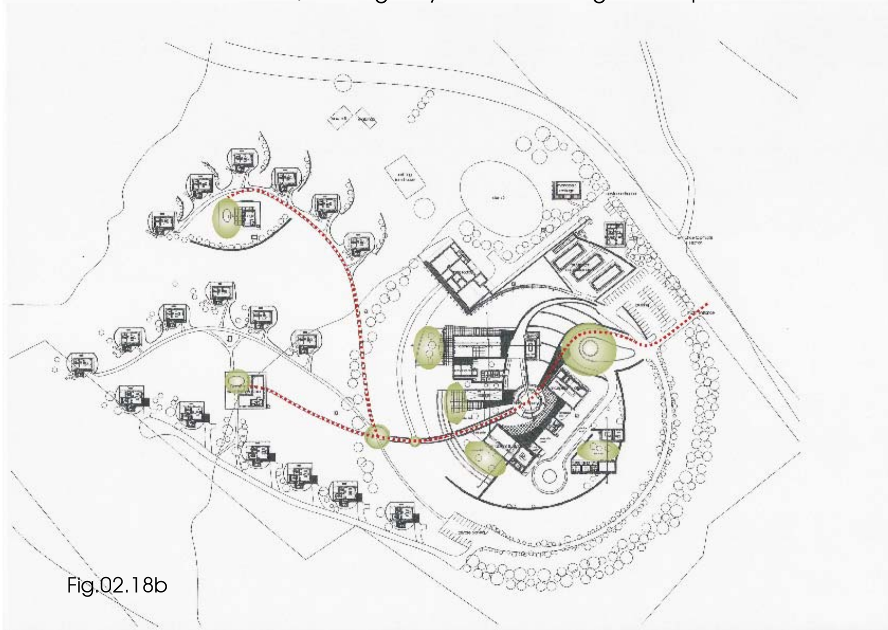


Fig.02.18b

02.03.3 The meaning of "Mkhonda"

The original meaning of Mkhonda is "spoor" or the track or scent of an animal. (See Appendix 02.03.3) Instead of using the actual footprint of an animal or human to generate a possible layout, the focus shifted to representing the action associated with a spoor. Tracking a spoor means that one is actually led along a specific path towards the final destination. By strategically placing the buildings, circulation routes are created and the user is led along these movement lines and patterns within the design. As is the case with Zulu villages, the spoor allows public spaces to gradually flow into private enclosed areas.

02.04 DESIGN EXPLORATION

The modern industrial culture has banished most of us from the essential connection with our environment and community. Our future lies in re-establishing those links. The above discussion is a broader interpretation of the local context which moves beyond the visual to the social, environmental, economic, and climatic context. Buildings then respond to the public needs as well as their private function, and respect the uniqueness of the site rather than the mechanistic universality of a modern industry. The design strives to amalgamate the concept of green buildings and modern convenience to create a built environment that serves its users effectively and ensures harmony with our precious environment.

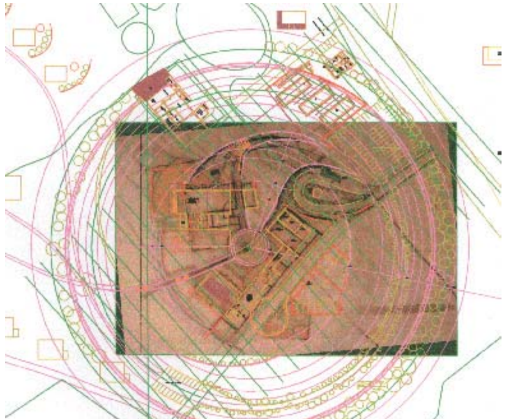


Fig.02.22 Circle / Courtyard as layout generator

Fig.02.19 Contour model of farm Madola

Fig.02.20 Contour model of farm Madola

Fig.02.21 Contour model of farm Madola

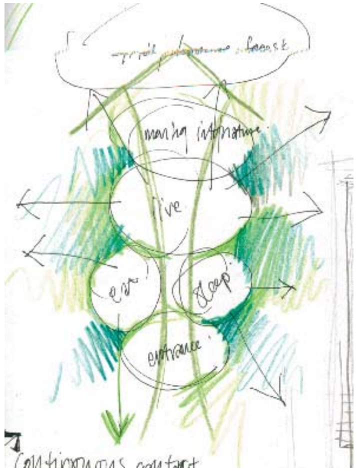


Fig.02.23 Initial concept sketch of experience within cottage

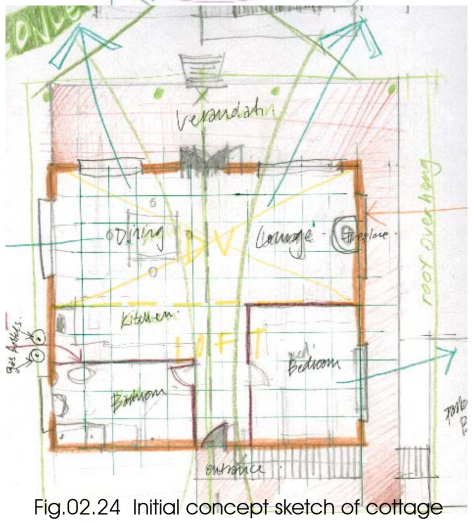


Fig.02.24 Initial concept sketch of cottage plan

Fig.02.25 Initial concept sketch of cottage elevation

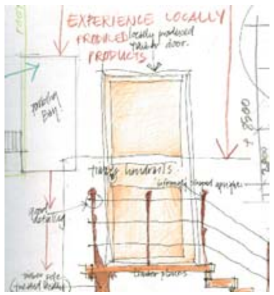


Fig.02.26 Initial concept sketch of locally produced elements within each cottage

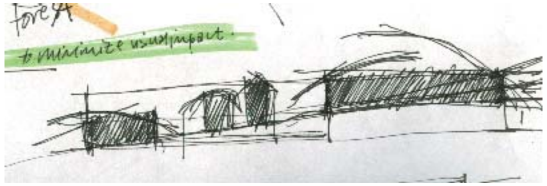


Fig.02.27 Exploration of sloping site - Main development area

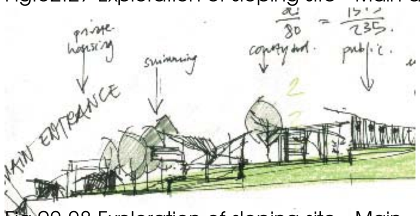


Fig.02.28 Exploration of sloping site - Main development area

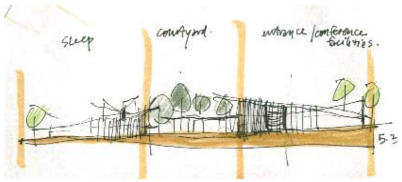


Fig.02.29 Arranging functions around central courtyard

Fig.02.30 Concept sketch of proposed architectural character & aesthetic quality of the design

Fig.02.31 Initial proposed layout of Main development area

Fig.02.32 Stone walls proposed as landscaping elements to improve overall legibility within the landscape

Fig.02.33 Developing the layout of the Main development area

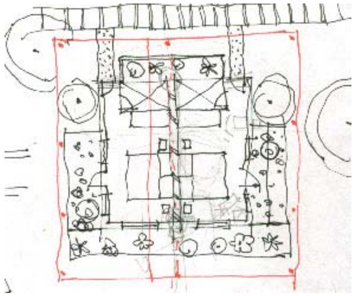


Fig.02.34 Investigation of joining two sleeping units

Fig.02.35 Incorporating solar panels into the design

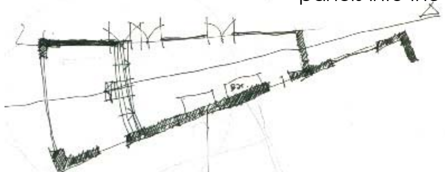


Fig.02.36 Concept sketches of Lounge & Bar to embrace the most important view

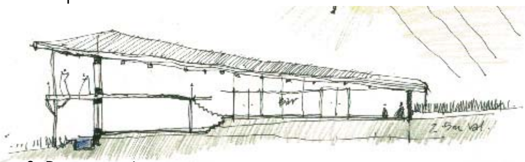


Fig.02.37 Lounge & Bar opening up towards the view

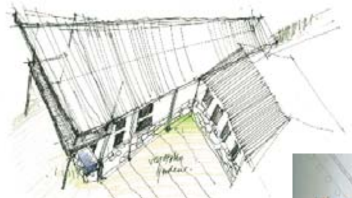


Fig.02.38 Lounge & Bar overlooking vegetable gardens

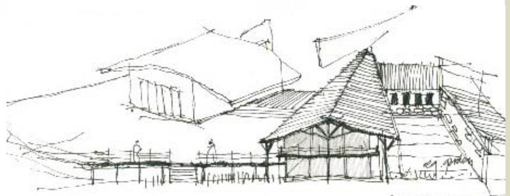


Fig.02.39 Initial sketch of outdoor deck area overlooking the landscape

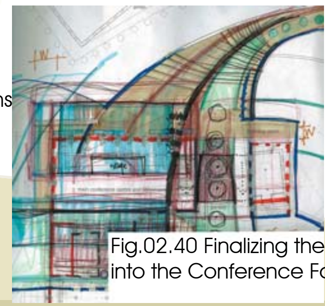


Fig.02.40 Finalizing the entrance into the Conference Facility

DESIGN DISCOURSE

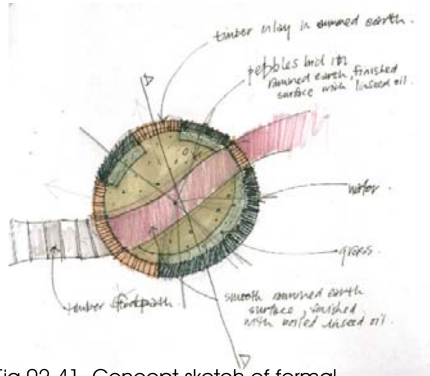


Fig.02.41 Concept sketch of formal courtyard layout

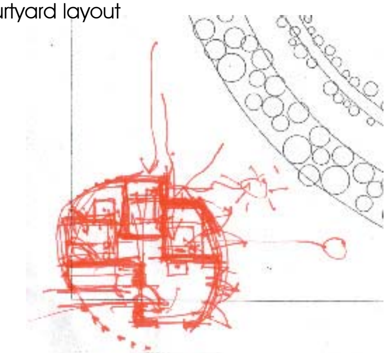


Fig.02.42 Sketch indicating the influence of circular lines on cottage's layout

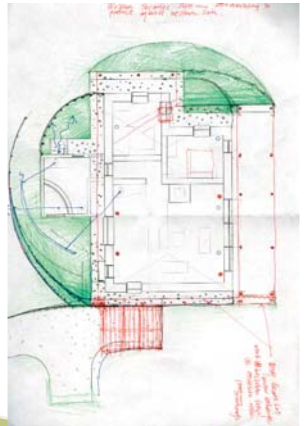


Fig.02.43 Developed cottage plan

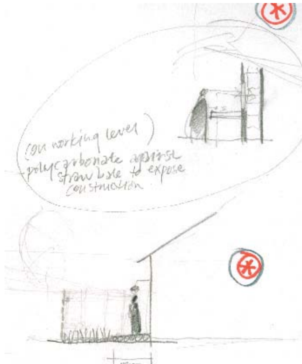


Fig.02.44 Investigating the possibility of an outside shower

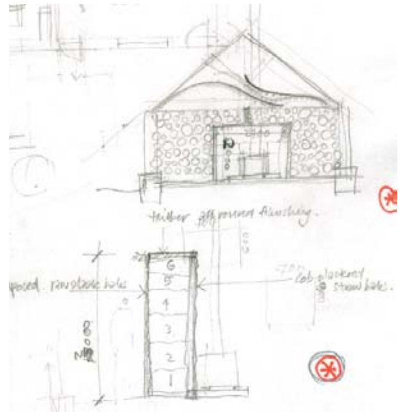


Fig.02.46 Concept design of an exposed straw bale wall

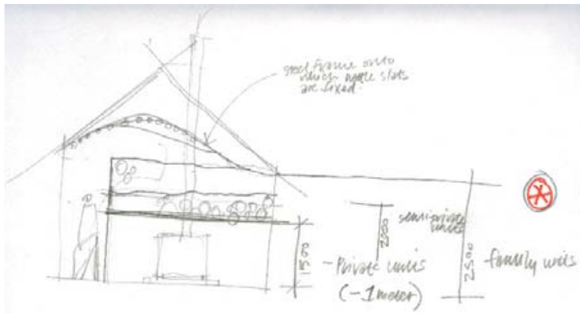


Fig.02.47 Designing cordwood space dividers within the various cottages

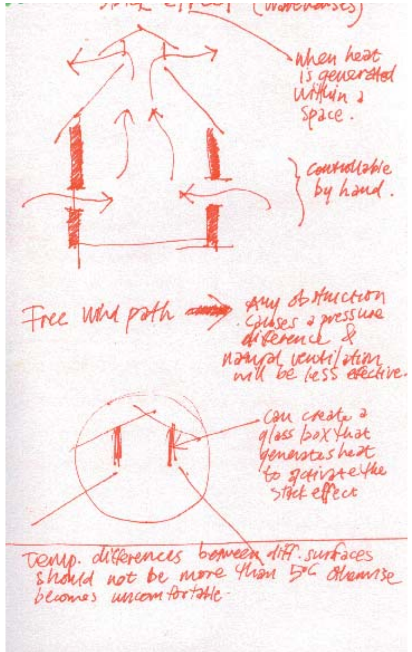


Fig.02.45 Influence of natural ventilation patterns to displace warm air through clerestory windows

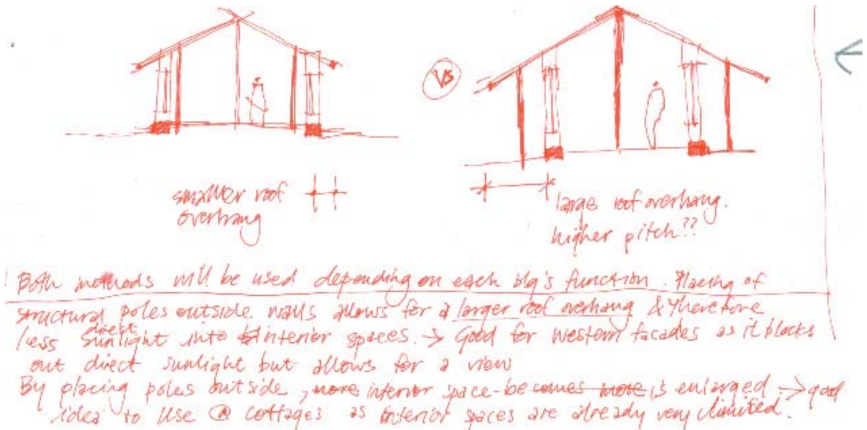


Fig.02.48 Advantages & disadvantages of placing timber roof structure in- and outside straw bale walls

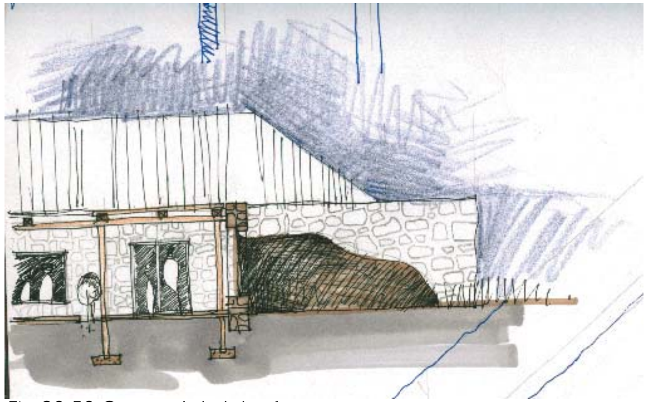


Fig.02.52 Concept sketch of exposed composting area

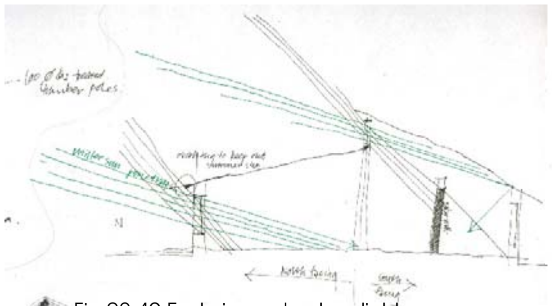


Fig.02.49 Exploring natural sunlight penetration into larger buildings

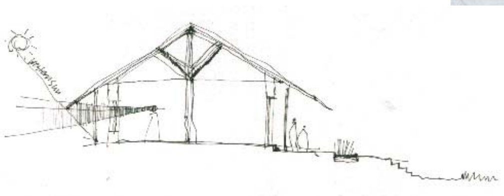


Fig.02.50 Designing roof overhangs for optimal interior temperatures

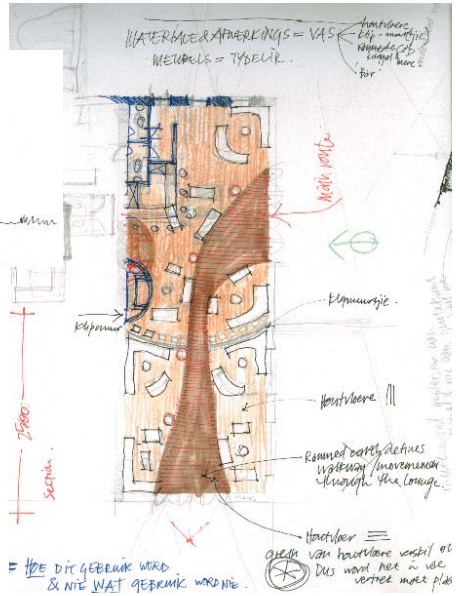


Fig.02.53 Detail investigation of the Lounge's layout and finishes used

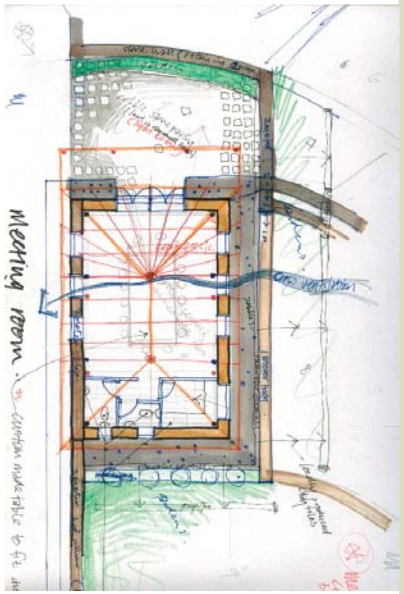


Fig.02.54 Finalizing the plan of the Meeting room

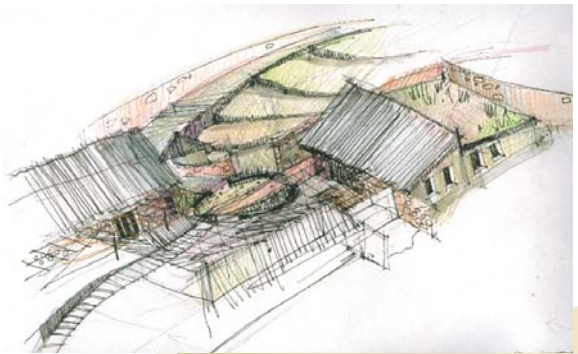


Fig.02.51 Concept sketch of central courtyard as focus point in Main development area

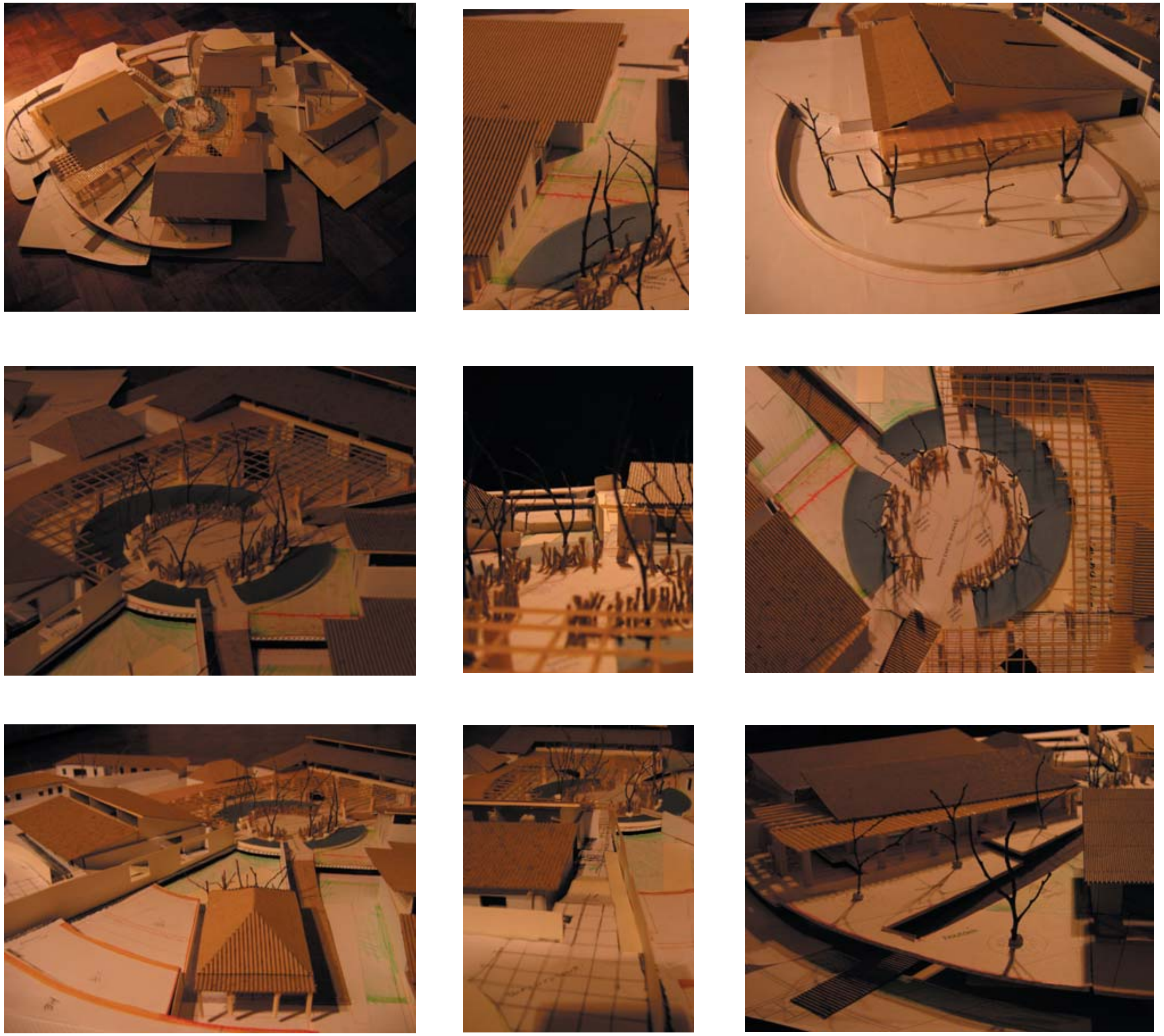
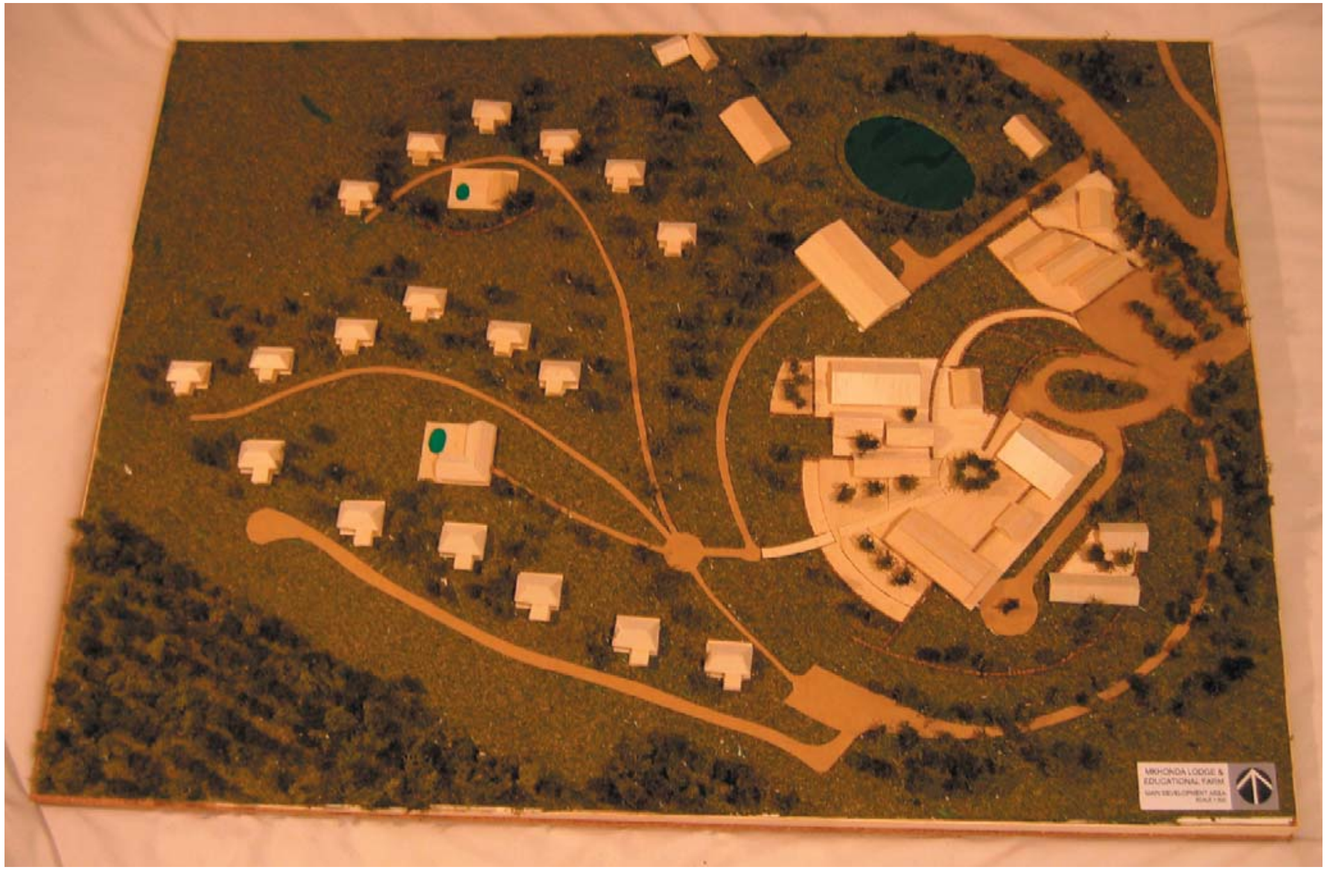
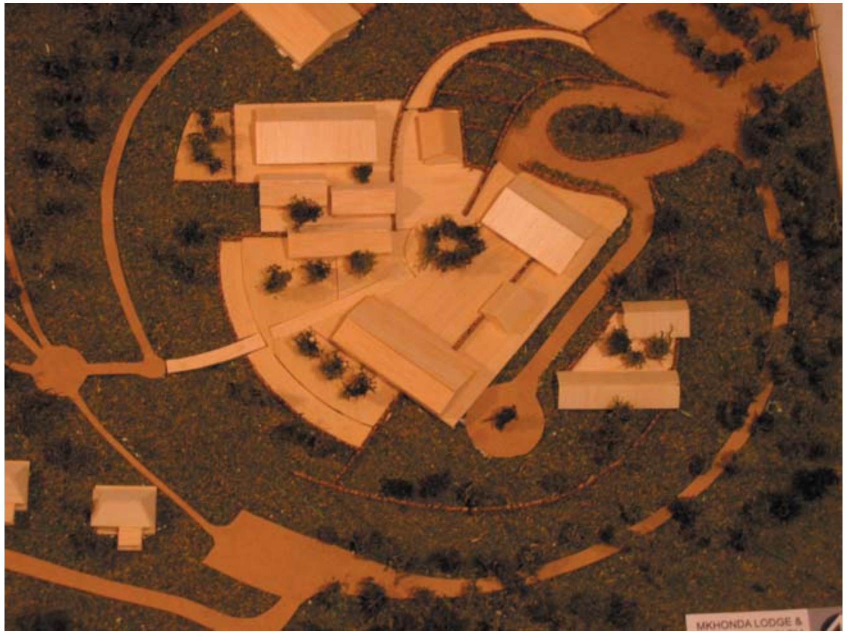


Fig.02.55 - 02.63 Photos of concept model before finalizing the design.

02.05 DESIGN

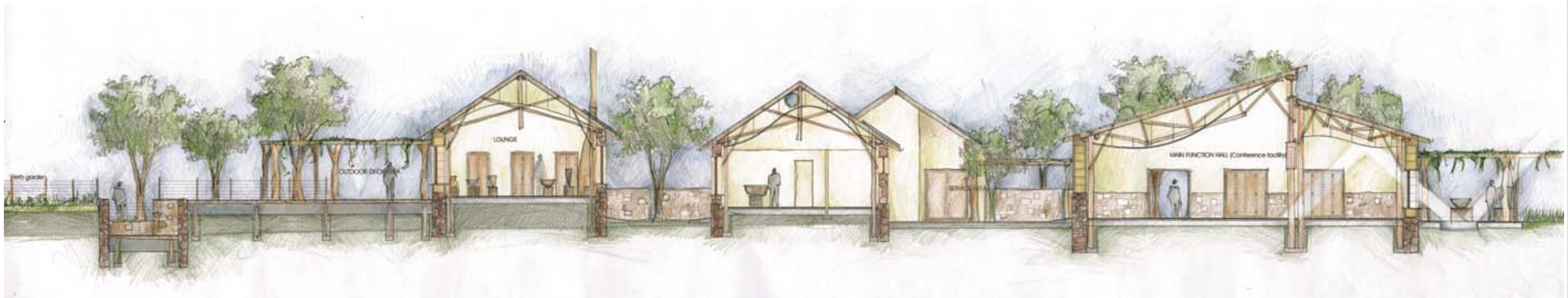


DESIGN DISCOURSE


MKHONDA LODGE &

DESIGN DISCOURSE


bathroom
bedroom


LOUNGE
MAIN FUNCTION HALL (Conference facility)

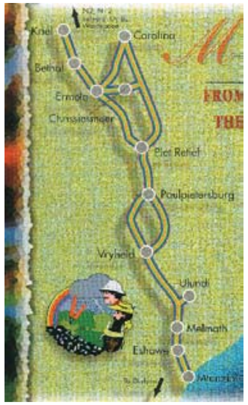


Fig.03.01


Fig. 03.02


Fig.03.03


Fig.03.04

03 CONTEXT

03.01 TOURISM IN PIET RETIEF

03.01.1 Piet Retief as a tourist node

> *"For the industrialist, the commercial man, and the man who wishes to make Piet Retief his home, the attractions, facilities and the advantages offered are many and varied. Its outstanding richness of natural resources is unrivalled…It has a superb climate and possesses all the amenities of a modern town."* (Piet Retief: 75 jaar van vooruitgang 1959, p.2)

Piet Retief lies at the meeting point of several important national roads. It lies on two major holiday routes: The Zululand Kingfisher Route and the Rainbow Route. (Figure 03.01) The Rainbow Route is an innovative tourism initiative that includes the leisure, sporting and recreational opportunities of twelve towns in Mpumalanga. The roads that converge here are also important trade routes and the town forms the gateway to the mountain Kingdom of Swaziland. The area is becoming increasingly known as a unique tourist destination with many guesthouses, game farms and hiking trails. (LABUSCHAGNE, H. 1998 p.6) Most of the tourist activities are nature-related and include the following: Moderate to strenuous hiking trails, 4x4 safari trails, fly-fishing, bird watching and game viewing on horseback or by specially adapted game viewing vehicles. Historical tourist attractions in Piet Retief include the Dutch Reformed Church, designed by Gerhard Moerdijk and the relics of the British Fort "Clerie". These buildings portray the rich and colourful history of the area.

03.01.2 Farm Madola as a tourist attraction

The main tourist attractions are the farm's visual landscape character, fishing opportunities and the organic production of produce. The focus is on providing an environment that enhances the natural beauty of its setting and responds to the need for quality accommodation in the area. It does not include a vast array of tourist activities, but rather a base from where the tourist can take part in the different activities that the Piet Retief region has to offer.

03.02 HISTORICAL CONTEXT

In the late 1800's, Piet Retief was a true frontier district. The whole area fell to the marauding Swazi citizens. The tsetse fly plague and malaria were rife in some areas, but it, for the largest part, was open and uninhabited. The settlers who came from the highveld found it to be a region of mild climatic conditions and high rainfall with fertile soil. It was not long before they were using the Assegai Valley in the winter for grazing purposes. The old farmers soon found that the area was particularly suited for the cultivation of tobacco, timber, maize and for raising cattle and sheep. Indeed, Piet Retief used to be famous for its tobacco and to this very day, the pipe tobacco brand, 'Boxer', is still called 'Piet Retief tobacco'. (LABUSCHAGNE, H. 1998 p.1-2)

Being part of a tobacco production district, the main activity on the farm Madola used to be just that. But during the past years the tobacco industry phased out and the farm's main focus became the planting of trees, especially black wattle and eucalyptus. (See Addendum 08.01.3) Today, the farm's main income is generated through a small-scale strawberry operation and the exportation of timber logs and planks. (Figures 03.02 - 03.04)

03.03 SOCIAL CONTEXT

As was the case in most of South Africa, in the early days Piet Retief was divided into separate zones that housed different races. The town was mainly occupied by white people, whilst coloured, black and Indian races each occupied their own residential areas on the outskirts of Piet Retief. (see Addendum 08.01.2) The Indians called their area Kempville, coloured people stayed in Retiefville and black people called their town eThandakukhanya ("we love our town/place").

Today, the town of Piet Retief is about 121 years old, and currently has a population of approximately 40,000 inhabitants. It is fast-growing, with residential and industrial development continuously taking place. Presently, two residential extensions with 3 200 stands are being developed with land identified for a further 4 000 stands, should the need arise. An abundant water supply is available from the Assegai Valley and Heyshope dam (about 70km from Piet Retief). This is the 4th largest water source in South Africa. Much of the town's electricity is supplied by its own hydro-electric scheme in the Assegai River. The Piet Retief municipality is presently expanding both its water and sewer purification works. This is to ensure that a potable water supply for residential and industrial use will be sufficient.

03.04 ECONOMICAL CONTEXT

Today Piet Retief is economically strong and stable. The premier agricultural activity is silviculture and Piet Retief forms the southern boundary of what is called the largest man-made plantation in the world, stretching from Sabie to the southern region of the town. The timber industry incorporates the exportation of mainly pine, wattle and eucalyptus species (encompassing 150 000ha of plantations) and the production of a variety of timber products, such as chipboard and paper. Eucalyptus species are used for mining timber, chipboard and ever-increasing volumes are being exported in chip form to global markets. Wattle bark extract is used in the leather tanning industry and the manufacture of resins, whereas wattle timber is the preferred raw material in charcoal manufacture. Wattle pulp is now being exported to Japan and as far as Norway to supplement their shortages in hardwood pulp. Pine is mainly used as saw logs and a source of long fibre pulp, most of which is processed in South Africa.

Although a large proportion of timber grown in the area is exported, Piet Retief's economical growth can be attributed to adding value to this raw material. These captive markets include a pulp and paper mill, chipboard plants, mining timber mills, lumber mills, etc. Maize and cattle are still very important, but tobacco is no longer cultivated commercially. (see Addendum 08.01.3) In recent years, coal mining has become a major part of the economy. There is even a gold mine that has been productive since the late 1800's.

Apart from the mentioned industries, the economy of Piet Retief is starting to rely greatly on its tourist and travelers industry. Most of the guesthouses and smaller accommodation enterprises are dependent on the large timber industry, for it provides them with regular clients who work in Piet Retief on a weekly basis. Local garages and convenient stores, restaurants, coffee shops, café's and motor vehicle service centres all thrive economically during the festive. As it is seen as the perfect halfway stopover between destinations, tourists often spend time and subsequently money in Piet Retief, contributing to the overall economical well-being of the community.

03.04.1 Economical & Social Implications of constructing a lodge

SATOUR estimates that one direct and indirect work opportunity is created for every 30 new international tourists who visit South Africa. (NEL, S.J., 1995 fig 1.1) As a tourism effort, Mkhonda Lodge will bring an influx of tourists to the area, which will indirectly uplift the community by creating additional work opportunities. In this way, social and economical growth takes place within the town. Furthermore, the lodge will serve its own community by providing them with a place of relaxation out of town.

The development on Madola may have a negative effect on private or smaller tourist industries within Piet Retief, but it should be kept in mind that the lodge will cater for a more diverse group of people to those staying in town. For example, large groups of people attending mushroom conferences or tourist groups that are interested in culturally rich areas with superior natural beauty will be housed at Mkhonda Lodge.

03.04.2 Economic sustainability of Mkhonda

Madola is a relatively small farm that does not lend itself to agricultural activities as a main source of income, as the ground has been overused over the last few years. The topography of the farm is irregular, as a large portion of the farm is mountainous. Land value can therefore be best enhanced through incorporating another development that is not as much land dependent, but can capture the aesthetic qualities that the farm has to offer. Mkhonda Country Lodge provides the necessary facilities to be able to use the land for this purpose, having tourism as its main focus.

03.05 PHYSICAL CONTEXT

03.05.1 Location

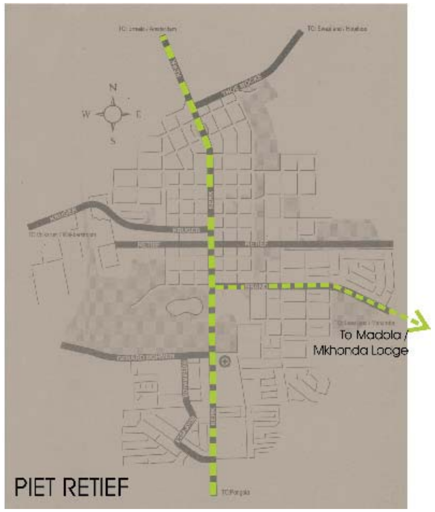


Fig.03.05

Both Piet Retief and Madola are on the doorstep of the N2 and strategically in the corner of Mpumalanga, with Swaziland and KwaZulu-Natal as their neighbours. The town is known to be the gateway to the game reserves of Swaziland, Northern KwaZulu-Natal, Southern Mozambique and Mpumalanga Lowveld. It can also be seen as the major route to Pongola, St Lucia, Richards Bay and other exotic spots along the KwaZulu-Natal South Coast. To the south lies the bird paradise of Wakkerstroom with its rich birding culture, followed by Volksrust, a place of major battles in the Boer War. To the north lies Amsterdam, with its strong Anglo Boer War history and Ermelo, which is seen as the major node of tourist routes throughout Mpumalanga.

03.05.2 Site - Madola 154 H.T., Portion 5

Lying approximately15km east of Piet Retief, (Figures 03.05, 03.06) the farm Madola consists of 9 subdivisions of which only one, Portion 5, is the appointed site. FIgure 03.08 indicates the exact position of Portion 5 and its relation to Swaziland. Portion 5 is connected to the main road by means of a 2.5km dirt road. (Figure 03.09)

Fig.03.06

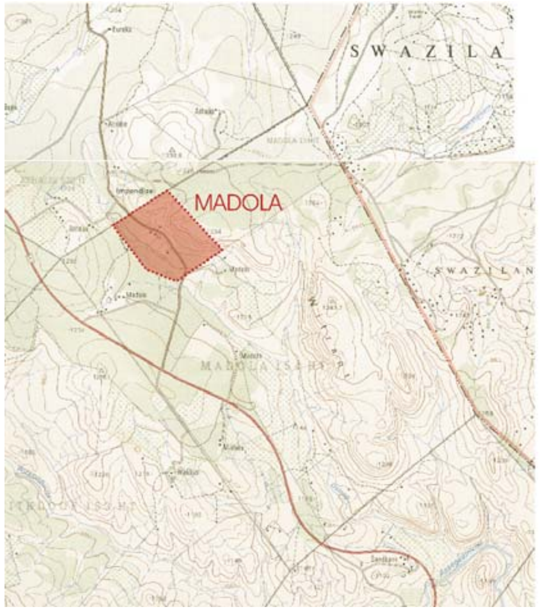


Fig.03.07

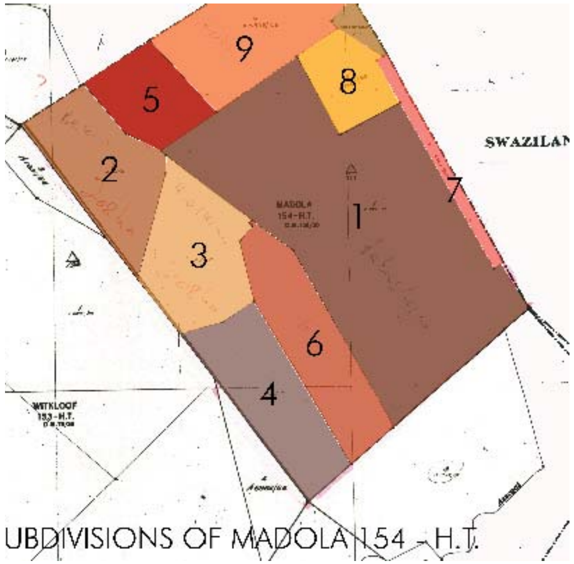


Fig.03.08

Fig.03.09

03.05.3 Geology

The farm Madola lies between the Lowveld and Highveld with an undulating topography. (Figures 03.10, 03.11) It is on the escarpment between 1180 and 1334 meters above sea level. (Figure 03.07) The farm therefore has a 150 metre vertical change, which includes the Osloop Spruit at the lowest part on the western boundary and a mountain range on the eastern boundary of the farm. The main development will take place at approximately 1250m above sea level and the Farm Factory at 1220m. Earth layers exist of mainly dolerite and contain misphas (soil with rocky sub-layers). No impenetrable layers occur. The largest part of the farm consists of highly weathered Hutton type soil with an average clay content of only 28%. Clay will therefore not have a considerable effect on construction methods. Other soil types include Griffin and Glenrosa.

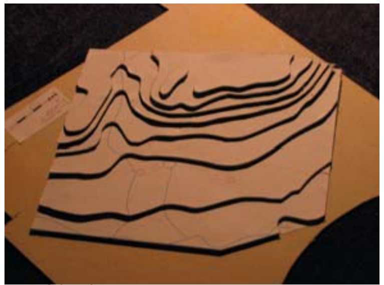


Fig. 03.10

Fig. 03.11

Fig. 03.12

Fig. 03.13

03.05.4 Climate

Madola and the rest of Piet Retief lie in the Middleveld with a unique and moderate climate. Average summer temperatures soar to 28ºC and coldest winter nights dip to 3.8ºC. The farm lies in a summer rainfall region with an average of 843-880mm per annum, which reaches its peak during December and an average annual winter rainfall of 148mm. The climate is mild with hardly any frost. Madola lies within a mist belt and therefore it has a relatively high humidity, which is optimal for forestry. Overall, the farm has little wind activity with only a light eastern wind during late afternoons and at night. During winter and early spring, cold fronts are usually brought about by the northwestern winds that blow during the day but calms down during the night. Piet Retief is also known as having some of the highest lightning activity in the world. During summer, thunderstorms reaching 11.7 on the ground flash index have been experienced.

03.05.5 Vegetation

On the site, there is a variety of vegetation including mixed grasslands, man-made plantations and a dense forest area, playing host to a large variety of indigenous tree species. (See appendix 08.01.4) Extinct species in the area include white stinkwood, yellowwood and wild olive.

In the 1800's, early German settlers in the region traded with yellowwood trees on a large scale, exporting to the Johannesburg region. (See appendix 08.01.1)
As a result, only the largest yellowwood trees remained in inaccessible terrains. Another reason for their becoming extinct was the use of bark by the African community for traditional medicine, or so-called 'muti'. On Madola, yellowwood and wild olive, but not white stinkwood, have been re-established. The development will incorporate specific efforts to rehabilitate this tree species. A hiking trail will be included into the overall design in order to bring the tourist into contact with these trees.

03.05.6 Water resources

There is an abundance of water available on site and during summer the water table rises to only 8 meters below natural ground level. Water resources include dams, boreholes, fountains and springs. Although the Osloop Spruit runs along the western boundary of the farm, it is an insignificant source of water for agricultural activities, as it is very small.

There are two dams that collect rainwater and runoff during summer when rainfall is high. The water content of the upper dam, Dam 1 (Figure 03.12), is dependent on the amount of rainfall the farm receives, as it is filled with runoff within the mountain catchment's area. Because of the large topographic difference on site, strong underground water current exists, which fills up the lower dam, Dam 2. (Figure 03.13) This dam is therefore full for the largest part of the year and becomes very important in winter for household and agricultural purposes. In future, if the agricultural activities and therefore the need for water increases, an additional dam can be built on the western boundary of the farm which will be filled with water from the Osloop Spruit and the strong underground water current. Additional rainwater tanks are included at various points on site that can collect water for irrigation purposes.

03.05.7 Existing buildings

Existing buildings in the area of the homestead will be left as is, with only minor alterations to facades in order to keep in line with the overall theme of the development.

03.05.8 Site selection

The design requires two separate sites that could host the main development and production area and another site for the placing of private cottages. To be able to determine the best solution for each situation, site requirements were determined and the different options were analyzed. The site requirements are:

SITE 1 – MAIN DEVELOPMENT & PRODUCTION AREA

1. Should be highly accessible
2. Should be relatively close to existing homestead and services
3. Preferably a site which is already disturbed and needs rehabilitation, since the overall building footprint will be significant
4. Should capture most important views
5. North-south orientation is preferred

SITE 2 – PRIVATE COTTAGES

1. Privacy should enjoy highest priority
2. Accessibility relatively important
3. Should be unique in vegetation and experience
4. Availability of services not as important as with main development

It is important that the design should respect and build upon the landscape's distinctiveness. The following questions were asked before decisions were made about the location of the new development:

1. Can the development help restore or reconstruct the local landscape character and its distinctiveness?
2. Can it assist in meeting the local authority objectives for the area?
3. Can it help solve specific issues such as derelict land reclamation?

Fig. 03.14

Fig. 03.15


Fig. 03.16


Fig. 03.17


Fig. 03.19b


Fig. 03.19a

It was agreed upon that the development of Mkhonda Lodge will contribute positively to the landscape of the site and the local area through adding diversity in terms of vegetation and infrastructure. Through carefully analyzing different possible areas for the development, the following two sites (Figure 03.14 & figure 03.15) were chosen for the following reasons:

SITE 1 – MAIN DEVELOPMENT & PRODUCTION AREA (Figure 03.16 & 03.17)

1. Is an already disturbed landscape.
   a. southern side - very rocky area and not suitable for intensive agriculture. Best for plantations, which can lessen visual impact.
   b. western side – good agricultural land suitable for permacultural activities
2. Has a 14m x 50m flat piece of land behind the dam that is ideal for the placing of the Farm Factory (Figure 03.18)
3. Enjoys great views (Figure 03.19a,b,c)
4. Sloping site, thus opening up design possibilities
5. Water resources in close proximity
6. Situated next to dirt road, therefore highly accessible (Figure 03.20)
7. Close to existing power lines and services.
8. Next to farm house to alleviate management
9. Screened off from road by wattle trees (Figure 03.21)

SITE 2 – PRIVATE COTTAGES (Figure 03.22)

1. Very private and sheltered area
2. Unique in that it hosts 31 indigenous species
3. Existing informal road, thus relatively accessible (Figure 03.15)
4. Relatively close to power lines
5. Site fairly even slope of 1:13, minimal cut & fill required (Figure 03.23a,b)
6. Visually stimulating area (Figure 03.24)

Fig. 03.18

Fig. 03.19c

03.06 VISUAL IMPACT ASSESSMENT

Since the site is enclosed by surrounding plantations all year round, the visual impact of the proposed development on Mkhonda will be insignificant. However, a visual analysis was done to determine the best layout and arrangement of buildings to further enhance natural elements and add to the overall visual quality of the site.

The three separate entrances of Mkhonda Lodge will be situated within the first two kilometers of the dirt road (Figure 03.25), while the existing farmstead and sawmill are found a further 500 meters down the road. Therefore tourists will never travel far enough to pass the existing private sector of the farm. (Figure 03.26) A visual analysis therefore needs only be done for the exposed parts within the first two kilometers of the dirt road.

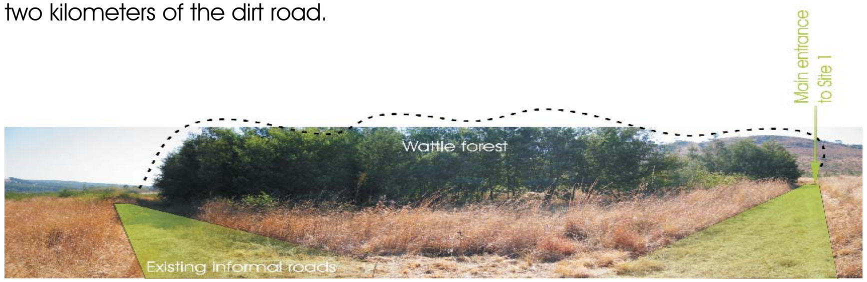


Fig. 03.20

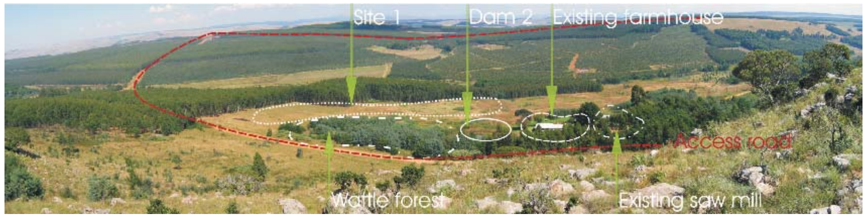


Fig. 03.21

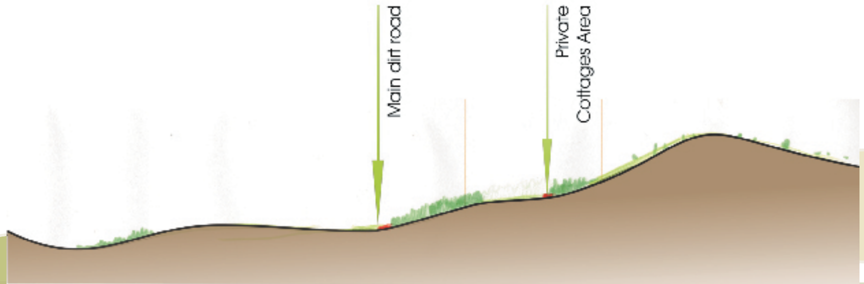


Fig. 03.22

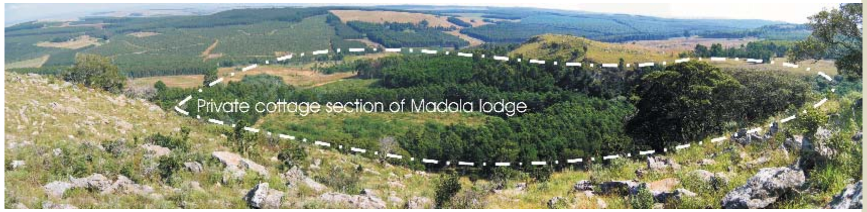


Fig. 03.23a

Fig. 03.23b


Fig. 03.24

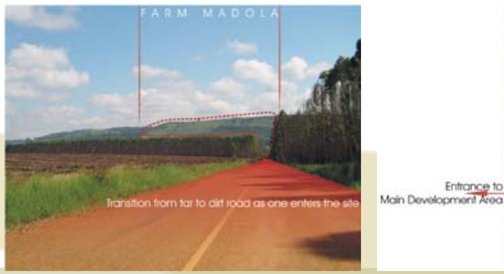


Fig. 03.25

Fig. 03.26


Fig. 03.27

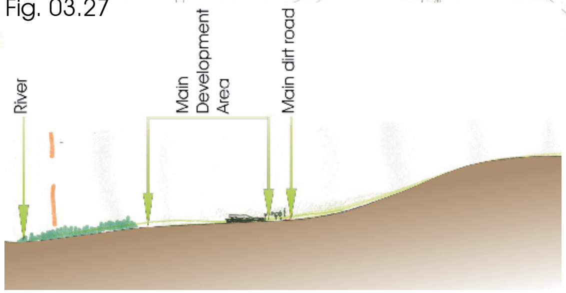


Fig. 03.28b

03.06.1 SITE1 – Main Development

When driving along the main dirt road for approximately 2km, the open area to the left of the road is not clearly visible (Figure 03.27), as the natural ground level slopes downwards and away from the road. (Figure 03.28a,b) Since this area will mostly be seen from this point of view, it is of low visual importance. The design stage hence needs to take the required visual quality from road level into account when designing the façades of buildings closest to the road. Buildings should blend into the natural landscape. Stone walls will contribute greatly to enhancing visual quality. (Figure 03.29) By recessing buildings from the dirt road by 50 meters and stepping buildings down according to the natural slope of the site, the visual impact can further be reduced. (Figure 03.30a,b) The stepping down of buildings also allows for the opening up on the opposite side of the road to be able to capture the most valued views on site. (Figure 03.30c,d)

Another contributing factor to the low visual quality of this particular area is the forest next to the road, which screens off the largest part of the site. (Figure 03.21) It would therefore be best to place the largest part of the development behind this dense forest area. Although this forest consists of mainly wattle trees that need to be removed, at first many of these trees will be preserved, providing sufficient shading for the proposed parking area. (Figure 03.31) An indigenous canopy will gradually replace wattle trees. This means that, throughout the lifespan of the building, the road edge will be defined by a green buffer that will screen off the rest of the development to lessen visual impact from the main access road. Within a few years, the first portion of the open site will be planted with trees, creating a dense green area to completely close of the development.

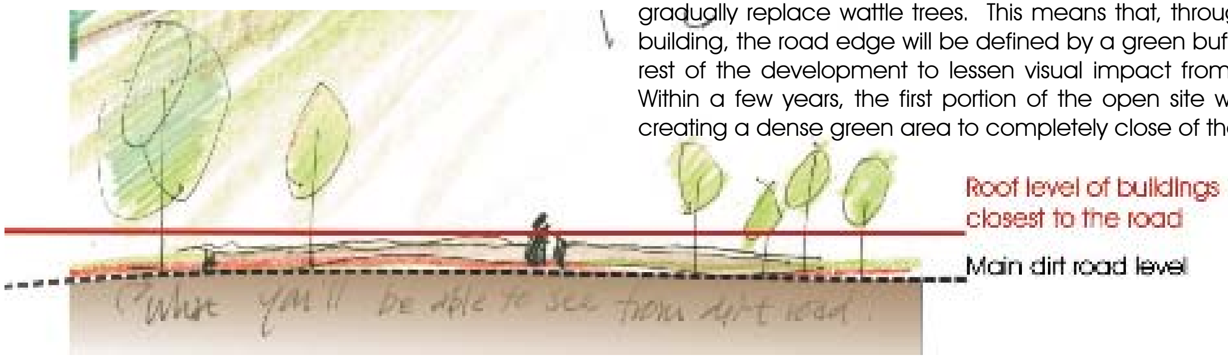


Fig. 03.29

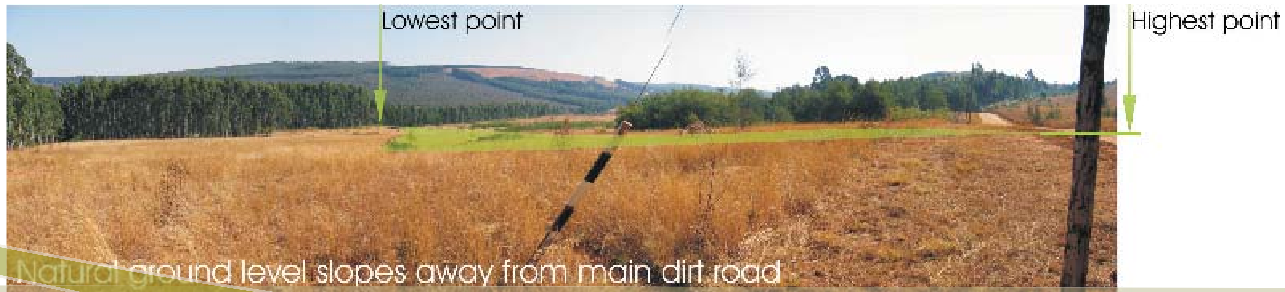


Fig. 03.28a

Very seldom, plantations between Madola and the main tar road are cut down, causing Madola and thus Mkhonda Lodge to be visible from the road. (Figure 03.32) However, the distance between the traveler and Mkhonda Lodge is large enough to ensure an insignificant visual impact. Travel time can also be reduced when considering that most of the road users are traveling at an average of 110km per hour, calculating the total time of exposure to the site at less than three seconds. Only one farmhouse, currently unoccupied, has a fixed view onto the farm. However, the house in itself is surrounded by large evergreen trees, which further reduce a clear view onto Mkhonda Lodge. (Figure 03.33)

The entire farm is visible from the opposite farm, which forms the highest point above sea level in the area. Visual impact from this point is therefore very high, but since there is no fixed infrastructure that overlooks Madola on that point and having only the occasional passerby, the development need not take minimal visual impact into account in this particular instance. (Figure 03.14)

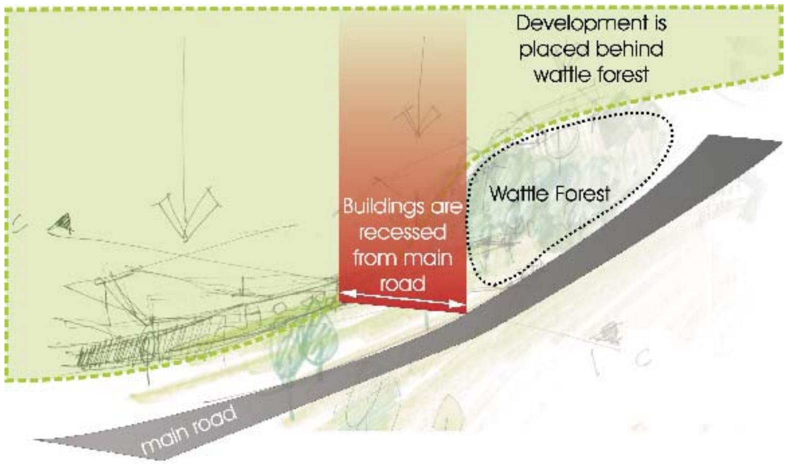


Fig. 03.30b

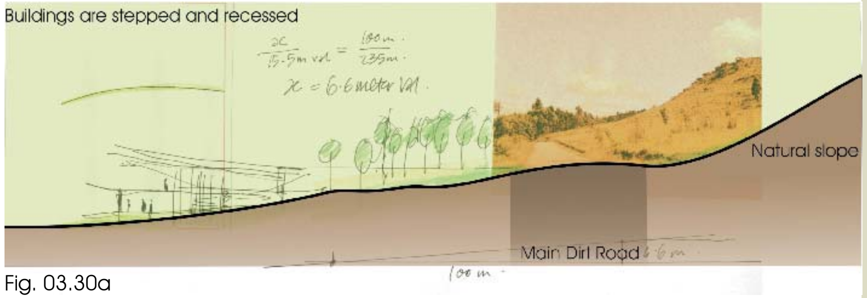


Fig. 03.30a

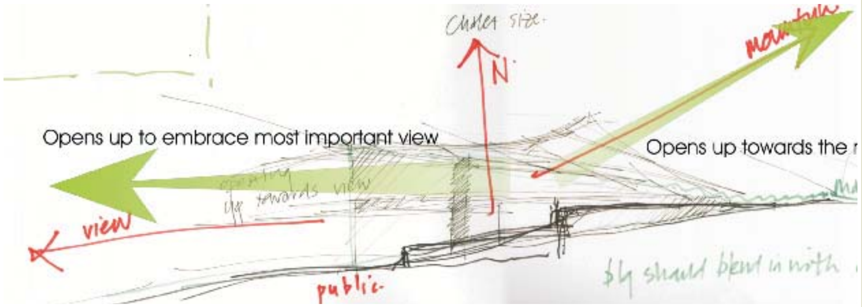


Fig. 03.30c

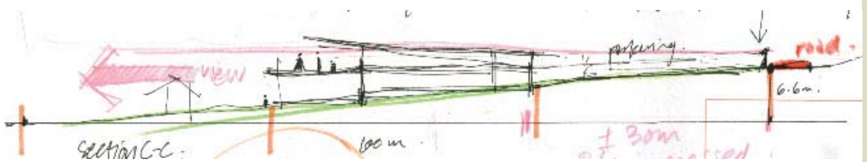


Fig. 03.30d

Fig. 03.31

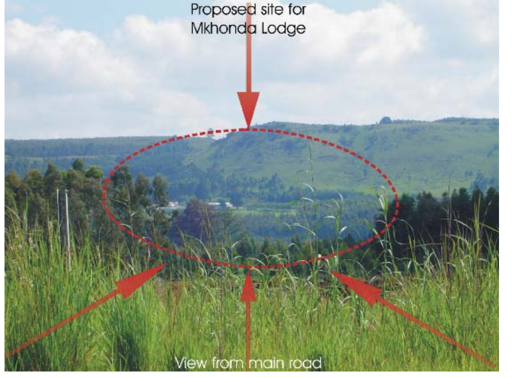


Fig. 03.32

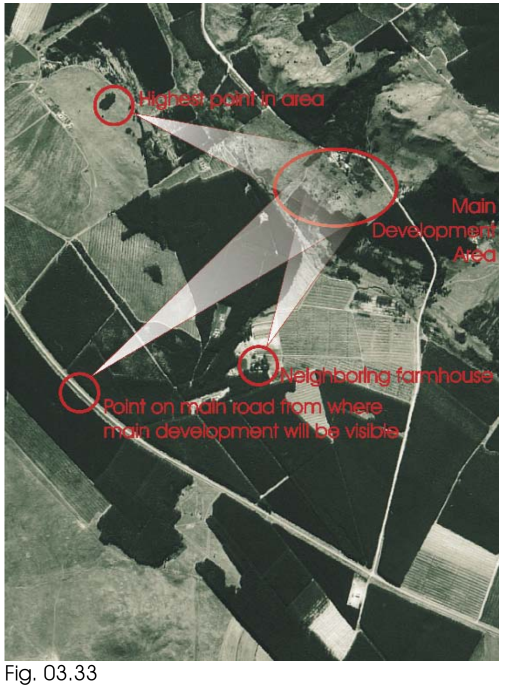


Fig. 03.33

03.06.2 SITE 2 – Private cottages in Kloof

Site 2 is completely closed off from its surroundings and, by placing cottages within the existing forest, will entirely remove visual impact. (Figure 03.34) The existing roads can be used and therefore there is no need for additional landscaping alterations that could increase visual impact. Cottages will be spaced at a proper distance so as to ensure the required privacy between units and to maintain the visual quality that currently exists in the forest. Each cottage will be placed strategically so as to eliminate damage to the natural environment during construction. (Figure 03.35) Materials and finishes used should consider the current aesthetic quality of the forest and strive to maintain it. Specific indigenous trees should be tracked down and protected during construction. (Figure 03.36)

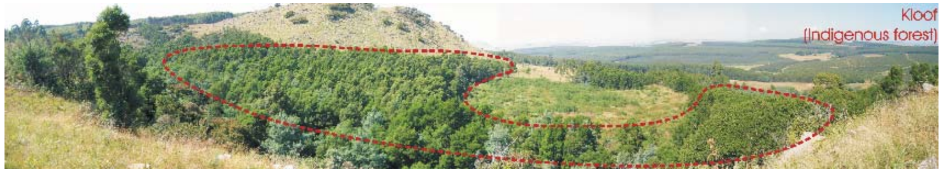


Fig. 03.34

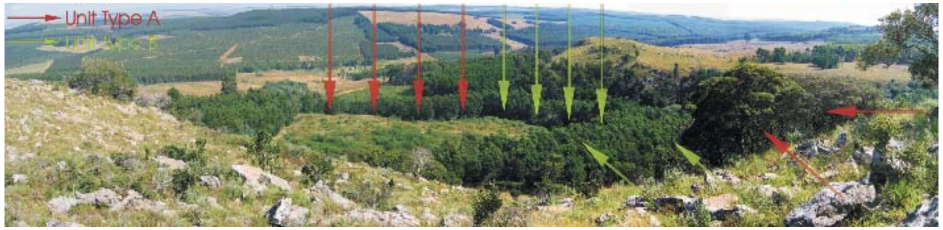


Fig. 03.35

Fig. 03.36

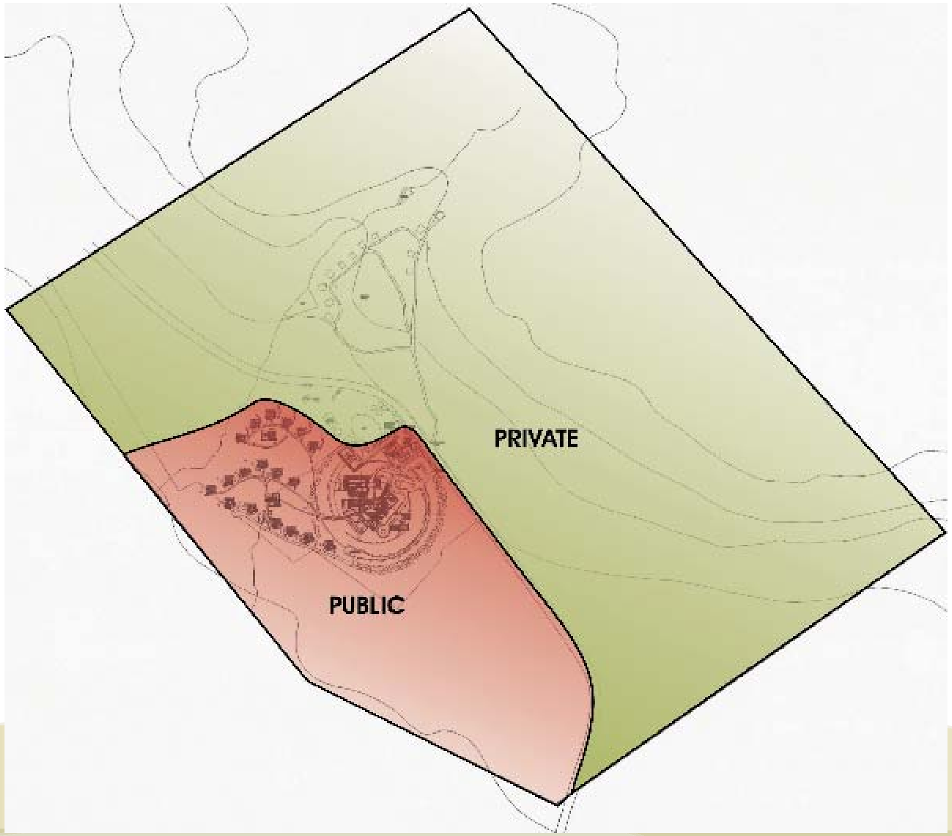


Fig. 03.37

fig.04.01a

fig.04.01b

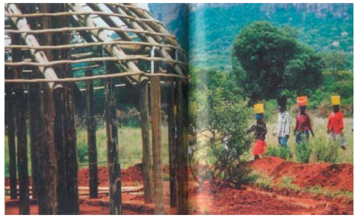


fig.04.01c

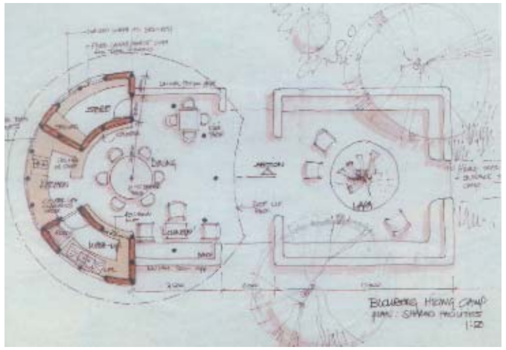


fig.04.01d

04 PRECEDENT STUDIES

04.01 Sustainable design & appropriate building technologies

04.01.1 Blouberg Cultural Village, by Crafford & Crafford Architects

(Blouberg Cultural Village 2004 p.96-97)

In an effort to generate employment and income for the local community, a 12-bed overnight facility was built, which serves as a base camp for a hiking trail in the Blouberg Mountain. (Figure 04.01a) The traditional local village orientation was utilized and modified to accommodate site restrictions and tourist needs, such as gas-operated geysers and fridges.

Simple effective building methods were needed, as fewer than 25% of the laborers were skilled. Because the site was so secluded, all the construction materials had to be carried uphill to the site, thus considerably influencing construction methods and the weight of the materials which were used. The contractor produced adobe blocks on site from locally excavated materials, while packed rock foundations replaced conventional concrete footings.

Vertical poles smeared with mud with 'windows' made up the traditional wall construction, utilizing a combination of welded mesh, rocks and mortar, which allowed for large openings that allowed sufficient light into the rooms. (figures 04.01b,c) Openings were covered using canvas, roll-up canvas doors were affixed to the timber pole supports of the roof structure. All working drawings were done freehand, as they were better understood by the contractor and were faster to produce. (Figure 04.01d)

Important design issues relevant to the development of Mkhonda Lodge:

1. Utilizing and educating the local community, transferring skills
2. Materials acquired on site, e.g. cut grass for production of straw bales, timber poles as structural elements and mud for plastering
3. Using local villages as precedents in terms of flow of spaces, orientation, arrangement of functions and construction methods

04.01.2 Kalahari Tent Camp, Northern Cape, by Crafford & Crafford Architects

(CRAFFORD, N. 2003 p.88-89)

The brief called for a design that would give visitors a 'tent experience' with a design that blends into the environment and makes use of the sand in the area as a building material. (figures 04.02a,b) The view had to be of the river, but not directly to the west and privacy had to be provided for outside braai areas. In the Kalahari, heat is a critical climatic factor and therefore an important design consideration. By utilizing lightweight materials, daytime heat is retained and then transmitted back to the interiors at night. Decks are constructed from Rhodesian teak boards with poles of treated pine. Solar panels provide electricity, while gas geysers provide hot water. The stove and fridge are also gas fired. The end result sported an architectural style true to its surroundings, called 'camp architecture'.

Although the context of this project in the Kalahari differs greatly from Madola's context, the concept of utilizing and designing for everything that is found on site, offers useful design guidelines to Mkhonda Lodge.
These guidelines include:

1. Using available local materials (sand) as main structural material. At Madola, straw and timber are in abundance and will be best to incorporate these as main building materials.
2. Capitalizing on views
3. Design reacts to wind conditions – 'tents' are orientated to be screened from prevailing winds, where different buildings within Mkhonda Lodge will be placed and orientated to take advantage of prevailing winds to allow for natural ventilation.
4. Using sustainable resources, e.g. solar panels to generate electricity that can sustain lighting requirements. Cottages within Mkhonda Lodge will make use of solar water heating systems with electrical geysers to serve as back-up system.

04.01.3 North Island, Seychelles by Silvio Rech & Lesley Carstens
(DU PREEZ, K. 2004 p.148-159)

North Island is a new eco destination in the Seychelles that includes a main lodge and 11 villas. In 1998, the island's government made a commitment to restore the local ecosystem. Architects Silvio Rech and Lesley Carstens shared this vision to rehabilitate the island and create an eco-tourist destination. They had an enviable task: In order to come up with the best solution, they lived on the island for 2,5 years, familiarizing themselves with annual beach and weather conditions, therefore creating a refined architectural language that is specific to the island. (figures 04.03a,b,c,d) Existing buildings are restored and the uses thereof maximized. As the design developed, the use of material was carefully considered so as to find the most appropriate and sustainable solution for each individual scenario. For example, the local trees afflicted with disease are felled and turned upside down to be used as structural elements or columns (figure 04.03b); rocks are used to support table tops and balustrades are made from curved branches. In a symbiotic play with nature, many a time the design encircles existing trees (figure 04.03a).

This precedent is an important guideline for the development at Madola, as it portrays a design solution, which has absolute respect for the site. It illustrates the importance of getting to know a site and its context thoroughly to be able to design optimally.

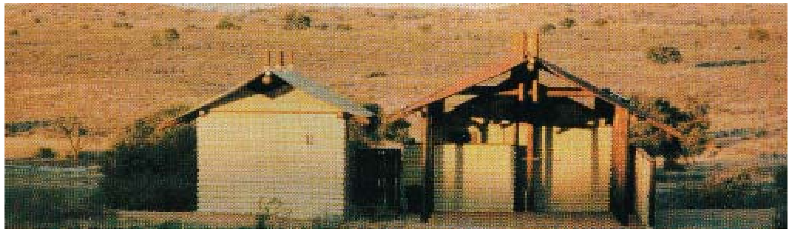


fig.04.02a


fig.04.02b


fig.04.03a


fig.04.03b


fig.04.03c

fig.04.3d

fig.04.04a

fig.04.04b

fig.04.04c

fig.04.04d

fig.04.04e

fig.04.04f

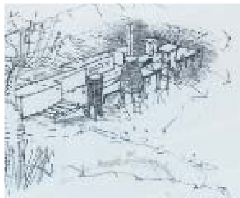


fig.04.04g

fig.04.04h

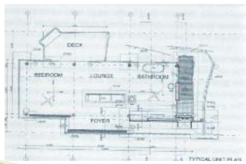


fig.04.04i

04.01.4 Singita Lebombo, Kruger Park, by OMM Design

(Singita Lebombo, Kruger Park. 2004 p.132,133) &
(VAN DER MERWE, E. 2003 p.138-147)

Singita Lebombo strived to differentiate itself from other lodges and the environmental design principles applied during the project were to have as little impact on the site as possible. The structures are integrated into the vegetation and topography with a unique blend of natural night and panoramic views. (figures 04.04a,b,c,d,e,f,g,h,i)

However, both Singita Lebombo and North Island's target market differs from that of Mkhonda Lodge in that it caters for the elite of society. Finishes and products used for interior spaces are of the highest standard. Mkhonda Lodge will not neglect the importance of great detailing and finishes, but will opt for a more economic solution. This will provide a larger portion of society with the opportunity to experience an eco destination showcasing good and sustainable design.

04.01.5 Wallers Camp, Mavhulani, by Peter and Sean Waller

(KNOLL, C. 1998 p.19)

Designed by the owners, Peter and Sean Waller, Wallers Camp is situated close to where the borders of South Africa, Zimbabwe and Mozambique converge. The owners showed great respect for the site. Although they are not classically trained architects, much can be learned from their approach to design. The fact that they have no problems with crime, as apposed to some other resorts, is proof that the community views the lodge as an asset.

Design issues relevant for the development of Mkhonda Lodge include:

1. Getting to know the site - the Wallers camped on each individual site to experience the local conditions, wind direction, views and shading.
2. Creating a unique lodge - they did not look at any other lodges and did not use any of the conventional thatched roofs or tent structures.
3. Using local materials - they opted for sisal, for it was locally available, lasted longer in the very dry climate, is a good insulator (noise and temperature) and is not prone to borers and termites.
4. Not disturbing the natural surroundings - the entire lodge is built on stilts above the ground. Not a single tree has been removed.
5. Involving local communities - the Wallers undertook to employ only locals, as they believe in working with and encouraging the community.

04.02 CREATING A NEW VERNACULAR

04.02.1 House in Johannesburg, by Silvio Rech & Lesley Carstens
(VAN DYK, M. 2004 p.96-105)

The significance of this Johannesburg home is the manner in which the owners/ architects incorporated nature into the house in a unique way. The functions of the buildings are placed randomly on the site with the bedroom blending in with its natural surroundings. (figure 04.05) A tree reaches through the roof; roughly finished timber poles are used as is with thatched roofs and windows placed strategically to allow for natural light penetration and glimpses of the forest beyond. Silvio and Lesley have succeeded in opening up new possibilities for homes in terms of aesthetics and function.

This concept of producing a **new vernacular** forms part of four of the main design directives in the development of Mkhonda Lodge, which is discussed later.

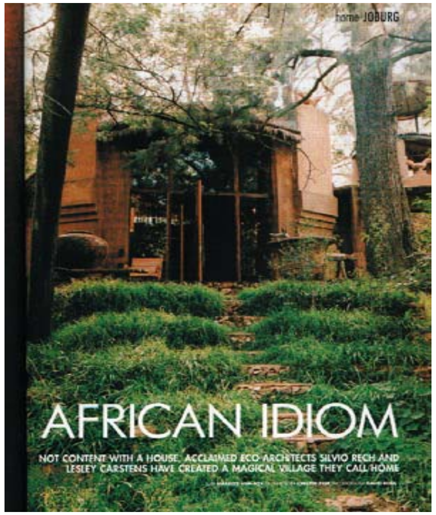


fig.04.05

04.02.2 "Glorious Mud", by Herta Sturmann
(CREMER, A. 1999 p.44-50)

Herta Sturmann's latest clay-and-straw house is built on the farm Athena at The Crags near Plettenberg Bay. (figures 04.06a,b,c,d) The house has a basic cob construction, like her first house at Crystal Kloof outside Hermanus.
(figures 04.06e,f)

What is interesting about both designs and of relevance to the design of Mkhonda Lodge is the way in which the builder had freedom of expression throughout the building process and used only locally available materials. Views are framed and organic shapes and forms outline the building's footprint and facades, creating an informal building which portrays a **new vernacular style** where form is the direct result of the different functions of each building.

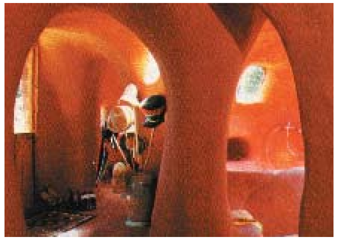


fig.04.06a

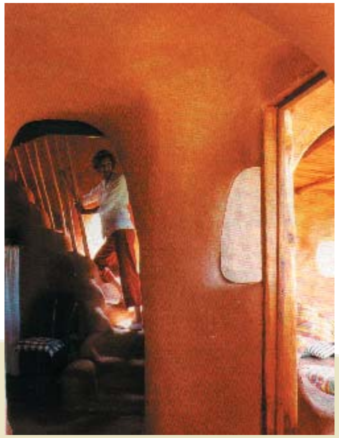


fig.04.06b


fig.04.06c


fig.04.06d


fig.04.06e


fig.04.06f

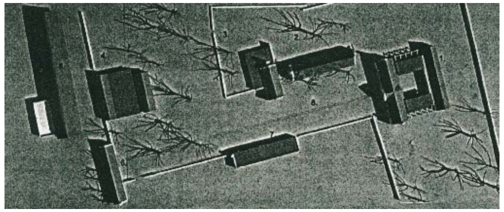


fig.04.07a


fig.04.07b


fig.04.07c

04.02.3 "Nieuwe Sion Farmstead, Simondium, Western Cape", by KrugerRoos Architects

(Nieuwe Sion Farmstead, Simondium. 2004 p.130-131)

In the reconstruction of the farmstead on the farm Nieuwe Sion in Simonium, KrugerRoos architects made a study of local Cape farmstead settlement patterns, which guided the design process. The different typologies studied delivered significant factors that can contribute to this specific Cape vernacular. The architecture of Nieuwe Sion is therefore an attempt to work within the given language and materials of the Cape Vernacular where the challenge lies in reinterpreting these elements (figures 04.07a,b,c) in a contemporary way.

In the same way, a study of local farmsteads in the Mpumalanga region has revealed a set of prominent characteristics for typical Transvaal architecture, which is discussed in the Design Discourse.

04.03 STRAW BALE AND COB CONSTRUCTION

Through communicating with experts on the field of straw bale construction and studying various articles and websites, the required specifications and design guidelines have been obtained. Some of the case studies include:

04.03.1 Straw bale housing, Blanco near George, S.A.

(CREMER, A. 1999 p.44-50)

The design has in-fill walls with a post-and-beam design. Less reinforcement is needed in the walls, because instead of simply stacking and then reinforcing the straw bales to carry the full load, a series of treated poles forms the structural support system for the roof. The owners used local materials. The wheat for straw bales and the rocks for the foundations came from a community in the area and the walls were plastered with a layer of cob, which is a mix of straw, clay and sand. By choice, the plastering was not done traditionally, but followed the contours of the straw bales. (figures 04.08a,b,c)


fig.04.08a


fig.04.08b


fig.04.08c

04.03.2 Inexpensive houses from straw bales

This illustration (figure 04.09) of a simple housing unit gives a detailed version of how to construct your own straw bale wall.

(*Landbouweekblad* 1995 p.46-47)

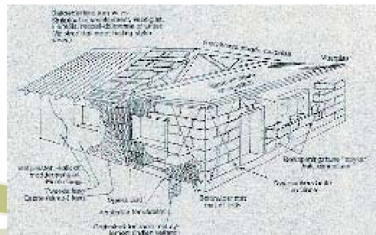


fig.04.09

04.03.3 Straw House, Wales

Welsh farmer Brian Stinchcombe, who wanted a house that was both cheap and environmentally friendly, built this house. This ended up being the first straw house built in the UK. The walls were from extra large straw bales, 2.5m x 1m and 600mm high. (GLAKIN, M. 1997 p.38-39)

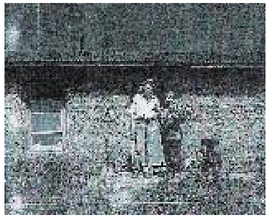


fig.04.10a

fig.04.10b

04.04 LODGES

Lodges in general have recognizable appearances, building techniques and use of materials. Different precedent studies on lodges can open up new possibilities in order to create a lodge with an unconventional and fresh appearance. (Information on the following precedents were collected from brochures given out by the individual lodges.) Elements which contributed to the design of Mkhonda Lodge briefly include:

fig.04.11

fig.04.12

04.04.1 Jaci's Safari Lodge n Madikwe Game Reserve

The design of Jaci's Safari Lodge is flexible in terms of hosting a variety of required functions i.e. outdoor spaces are turned into outdoor dining areas at request or specific, weather permitting, nights or days. (Figure 04.11)

04.04.2 Makanyane Safari Lodge

This precedent is relevant in how it handles its outdoor pool area in order to provide it with sufficient seclusion. A solid wall screens off the pool / deck area and guests can therefore enjoy the swimming pools in all privacy. (Figure 04.12)

fig.04.13a

fig.04.13b

04.04.3 Etali Safari Lodge in Madilow Game Reserve

The design gives special attention to the last detail. Rooms are very interactive with their surroundings and have large glass doors that open up the room onto an outdoor private deck area. (Figures 04.13a,b)

fig.04.14a

04.04.4 Mateya Safari lodge, within Madikwe Game Reserve

The design successfully layers different spaces and functions. Interiors are well lit because of glass facades that allow natural daylight to freely penetrate the interiors. The timber structure is completely exposed with timber poles as main structural elements. (Figures 04.14a,b,c)

fig.04.14b

fig.04.14c

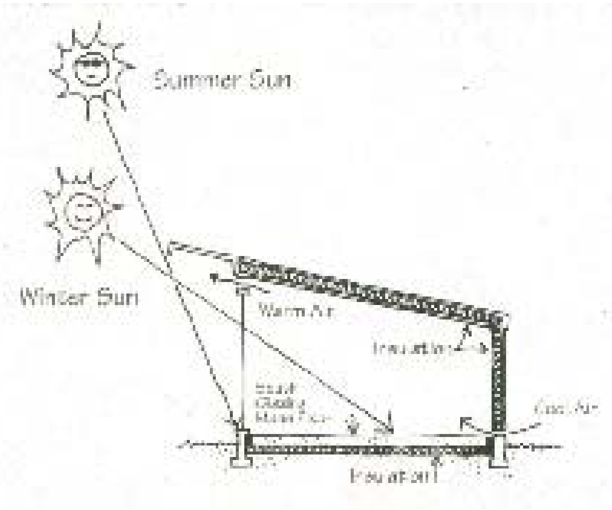


Fig.05.01

Month	Mean Daily Sunshine Hours
January	6.9
February	7.3
March	6.5
April	8.1
May	8.5
June	8.4
July	8.2
August	8.6
September	7.9
October	6.6
November	6.3
December	6.9

Table 05.01

05 BASELINE CRITERIA

05.1 SUSTAINABILITY

The design of the development should be driven to the smallest detail and on a range of different levels by sustainable principles to create a model for sustainable building practices and appropriate building technologies.

05.02 NATURAL SUNLIGHT

05.02.1 Ponds to reflect light

Ponds allow light to reflect off the surface of the water and into the interior spaces of buildings. This creates a magical effect where reflected light bounces and shimmers off the walls and ceiling. Because of more exposure to sunlight, plants placed next to ponds grow more excessively. (KENNEDY, J.F., SMITH, M.G., WANEK, C. 2002 p.259). To enhance tranquility, ponds will be placed in the central courtyard and to allow for additional natural light penetration into the interior spaces, next to the conference facility and offices.

05.03 ENERGY EFFICIENCY

05.03.1 Designing with the sun

The orientation of buildings on the site will ensure that heat gain is enhanced during winter and kept to a minimum during summer. In summer, when the sun is high, roof overhangs, trellises and other devices provide shade. Because the sun is low during winter, these devices allow sunlight to stream in below them, providing heat to the interior.

Shading on west and east faces is more challenging, since the sun is lower in the sky in the morning and evenings, lessening the use of overhangs. (KENNEDY, J.F., SMITH, M.G., WANEK, C. 2002 p.66)

05.03.1.1Sunshine duration

Tabel 05.01 indicates the average monthly sunshine duration for Piet Retief and proves that the site has adequate amount of sun exposure for the successful functioning of solar water heaters.

05.03.2 Embodied energy

Materials used in the development are low in embodied energy as the timber, clay, straw and a portion of the stone come from Madola. Local labour will be used in the construction processes and timber furniture manufacture.

05.03.3 Solar panels (water heating)

South Africa receives around 5kWh/m²/day in mid-winter and 8kWh/m²/day sun in mid-summer. This can be utilized to great effect for solar water heating, sustaining all warm water requirements of the development.

Energy in the form of solar radiation reaches the earth's atmosphere at the rate of 1395 Joules per square meter per second. This is also known as the solar constant = 1395 W/m². South Africa has the highest solar energy availability in the world – 5-8kWh per square metre per day. A solar water heater will catch the most rays at the sun's peak hours in midday to provide the required amount of hot water at peak demand hours.
(*Engineering News*, 29 Sept – 5 Oct 2000, p.40,41)

A solar water heater will be able to pay for itself within 6 to 15 years, depending on the type of geyser installed. (class notes) The design makes use of a combined electrical and solar geyser to warm water (figure 05.03), thus saving 45% on the electricity costs of a normal geyser. A separate collector storage system is used for water heating and has an electrical booster that is used as back-up water heating system during cold weather and prolonged cloudy periods. Solar panels are installed on top of the corrugated iron roof sheeting, while the geysers are placed within the ceiling. To optimize performance, the collector should face the sun directly. As a rule, it should face true north, or less than 30° off true north. For a year-round optimum performance, it should be tilted towards the equator at roughly the latitude angle of the site plus five to ten degrees. In other words, for optimal results in the Piet Retief (27°) region, solar collectors should ideally be tilted at 32 to 37 degrees. (figure 05.02)

In designing for the worst-case scenario (mid-winter), a 200 litre solar geyser will need 10kWh in order to raise the water temperature from 17°C to 60°C. Allowing for 50% efficiency means that 20kWh will actually be needed. Thus, each cottage will need solar panels that are 4m² in size. (lecture notes)

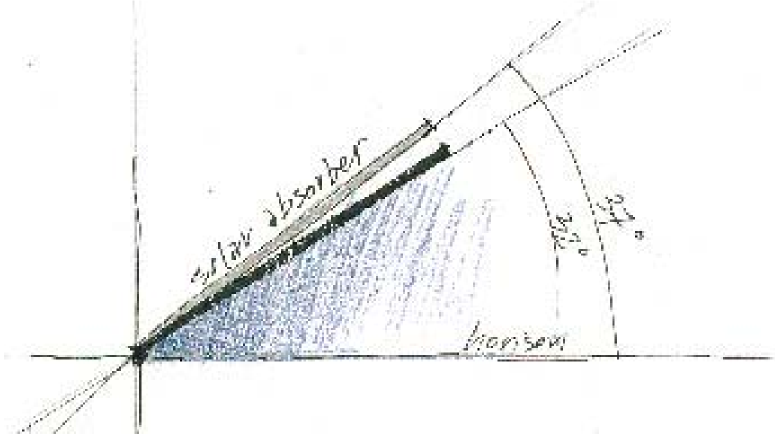


Fig.05.02

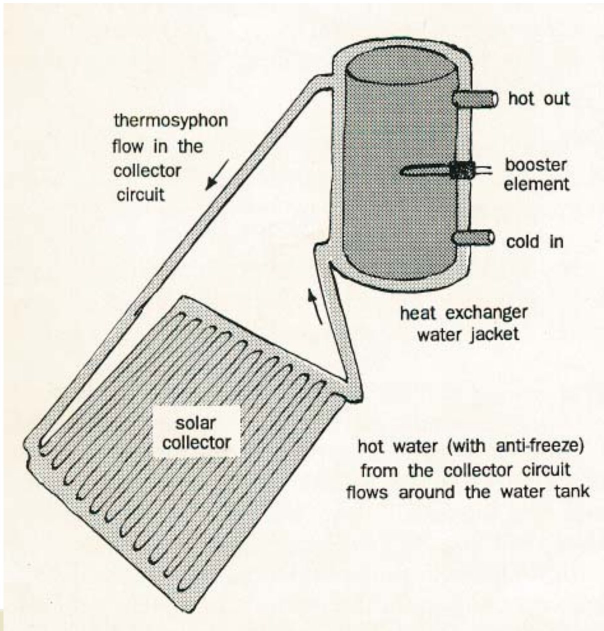


Fig.05.03

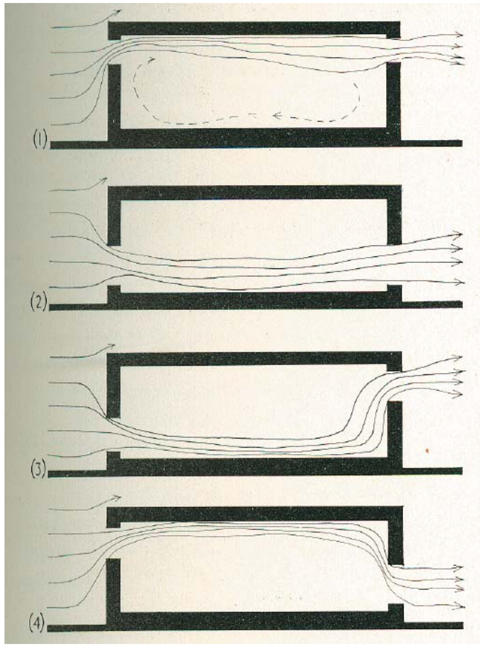


Fig.05.04

05.03.4 Heating swimming pools

Swimming pools only need to be heated to 25-30°C and at an operating temperature of 30°C, the pool will not lose heat. As the swimming pool is supplied with its own electrical pump, it is easy to circulate water through the solar collector by means of this pump. A collecting surface roughly equal to the pool surface is needed to raise the water temperature by about 1°C. A coil of black UPVC pipe laid on top of the roof structure will work efficiently. (WOLFGANG, P. 1978 p.85)

Practical considerations:

1. The electrical swimming pool pump, which is used to circulate water, should only be used during the day to minimize heat loss.
2. It will be beneficial to cover the pool to further prevent heat loss through evaporation and radiation.

05.03.5 Passive design and thermal regulations

Passive solar design is introduced in an attempt to satisfy the need for space, heating, cooling and lighting as far as possible by natural means. This uses the building itself to collect and store solar energy when it is needed, to exclude solar energy when not needed and to encourage natural cooling.

Different methods of passive temperature regulation include:

05.03.5.1 Natural ventilation

Since no mechanical system is used for ventilation, except for the extractor fan used in the main kitchen, it is important to design buildings to optimize natural ventilation patterns. Building size, form and orientation is essential. Buildings placed perpendicular to main wind directions create a natural flow of air through the building and have a cooling effect on the spaces it penetrates. Buildings are therefore long and narrow which allow north-western and eastern winds to cool down interior spaces. Window and door openings are aligned to assist in natural air flow across the span of each building. (figure05.04) The placing of buildings relative to each other onsite also helps to promote natural ventilation when there is a proper distance between adjacent buildings. Windows at ceiling level in the larger buildings provide outlets that can regulate the displacement of hot air, which is essential to maintain comfortable interior temperature levels.

Each building and function has its own specific natural air flow requirements and in all habitable rooms, air movement is required at approximately shoulder height (approx 1300 – 1700mm). In bedrooms, however, ventilation should take place at bed height (400 – 600mm). In the offices and lounge, air movement can be directed at the height or the head of a seated person (900 – 1200mm). The distribution on plan can also vary. In a bedroom, the flow must be directed to the area of the bed. In living rooms, a wider distribution over the usable area is required. Air flow related to the position of the inlet in the wall is illustrated in figure 05.04. (EVANS, M.1980 p.128, 129)

05.03.5.2 Sun angles

Sun angles should be carefully analyzed and incorporated into the design. Natural light can greatly enhance certain spaces and improve the functionality thereof. The main design requirements are therefore based on optimizing what is locally available on site.

05.03.5.3 Thermal Mass (solar walls, heat absorbing materials)

Figure 05.05 illustrates the basic priciples which should be applied when designing buildings in moderate to cool climatic conditions that are associated with Piet Retief. Rock, earth, concrete and water are common thermal mass materials that have the capacity to absorb large amounts of heat. These materials change temperature slowly, coming to equilibrium with the surroundings over a period of time. Thermal mass harnesses a few hours of intense sun in the midday to provide heat all day and night, without overheating at the peak insulation period.

No full floor carpets are used, as these insulate the high-mass floor, which they cover. It is ideal that sunlight warms the floor, where the mass of the structure lies, therefore large northern solar windows are designed to allow solar heat into the interior. Through this, the rammed earth floors and straw bale walls can absorb and store vast amounts of heat. Windows must be insulated (through shutters or thick curtains). For walls and floors, effective heat-absorbing surfaces include concrete, stone, brick, rammed earth, stucco or tile of 100 – 180mm thick. (RUCKER, D. G. 1993 p.86)

In summer, most solar radiation strikes the insulated roof and does not significantly heat the building interior. In winter, the sun is lower, warms up the thick straw bale walls and thus heats the building interior.

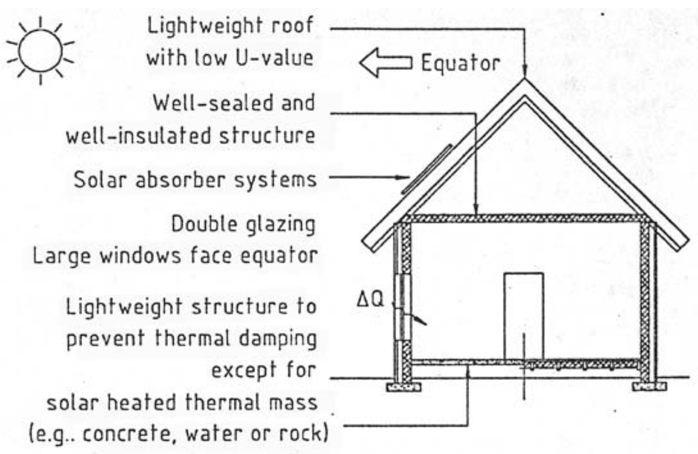


Fig.05.05

05.03.5.4 Western facades (orientation and size)

The orientation of a building should be decided according to climatological factors to maximise the use of natural lighting and heating, thus keeping the building comfortable throughout the seasons with little need for artificial intervention. The more a building design mimics nature, the more it functions like an organism, and organisms are adaptable to the climate.
(Green 2004 p.9)

When both sunlight and prevailing winds come from the west, it is difficult to prevent the sun from entering a space when windows need to be opened to allow for natural ventilation. Since compromise is not easy, the choice is between both sun and wind, or neither. When solar radiation enters through a west-facing window it may easily increase the internal air temperature by 5 degrees and will cause an even greater discomfort if direct radiation falls on the occupants. The effect of good air movement will be equivalent to a reduction in temperature of about only 2.5 degrees. It is possible to exclude direct solar radiation from west-facing windows by the use of shading devices, but these will be heated by solar radiation and may heat up the air before it enters the room. Shading devices on west walls that exclude the sun will inevitably severely limit any view from the window and deflect air movement in directions where it may not be effective. (EVANS, M.1980 p.62)

The main development excludes west-facing windows as far as possible, but where there is no alternative, the design incorporates these windows with large overhangs to maintain western views but minimize heat gain. The farm factory will need western windows to ensure the necessary ventilation in rooms on that side of the building. These windows, however, will be smaller and placed higher than normal in order to minimize solar heat gain.

The design of the cottages is more complex. Despite all the thermal warnings against west-facing windows, the view from the bedroom is regarded as main priority and a window will be incorporated. As straw bale construction has good thermal insulation qualities, it allows for the cottages to have west-facing windows that will only be used for ventilation purposes at specific times in a day. A large roof overhang will ensure minimal western solar heat gain while the window provides the bedroom with a view. The view will mainly be experienced when lying in bed, which means that, although the roof overhang is large, one will still be able to enjoy the view in the mornings when the western sun is not a problem.

05.03.5.5 Insulation of building structures

Generally, Piet Retief has a mild climate, but careful attention should be given so as to insulate cottages from extremely cold winter nights. This can be done by applying the following climatic design principles:

05.03.5.6 Building form & orientation

The optimum design for the climate of Madola will be a moderately dense one-storey layout, with main openings to the north and south. Dwellings facing onto fairly generously proportioned courtyards with greater dimensions in an east-west direction and terraced dwellings facing north and south are also appropriate. The northern spaces will receive sun in the winter, while an overhang or creeper plants can be used to shade these in summer. (EVANS, M.1980 p.71) Clerestory windows will allow for additional northern sunlight into larger buildings.

In designing the cottages, the two most important factors influencing the orientation are: Firstly, to provide the main living space within the cottage with a north-facing window and verandah so as to maximize thermal comfort. Secondly, the roof will need to slope in a northern direction to provide a surface onto which the solar heat collectors could be fixed.

05.03.5.7 Sizing and location of windows

Windows on the eastern and southern sides of a house should each represent no more than 4% of the house's floor area, while maximum recommendations for windows on the west wall is only 2% of the floor area. To capture heat from the sun, the square footage of north-facing glass should be a minimum of 7% of the floor area and the maximum should not exceed 12%. This method of sun tempering is especially good for hot climates. When north-facing glass is above the 7% threshold, it must be balanced with an increase in heat-absorbing materials. Clerestory windows allow natural sunlight to penetrate buildings and provide interior spaces with the required level of natural lighting. (figure 05.06) It also enhances the interior quality of spaces. In winter, these windows improve the effectiveness of thermal mass elements.

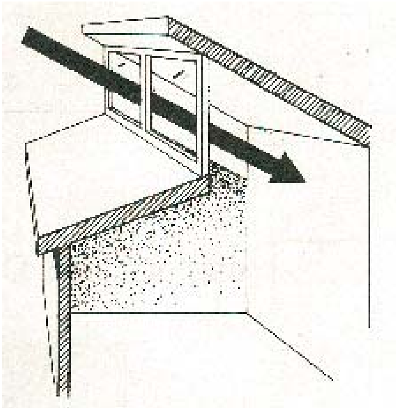


Fig.05.06

05.03.5.8 Roof overhang

Northern windows are to be shaded from the summer sun but should allow the low winter sun to penetrate far into the house. Western windows should be protected against harsh western sun and, where possible, completely avoided. Roof overhangs are important in terms of protecting straw bale walls from rain. On Madola, rain hits buildings from a north-western and slightly eastern direction. It is therefore beneficial to the for roof overhangs to be increased by up to 1000mm on western and eastern facades. It would be beneficial to combine roof overhangs with a strip of grass or vegetation at ground level around the various proposed buildings as to prevent surfaces from heating up.

05.03.5.9 Active systems

Active systems use components to pump and store heat as desired, eg solar heat collectors for the swimming pool and hot water in kitchens and bathrooms.

05.04 OCCUPANT COMFORT

All interior spaces will be provided with sufficient windows that can be opened to allow for natural ventilation. The user will therefore be able to control the immediate surroundings according to his or her personal needs. In the same way, selected windows will be provided with timber shutters that can be operated manually, preventing harsh sunrays from hindering interior activities.

Floor finishes of outside social areas are to be made from materials that only partially absorb heat from the sun, making it not too hot to walk on and which is not too light in colour to ensure minimal glare. Materials that are used include: Timber decking and cobblestone paving blocks laid in rammed earth. Vegetation should greatly be incorporated. This ensures that the user is constantly reminded of his/her surroundings and closeness to nature.

05.04.1 Foot comfort

Some people may walk barefoot, particularly in bedrooms and bathrooms. Floors with high admittances may feel uncomfortably cold. When walking on a cold floor, the foot will only be in contact with a particular part of the floor surface for a few seconds and therefore the heat flow from the foot to the surface will be dependant on the floor finish and not the sub-floor.

In summer, when temperatures are generally above 25°C, concrete floors, terrazzo tiles and other hard and 'cold' materials become comfortable. These floor finishes will not be too hot for comfort until temperatures in excess of 45°C are reached, which is unlikely on Madola. However, outside paved areas that are exposed and heated by the sun could become uncomfortable and therefore the designed will mainly incorporate gravel. When floor temperatures drop below 19°C, the choice of comfortable floor finishes becomes more limited. At 18°C, softwood boards make for efficient flooring materials. (EVANS, M.1980 p.103) A timber deck absorbs less heat than thermal floors and is therefore a good solution for outdoor spaces that need to be cool during daytime when it receives most of its traffic.

05.05 WASTE MANAGEMENT

05.05.1 Grey water recycling

The design will, from inception, include integrated systems for grey water recycling. In both the main building's kitchens and cottages, grey water from hand basins will be led to perforated geopipes placed beneath gardens to ensure slow release for irrigation purposes. Grey water from hand basins in public bathrooms will join black water from the water closets to ensure the efficient flushing solids. For the same reason, the grey water from baths in cottages joins the black water from water closets in each cottage. Water which is discharged by the kitchen should go through a grease trap before being recycled as grey water or being fed to the septic tanks.

05.05.2 Storm water management

Good site drainage is extremely important throughout, as excess water left unattended may penetrate the buildings, which can be detrimental to straw bale construction. Each building (in both the main and private developments) will therefore include a slightly sloping hard surface around the perimeter of each individual building that allows water to efficiently drain. Trenches will be dug to channel surface and subsurface runoff to carry water around or away from the buildings.

As the site is terraced, the overall flow of water during rainstorms is slowed down, thus limiting possible erosion and maximizing water intake through vegetation, which covers each terrace. Indigenous species have low water requirements and therefore the design promotes the planting thereof in an effort to conserve water resources.

The most northern part of the development (Mushroom cultivation area) will include drainage trenches that catch and eventually lead water runoff to the adjacent dam. All the drained water and runoff on the southern part of the dam will penetrate the subsoil and move downwards. There it will eventually, after passing through plantations, end up in the river at the lowest point of the site. In the private development, rainwater will naturally be drained away from each cottage, as the natural ground level slopes from each cottage towards the forest and river.

05.05.3 Rainwater Collection

In determining the sizes of water tanks it is necessary to design for the worst case scenario. Rainfall on farm Madola reaches a maximum during summer months to provide a summer average rainfall of 125mm, with December being the highest month. It has been recorded that a single rainstorm can deliver up to 75mm of rain in one storm.

Average rainfalls per month are as follow:

October	–	75mm
November	–	125mm
December	–	150mm
January	–	125mm
February	–	75mm

The design includes 3 000 and 5 000 litre water tanks that are able to contain the summer average rainfall of 125mm per month, depending on the various roof areas of the proposed buildings.

Collected rainwater is intended for human consumption and is therefore placed close to the kitchens and bathrooms. Down pipes that lead water into the tanks are taken below the level of the inlet pipe with a plug in the bottom of the down pipes. This ensures that the rain's first foul flush is diverted away by removing the plug after the rainstorm.

05.05.4 Septic tanks/ sanitary drainage system

Sewage will be collected by a large septic tank specifically designed to hold the amount of waste produced by the entire development. Waste from public bathrooms and individual cottages will therefore be channeled to join in a single septic tank at the lowest point of the site, from where it will drain into a French drain that feeds the surrounding plantations.

05.05.5 Organic waste

Organic matter produced during daily farm operations is to be collected at a central point to be turned into compost. The result is a soil product that can be reworked into the landscape. Timber off-cuts and waste produced by the sawmill on site can be worked into strawberry patches and vegetable gardens. This helps to inhibit the growth of unwanted species that affect the productivity of these plants. Cut grass is worked into gardens and placed on the ground surface of plantations to generate compost, which will increase soil fertility.

05.05.6 Water provision on site

Water used within the main development area is pumped from Dam 2 into the main settling tank which is the only tank that will need management and regular cleaning. Water is then distributed from this tank to 5 other water tanks which serve the various sections of the main development area. Therefore, should a particular section require more water on a specific occasion, it can be pumped back from other sections or water tanks to the main settling tank. The main tank will then provide the relevant section with additional water.

The private section of Mkhonda Lodge will receive its water from Dam 1. Two water tanks are provided to serve the various cottages and water from Dam 1 will be pumped directly into the tanks. Both tanks will therefore need management and regular cleaning.

05.06 ACCESSIBILITY AND CIRCULATION

05.06.1 Legibility

Routes between buildings are strategic to fit into the existing landscape. Public and exposed routes are highlighted through the use of landscape elements (stone walls, gardens and trees) and are intended for use by daily visitors. Private roads and walkways only used by guests are less visible. Service roads have separate entrances and are situated away from the central development.

05.06.2 Persons with disabilities

All levels and buildings are wheelchair accessible. Depending on the height difference, the slope of the ramps varies between 1:8 and 1:12.

05.06.3 Accessibility between different buildings

Within the main development, accessibility between separate buildings is important. Four main functions are distinguished, namely lounge and restaurant, conference facility, production area and private accommodation area. Each has their own separate entrance, but guests will be able to freely move between them by means of open and covered walkways or ramps.


Fig.05.07


Fig.05.08


Fig.05.09

05.07 EDUCATION, HEALTH AND SAFETY

One of the key objectives of the project is to inform all users and individuals of a new vernacular and approach to design where economic, social and environmental sustainability and sensitivity towards a site would be the main design criteria in building their own homes and dwellings.

With the development having an educational undertone, compost heaps were designed to be exposed to the public. Guests will be made familiar with the route organic matter travels throughout the development. Trellis work, timber counters and table tops, as well as window and door frames will be locally produced to provide the community with skills that will be of great value to them in future. In the central courtyard and restaurant area, timber trellises will showcase the cultivation of certain vegetable species. The education aspect will be further explored when dealing with water. The aforementioned water recycling implements will be placed strategically to display proper rainwater management.

05.08 FLEXIBILITY

The proposed development is flexible in terms of material usage. Buildings are able to decompose completely and return to their natural state of raw materials, once the development has completed its life cycle. Materials used therefore need to be biodegradable, whilst elements like metal roof sheeting and timber windows and doors can be reused in other applications.

Interior spaces have flexible layouts and forms with no fixed furniture, except for balustrades and counters. Spaces are able to adjust and conform to different needs and functions throughout the lifecycle of the buildings as the demand for additional accommodation and production facilities arises.

The design is also flexible in the range of accommodation options. Generally, accommodation facilities need to provide for people in groups of 8, 12, 16, 24, or 45 to 60 (one busload of tourists). Although a number of units are available, they are dispersed over the entire site. For example, the private kloof area includes 12 cottages. Six of these units can accommodate four people while the rest sleeps two. However, the arrangement of cottages in relation to each other makes it possible for groups of 2, 4, 8, 16, 36 or even 60 people to stay in the private section of Mkhonda Lodge. The main development focus on the accommodation needs of larger tourist groups and therefore the proposed 18 cottages can, in total, provide 48 to 60 people with accommodation. Therefore, through the grouping of different types of cottages, a greater flexibility in accommodation combinations is created. Later design sketches illustrate the different types of cottages (Units A, B, C, D and E) and their relationship on site. Units A and B are in the private kloof area, while units C, D and E form part of the main development.

Available accommodation within each unit is as follows:

1. Unit A – Sleeps 4, fixed layout, private
2. Unit B – Sleeps 2, sleeper couch in lounge to accommodate additional 2 persons, private
3. Unit C – Sleeps 2, fixed layout, private
4. Unit D – Sleeps 2, sleeper couch in lounge to accommodate additional 2 persons, semi-private
5. Unit E – Sleeps 4, largest, family unit, sleeper couch in lounge to accommodate additional 2 persons

05.09 LOCAL LABOUR AND PARTICIPATION

In the surrounding area, the taxi industry is expansive and a large number of workers are currently making use of this transport system. Therefore, staff will be able to move between the lodge and their homes with ease. Occasionally, it will be necessary to provide accommodation for workers that are working night or early morning shifts. The design of the lodge will therefore include four rooms with a shower and toilet, linked with the staff quarters next to the kitchen.

05.10 COMMUNITY INVOLVEMENT

Community involvement plays a dominant role throughout the project and ensures the empowerment, skills transfer and long-term sustainability of local communities. In accordance with Crafford&Crafford Architects' view on the construction of eco-tourism projects, Mkhonda Lodge ensures that locally available materials, craftsmen and customs are utilized in the design and construction. (Blouberg Cultural Village 2004 p.96-97) This enables the development to provide direct benefits to the local community. Through job creation, people will be encouraged to embrace opportunities for small emerging businesses. Residents of Madola and surrounding farms will therefore be used in the construction of Mkhonda Lodge, where their techniques can be demonstrated and supplemented by the technical expertise of professionals. In this way, skills transfer can take place and the community is enriched socially and economically.

05.11 LOCAL PRODUCTION OF FOOD

Mkhonda Lodge will make use of locally produced products as far as possible in an effort to increase overall sustainability. Not only does this reduce operating expenses, but local people are also educated in managing their own production of food. Locally produced food include cow and goats milk and cheeses, vegetables, fruit, poultry, mushrooms, wine and preserves. (figures 05.07-05.14)


Fig.05.10


Fig.05.11

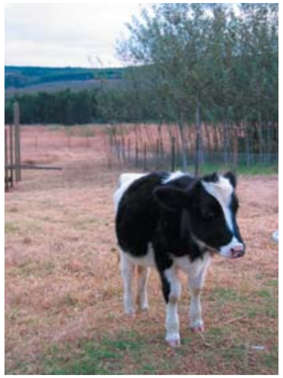


Fig.05.12


Fig.05.13


Fig.05.14

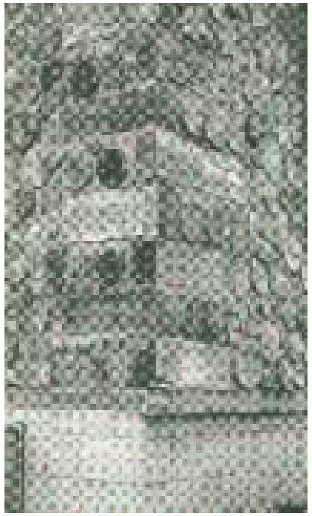


Fig.05.15

05.12 BUILDING MATERIALS AND COMPONENTS

"We can create a comfortable environment with primarily natural materials by simply orienting our homes to the sun and combining exterior insulation with interior thermal mass. Understanding the properties of natural materials and how they can complement each other will lead to healthy and energy-efficient built environments that nurture human life."
(KENNEDY, J.F., SMITH, M.G., WANEK, C. 2002 p.65)

05.12.1 Use of local materials

To ensure low energy expenditure, materials that need little processing and are locally grown is used in the overall design. Madola, in itself, has a rich diversity of natural materials (stone, grass, clay, sand, straw, timber planks and poles) and where other, non-local materials are required, it can easily be obtained in town or the immediate surroundings.

05.12.2 Renewable materials

Traditional materials that are broken down completely and reabsorbed into the natural cycles of the environment once their use as a building material is over should be used. These materials include clay bricks and floors, timber products (eucalyptus poles, doors, window frames, etc), straw bales, grass and stone. Additional building materials that are cannot decompose completely, such as steel profiles and iron roof sheeting are recyclable and reusable for later applications.

05.12.3 Straw bales

Straw bales form the key wall construction material of the entire development and therefore a thorough study needs to be made of straw bale construction specifications and design guidelines. Straw is available locally and will be baled during the winter when the straw is at its driest and there is no main farm activity that requires an intensive labour force. (see appendix 08.01.8)

ENERGY ACCOUNTING OF STRAW BALES

Primary processing of straw bales take place at its production site with low energy inputs, no required water and minimal pollution. Since it is grown locally, cost of transportation is kept to a minimum. Straw bale requires little installation energy or energy-intensive companion systems. It saves heating and cooling energy over the life of a building and releases no toxic materials. At the end of the life of the building, straw can be composted back into the earth. As more energy conservation codes are adopted and lumber becomes more expensive, straw-bale construction will become even more financially attractive. (Lecture notes)

05.12.4 Wood

Piet Retief has a flourishing local timber industry and the use of timber will reflect the local context. High availability of timber and treated timber poles will alleviate transportation fees and consequently minimize building costs. It would therefore be viable to concentrate on timber as main structural element throughout the design. Timber is very strong in compression and tension and can be used for posts, beams, floors, roofs, ceilings, lattice work, windows, doors and furniture. All these products will be manufactured locally at the existing sawmill in an effort to create jobs and to educate the local community through skills development.

Lattice work will be done with timber that is cut and reworked on site. A large number of wattle and eucalyptus slats are produced during regular trimming of plantations, therefore making it a viable option as the slats usually become waste material.

05.12.5 Cord wood

Walls are constructed of entirely natural materials where short logs are laid transversely in the wall in the same way that firewood would be stacked with a cob mixture in between. (figure 05.15) The walls are able to breathe along the end grains of the timber, which allows for quick drying after rainstorms. (KENNEDY, J.F., SMITH, M.G., WANEK, C. 2002 p.143-148) Any available wood can be used, but poplar and pine is preferred as they are lighter with better insulation value and less prone to shrinkage. Currently there are a few poplar forests that need to be removed from Madola, making the use of poplar for cordwood walls a viable option. (KENNEDY, J.F., SMITH, M.G., WANEK, C. 2002 p.145)

05.12.6 Stone and pebbles

Stone will be utilized as a structural material, as its density makes it good thermal mass. This means that it absorbs heat or cold from the surrounding air and, as the air temperature changes, it slowly equalizes to match it, releasing the stored heat or cold. Thermal mass materials absorb heat most effectively when it is dark in colour and the sun hits it directly. (KENNEDY, J.F., SMITH, M.G., WANEK, C. 2002 p.63) A large portion of the stone that will be used in the development will come from rocks dug out during excavations on site. The type of stone generally used is sandstone, soft sedimentary rock that is fairly easy to shape to the desired size. The remaining stone requirements will be met by acquiring stone from the quarry situated within 10km of Madola. In this way, the mountain on the farm is kept in its natural state.

05.12.7 Earthen Plaster & floors

EARTHEN PLASTERS
Plasters protect straw bale walls from wind and rain, seal bales from birds and rodents and add structural strength to the wall. A thick plaster on straw bale interior walls adds up to provide a significant part of the thermal mass that is required for effective solar design.

These plasters will also moderate humidity inside homes, providing the perfect range for human health. (KENNEDY, J.F., SMITH, M.G., WANEK, C. 2002 p.191) Walls will be left in its natural state and colour, for paint keeps the wall from 'breathing' properly and inhibits the wall's ability to transpire moisture. Earthen plasters, on the other hand, absorb moisture but dries out again without creating major moisture problems. (KENNEDY, J.F., SMITH, M.G., WANEK, C. 2002 p.219)

EARTHEN FLOORS
Earthen floors are easier to install and repair than brick, tile or concrete and, if built correctly, can withstand heavy traffic. Different coloured clays can be added for variety.

05.21.8 Sand & Gravel

Sand is an essential ingredient in the construction of Mkhonda, especially in the mixing of cob that is used for plastering the straw bale walls. The sand will be transported from the riverbed on the adjacent farm. Gravel, obtained at the local quarry, will be used for service roads and to fill drainage trenches, as it allows water to gradually seep through topsoil layers.

05.12.9 Corrugated iron roofs

A corrugated iron roof resembles traditional Transvaal farm architecture and is therefore used as the main roofing material. In addition, iron roof sheets are much more practical and have several advantages, including durability, ability to collect rainwater and acting as a surface to secure solar panels. In the Piet Retief region, solar panels need to be fixed at a slope of preferably 32–37 degrees and corrugated iron sheets can be fastened at the required pitch.

Most heat loss and gain take place through the roof of a building and therefore the appropriate ceiling insulation is essential. Any cracks or openings, especially the connection between walls and the ceiling, need to be properly sealed off. Any exposed surface has to be plastered with cob, which acts as a fire-retardant.

05.12.10 Glass

Although glass is not available on site, it can very easily be obtained in Piet Retief.

1. East and west facades should not be more than 20% glazed
2. Reflected glass should be avoided in spaces that will be negatively affected by direct solar radiation and reflection
3. Guests should be able to see activities in the lodge to enhance social interaction

05.13 AESTHETICS

05.13.1 Architectural character

The aesthetic and architectural character of all the buildings should represent Mpumalanga as a South African province, but should be careful to not become another stereotypical design added as an afterthought. South Africa and its diversity should clothe the interiors and exteriors of buildings in an innovative way.

05.13.2 Representing local culture

Certain elements used in the local buildings on Madola will be incorporated into the design, reflecting the local culture and its importance to the design. These elements include timber pole roof structures, walls plastered in natural earthy colours, corrugated iron roofs and natural earth floors. Traditionally, floors are made of clay rubbed with a mixture of dung and water with hand-drawn patterns as decoration. As the cow dung dries out, it forms a strong layer, which keeps the surface together, and dust free.

05.14 LANDSCAPING & VEGETATION

Only indigenous species will be used in the design of terraces, gardens and interior planters, except for particular species used in the herb garden. Deciduous trees will be strategically placed to screen off areas prone to sunshine during summer and allow the winter sun to heat up spaces through shedding their leaves. Western facades will additionally be protected by the planting of trees that will be carefully placed as not to limit the view. Landscaping will be informally arranged (except for the central courtyard) and allowed to freely grow and spread out between buildings and on lattice work.

05.15 NATIONAL BUILDING REGULATIONS

All the buildings should comply with national building regulations as set out by the National Building Code, which should guide structural integrity and enforce minimum standards and at all times be designed to cater for physically disabled persons. All buildings and spaces are to comply with legislative bylaws.

05.16 RATIONAL FIRE DESIGN

All timber poles that are not exposed to weather conditions will be treated with Flambor for better fire resistance. Plastered straw bale walls in themselves are extremely fire resistant (see addendum). As the overall design is informal and spread out over the entire landscape, there is no need for specific fire escape routes. Each building has sufficient exits and users will be able to move freely outwards when a fire breaks out.

FIRE RESISTANCE OF STRAW BALES

Concern about fire is often the first reaction to the idea of building with straw. This is ungrounded. While loose straw burns, when densely packed it is remarkably fire resistant, for this tight packing limits the available oxygen needed for combustion. Furthermore, the high silica content in straw (3-14%) is said to impede fire -as it begins burning a layer of char develops which insulates the inner straw. (www.BuildingGreen.com) However, it is important to remember that walls need to be plastered on both sides to seal out oxygen.

05.17 ELECTRICAL INSTALLATIONS

The electricity needs, which include lighting, water and interior heating, will be met by Eskom power already used on the farm.

Lighting requirements of cottages within the main development area of Mkhonda Lodge will be met by an underground 24V electrical supply. This enhances the aesthetic quality of the development by eliminating the need for large power lines to penetrate forest areas on site. Energy efficient lights are to be used. Where it may be necessary to provide stronger electrical currents (eg the use of electrical shavers, hair dryers, etc) inverters will be incorporated into the electrical design that provides the required 220V alternating current.

Cooking will be done using gas throughout. Cottages are supplied with two-plate gas stoves and the main kitchen will make use of gas stoves and ovens as well as outside food-fired clay ovens.

Solar **water heating** systems will meet the necessary warm water needs, but will make use of a backup system in the case of cloudy days. These backup systems include:

1. For the main development - an electrical booster, which functions in the same way a normal geyser element does.
2. For the private development – as it is difficult to provide these remote cottages with electricity, the backup system consists of a traditional direct-fired heater, also known as a donkey.
3. It is important to note that, in both cases, the solar heaters will continue to operate in conjunction with the backup systems and therefore serve as pre-heaters to water contained in each geyser. In this way, much less energy input is needed to heat water to the required 60°C.

Interior heating will be achieved through effective insulation methods and central heating by means of solar energy collectors situated underneath floors. Additional heating will be produced by stoves and fireplaces located within buildings.

05.18 PARKING REQUIREMENTS

FUNCTION	NUMBER OF PARKING BAYS NEEDED
Manager's cottage	1
Mushroom cultivation area	3
Farm factory	4
Restaurant	20
	1 bus stop
Conference facility & Meeting room	40
18 Cottages (Main development)	6 x 1 at family units
	12 x 1 separate parking
12 Private cottages (Kloof)	12 x 1 at each cottage
Staff parking	5
TOTAL	103

Table 05.02

05.19 ACCOMMODATION SCHEDULE

ACCOMMODATION SCHEDULE FOR MKHONDA LODGE

		DIMENSIONS	NUMBER	AREA	NOTES	FLOOR FINISH	VENTILATION	TEMPERATURES
FARM FACTORY (phase 2)		(m)		(m^2)				(°C)
Store room		6 x 6	1	36 m^2	store of finished products, highly accessible	tiles	natural	ambient
Packaging Room		13 x 17	1	221 m^2	highly accessible	tiles	natural	ambient
Fermentation Room		4 x 10	1	40 m^2		tiles	natural	ambient
Cooler Room		4.5 x 5	1	22.5 m^2	inner insulation layer of isowalls - 100mm	tiles	a/c	1 to 4
Freeze Room		4.5 x 5	1	22.5 m^2	inner insulation layer of isowalls - 150mm	tiles	a/c	-8
Maturation room		5 x 7	1	35 m^2		tiles	a/c	16
Display room		7 x 8.5	1	59.5 m^2		timber	natural	ambient
Marketing office		3 x 6	1	18 m^2	linked with coffee shop	timber	natural	ambient
Coffee shop		7 x 8	1	56 m^2	should open up onto a deck area	timber	natural	ambient
Large Kitchen		6.5 x 15	1	97.5 m^2		tiles	natural	ambient
Services & waste area		4 x 4	1	16 m^2	next to kitchen, highly accessible, close to store & packaging roo	gravel	n/a	ambient
Public toilets:						tiles	natural	ambient
Male	(2WC, 2HWB)	3 x 4	1	12 m^2				
Female	(2WC, 2HWB)	3 x 4	1	12 m^2				
Staff toilet	(1WC, 1HWB)	2.5 x 1.5	1	3.75 m^2				
Deck		9 x 22	1	198 m^2	elevated to capture views	timber	n/a	n/a
TOTAL AREA				**850 m^2**				
MUSHROOM CULTIVATION AREA (phase 2)								
SPAWN LABORATORY		10 x 13	1	130 m^2	very thorough insulation needed	r / earth	natural	ambient
GROWING ROOMS		5.5 x 19.5	3	322 m^2	very thorough insulation needed	r / earth	mechanical	ambient
SOLAR DRYER		5 x 25	1	125 m^2	face north, placed open in landscape	n/a	natural	ambient
TOTAL AREA				**577 m^2**				
MANAGER'S COTTAGE (phase 2)								
Lounge/dining area		5 x 8	1	40 m^2		cob	natural	ambient
Kitchen		4 x 5	1	20 m^2		cob	natural	ambient
Bedroom		5 x 5	1	25 m^2		cob	natural	ambient
Bathroom (1SHW,1BATH,1WC,1HWB)		3 x 5	1	15 m^2		tiles	natural	ambient
Verandah		3x15 + 3x11	1	78 m^2		timber	natural	n/a
Parking (1 bay)		2.5 x 5	1	12.5 m^2		n/a	n/a	n/a
TOTAL AREA				**210.5 m^2**				
12 PRIVATE COTTAGES (KLOOF) (phase 3)								
Lounge/dining area		6 x 6	1	36 m^2		cob/timber	natural	ambient
Kitchen		3 x 3	1	9 m^2		cob/timber	natural	ambient
Bedroom 1		4 x 4	1	16 m^2		cob/timber	natural	ambient
Bedroom 2		4 x 4	1	16 m^2		cob/timber	natural	ambient
Bathroom (1SHW,1BATH,1WC,1HWB)		3 x 4	1	12 m^2	wet core separate entity, outside shower	tiles	natural	ambient
Verandah		4 x 3	1	12 m^2		timber	natural	n/a
Parking (1 bay)		2.5 x 5	1	12.5 m^2		n/a	n/a	n/a
TOTAL AREA FOR 12 COTTAGES				**113.5 m^2**				

LODGE / MAIN BUILDING (phase 4)								
RECEPTION & OFFICES:								
Office 1		9 x 5	1	45 m^2	should open onto private garden area	r / earth	natural	ambient
Office 2		5 x 5	1	25 m^2		r / earth	natural	ambient
Foyer / Reception / Waiting area		9 x 22	1	198 m^2	suffient windows	r / earth	natural	ambient
Safety unit		2.5 x 4	1	10 m^2	doulbe wall construction, steel door	r / earth	natural	ambient
Storage		3.5 x 5	1	17.5 m^2	area least exposed to direct sunlight	r / earth	natural	ambient
Public Bathrooms:					placed central to serve restaurant & reception	tiles	natural	ambient
Male		3 x 4	1	12 m^2				
Female		3 x 4	1	12 m^2				
Disabled		1.8 x 2	1	3.6 m^2				
COMPOSTING AREA		7.5 x 12.5	1	94 m^2	should be visible from courtyard	n /a	natural	ambient
VEGETABLE GARDEN		7.5 x 12.5	1	94 m^2	should be visible from courtyard	n /a	natural	ambient
RESTAURANT		14 x 21	1	294 m^2	linked with kitchen	r / earth	natural	ambient
KITCHEN								
Food preparation area		10 x 10	1	100 m^2		tiles	natural	ambient
Pantry		2.5 x 3.5	1	8.75 m^2		tiles	natural	ambient
Freeze room		3 x 3	1	9 m^2	inner insulation layer of isowalls - 150mm	tiles	a/c	1 to 4
Cooler room		3 x 3	1	9 m^2	inner insulation layer of isowalls - 100mm	tiles	a/c	-8
Services area		3 x 5.5	1	16.5 m^2	next to kitchen, highly accessible	tiles	natural	ambient
Clay oven area		5 x 7.5	1	37.5 m^2	linked with kitchen, opens up onto restaurant	tiles	natural	ambient
STAFF QUARTERS & LAUNDRY					activities arranged around central courtyard			
Staff lounge		6.5 x 10	1	65 m^2		tiles	natural	ambient
Staff Bathroom (2SHW,2WC,2HWB)		4 x 4.5	1	18 m^2		tiles	natural	ambient
Staff accommodation		2.6 x 4.5	4	12 m^2		r / earth	natural	ambient
Laundry		6.8 x 6.8	1	46 m^2		r / earth	natural	ambient
Storage		6.8 x 6.8	1	46 m^2		r / earth	natural	ambient
LOUNGE		6.8 x 24.5	1	167 m^2	views to enjoy high priority	timber	natural	ambient
CONFERENCE FACILITY					in close proximity of kitchen			
Main function hall		14.3 x 30	1	430 m^2		r / earth	natural	ambient
Pump room		3 x 3.5	1	10.5 m^2	sufficient space for alternative layouts	r / earth	natural	ambient
Service kitchen		6.5 x 6.8	1	44 m^2	linked with conference facility, separate entrance	tiles	natural	ambient
Storage		4 x 6.8	1	27 m^2	linked with conference facility, storage of equipment&furniture	r / earth	natural	ambient
Public toilets:		7 x 13.5	1	94.5 m^2	separate building to serve various blgs, central HWB	r / earth	natural	ambient
Male	(4WC,)							
Female	(5WC)							
Disabled	(1WC, 1HWB)							
MEETING ROOM		6.8 x 10	1	68 m^2	formal layout, good ventilation essential	carpet	natural	ambient
ACCOMMODATION (COTTAGES)					wet core separate entity, outside shower			
6 FAMILY UNITS			6	310 m^2	has own parking bay, sleeps 4 - 6	r / earth	natural	ambient
6 SEMI-PRIVATE UNITS			6	200 m^2	sleeps 2 - 4	r / earth	natural	ambient
6 VERY PRIVATE UNITS			6	200 m^2	sleeps 2 only	r / earth	natural	ambient
PUBLIC SWIMMING POOL AREA			1	600 m^2	serves public & semi-private cottages	r/e & stone	natural	ambient
PRIVATE SWIMMING POOL AREA			1	500 m^2	serves private cottages only	timber	natural	ambient
PARKING		2.5 x 5	95	237.5 m^2	separate access road to serve accommodation units	gravel	n/a	n/a
TOTAL AREA				**7611 m^2**				

Table 05.03

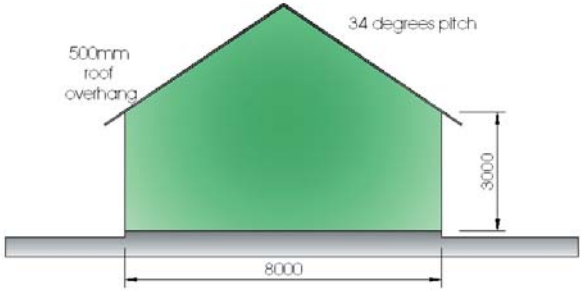


Fig.06.01

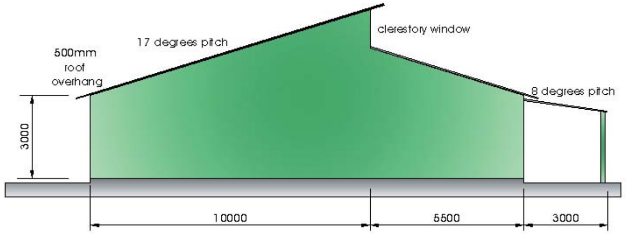


Fig.06.02

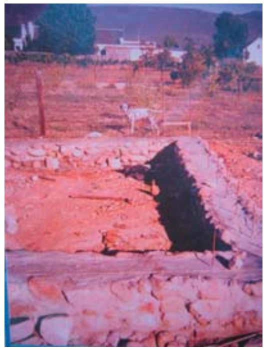


Fig.06.03

06 TECHNICAL INVESTIGATION

06.01 BUILDING STRUCTURE

06.01.1 Structural Timber Frames (Timber Roof Structure)

The main concept throughout the design, in terms of building structures and frames, is to keep the overall construction as simple as possible and to standardize elements. This makes the development economically viable where limitations on local labour and skills were important considerations. After a prolonged design exploration of possible solutions, the end result is extremely simple and viable within the scope of the project, as it resembles the simplicity and honesty that are evident in the rest of the project. The solution stipulates that the entire development of the main area is based on only two structural timber frames, each with its own set of sectional dimensions that can be added onto individual buildings. The construction procedures are thus greatly simplified, while no limit is placed on acceptable lengths of the various buildings. As these timber structural frames support the roof, walls are simply used as infill and are placed either in or outside the timber structure, depending on the building's function.

The first solution is a simple 34 degree pitched roof placed over an 8 meter span (figure 06.01), while the second is more complicated, with 17 degree pitched roofs that include clerestory windows with a structure that allows for spans between 5,5 and 10 meters (figure 06.02). Doors and windows are custom made with eucalyptus saligna and sizes are standardized with only 4 variations, depending on the function of a particular space. Sizes are subject to limitations placed on spacing, because of straw bale construction. These variations include:

1. standard single door – 813 x 2100 / 2500 mm
2. double door – 1626 x 2500 mm
3. standard window – 813 x 700 / 1400 / 2100 / 2500 mm
4. custom-made doors – 2100 x 2100 mm

06.01.2 Foundations

The construction of foundations is based on techniques used by a professional green architect, Etienne Bruwer. (KNOLL, C. 1998 p.19) Foundations comprise of timber shutters placed vertically on top of each other, into which stone is then poured with 500-1000mm steel reinforcing bars at 800mm spacing. The top 100mm of these bars are exposed, onto which the first layer of straw bales can be secured (figure 06.03). A concrete and lime mix is then poured into the shuttering to settle and reach full strength. After the foundation has settled, the exposed part of each foundation will be carefully finished off with neatly cut stones so as to add to the overall aesthetic quality of the development. (see details 10 & 11)

06.02 SEWAGE SYSTEMS (SEPTIC TANK)

Figure 06.04 represents the route along which sewage is discharged. Ultimately, all sewage is led to a central septic tank that overflows into a French drain.

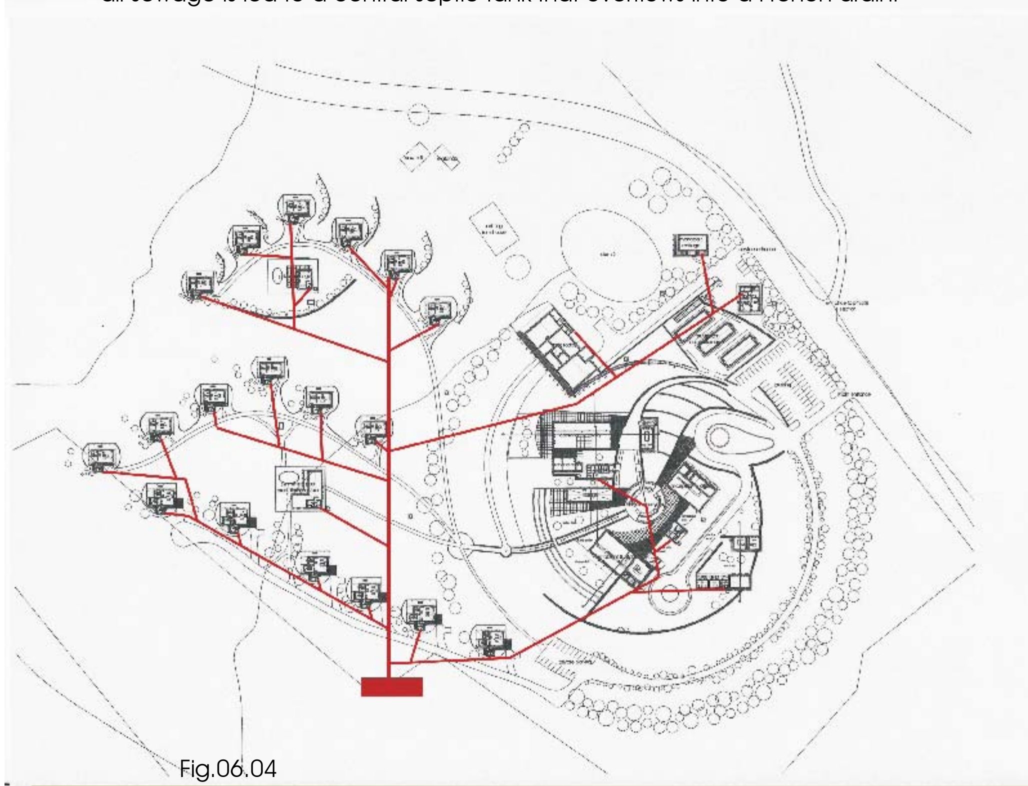


Fig.06.04

06.03 BUILDING MATERIALS

06.03.1 Straw Bales

06.03.1.1 Straw Bale Dimensions

It is important that the design uses the same straw bale dimensions from the outset to be able to create a modular design solution. The local bale machine produces bales 900mm long, 460mm wide and 360mm high. It is necessary that these bales are checked on site and trimmed to the exact size.

06.03.1.2 Construction

The design will make use of the **post and beam** method to construct the buildings. This method combines a vertical load-bearing timber frame with the bale wall (See figures 06.05 and 06.06). Straw bales can be used as **infill** between the panels of vertical support, or as **fabric** (Mushroom growing rooms) where the continuous bale wall runs alongside the exposed timber frame. (Lecture notes) These construction methods have the advantage that the roof frame can be erected first and protect the bale walls as they are raised. The use of bale as **fabric** has the additional advantage of providing the walls with more architectural freedom of movement. Using straw bales as infill allows for greater design flexibility, irregular and gable roof designs, taller one-and-a-half storey buildings, complex floor plans, different amounts of glazing on different orientations and requires smaller framing members.

(www.BuildingGreen.com)

06.03.1.3 Height & width limits

For unbraced bale walls, the recommended height/width ratio should be 5,6:1 and length/width ratio 13:1. (Lecture notes) Therefore, when using 460x360x900mm bales, the unbraced load-bearing straw bale walls can only be taken up to a height of about 3 metres or 7 layers of straw bales, which are 6 metres long. If the building requires a second storey, the walls need to be discontinued after 3 metres and should be topped with the second floor which, in turn, provides the base for the next 7 layers of straw of the second storey. Maximum wall heights can be increased through incorporating external bracing or 'baskets' into the construction of walls (see detail 10), thus making it possible to extend walls of the more complicated structures of Mkhonda Lodge were large interior spaces need to be ventilated and where natural sunlight penetration through clerestory windows is essential. In these situations, gable walls should be designed with great care and all straw bale layers that are placed additionally on top of the initial 7 layers should be wrapped in wire before being finished off with rammed earth plaster.


Fig.06.05


Fig.06.06

06.03.1.4 Strengthened straw bale walls

A combination of bales together with cob, timber, etc is used for a stronger composite structure. Walls that need additional strength will be braced by means of exterior ribbing-stiffened baskets. These baskets consist of 38 x 38mm vertical timber laths spaced at 600mm centres, tied to each other on opposite sides of the bale wall and then covered by chicken wire mesh. For additional strength, larger laths can be used which are horizontally braced through the bale walls and vertically braced to laths on the same side of the wall. (see detail 10)

06.03.1.5 Protection against moisture

The importance of keeping continuous moisture away from walls cannot be stressed enough. Walls with a moisture content of more than 20% (about 80% relative humidity) will support fungal growth and begin to decompose. Wise use of materials, good architectural detailing and regular maintenance generally keep the moisture content of straw below the decay threshold. Conventional frame construction often relies on a plastic film, vapor retardant paint, or other vapor diffusion retardant to help keep moisture out of walls. Most straw-bale building proponents recommend leaving walls relatively permeable to moisture diffusion, ensuring that moisture in the bales are able to escape. The following principles will secure a moisture resistant straw-bale building:

1. Exposed window ledges require flashing and care should be taken to protect horizontal surfaces and drip edges on windows and walls should lead water away from the walls
2. Sloping the ground plane from the building and foundations
3. Installing a good capillary break between the foundation and bale walls.
4. Door and window flashing
5. A skin of good weathering plaster
6. Provide a 'toe-up' on the inside of a straw bale wall to protect it in case of interior flooding
7. A watertight roof with large overhanging eaves - the roof design should preferably incorporate wide eaves of 0.5 to 1 metre in order to shed rain and protect earthen plasters from erosion.
8. Flat roofs and parapet walls are not recommended, as they tend to eventually leak
9. Good window detailing is also critical to avoid moisture infiltration – commonly, glass is set all the way up to the outside of an opening, creating a window-seat on the inside and leaving a minimum surface that needs to be protected from the weather outside.

(KENNEDY, J.F., SMITH, M.G., WANEK, C. 2002 p.190)

As the moisture content within the mushroom cultivation buildings will be very high, it will be impractical to construct these buildings with straw bales only, as they are very sensitive to moisture in general. However, straw bales can be of high insulation value to keep temperatures within these buildings constant and will be used as wrapping around a brick inner shell. In this way, the laboratory and growing rooms become extra insulated, assuring optimal growing conditions.

06.03.1.6 Joining straw bales with other materials

Since straw bales are unconventional building materials, new techniques have to be developed so as to join different building materials with straw bales. The idea would be to separate the different types of structures and fill in the gaps with a softwood spacer or cob mixture that is relatively high in clay content. Each structure within the design should be self-supportive, displaying its inherent qualities. Ideally, two different types of walls should be joined by using brick forcing in the construction of walls and ensuring that the layers of reinforcement in each wall overlap and join to add to the overall structural stability of both walls. (see detail 9)

06.03.2 Stone

Solid stone walls are strong in compression but not in tension and for this reason it is necessary to provide walls with additional reinforcement. Pre-cast reinforced concrete beams can be built into the wall at the base and top of the wall to add to the structural stability of stone walls. Where stone walls need to be at least 3 metres high, a third beam can be built into the wall at mid-height. The stone wall will be built using a mortar mix of sand, lime and clay to bind stones to each other.

06.03.3 Wood

TIMBER TREATMENT

The poles used in the design of Mkhonda have to be treated to ensure maximum lifespan. Poles used in outside areas, where they will be exposed to a range of harsh weather conditions and those in contact with the ground have to be treated with Totim-B (a non-toxic, mammal-friendly timber preservative), which keeps the wood's natural colour. Structural poles not exposed to weather conditions will be treated with Flambor for increased fire resistance. (Flambor is a product consisting bore and a flame retardant, making the timber more fire resistant). Poles used in the interior spaces as non-structural elements will be treated with borax in order to keep insects out. Borax poses no threat to the environment.

TIMBER POLES

Types of poles used in construction vary according to the specific design needs. Straight, graded poles are used where the structure needs to carry a large and intricate load (figure 06.07), for example the complex roof structures of the larger buildings, whereas naturally rough or uneven poles will be used to carry lighter structures such as lattice work or small roof spans. Warped poles are used in especially outdoor areas add to the idea of using materials as close as possible to its natural state, blending into its surroundings. The poles can therefore be sourced and treated locally, reducing transportation costs while promoting local job creation.

TIMBER LATTICE WORK

Elements are designed to have maximum protection through incorporating sheltering, overhangs, flashings etc. into the design, which will facilitate quick drying of various components of the lattice structure. Top ends of vertical elements are cut at an angle to shed water and are held with a wall plate to prevent splitting.

Fig.06.07

06.03.4 Cordwood walls

The cob mix used between logs consists of sand, lime and sawdust (soaked in water overnight). Lime makes the mix more workable and adds strength.
(KENNEDY, J.F., SMITH, M.G., WANEK, C. 2002 p.143-148)

Precaution measures when building a cordwood wall:

1. Use only sound wood with the bark removed
2. Do not allow log ends to touch each other to prevent the entrapment of moisture
3. A roof overhang of at least 500mm is necessary
4. Cordwood masonry should be at least 100mm above ground level and placed on a moisture-proof stone foundation.

06.03.5 Earthen plasters and floors

06.03.5.1 Plasters

The straw bale walls need to be plastered with a mixture of sand, clay and straw, also known as a 'cob' mixture. The mixture is site-specific and tests need to be done beforehand on each individual site to determine the natural composition of the soil. Generally, the cob mixture is consists 1 wheelbarrow local sand, 2 buckets river sand, 1 bucket red building sand, ½ bucket clay, a few handfuls of straw (or bran, depending on the type of finish required) and water. It is important not to add cement to the cob mixture, as cement's moisture content is higher (15%) than that of cob (5-8%). Thus with cement, moisture is retained within the wall to form a damp mass that gradually moves down along the cement barrier within the wall until it reaches the bottom to cause major cracks and damage after a few years. This is not the case with cob walls, as they are able to 'breathe' and let moisture through.

PLASTERING STRAW BALES

First, a thin layer of cob with large clay content is spread onto the straw bales that have been covered with chicken wire mesh and locks into the bales to provide a surface to which the next layer can stick. A thicker layer containing more straw is then applied to this layer, which is worked off roughly to once again provide a surface for the next layer. The final layer of cob wall plaster uses fibre in stead of straw so as to provide a much smoother finish to the walls.

06.03.5.2 Floors

CONSTRUCTION OF EARTHEN FLOORS

The ground on which the floor will be placed needs to be well-compacted and dry prior construction. A drainage layer of 250mm coarse sand or gravel should be incorporated. This will stop the upward movement of moisture. The sub-floor, constructed on top of gravel, consists of 50mm moistened sandy soil with enough clay to assure the necessary bonding. This floor serves as a working surface during construction and only after all heavy construction has been completed, should the finished floor be installed. The finished floor consists of two thin (25mm) layers. The first layer could be left rough and the second layer should be applied while the first layer is still damp. Once the floor is completely dry, it needs to be sealed to make it resistant to dust and water damage. This is done by using boiled linseed oil, which is mixed with odourless, which penetrates deeply into the earthen floor. Four layers of this mix should be applied.

(KENNEDY, J.F., SMITH, M.G., WANEK, C. 2002 p.113-117)

06.04 TECHNICAL EXPLORATION OF PROPOSED BUILDINGS

The design of Mkhonda Lodge focuses on the use of locally available materials as close as possible to their natural state. Construction techniques are simple but unconventional, thus posing a challenge on a technical level to be able to come up with alternative technologies. Particular care is taken in clothing interior spaces with natural elements and materials, as they add to the overall rustic feel of the buildings. Certain details and finishes recur throughout the various buildings to create an integrated design.

The project only focuses on the detail design of buildings contained within the main development area and thus excludes the detail design of the Private Lounge, Semi-public swimming area, Farm Factory, Manager's cottage and cottages in the private section of Mkhonda Lodge. The buildings that will be discussed in detail in following segment include: Cottages of type C, D and E; Offices and Reception; Composting Area; Restaurant and Kitchen; Lounge; Conference Facility and Meeting room; Staff Quarters; courtyard and landscaping. The basic design of the Mushroom Cultivation Area is also included in the discussion.

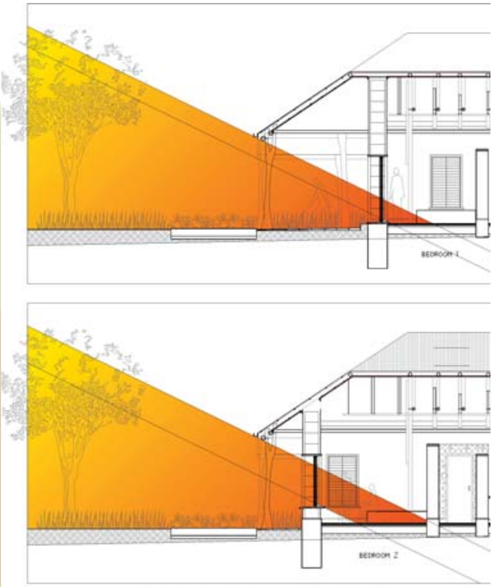
06.04.1 COTTAGES (Units C,D and E)

The design of the cottages reiterates most of the design and construction techniques used in the rest of the development. Therefore, the proper resolving of technical aspects within the cottages is extremely valuable to the rest of the development.

COTTAGES IN PRIVATE SECTION OF DEVELOPMENT

The cottages in the private section of Mkhonda Lodge (Units A and B) are designed using the same materials and construction methods of the cottages in the main development area. However, the cottages in the kloof will be more diverse in terms of shape and functions, for the natural landscape and existing trees have to be incorporated into the design. The layout of the various cottages is therefore site-specific and not standard as with the main development. The private cottages are furthermore not supplied with electricity and therefore make use of gas stoves for cooking, candles for lighting and a solar geyser without an electrical booster to heat water. Since the cottages are less exposed to sunlight, a backup water heating system is essential, thus the use of an outside direct-fired water heater.

Fig.06.08



This project focuses on the detail design of units C, D and E only.

COTTAGES – UNITS C, D and E

Cottages are designed to ensure continuous contact between the user and the immediate environment. In effect, interior spaces reach out to the surrounding natural elements through the use of building materials, finishes and detailing, incorporating gardens around each cottage and the strategic placement of openings to maximize views. For example, each bedroom overlooks a private garden and the mountain. As with the rest of the design, buildings are mitigated and merged into the landscape through the use of circular natural elements that surround each cottage, for example the circular lines of planted gardens, timber partitions which screen off outside showers and stone walls in type C units.

In order to protect the straw bale walls against rain, the northwestern and eastern facades of each cottage are provided with a sufficient roof overhang, which lessens the impact of a rainstorm.

Cottages are smaller entities and therefore the heating effect of the sun will be more concentrated on them than on the larger buildings on site. To be able to minimize thermal heat gain through the straw bale walls and the penetration of western sun into the bedrooms of each cottage, it was necessary to reduce the

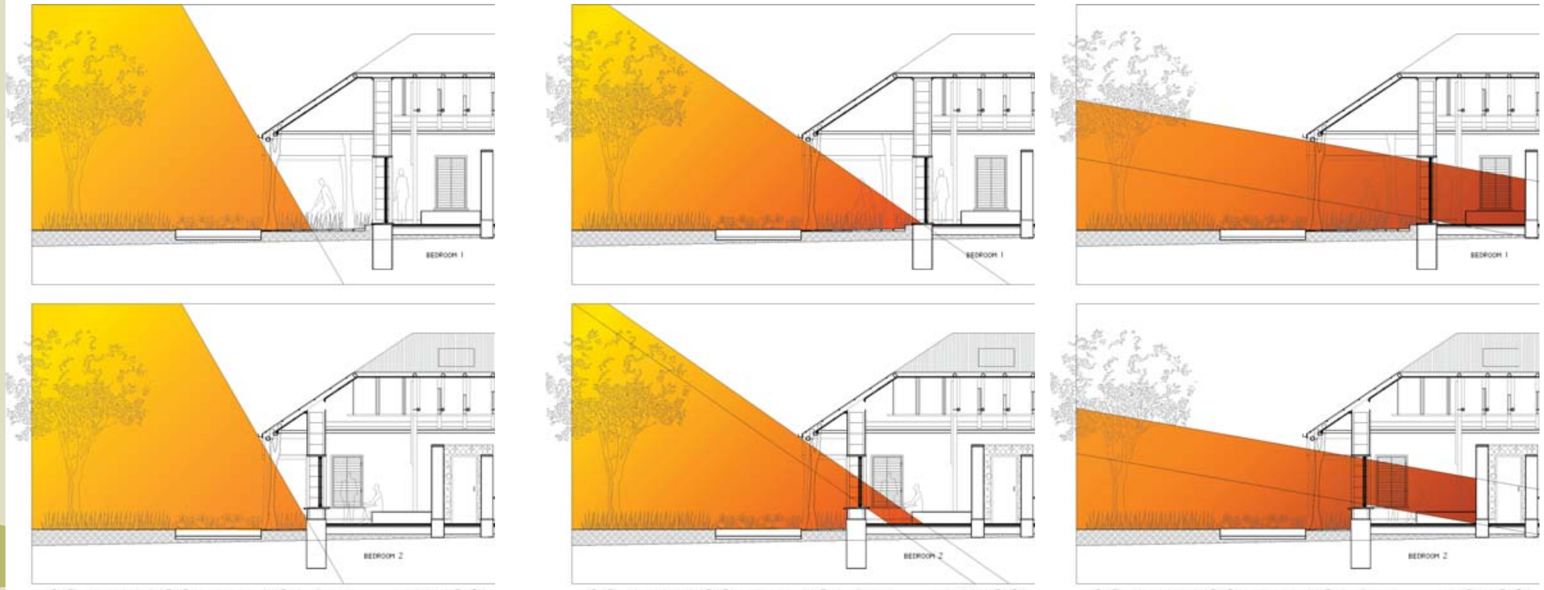
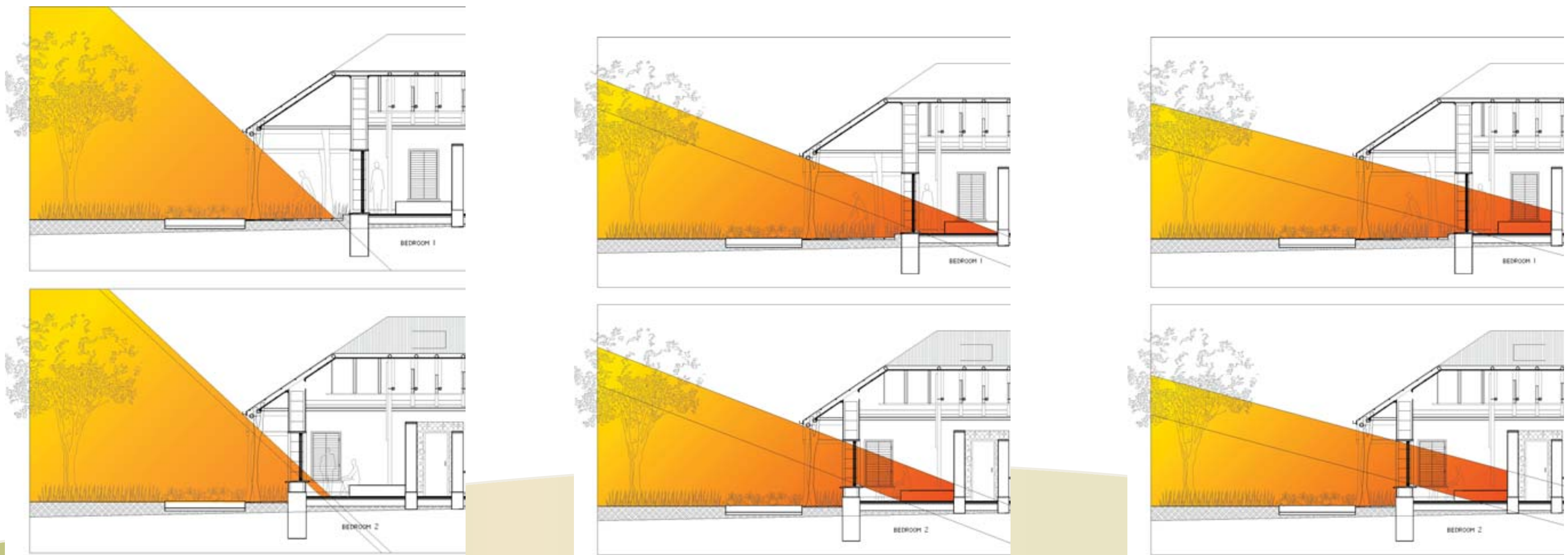


Fig.06.09

total area of **exposed western facades** and to provide them with a large **roof overhang** of 500 - 1500mm. Roof overhangs are accompanied by strips of grass and vegetation around the cottage to prevent the surface from heating up too much. Additionally, timber shutters were incorporated into the window design, which enables the user to manually regulate interior temperatures.

Only family units or type E units have an additional bedroom on the western end of each cottage, as opposed to units of types C and D, which have only one bedroom that faces both north and west. The design of the bedrooms within unit types C and D will therefore be approached in the same way as the main bedroom of family unit type E. The main bedroom of unit E faces north and west simultaneously and is recessed to have a larger roof overhang than the second bedroom on the southern end of the cottage. By recessing the main bedroom, the secondary bedroom is provided with a small northern window. During daytime, the northern sides of the cottages are more exposed to natural sunlight and therefore tend to build up heat as the day progress, as opposed to the southern facades, which are less exposed. Thus, at the time when the western sun reaches each cottage, the northern part of the cottage will be warmer than the southern part. The main bedroom will therefore need the most protection against harsh western sunrays and requires a larger roof overhang than the secondary bedroom. By providing each cottage with the same gable or clerestory roof design used in the buildings within the main development, a larger structural design where western and southern sides of each cottage are considerably exposed to sunrays occurs. To be able to prevent this, each cottage will need additional shading and a larger roof structure on the western façade, which will have an effect on the overall building costs. However, the cottages need to be placed within a certain defined area on site, which means that providing maximum privacy between adjacent cottages is already a fairly difficult task to achieve. Cottages with larger shading devices and substantial roof structures require an even larger building footprint and will increase visual impact. This will, in effect, lessen the overall privacy of the accommodation. The solution is therefore to integrate the shading device into the actual roof structure in order to save costs and space and, for this reason, hipped roofs, where the corrugated iron roof sheeting is simply extended to the required length of roof overhang, are used. These are refined and less bulky structures, which will enhance the existing visual quality of a subtle landscape.



16 april - 14h00

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22 jun / 24 jul - 16h00

TECHNICAL INVESTIGATION

Hipped roofs require a relatively intricate roof design where a combination of materials needs to be used in order to join the large amount of timber poles at the two opposite top ends of each roof. To provide the efficient structural stability, vertical load-bearing poles (which aid in overall load distribution) were additionally bolted to each end truss.

Roof trusses are made on site and while the roof structure is being raised. Different poles are joined using 16 to 20mm diameter metal bolts. Generally, **timber poles** are not consistent in thickness and therefore to ensure a perfect join, the connecting area between two or more poles requires the adequate leveling of these separate irregular surfaces. Timber poles are embedded for 1 meter into the ground after which it is secured with well-compacted backfill. A concrete collar is added at the top of the foundation for additional support. A drainage layer is placed at the bottom of the pole to cater for proper drainage through the pole. All the poles are obtained on site and are preserved with a non-toxic boron-based treatment.

An independent **timber pole structure** not supported or fixed to a wall or any stable element, tends to move outwards because of the forces working in on the vertical supporting elements of the roof structure. It is therefore essential to have **lateral bracing** that counteracts this likely movement of a timber structure. As the straw bale walls are only used as infill, the roof structure cannot be fixed to these walls, for they do not provide sufficient stability. The use of bracing elements to connect timber roof poles and trusses with the vertical supporting elements is thus essential to secure the entire roof structure. The bracing elements are visible in interior spaces and are therefore adjusted to adhere to the specific functions of the various spaces.

The top ends of straw bale walls are encapsulated by an unconventional **wall plate** so as to completely seal off and protect the end of the wall. These wall plates are fixed to the vertical bracing elements that form part of the overall construction of the straw bale walls and for certain parts of the wall length provide a base onto which various 400mm high strip windows can be fixed. These narrow **strip windows** are incorporated to emphasize the fact that the straw bale walls are non-load bearing structures that do not carry the roof structure and in addition allows natural light into the interior.Where strip windows are excluded from the design, wall plates will be replaced by extending the top insulating layer of cob at the top of the straw bale walls up to corrugated iron roof sheeting level.

The design of the cottage includes the use of **timber windows and doors** that are built on site. Specific doors incorporate glass panels for views from interior spaces, for example the bathroom door, which opens onto the outside shower and western- and northern-orientated doors, which capture the surrounding views. Each window and door is provided with timber shutters that fit into the thick straw bale wall, thus displaying the efficient use and practical considerations of these walls.

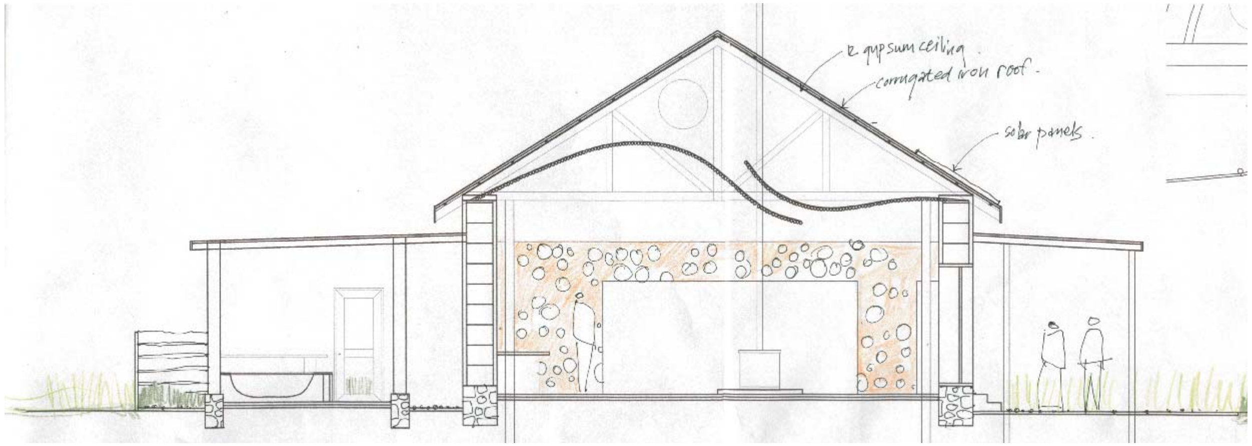

Fig.06.10a

Fig.06.10b

TECHNICAL INVESTIGATION

Fig.06.10e

The design of the shutters is repeated throughout the whole development and therefore principles that pertain to windows and doors within the cottages can be applied throughout the rest of the design. Generally, shutters are placed both in and outside of windows and doors, depending on the desired outcome. Shutters placed outside buildings are constantly exposed to harsh weather conditions and therefore needs to be treated with Totim-B and Flambor, as well as being finished off with a few coats of varnish. Interior shutters need only be varnished as to enhance the natural wood quality of the shutters. At the western windows, glazing is recessed and shutters are placed on the outside of the windows to prevent early-morning sunrays from penetrating interior spaces, thus heating the cottages. (see detail 8) The design of northern, southern and eastern windows also incorporates the use of shutters. These shutters contribute to the privacy of each cottage and additionally they are placed on the inside of windows and doors for ease of use. In this case, shutters fold up inwardly to allow windows to open up to the outside, which improves natural wind flow into the cottage. North-facing glazed doors open up onto the shaded verandah and it is therefore not necessary to have shutters outside, but rather on the inside. The extended corrugated iron roof above the verandah keeps out harsh summer sunrays while still allowing the low winter sun to penetrate and heat interior spaces.

Solar panels are fixed to the galvanized corrugated iron roof sheeting at an angle of 34 degrees and are connected to a solar geyser (with an additional electrical booster) and covered with a suspended ceiling of wattle slats. To eventually provide the sink and external wet core area with warm water, pipes are fixed at ceiling level and along the top of the straw bale walls.

The design incorporates curved ceilings, which resemble the circular patterns in the landscape. The actual buildings make use of simple rectangular straw bale construction with uncomplicated layouts, but strive to incorporate nature into the design through clothing interior spaces with natural shapes and elements. These ceilings are represented in different ways through using a variety of materials, depending on the function and other interior finishes of each space. (see detail 12)

Within each cottage, the bathroom's ceiling is manufactured from wattle slats closely fit so as to properly cover the entire ceiling area, whilst ceilings in the rest of the cottage are from 6mm gypsum ceiling board fixed to the timber poles, trusses and laths. Adequate fiberglass insulation is placed between the gypsum boards and metal roof sheeting to enhance the thermal insulation qualities of straw bales. Suspended ceilings are used in the bedroom areas for warmer and more intimate spaces. These curved ceilings are made from 50mm diameter wattle slats that are individually fixed to a bended steel frame, which, in turn, is fixed to the timber roof structure. The entire roof is properly insulated with 75mm of 'Isotherm' polyester blanket. (see detail 2)

Cordwood walls are included in the design to symbolize the local context, as it uses timber off-cuts. These walls add warmth and texture to the interior of the cottage and are only used as non-structural space dividers. Cordwood walls enhance the aesthetic quality of the bedrooms and lounge in that they contrast with the natural colours and smooth finishes of the plastered straw bale walls and rammed earth floors. The walls differ in height, depending on the type of unit. (see detail 3) The family unit type E includes walls that are 2 500mm high, providing the necessary privacy within the two bedrooms. Unit type D is a semi-private unit needing less privacy and therefore a wall height of 2000mm is sufficient. The remaining unit type C is an enclosed cottage situated in the private end of the main development and therefore the wall need only be 1 400mm high to separate the bed from the central coal stove. Cordwood walls are constructed from timber poles obtained through the trimming of local poplar forests cut into logs of 400mm, which they are laid on top of each other in a bonding mixture of cob. Walls are stabilized through incorporating brick forcing into the construction of the wall at every 1000mm of wall height. This brick forcing is then continued to the adjacent cordwood or straw bale wall and aids in providing a proper connection between individual walls to improve the overall stability of walls. Softwood spacers, which allows for the thermal movement of walls, are placed to seal off the gap between different walls, which are then finished off by covering the joints with timber strips.

The recycling of grey water in each cottage is done through channeling the water discharged by both handwash basins into a geopipe placed under the garden surface. This allows for the slow release of water, which could irrigate the garden. The design of the outside shower includes a slightly sloping base, thus allowing grey water to simply flow from the shower base to the adjacent garden. Walls that are exposed to water from the outside shower are finished off with pebbles laid in waterproofed mortar. Grey water from the bath joins black water from the water closet so as to ensure the efficient flushing away of solids.

In winter, the cottage is heated by means of a centrally placed wood stove placed on a stone platform. The users will therefore be able adjust interior temperatures according to their wishes.

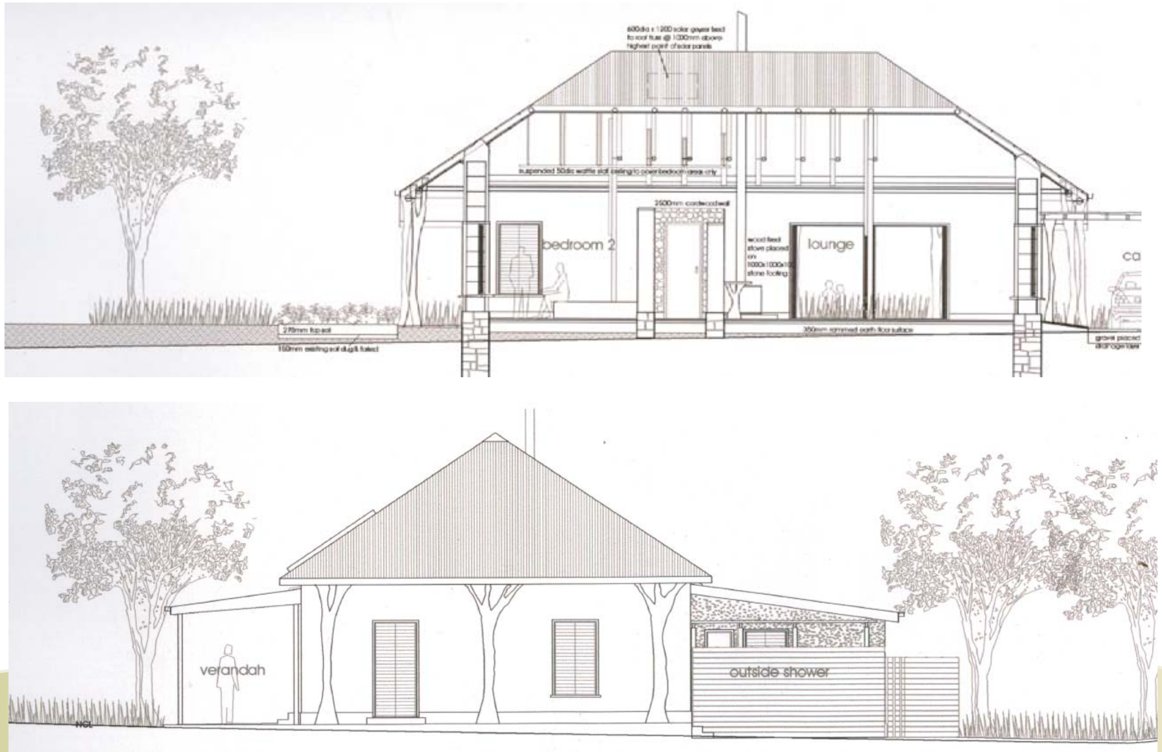

Fig.06.10c,d

06.04.2 CONFERENCE FACILITY

The Conference facility consists of a large main function hall, service kitchen and storage building, as well as a separate building with the public toilets.

The main function hall is a large building requiring a complicated roof design, as natural sunlight penetration and ventilation is essential for comfortable interior temperature levels. The building hence makes use of the proposed clerestory roof design. (see detail 1) This is the same for all the other larger structures within the main development and includes the main function hall of the conference facility; offices and reception, as well as the restaurant and kitchen.

In each instance, the walls used in conjunction with these roof structures need special design attention, as the end gable walls reach a maximum height of 6 metres. Laterally braced straw bale walls can safely be taken up to a height of only 5 meters and therefore the solution lies in elevating the entire straw bale wall construction with an additional 1 metre above ground level. Typically, the stone foundation wall is extended to a height of 300mm above natural ground level to protect the base of straw bale walls against water penetration, which means that the total stone foundation wall height is 700mm. By extending the wall with an additional 1 metre, the total exposed stone wall area will be 1300mm high, which affects interior finishes within the various buildings. However, this portrays the honesty of adjusted design methods and construction techniques that accompany buildings assembled using straw bales.

As the building faces west to embrace the main view, exposure to western sunrays once again becomes an important design consideration. In late afternoons, the western sun might cause a certain level of discomfort in the outdoor space, but can be resolved through the planting of evergreen indigenous trees and through providing the verandah with a dense timber lattice work. The outdoor space is enclosed by a stone wall, which gradually slopes from 1500mm to a minimum height of 450mm to serve as seating. Through lowering the wall, natural airflow is permitted, thus enhancing ventilation within the exterior space.

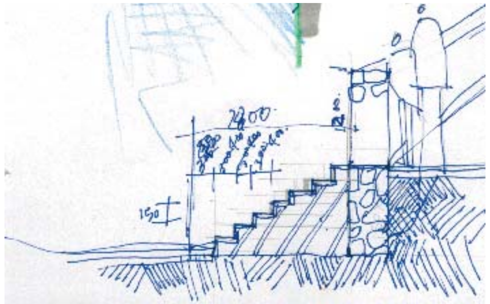

Fig.06.11a

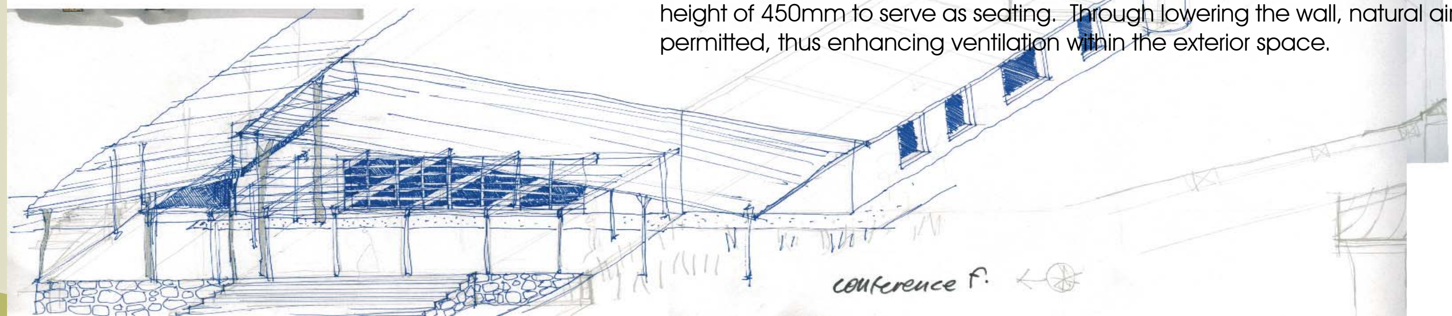

Fig.06.11b

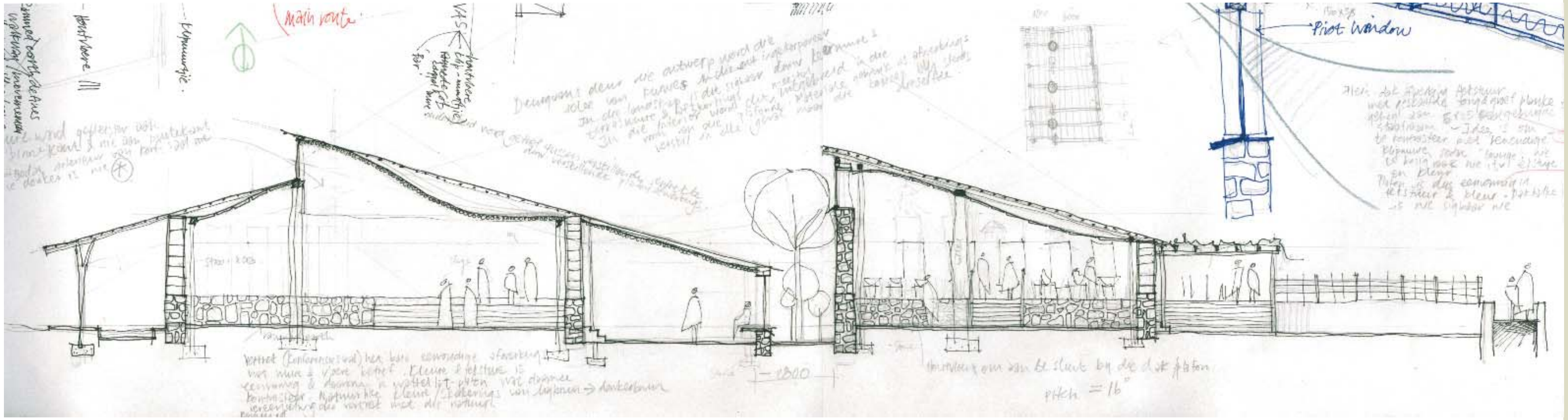

Fig.06.11c

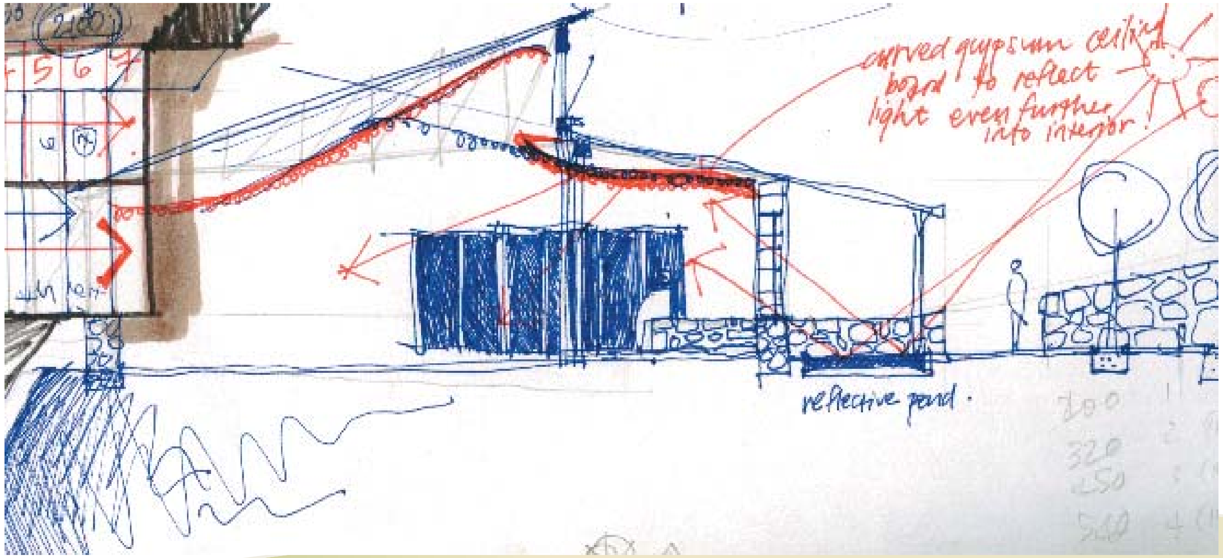

Fig.06.12a

TECHNICAL INVESTIGATION

As with the cottages, the design incorporates curves, which blend buildings with the natural landscape. In the landscape, the natural curves are represented in the stone walls used for the retention of soil. In the interior use of curves are evident in the ceilings of the main conference hall and public toilets. Materials and finishes used to construct the ceilings vary, but the notion remains the same. These ceiling materials and finishes include: 50mm dia wattle slats, 6mm gypsum board and 25x150mm timber planks. The gypsum curved ceiling is constructed by cutting the boards into narrow panels that are fixed to the curved steel frames. These are in turn fixed to timber trusses.

Ponds have been placed at the northern facade of the conference facility to allow sunlight to reflect into the interior spaces. The roof design includes two types of ceilings with the northern half made from gypsum board, painted white. In this way, light initially reflected off the water surface, is reflected for a second time, thus creating a magical effect.

The eastern wall of the conference facility is constructed of stone to contribute to the stone corridor between the conference facility and the meeting room. The eastern walls of the public toilets and lounge and the western wall of the meeting room are therefore also from stone. Outdoor steps at the conference facility will be finished off with selected stone laid on a brick base.
Rainwater collection tanks are incorporated into the design of the service area of the conference facility, as well as at the kitchen. Corrugated iron roof sheets lead water along a corrugated iron gutter connected to the collectors to harvest rainwater, which will be used in both the kitchens and public toilet buildings.

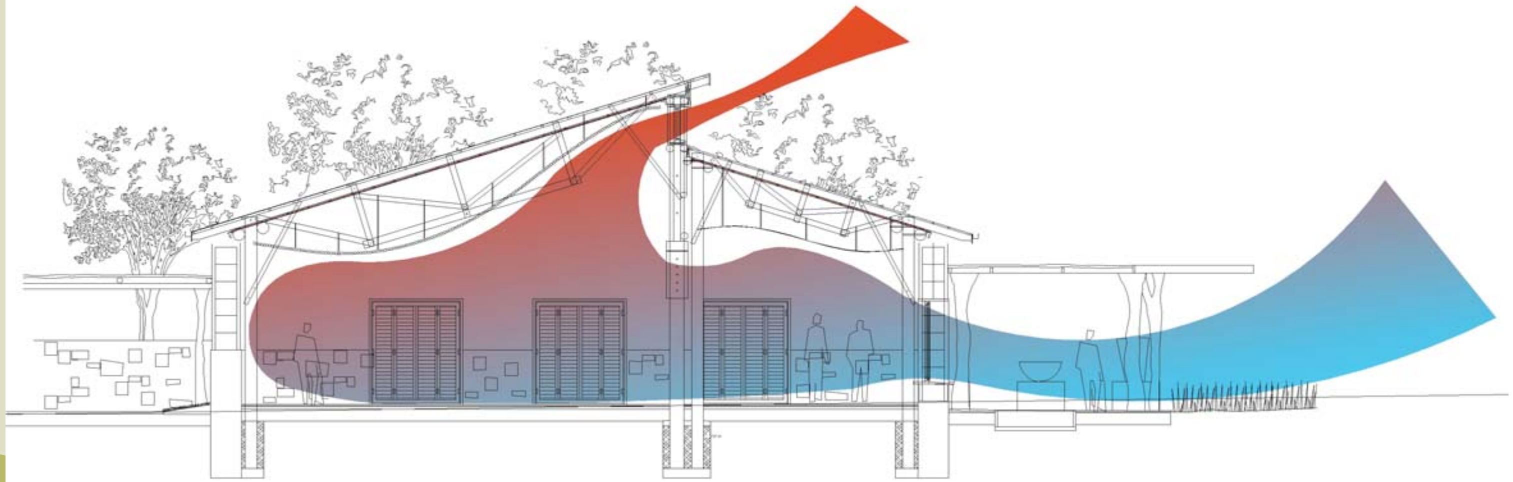

Fig.06.13

WINTER

Fig.06.12b

SUMMER

Fig.06.12c

06.04.3 MEETING ROOM

The western wall of the meeting room is made from stone as to complete the 'stone corridor', while the rest of the walls comprise of straw bales.

The two main interior requirements within the meeting room deals with glare and ventilation aspects. The use of projectors may be necessary at times and therefore each window will include a timber shutter that can be opened and closed from the inside, depending on the lighting requirements. The shutters only need to prevent unwanted glare and not heat buildup, as the conference facility blocks out western sun. Since people using the meeting room will need to maintain high levels of concentration, efficient natural ventilation is an important design guideline and windows are therefore aligned to ensure maximum ventilation. The boardroom table will be constructed from eucalyptus saligna on site to fit around the central timber structural poles.

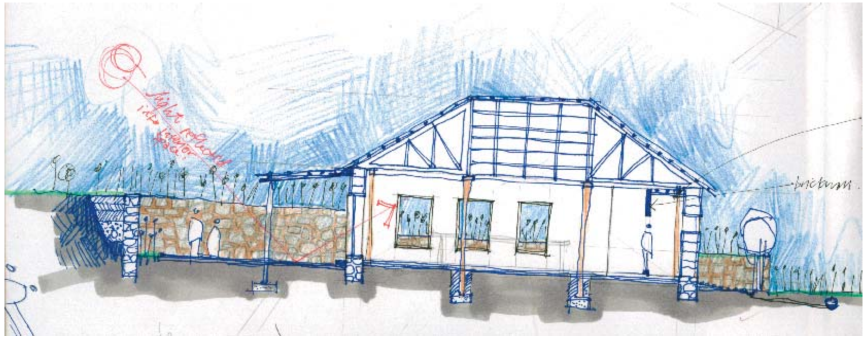

Fig.06.14a

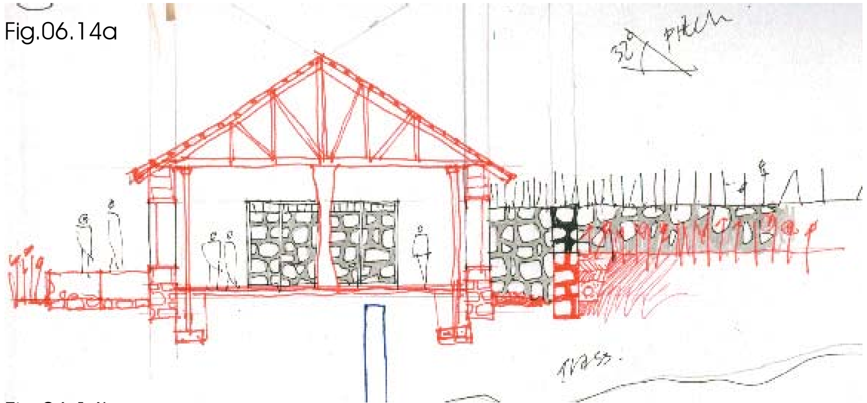

Fig.06.14b

06.04.4 COMPOSTING AREA

Guests will be able to overlook the composting area from the central courtyard through glass panels built into a stone wall. Special care needs to be taken in making those components in contact with the compost heap completely water-resistant. This means that timber window elements need to be separated from the compost heap by sufficient glazing, thereby strengthening the glass to resist pressure from the heap. (see detail 7) The design thus uses 12mm clear laminated safety glass. In constructing the stone wall, stones are placed in mortar to keep them from shifting and to prevent the passage of air, water and small creatures. The mortar mix consist of sand, clay and lime putty which slows down the setting of mortar, thus making the mix workable over a longer time period; it also reduces the mortar's brittleness. (KENNEDY, J.F. 2002 p.186) Spaces and gaps between stones of different rows are filled with mortar and small stones.

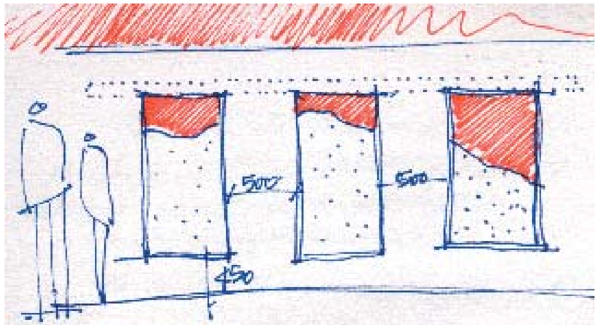

Fig.06.15a

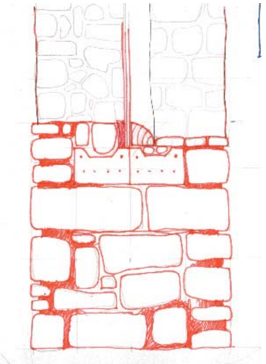
Fig.06.15b

06.04.5 OFFICES AND RECEPTION

Upon entering the reception area, the visitor is introduced to main design elements that define the architectural language throughout the rest of the design. These elements include: stone walls; terraced gardens; rammed earth floors; straw bale walls; cordwood walls; curved ceilings; and the timber pole roof structure. Openings in walls are aligned to create a visual link between the individual and his or her natural environment. An exposed straw bale wall of which only the one side has been left unplastered is placed next to the reception counter to inform guests of exactly how a straw bale wall is constructed. The timber roof structure is a direct application of the design solution used in the main function hall of the conference facility.

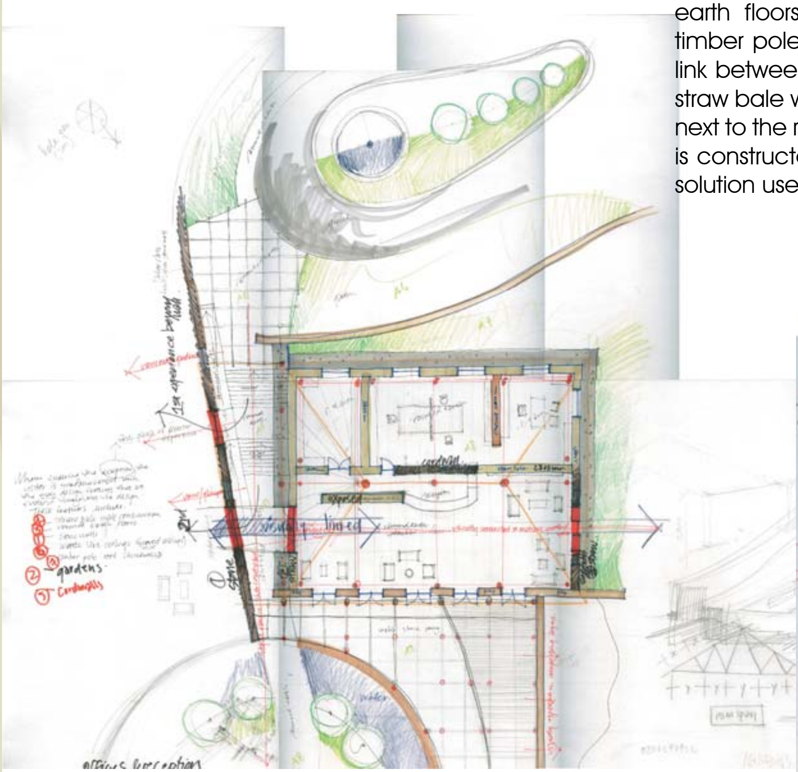

Fig.06.16

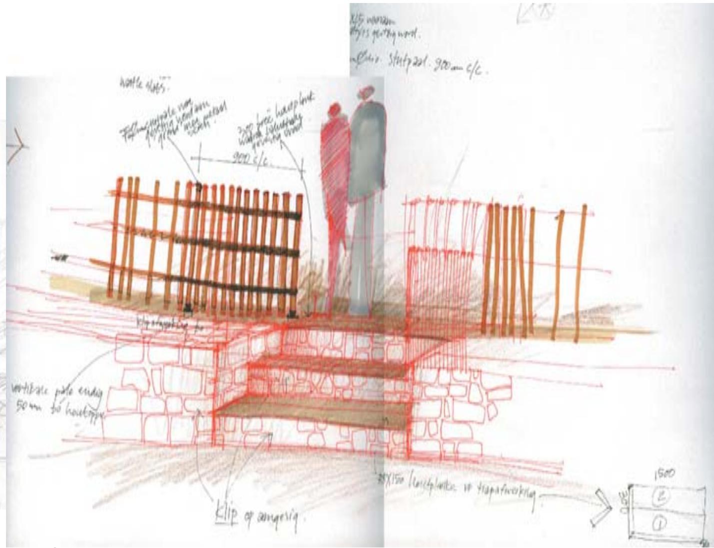

Fig.06.17a

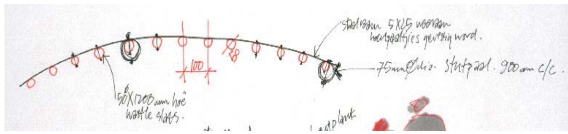

Fig.06.17b

06.04.6 RESTAURANT AND KITCHEN

The area surrounding the restaurant compliments local food preparation. The outdoor dining area overlooks the vegetable gardens, latticework displays the growing of tomatoes and other vegetables and the herb garden next to the dining area forms a green backdrop to a series of window openings included in the northern façade of the restaurant. Additionally, clay ovens overlook the outdoor dining area and therefore guests will witness traditional bread making. The ovens are wood fired which will lessen electricity costs considerably. Ovens are built using a combination of local bricks and cob.

The timber roof structure allows for clerestory windows. This change in roof shape is complimented by a change in floor levels inside the restaurant. The change in level is supported by a stone wall and the conventional balustrade replaced with planters. A fireplace is centrally located in the dining area and is constructed in the same way as the fireplace in the Lounge.

The kitchen is linked to a service road for delivery purposes. The roof design allows hot air to escape through the high clerestory windows. Grey water discharged by the kitchen and hand wash basins of the adjacent public toilets are led to geopipes underneath the vegetable gardens.

Both the freezer and cooler rooms in the kitchen are custom made on site. The interior walls are made from modular isowall panels of varying widths, up to 1200mm. The cooler room needs to maintain a temperature of around 1-4 °C and therefore requires a panel thickness of 100mm, while the freezer room requires panels of 150mm thick to maintain the required temperature of -8°C. The isowall is sealed off completely and enclosed by an additional layer of insulating straw bales. Since the cooler and freezer rooms face west, this additional layer of straw bale insulation helps to maintain the required interior temperatures. Additionally, the western facade is planted with trees to keep out direct western sun.

Fig.06.18

06.04.7 LOUNGE

Floors are made from timber planks laid parallel or perpendicular to walls in order to highlight the movement path at floor level. The overall floor colour and texture therefore stays constant to enhance the roughness of the adjacent stone wall.

At mid-floor length, the floor is divided into two levels by a stone wall, while the timber deck on the outside of the lounge runs concurrently. Rather than using a balustrade, 400x400x400mm timber blocks are placed on the edge of the higher floor level to exhibit a variety of local artworks.

Once again, a curved gypsum ceiling is also used here and is painted white to compliment the other natural materials and finishes used in the lounge. These also include stone walls, earth plastered straw bale walls, timber floors and stairs and timber door and window frames.

The fireplace is on the lower floor level and will be built on site, meaning that the final appearance thereof is not fixed. The structure consists of a standard steel casing built into a normal brick wall, which is then extended with a stone construction and finally finished off with a layer of rammed earth plaster. The slightly moist rammed earth surface is brushed off to create an uneven texture on the surface of the fireplace, paying tribute to the plastered straw bale walls.

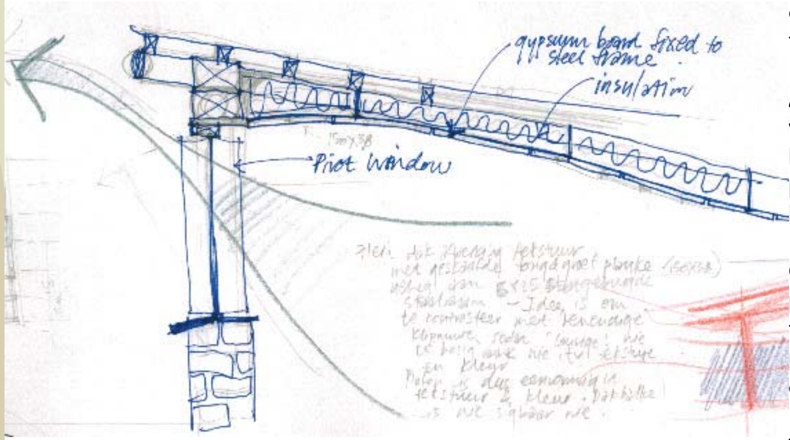

Fig.06.19a

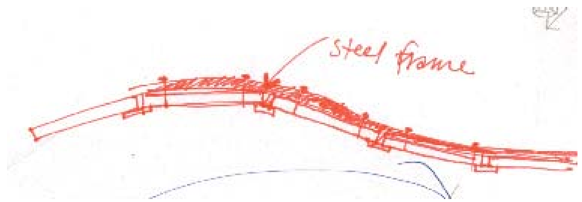

Fig.06.19b

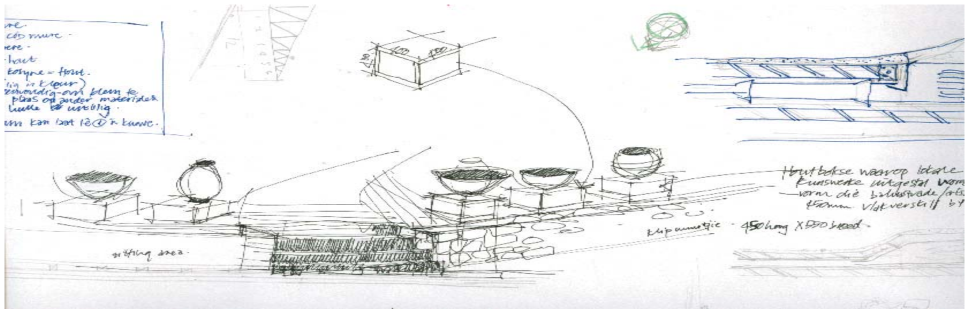

Fig.06.20

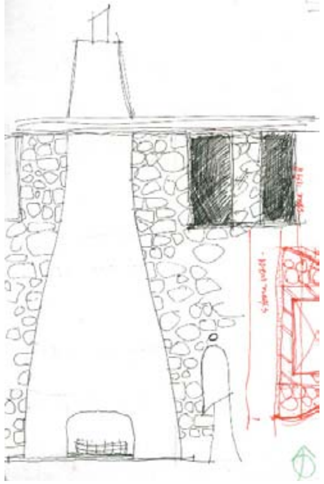

Fig.06.21a

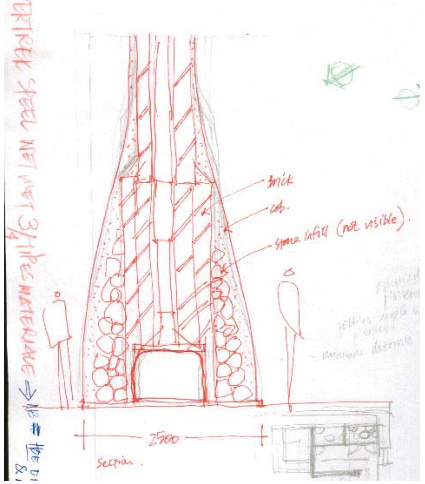

Fig.06.21b

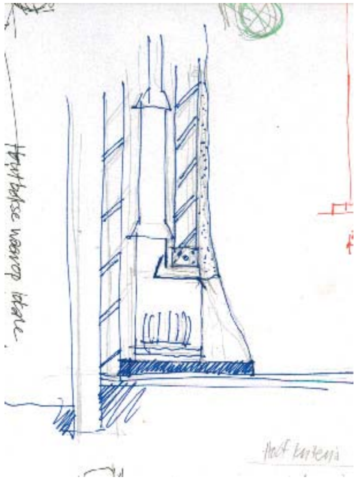

Fig.06.21c

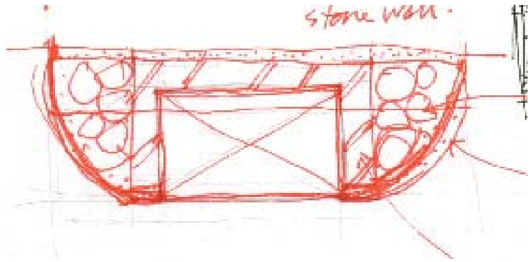

Fig.06.21d

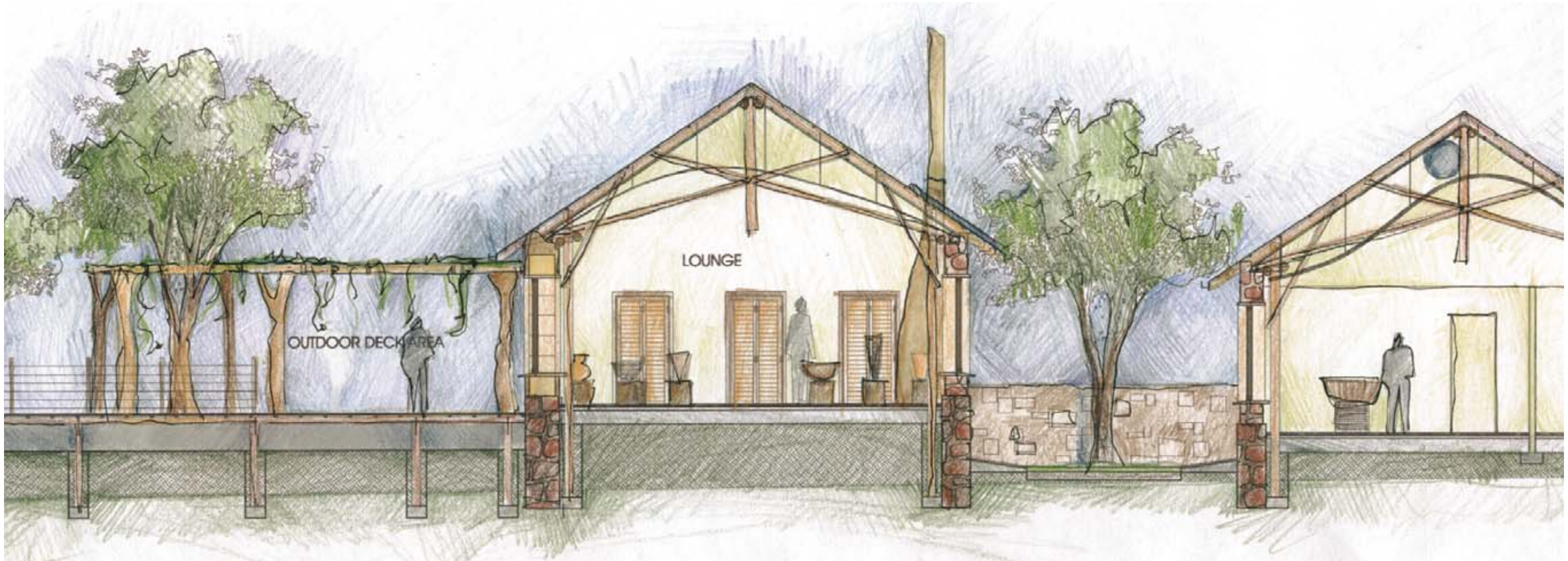

Fig.06.22

06.04.8 TIMBER DECKING

Treated timber decking is used for a large part of outdoor areas and will sustain a considerable amount of traffic. The decking areas will in effect be an extension of functions within the lounge and restaurant to, weather permitting, host events outside. Good detailing therefore becomes important in terms of durability and sufficient drainage. Design specifications include:

1. Narrow timber planks to facilitate repair and add strength
2. Double galvanized screws and bolts
3. Minimum final decking board spacing of 6mm to allow for drainage
4. All joints are self-draining and receive maximum amount of natural ventilation
5. End grain of each timber element is designed for minimal exposure to weather conditions
6. Top surfaces are slightly sloped to shed water
7. Bollards and posts are chamfered to reduce the tendency to splinter

06.04.9 COURTYARD AND LANDSCAPING

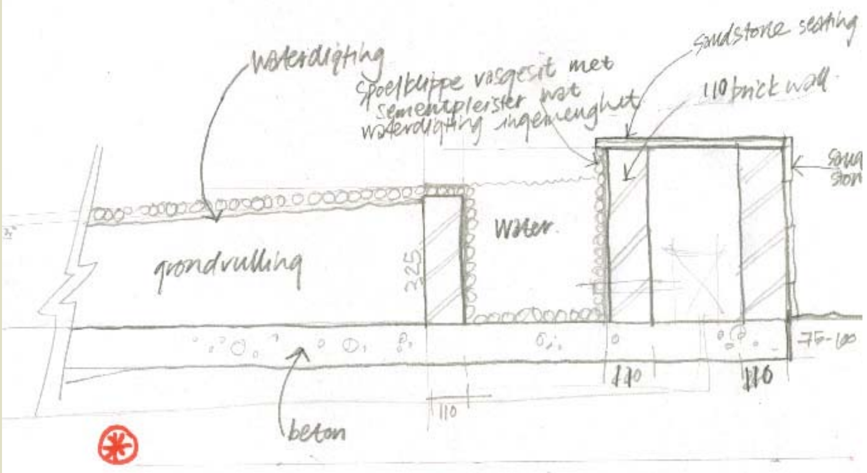

Fig.06.23a

The most central point of the main development is a courtyard linked to three other formal courtyards by means of a clearly defined walkway. These courtyards expand into a number of less formal courtyards as one move away from the centre and diverts from the main line of movement.

The central courtyard is a perfect circle consisting of a water feature, planted grass and a hard surface of rammed earth. (see detail 4) The grass is formally arranged along the inside of the water feature so as to portray the idea of nature being trapped by man-made structures and human activities. However, through sensitive design nature is 'freed' as we learn to work with instead of against nature. Buildings and elements should be designed to blend into nature and form part of it. This idea of nature being freed becomes evident as the courtyards become less formal towards the outer edges of the main development area and vegetation becomes more loosely arranged around circular lines and courtyards until it eventually breaks away from the stringent circular lines on site and is not trapped within strict courtyard layouts.

The prominence of the six terraces within the main development area makes it an important visual element. These terraces will be planted with cultivated annuals, providing an ever changing backdrop of colours.

Gabions will be used to contain the soil of each terrace in the landscape. Throughout, gabion wall heights do not exceed 2000mm. Gabion sizes used include 1m x 1m x 2m and 0,5m x 0,5m x 2m. The base on which the structure is founded should be leveled and compacted. Each gabion should be braced with at least 4 bracing wires per square meter of gabion, as figure 06.29 indicates. Rocks placed in the gabion structure should be clean, durable and graded between 100 – 250mm. When filling the gabions, the void ratio should be approximately 0,3. Water collected at the back of each gabion structure is channeled away by means of a geopipe embedded in a compacted layer of gravel, as the sketch indicates. (see detail 6)

Geotextiles prevent the loss of fine particles from the soil behind the gabion structure through the rockfill and simultaneously negate the buildup of any water pressure behind the wall. Geotextiles must be placed at each soil-gabion interface and a minimum overlap of 300mm should be maintained.

Trees planted in public areas are provided with a grid supporting frame which is incorporated into the design of timber decks. This allows for necessary and protection. (Dimensions of these grids are 1510 x 1510mm, central circular opening of 600mm in diameter, 125mm overall depth.)

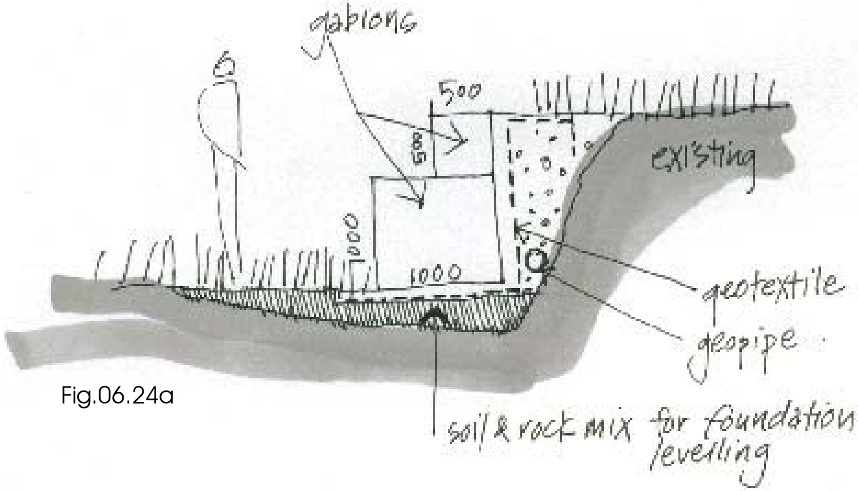

Fig.06.24a

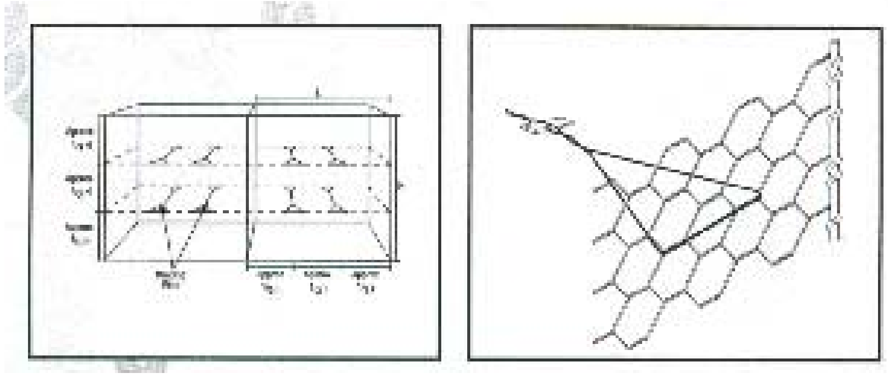

Fig.06.24b

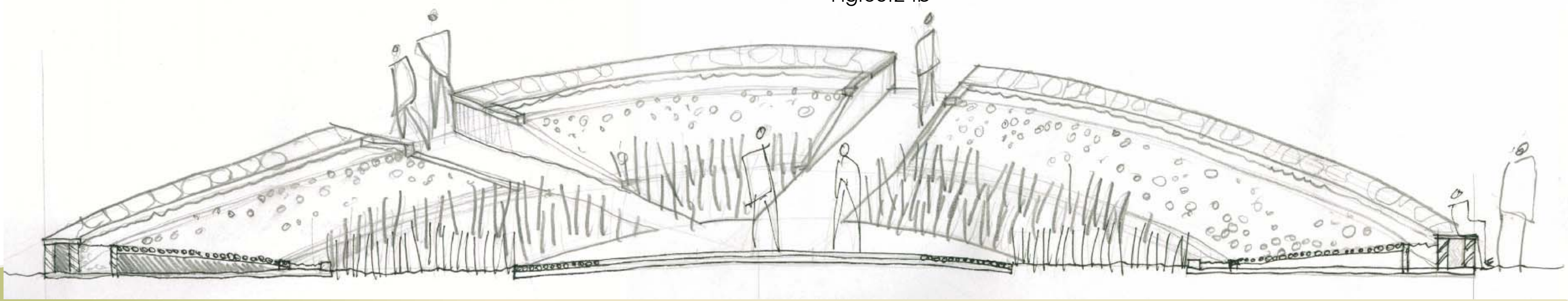

Fig.06.23b

06.04.10 STAFF QUARTERS & LAUNDRY

The Staff quarters and Laundry are enclosed by stone walls and spill out onto an inner courtyard. The buildings comprise of mainly stone and as they are partly situated away from the other buildings it helps to integrate them into the landscape. Each of the 4 bedrooms has north facing doors and windows, and has smaller southern windows to facilitate natural airflow through the bedroom. The design makes use of the gable end (with 34 degrees pitch) roof structure to cover the total span of 8 meters.

Fig.06.25

Fig.06.26a

Fig.06.26b

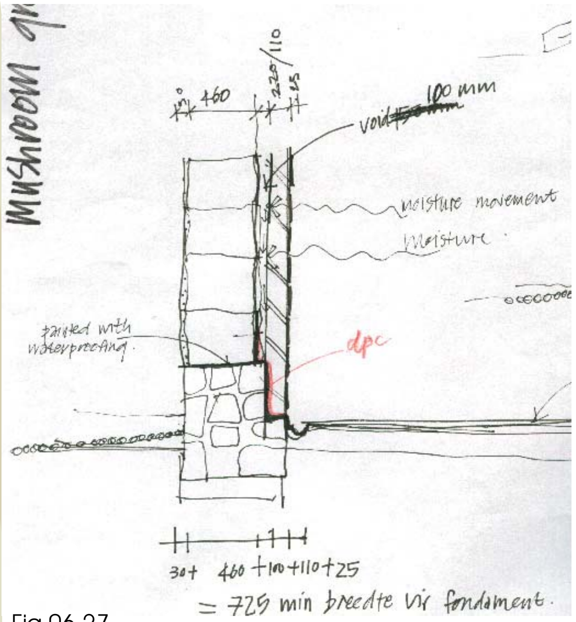

Fig.06.27

01.04.11 BASIC DESIGN OF MUSHROOM CULTIVATION AREA

The technical data required for the effective design of the various mushroom production buildings are contained within appendix xxx. The most important design aspect in terms of the actual structure of these buildings is dealing with the extremely high interior moisture content produced by the growing mycelium. Therefore, the walls and ceilings need to be constructed to be completely moisture-resistant. Conventional straw bale walls are prone to rotting when exposed to such high moisture levels. The solution is an additional brick wall placed on the inside of the straw bale walls onto which the tiles, which is the required wall finish, can be applied. A gap of 100mm is allowed for between the straw bale and brick walls to enhance the thermal insulation of the overall wall structure. Roofs are sloped to lead water away from the apex. This ensures that moisture collecting on the surface of the ceiling do not drip on growing mushrooms, but flows from the roof apex along the inside of the ceiling and brick wall until it eventually reaches the bottom of the wall where a dpc layer is carefully placed. Rammed earth floors are sloped at 2 degrees to drain water into small channels alongside the longest walls, which eventually lead water away from the buildings. Throughout, moisture makes no contact with the straw bale walls. The ceilings need to be sealed off to ensure that no moisture flows onto the straw bale walls and are therefore cut short to finish in line with the brick walls. The connection between the ceiling and wall is sealed off with a cornice and a fair amount of silicone. Another design aspect to deal with is the high level of insulation value needed within the growing rooms and laboratory. A straw bale wall has a very high U-value and is therefore an ideal insulation material. Placing an air void between the brick and straw bale walls will further increase the insulation properties of the overall wall construction.

To be able to carry the load of an additional 110mm brick wall, foundations have to be 725 - 750mm wide and stepped on the interior side of the foundation.

06.04.12 HIKING TRAILS

06.04.12.1 Mushroom trails

Various mushroom trails exist, on Madola and a number of other farms in the immediate surroundings. The availability of mushrooms on each trail is subject to weather conditions and therefore guests will be advised as to which trail to explore at certain times of the year.

06.05.12.2 Indigenous trails

The private development in the kloof area is concentrated around an indigenous arboretum. A trial is carefully planned around the 31 different indigenous species and tourists will take pleasure in visiting the individual trees. (Read in conjunction with Tabel 08.01of Appendix 08.01.4)

06.04.12.3 Educational excursions

The development is planned to facilitate free movement between buildings and guests will be able to visit the various production areas on the farm. This includes a visit to the mushroom growing rooms and solar dryer and a guided tour through the Farm factory, where visitors will be informed exactly how farm products are manufactured, for example the manufacture of berry, mushroom and vegetable preserves, cultivation of wines and liqueurs, as well as cheese making.

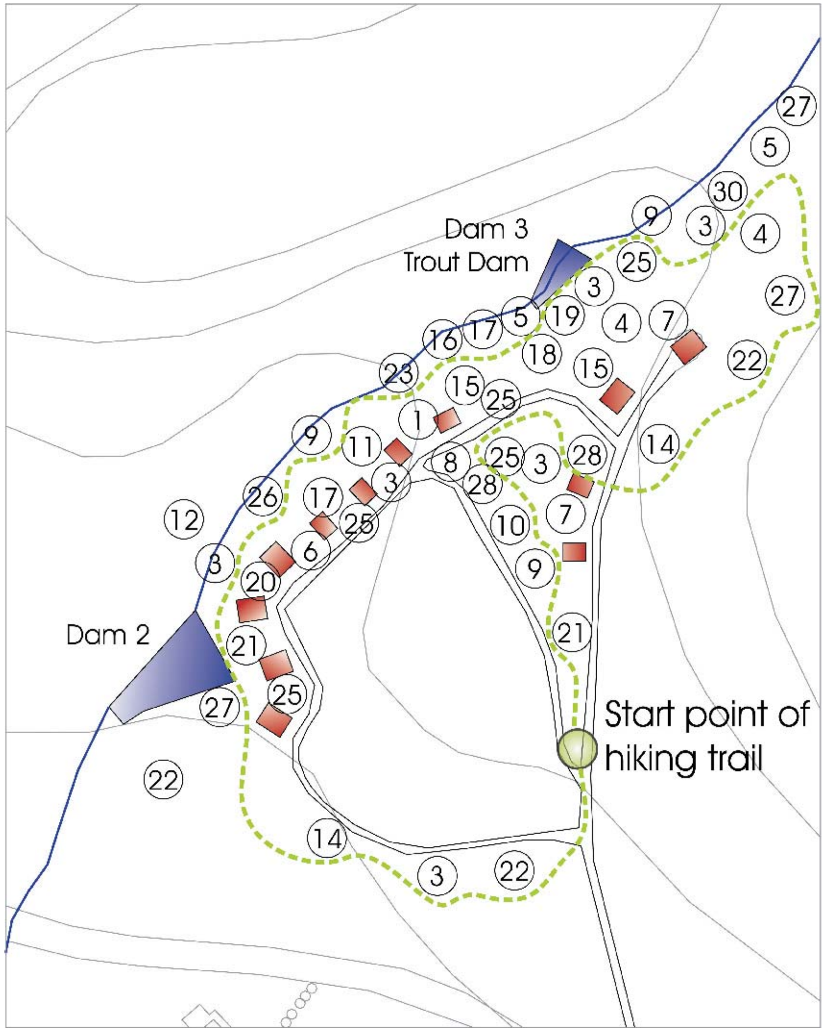

Fig.06.28

08 APPENDICES

08.01 CONTEXT

08.01.1 History of Piet Retief

The historic town of Piet Retief was established in 1883 on the farms 'Osloop' and 'Geluk' in the region called the Assegai Valley. This valley was so called after the Assegai River, which runs through the valley which is formed between the mountains of Swaziland, and the Drakensberg escarpment of the highveld that runs between Ermelo and Wakkerstroom. An interesting and little known fact is that the Assegai River is a misnomer that was derived from the Zulu name for this river. In Zulu it is properly called the Mkonda River. This refers to an animal 'spoor' and signifies how the river runs along a meandering course like the spoor of an animal. White settlers, however, confused the word Mkonda with Mkondo, which means spear. Therefore the word was improperly translated to be the Assegai or Spear-River. It was therefore decided that the lodge should bear the name "Mkhonda Lodge.".

At first, Piet Retief was not a separate district. It used to be part of the Wakkerstroom district, which used to be a very large district indeed. A Scottish settler by the name of Alexander MacCorkindale then managed to acquire a very large area of land which stretched from the region of Carolina, through the town of Amsterdam, and included parts of Piet Retief. For quite some time it used to be known as 'New Scotland', because of the fact that the region reminded the settlers so much of Scotland, during summer. His settlement was part of a plan of the old Transvaal Government to establish a Scottish buffer zone between the marauding Swazi and Zulu tribes, and in the Transvaal. The planned Scottish settlement was never really successful, but even today the Scottish influence can still be seen on farm and place names.

After MacCorkindale's death, the land was divided and sold off to mostly Afrikaner families. In later years, many German immigrants also came to this region. At first they came as tradesmen and since the 1870's they had been busy working as woodcutters and carpenters in the mountains between Piet Retief and Wakkerstroom. It is not widely known that there are lush indigenous evergreen forests in this area with magnificent old yellow wood and other precious hardwood trees. These were cut up into planks and beams for the young and growing Transvaal Republic, and much of the wood was transported as far as Lourenco Marques (Maputo), Kimberley, Warden, Barberton and even Botswana. Over the years, the German settlers became successful farmers, and today Piet Retief has a particularly large and thriving German community. After 130 years and more, most German families still speak German as a mother tongue, and the German culture and religion is still strong.

During the Boer War (1899-1902) the Assegai Valley saw much fighting, but the many valleys, mountains and forests proved to be a safe haven for the harassed Boer forces. During this war, the whole picturesque cowboy-like town, Piet Retief, was burned to the ground in its entirety. The whole valley was burnt and nearly every single farm was burnt down, all women and children captured were sent to concentration camps at Volksrust, Pietermaritzburg and Irene, and all orchards and crops were ravaged. The German settlers fought along with the Boers and many of them became brave and well known fighters.

(LABUSCHAGNE, H., 1998. p.1-10)

08.01.2 The Influence of Apartheid on residential areas of PietRetief

African people

In 1905, the municipality of Piet Retief strongly opposed the settlement of Africans in a location, as, for instance, health service provision would be too expensive. As an alternative, Africans were allowed to live on agricultural plots that formed part of the town grounds at a nominal rent of £2 per year. Problems started to arise as a large number refused to pay their rent, but the town council was by no means allowed to take law into own hands in forcing these people into paying. After many attempts, the first layout for an African location was approved in 1923. This area was enlarged another five times, with the most drastic extension taking place in April 1955. After this there still remained a few African people who lived in the town and the town council tried everything to remove them to the outskirts of Piet Retief. In the 1960's, a housing scheme was drawn up for African people that provided them with houses and the necessary services.

Since 1973, it was no longer the responsibility of the local municipality to provide African people with homes. In 1977, the law granted African people more authority through the creation a Community council, chosen by the local community itself. From the 1970's until the present day, the development of African communities takes place, with the newest development being 'Harmony Park'.

Indian and Coloured people

ndian and Coloured communities used to live in the middle of town, but in the 1970's they were relocated to the fringes. In 1968, a new residential and business area was developed to the west of the Paulpietersburg road. This suburb was called Kempville, a name which was chosen by the Muslim community itself. It is named after Dr. J.C.G. Kemp, the son of well-known General J.C.G. Kemp, who was a medical doctor, businessman and mayor in Piet Retief. Although they received a new neighborhood, many Indian businessmen's shops remained within town. The living conditions of the Coloured people became a great source of irritation to the white people, as they lived in shacks between the white people's homes. In 1971, a coloured suburb was established northwest of Kempville, called Retiefville.

(BRITS, J.P., 1983 p.34-42)

08.01.3 The History of Boxer Pipe Tobacco

Historically, Piet Retief was the home of Boxer Pipe Tobacco. (figure 08.01) After the Second World War, the tobacco industry experienced a downturn. But in 1942, the already existing Piet Retief Co-operative Tobacco Planters Association (figure 08.02) received fresh stimulus by the appointment of Mr. J.J. Bezuidenhout as Chairman. Mr. Bezuidenhout was a prominent tobacco farmer on Madola Portion 2 (the western neighboring farm of Madola Portion 5, where Mkhonda Lodge will be built). His contribution to the expansion and progress of the Co-operative were manifold.

Since the 1950's, local tobacco farmers have gradually converted to the growing of Burley Tobacco. This type of tobacco needed very specific storage facilities, which Piet Retief did not have and after 1972, the Co-operation finally decided to not take in tobacco from Piet Retief anymore. As a result, the popularity of timber and maize surpassed that of tobacco.

(*Piet Retief: 75 jaar van vooruitgang.* 1959 p.10-12)

"BOXER PIPE TOBACCO
Rich flavor. Superior quality. Always satisfying.
The South African market leader for decades, a true South African classic. Boxer pipe tobacco, known for its rich flavor, superior quality, and universal availability, has been a South African favourite for over 60 years. Since its origin in 1937, Boxer has delivered the same smooth, tobacco flavour for three generations. Even Boxer´s logo and package design have remained unchanged, making Boxer a true South African classic. Packing a one-two, value-price punch, Boxer always delivers a fistful of flavour" *(www.swedishmatch.com)*

FIg:08.01

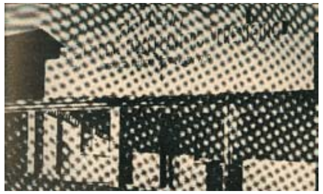
FIg:08.02 Headquarters of the Piet Retief Co-operative Tobacco Planters Association

08.01.4 Flora

Indigenous trees

	General name	Afrikaans name	Scientific name	Tree no	Height (m)
1	African holly #	Without	*Ilex mitis*	397	10 - 30
2	Ana tree #	Anaboom	*Acacia albida*	159	15 - 30
3	Cabbage tree*	Gewone kiepersol	*Cussonia spicata*	564	3 - 10
4	Cape beech*	Kaapse boekenhout	*Rapanea melanophloeos*	578	4 - 10 - 20
5	Common coral tree*	Koraalboom	*Erythrina lysistemon*	245	6 - 10
6	Common rothmannia #	Wildekatjiepiering	*Rothmannia capensis*	693	10 - 20
7	Flat-crown #	Platkroon	*Albizia adianthifolia*	148	10 - 40
8	Forest nuxia #	Bosvlier	*Nuxia floribunda*	634	3 - 10 - 15
9	Horsewood*	Perdepis	*Clausena anisata*	265	3 - 5 - 10
10	Karee #	Karee	*Rhus lancea*	386	8
11	Keurboom #	Keurboom	*Virgillia oroboides*	221	8 - 10
12	Mountain cabbage tree*	Berg kiepersol	*Cussonia paniculata*	563	5
13	Outeniqua yellowwood #	Outeniekwa geelhout	*Podocarpus falcatus*	16	20 - 60
14	Paperbark acacia #	Papierbasdoring	*Acacia sieberana*	187	6
15	Pittosporum #	Kasuur	*Pittosporum viridflorum*	139	10 - 20 - 30
16	Pompon tree #	Kannabas	*Dias cotinifolia*	760	3 - 7
17	Quinine tree #	Kinaboom	*Rauvolfia caffra*	647	6 - 20
18	Real yellowwood #	Opregte geelhout	*Podocarpus latifolius*	18	20 - 30
19	Red mahogany #	Oos-afrikaanse mahonie	*Khaya nyasica*	-	60
20	Sausage tree #	Worsboom	*Kigelia africana*	678	18
21	Transvaal bluebush #	Transvaalsebloubos	*Diospyros lycioides*	605.2	5
22	Tree-fuchsia*	Notsung	*Halleria lucida*	670	2 - 3 - 12
23	Water berry #	Waterbessie	*Syzygium cordatum*	555	8 - 15
24	Weeping wattle #	Huilboom	*Peltophorum africanum*	215	5 - 10
25	White stinkwood*	Witstinkhout	*Celtis africana*	39	12 - 30
26	White syringe #	Witsering	*Kirkia acuminata*	267	6 - 15
27	Wild medlar #	Grootmispel	*Vangueria infausta*	702	8
28	Wild olive #	Olienhout	*Olea europaea*	617	5 - 10
29	Wild peach #	Wildeperske	*Kiggelaria africana*	494	4 - 13
30	Wild pear #	Drolpeer	*Dombeya rotundifolia*	471	5
31	Wild plum #	Wildepruim	*Harpephyllum caffrum*	361	6 - 10
	* earliest indigenous species				
	# planted within the last 10 years				

Tabel 08.01a

Exotic trees

SPECIES		USE
Eucalyptus		
	Eucalyptus Grandis	saw logs
	Eucalyptus Smithii - planted in lower, cooler parts of the farm	pulp
***Acacia* (Wattle)**		
	Acacia Mearnsii (Black Wattle)	pulp
	Acacia Decurrens (Green Wattle)	pulp
Pinus		
	Pinus Patula	saw logs
	Pinus Eliottii	saw logs
Other unique species:		
	Quercus Acutissema (Saw tooth oak)	saw logs and wild mushroom stands
	Populus Canescens (Grey Poplar)	saw logs, wild and cultivated mushrooms

Tabel 08.01b

Fig:08.03
Yellow wood tree with damaged bark. Photo was taken in the region of Piet Retief.

08.01.5 Fauna

The following tables include fauna that has been positively identified on the farm Madola:

Reptiles

General name	Scientific name	Afrikaans name
Black mamba	Dendroaspis polylepis	Swart mamba
Brown house snake	Lamprophis fuliginosus	Bruin huisslang
Common or Rhombic night adder	Causus rhombeatus	Gewone nagadder
Common slug eater	Duberria lutrix	Tabakrolletjie
Flap-neck chameleon	Chamaeleo dilepis	
Puff adder	Bitis arietans	Pofadder
Rinkhals	Hemachatus haemachatus	Rinkhals
Swazi rock snake #	Lamprophis swazicus	
# Very scarce specie		

Table:08.02a

Mammals

General name	Scientific name	Afrikaans name
Aardvark	*Orycteropus*	Erdvark
Black-backed Jackal	*Canis mesomelas*	Rooijakkals
Bushpig	*Potamochoerus porcus*	Bosvark
Caracal	*Felis caracal*	Rooikat
Common Duiker	*Sylvicapra grimmia*	Gewone Duiker
Greater Cane-rat	*Thryonomys swinderianus*	Groot leerrot
Grey Rhebok	*Pelea capreolus*	Vaal ribbok
Honey Badger	*Mellivora capensis*	Ratel
House Mouse	*Mus musculus*	Huismuis
Mountain Reedbuck	*Redunca fulvorufula*	Rooi Ribbok
Natal Red Rock Rabbit	*Pronolagus crassicaudatus*	Die Natalse Rooi Klipkonyn
Oribi	*Ourebia ourebi*	Oribi
Porcupine	*Hystrix africaeaustralis*	Ystervark
Rock Dassie	*Procavia capensis*	Klipdassie
Scrub hare	*Lepus saxatilis*	Kolhaas / vlakhaas
Southern African Hedgehog	*Atelerix frontalis*	Krimpvarkie
Striped Polecat	*Ictonyx striatus*	Stinkmuishond
Striped Weasel	*Poecilogale albinucha*	Slangmuishond
Thick-tailed Bushbaby	*Otolemur crassicaudatus*	Bosnagaap
Vervet monkey	*Cercopithecus aethiops*	Blouaap
Woodland Dormouse	*Graphiurus murinus*	Bos Waaierstertmuis

Table:08.02b

Birds

General name	Scientific name	Afrikaans name
African Black Duck	*Anas sparsa*	Swarteend
African Spoonbill #	*Platalea alba*	Lepelaar
Black Cuckoo	*Cuculus clamosus*	Swartkoekoek
Black Saw-wing Swallow	*Psalidoprocne holomelas*	Swartsaagvlerkswael
Black Sunbird	*Nectarinia amethystina*	Swartsuikerbekkie
Blackcollared Barbet	*Lybius torquatus*	Rooikophoutkapper
Blackeyed Bulbul	*Pycnonotus barbatus*	Swartoogtiptol
Blackheaded Heron	*Ardea melanocephala*	Swartkopreier
Blackheaded Oriole	*Oriolus larvatus*	Swartkopwielewaal
Blackshouldered Kite	*Elanus caeruleus*	Blouvalk
Bluebilled Firefinch	*Lagonosticta rubricata*	Kaapse Robbin
Bokmakierie	*Telophorus zeylonus*	Bokmakierie
Brownhooded Kingfisher	*Halcyon albiventris*	Bruinkopvisvanger
Buffstreaked Chat	*Oenanthe bifasciata*	Bergklipwagter
Cape Canary	*Serinus canicollis*	Kaapse Kanarie
Cape Eagle Owl	*Bubo capensis*	Kaapse Ooruil
Cape Francolin	*Francolinus capensis*	Kaapse Fisant
Cape Robin	*Cossypha caffra*	Gewone Janfrederik
Cape Turtle Dove	*Streptopelia capicola*	Gewone Tortelduif
Cape White-eye	*Zosterops pallidus*	Kaapse Glasogie
Cardinal Woodpecker	*Dendropicos fuscescens*	Kardinaalspeg
Crowned Eagle #	*Stephanoaetus coronatus*	Kroonarend
Crowned Plover	*Vanellus coronatus*	Kroonkiewiet
Darter	*Anhinga melanogaster*	Slanghalsvoël
Diederik Cuckoo	*Chrysococcyx caprius*	Diederikkie
European Swallow	*Hirundo rustica*	Europese Swael
Fierynecked Nightjar	*Caprimulgus pectoralis*	Afrikaanse Naguil
Fiscal Shrike	*Lanius collaris*	Fiskaallaksman
Forest Weaver	*Ploceus bicolor*	Bosmusikant
Forktailed Drongo	*Dicrurus adsimilis*	Mikstertbyvanger
Great White Egret	*Egretta alba*	Grootwitreier
Greyheaded Bush Shrike	*Malaconotus blanchoti*	Spookvoël
Groundscraper Thrush	*Turdus litsitsirupa*	Gevlekte Lyster
Hadeda ibis	*Bostrychia hagedash*	Hadeda
Halfcollared Kingfisher #	*Alcedo semitorquata*	Blouvisvanger
Hamerkop	*Scopus umbretta*	Hamerkop
Helmeted Guineafowl	*Numida meleagris*	Gewone Tarentaal
Hoopoe	*Upupa epops*	Hoephoep
Lazy Cisticola	*Cisticola aberrans*	Luitinktinkie
Longcrested Eagle #	*Lophaetus occipitalis*	Langkuifarend
Mosque Swallow	*Hirundo senegalensis*	Moskeeswael
Namaqua Prinia	*Prinia substriata*	Namakwalangstertjie
Olive Thrush	*Turdus olivaceus*	Olyflyster
Paradise Flycatcher	*Terpsiphone viridis*	Paradysvlieëvanger
Pied Kingfisher	*Ceryle rudis*	Bontvisvanger
Pintailed Whydah	*Vidua macroura*	Koningweduweetjie
Rameron Pigeon	*Columba arquatrix*	Geelbekbosduif
Red Bishop	*Euplectes orix*	Rooivink
Redbreasted Sparrowhawk	*Accipiter rufiventris*	Rooiborssperwer
Redchested Cuckoo	*Cuculus solitarius*	Piet-my-vrou
Redcollared Widow	*Euplectes ardens*	Rooikeelflap
Redshouldered Widow	*Euplectes axillaris*	Kortstertflap
Reed Cormorant	*Phalacrocorax africanus*	Rietduiker

Table:08.02c

08.01.6 Tourism

08.01.6.1 The importance of tourism

"Tourism is a remarkable industry, unlike any other form of economic enterprise. Instead of exporting the product, you import the customer, who pays for his or her own fare. Resources are not consumed; they are merely experienced and then left behind for resale over and over again. It favors remote areas, where job creation is needed most, and creates more jobs, more quickly, across a broader front, and at less cost than any other industry. It supports infrastructural installation where otherwise this would not be justified. Tourism encourages entrepreneurship and spawns businesses that keep family units together. Tourism connects people with the world, promotes peace, and builds bridges across cultural barriers. Tourism is a civilizing process, for without recreation there can be no civilization. In short, it is the business of making people happy. "

08.01.6.4 Tourism as a source of income

Because of tourism, hotels are built to provide accommodation, buses and airplanes are built to transport tourists from one place to another. Restaurants are erected to provide food and beverages, and tourists also love to buy souvenirs. All of these activities generate income and create employment opportunities and therefore tourism plays a major role in the local economy.

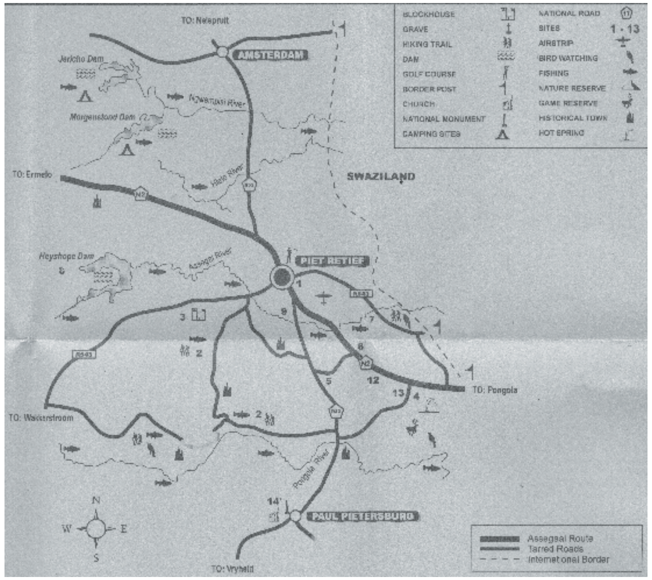

Fig: 08.04 Tourist activities in the Piet Retief vicinity

08.01.6.5 Accommodation possibilities in the town of Piet Retief

From the table it becomes evident that, except for Anchor's Inn, there is not a facility in the Piet Retief region that can accommodate a large group (45-60 people) of tourists. Except from being the only large-scale project in the region, Mkhonda Lodge also has an environmental focus in that it enhances its natural surroundings and makes use of sustainable building practices, again separating it from stereotypical accommodation options.

In an effort to contribute to the growing tourism industry in South Africa, or more specifically Mpumalanga, Piet Retief Municipality is in the process of providing the town with a Cultural Village. Facilities will include:

1. A tourist information office/museum – representing the historical development of the area from earliest times.
2. Cultural village/open air museum – a replica of a Zulu village with daily activities. The village will be a dynamic open-air museum where the daily activities of the traditional Zulu will be illustrated.
3. An "arts and crafts area", where artists and craftsmen from all over the towns and rural areas of Mkhondo Municipal area can manufacture, exhibit and sell their wares in an "African Market" atmosphere:
   i. Pottery
   ii. Traditional materials and clothing
   iii. Mat- and basketweaving
   iv. African beadwork
   v. African wood craft
   vi. Wool weaving and spinning
   vii. African sculptures
4. Amphitheatre where traditional dances and other shows will be enacted for the benefit of tourists.

NAME	NUMBER OF GUESTS	TYPE OF ACCOMMODATION
Greendoor Guesthouse	28	20 Rooms with *en suite* bathrooms
Holme Lea Manor	16	8 Rooms, *en suite* bathrooms
Our Place B & B	4	2 Rooms to bathroom
L.A. Guesthouse	4	2 Rooms *en suite*
Just 4 U	4	2 Rooms to bathroom
Waterside Lodge	28	Rooms *en suite*
Bossie's Inn (B & B)	16	Rooms with *en suite* bathrooms
Anchor's Inn	-	22 Rooms *en suite* ; 18 Rooms communal bathrooms
Uschi's Inn	2	1 Room *en suite* with kitchenette
The Swallows Nest	9	Rondavel for 3 *en suite* ; Room for 6max *en suite*
Retief Huis	4	2 Rooms to bathroom
Sundowner	14	3 Rooms *en suite*, 4 Rooms communal bathroom
Wetterau Guesthouse	-	2 Rooms, each *en suite*
Rohrs Guest Farm	8	-
Dusk to Dawn	9	
H H Game Ranch	6	
Wagendrift Bush Lodge	8	-
Bea's Cottage	5	Small flatlet
Assegaai Hiking Trial	10	Cabin & Caravan
Fisherman's Paradise	4	Room with *en suite* bathroom
Mooiman B & B	4	Rooms with *en suite* bathrooms

Table:08.03

08.01.6.6 The tourism cycle

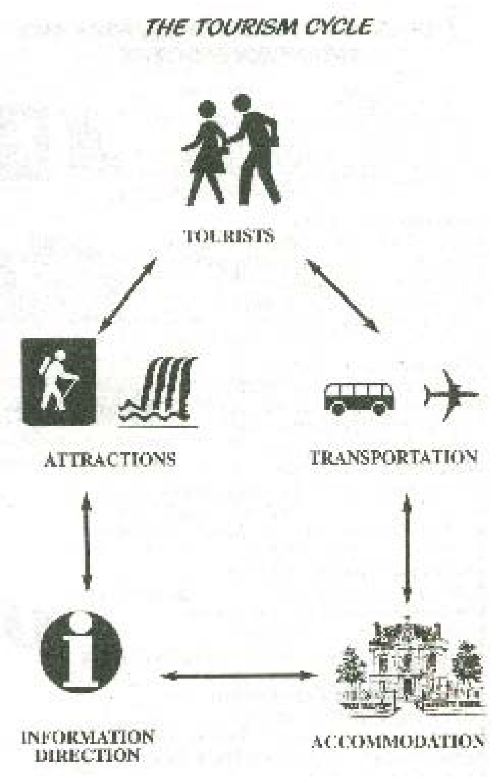

Fig:08.05

08.01.6.7 The benefits of tourism

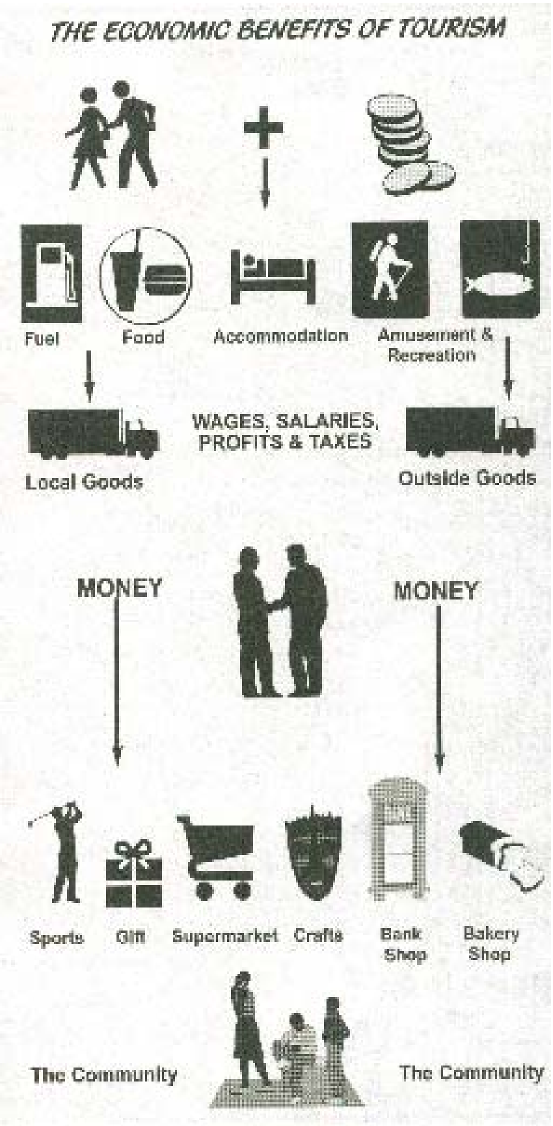

Fig:08.06

08.01.7 Proposed New Roads

According to Jan Weideman, a civil engineer from Piet Retief, a route has been pinned down for the last 25+ years that will allow traffic to and from KwaZulu-Natal, Gauteng and the Kruger National Park to bypass Piet Retief. This road was aimed at alleviating heavy traffic on the existing N2. However, it is not certain at this stage whether this road will be constructed. In KwaZulu-Natal, roads between Mkuze, Sodwana Bay, Kosi Bay, etc. are undergoing large-scale improvements. It is said that before 2010, improvements will start south of Pongola, carry on through the town towards Piet Retief until it reaches the border between KwaZulu-Natal and Mpumalanga. This process is once again uncertain, as it is very expensive to improve road structures. Until there is enough financial support, it is not possible to determine exactly when and how new roads will develop. Mpumalanga is responsible for the maintenance of the last part of the Pongola road and it is merely speculated that once this road is upgraded, there might be a chance for the proposed detour road to realise.

The design of Mkhonda lodge can therefore not rely on the planned detour road to provide it with tourists. However, a need for tourist accommodation in the area is a reality and with or without the additional road, tourists will continue to visit the Piet Retief. If the road is to be developed, it will positively affect the development, economically benefiting Mkhonda Lodge.

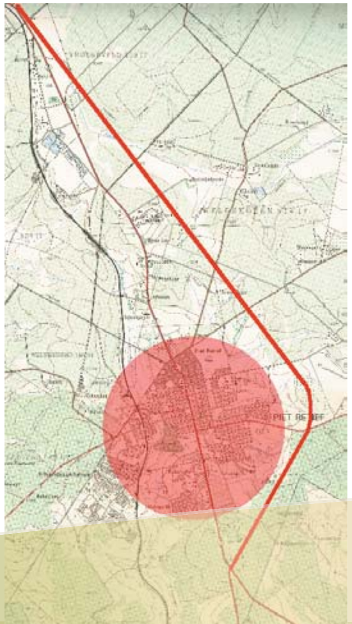

Fig:08.07

08.01.8 Annual farm activities

MONTH	PRODUCT	NOTES
January	Black berries	Black berry season
February		Cultivation of Black berry wine
March	Mushrooms	High Mushroom availability
		- harvest & rework mushrooms (fresh, pickle & dried)
April		High Mushroom availability
		- harvest & rework mushrooms (fresh, pickle & dried)
		Preparation of ground for planting of strawberries
May	Dry period on farm	Preserves made from frozen berries
June	(Ideal for straw bale harvesting)	Large number of dry straw available – turned into straw bales and stored in a dry place to be used for construction at later stage
July		
August		
September	Strawberries	Harvest & rework strawberries (Fresh, jams & other products)
October		
November	Strawberries	Harvest & rework strawberries (Fresh, jams & other products)
	Mushrooms	Harvest & rework mushrooms (fresh, pickle & dried)
December	Strawberries	Harvest & rework strawberries (Fresh, jams & other products)
	Black berries	Harvest & rework black berries (Fresh)

Table:08.04

08.01.9 Placing of cottages in the Kloof: building footprints and impact on the environment

Cattle farming used to be a main business at Madola, where large amounts of cattle that grazed freely, especially on top of the mountain. In order to provide these cattle with new grass each year, the owners started annual veld fires. However, these fires were not controlled, leading to scorched outer edges of the indigenous forest in the kloof. This meant that the forest gradually decreased in size, whilst the alien wattle species were rapidly invading. The proposed development stipulates that the indigenous species be further rehabilitated, whilst wattle should gradually be removed. The removal of wattle trees will disturb the surrounding grounds and therefore the introduction of a cottage would not have a significant impact. The cottages, however, should not intrude on the existing indigenous species. Careful planning of their situation in the forest will cause minimal harm to these species. Within 30 years, the forest should have formed an indigenous canopy that spreads out over the 12 proposed cottages.

08.02 BASELINE

08.02.1 Sun Angles

21 jan / 22 nov

	08h00	10h00	12h00	14h00	16h00	18h00
PLAN	-5°	11°	90°	169°	185°	197°
SECTION	35°	60°	81°	60°	35°	10°

22 june

	08h00	10h00	12h00	14h00	16h00	18h00
PLAN	36°	58°	90°	122°	144°	n / a
SECTION	14°	32°	39°	32°	14°	n / a

21 march

	08h00	10h00	12h00	14h00	16h00	18h00
PLAN	15°	40°	90°	140°	165°	180°
SECTION	26°	50°	60°	50°	26°	1°

24 july

	08h00	10h00	12h00	14h00	16h00	18h00
PLAN	33°	56°	90°	124°	147°	n / a
SECTION	15°	35°	42°	35°	15°	n / a

16 april

	08h00	10h00	12h00	14h00	16h00	18h00
PLAN	24°	48°	90°	132°	156°	n / a
SECTION	21°	43°	51°	43°	21°	n / a

22 december

	08h00	10h00	12h00	14h00	16h00	18h00
PLAN	-10°	4°	90°	176°	190°	201°
SECTION	36°	62°	84°	62°	36°	11°

Table:08.05a - f

08.02.2 Benefits and economic advantages of straw bale construction

A typical straw bale would cost R15 if bought directly from the farmer. If locally produced, cost savings can be enhanced even further. A common brick would cost R2 per brick (including transport costs). The dimensions of a straw bale are 340x360x900 which means that 16 bricks would be needed to fill the same volume. Therefore, straw bale walls cost around 50% less than ordinary brick walls and are easy and fast to erect.

Additional benefits include:

1. Insulation value of R-42
2. Yields an impressive super insulated wall that provides for a stable environment
3. Thick walls give designers opportunities to play with light and shadow, texture and form
4. Very low cost
5. Minimal embodied energy
6. Compared with conventional stud construction, it requires inexpensive materials and low-skilled labour
7. As it is relatively low-tech, it encourages owner involvement
8. Its friendly building process is inclusive, empowering and decentralized, which helps build a community

(Lecture notes)

08.02.3 Short-list of Requirements for Structural and Non-Structural Straw Bale Construction

1. Minimum wall thickness: 330 mm
2. Minimum density of straw bales: 120 kg/m^3
3. Maximum wall height: One storey with unloaded bale portion of wall to not exceed 5.6 times the wall thickness
4. Maximum unsupported wall length: 15.7 times the wall thickness.
5. Allowable load on bale walls: 2,684 kg/m^2
6. Minimum height of foundation wall: 150 mm above grade.
7. Structural anchoring to foundation: minimum 13 mm diameter steel anchor bolts at intervals of 1 800 mm minimum, connected to threaded rod to tie down top plate.
8. Moisture barrier between top of foundation and bottom of bale wall to block capillary moisture migration.
9. Roof plate: two double 50 x 150 mm or larger horizontal top plates located at inner and outer bale edges with cross-bracing
10. Wall openings for windows and doors: minimum of one full bale from an outside corner and framed to carry roof load
11. Plaster/stucco: cement stucco reinforced with woven wire stucco netting or equivalent, secured through the wall.

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08.02.4 New Mexico guidelines for Residential non-load bearing bale construction

08.02.4.1 Section 1: General

(Note that New Mexico does not allow load bearing straw bale structures.)

A. Straw bales shall not be used to support the weight of the building, beyond the weight of the bales themselves. The bales will be acting as wall in-fill between the structural members.

B. The structural support of the building shall be designed according to the provisions of the Uniform Building Code (UBC). All loadings shall be as required by Chapter 23 of the UBC for vertical and lateral loads.

C. For the purposes of placement of perimeter foundation insulation, straw bales shall not overhang the bearing surface by more than total of four inches (4”). Straw bale walls shall have an exterior and interior finish that will protect the in-fill bales from wind, moisture and pests.

D. The maximum height of a straw bale in-fill wall shall be 3meters and the maximum length of an unbuttressed in-fill wall panel shall be 5m.

08.02.4.2 Section 2: Straw bale construction standards

08.02.4.3 Definitions

1. IN-FILL: Straw bales shall be placed within the structural members so as not to carry any weight other than the weight of the bales themselves.
2. LAID FLAT: Refers to the stacking of the bales such that the longest edge of the bale is parallel to the wall plane and so the greatest cross-sectional area of the bale is horizontal. The resulting wall shall be at least 18” thick.
3. STRAW: The stalk or stem of grain from wheat, rye, oats, rice or barley left after threshing or when the seed head has been removed.
4. STRAW BALE: A rectangular compressed block of straw bound with polypropylene twine or bailing wire in minimum of two places with the twine running parallel to the longest side.
5. UNBUTTRESSED: A section of in-fill wall without perpendicular wall, column or other lateral support.

08.02.4.3.1Specifications

Bales shall be composed of straw, mechanically baled with baling wire or polypropylene twine. Bales must be sufficiently dry with a maximum moisture content of twenty percent (20%) at the time of installation. Bales shall have a minimum of two strings running parallel to the longest edge and shall be dense enough to be handled without coming apart and to resist settling. If a partial bale is required, it should be split from a full bale and retied to maintain the original compression of the bale. All bales shall be field tested for compression before placement in walls when lifted into position. Bales shall be of sufficient compression to remain intact when lifted by one bailing wire or polypropylene twine.

08.02.4.3.2Wall construction

Straw bales shall not be used below grade. The foundation shall be constructed so that the bottom of the · lowest course of straw bales is at least six inches 150mm above final exterior grade. Straw bales used for in-fill walls should be laid flat with the vertical joints staggered at each course with a minimum overlap of twelve inches 300mm. Vertical joints shall be field tested during placement of bales in the wall. Joints shall be sufficiently tight to prevent the end of a nominally dimensioned 25 x 100mm board 550mm long from being pushed more than 150mm into the joint.

08.02.4.3.3Vapour barriers

A moisture barrier shall be placed between the foundation and the first course of straw bales. The barrier shall run vertically between the perimeter insulation and the foundation wall and shall run horizontally under the straw bale and then double back to the outside edge of the foundation. A vapor barrier shall be placed over the top course of bales to prevent moisture entering the top of the wall of bales.

08.02.4.3.4Reinforcing

The bottom course of straw bales shall be pinned to the foundation with #4 rebar with a minimum of two pins per bale. These pins should be embedded into the foundation to a depth of not less than 175mm should continue vertically halfway into the second course of bales. Each subsequent course of bales shall have two rebar pins per bale: continuous from second course to one course below bond beam. Where rebar cannot be continuous, it should overlap other rebar by one course. All rebar should be approximately 225 mm from the bale ends and centered on the width of the bale. A continuous horizontal ladder reinforcing shall be placed horizontally between courses at mid-wall height and shall be fastened twice per bale to the twine or wire.

08.02.4.3.5Anchors

The straw bale in-fill walls shall be securely anchored to all adjacent structural members to sufficiently resist horizontal displacement of the wall. Anchors shall be placed at every horizontal joint or one per bale along vertical structure and a maximum of 600mm on center along horizontal structures at the top of straw bale walls beginning not more than 300mm from each end of the wall. Anchors shall be metal strips or rods. Metal strips shall be 150mm wide expanded metal lath or FHA perforated metal strips which shall be securely fastened to the vertical structural members and shall extend at least 300mm onto the adjacent bale and shall be pinned into the bale. Dowels shall be 13mm minimum diameter wood or steel and shall extend into the bale at least 150mm.

08.02.4.3.6Openings

Rough bucks and/or door and window frames shall be stabilized with 13mm diameter X 300mm wood dowels extended into every adjacent bale or by means of a continuous metal lath, prior to the application of plaster or stucco.

08.02.4.3.7Stucco/ plaster

Straw bales shall be stuccoed or plastered. Building paper shall not be used as a moisture barrier on vertical surfaces of straw bales in order to allow natural transpiration of moisture from the bales. Where stucco netting is not used, the first coat of plaster or stucco shall be thoroughly worked into the straw.

At all points where the straw bales are butted against a different material (wood, concrete, steel, etc.) metal lath shall be used to cover the junction. Expanded metal lath shall extend a minimum of 150mm over the edge of the straw bale and shall be securely fastened to the bale. Mesh fasteners shall have a maximum spacing of 150mm from each other.

08.02.4.3.8Parapets

Straw bales may be used for parapets with a maximum height of 2 courses. These bales shall be pinned together vertically with rebar and have a continuous wrap with stucco netting; up front, over the top and down the back side. A continuous seal shall be maintained from the roof surface to the top of the parapet and down the other side a minimum of two 50mm and a maximum of 150mm.

08.02.4.3.9Electrical

All wiring within bales may be pressed between vertical and horizontal joints of the bales, or bales may be channeled, maintaining a minimum depth of 30mm from the surface of the interior wall finish.
All junction boxes shall be fastened securely

08.02.5 Specific design criteria for Mushroom Cultivation Area
08.02.5.1 Spawn laboratory

The lab is designed and built for the benefit of the mushroom mycelium. Humans working as cultivators of mycelium are often the greatest threat to the viability of the mushroom cultures and therefore the path that one follows through the lab and growing rooms can have profound implications on the integrity of the entire operation and should be carefully planned.

DESIGN CRITERIA
Purposes: To isolate and develop mushroom cultures
To generate pure culture spawn.
Facility: A building well separated from the growing rooms.
Max temperature: 26 - 27ºC
Min temperature: 21 - 22ºC
Humidity: 35 – 50%
Light: 500 – 1000 lux
Insulation: R16 – R32
Positive Pressurization: Yes, through HEPA filters
Additional Comments:

1. Ideally, the laboratory should be uphill from the growing rooms so that passage of spawn is aided by gravity as it is transported.
2. Condensation surfaces must be minimized.
3. After construction, every seam should be sealed with silicone.
4. Growing rooms are destined to contaminate the air within the lab with mushroom spores. Since activities within the lab and growing rooms are distinctly different, separate buildings are preferred.
5. The lab should be continuously positive-pressurized with fresh air which has to be serially filtered. (First a coarse pre-filter, then an electrostatic filter and finally a HEPA filter)
6. Turbulent, filtered air in the lab is more desirable than a still air movement
7. There should be at least two doors, preferably three doors, separating the clean room from the outside environment - doors should be gasketed with dirt skirts.
8. Interior surfaces should not be biodegradable and support mold growth. Wood should be avoided.
9. Shelves storing the incubating bags should be wire meshed, and not solid, so that the heat generated from incubation is dissipated.
10. Ambience of temperature is critical and it is extremely important to ensure that walls and ceilings are well insulated.
11. Lights need to be covered with dustproof covers to prevent it from turning into a habitat for contaminants.

12. Larger tiles are preferred to smaller sizes as they are more sufficient in terms of hygiene management. Tiles will be used to cover both floor and wall surfaces of all the rooms in the lab, except the office and reception.
13. Internal walls will be made from bricks to improve overall hygiene.

08.02.5.2 Growing / Cultivating rooms

DESIGN CRITERIA:
Purposes: To grow as many mushrooms as possible
Facility: Rectangular rooms with large doors at both ends
Max temperature: 26 - 27°C
Min temperature: 7 - 9°C
Humidity: 50 – 100 %
Light: 500 – 1000 lux
Insulation: R8 – R16
Positive Pressurization: Yes, through electrostatic filters
Additional Comments:

1. growing room should be rectangular and should be at least twice as long as it is wide
2. The inside skin must be built of water- and mold-resistant materials.
3. Wood and metal surfaces should be painted with a mold- or rust-resistant glazing.
4. Growing rooms should be protected from the outside by at least two doors. The bottom of the door should be fitted with a brush-skirt to discourage insects from entering, and doorjambs should be gasketed to assure a tight seal when closed.
5. Structures should be very well insulated to prevent extreme temperature fluctuations
6. The inside roof should be curved or peaked for heat distribution by the air circulation system. The slope of the inside roof should be angled so that condensation adheres to the sloped roof surface and is carried to the walls, and eventually spills onto the floor. This allows for the re-evaporation from the floor back into the air.
7. The height of a growing room should be at least 3m.
8. Floors should be cement and sloped to a central drain which needs not be wider than 150mm.
9. A footbath prior to each growing room in order to disinfect footwear should be installed and can be incorporated into concrete floor. An ideal size would be 600 x 900 x 50mm deep. The bath is filled with water to which chlorine is added as disinfectant.
10. Air exchange is necessary to control the availability of fresh oxygen and the purging or carbon dioxide from the respiring mushroom mycelium.
11. It is recommended that a thermal exhaust fan is place at the apex of the growing room, opposite the incoming air and should be covered from the inside with a bug proof cloth.
12. Growing rooms should have cement floors with large drains and be equipped with water lines.
13. Electrical boxes and lights must be waterproofed.
14. Internal walls should be constructed of non-degradable materials.
15. Entries in each room should be large enough (2.5m - 5m) to allow for easy access using forklifts or other equipment.

08.02.5.3 Solar dryer

This dryer does not need a heat source as the huge volume of air removes the moisture through evaporation. Shiitake, Oyster, Morel, Reishi, and many other mushrooms dry readily and can be stored for many months. Mushrooms can be sold in their natural form or powdered for soups, spice mixtures, teas, etc.

(STAMETS, P. 2000 p.467-488)

08.03. Feasibility Study

DESIGN PARAMETERS						
CONSTRUCTION AREAS:						
26 Cottages		3 x		80	/m²	
		12 x		65	/m²	
		11 x		60	/m²	
Farm Factory Area				1 200	/m²	
Residential House Area				120	/m²	
Landscaping Area				955	/m²	
Open Parking Area (Incl. circulation & roads)				2 181	/m²	
Timber Decking Area				646	/m²	
Swimming pool (4m x 11m)				44	/m²	
Total Construction Area				**9 617**	**/m²**	
CONSTRUCTION PERIOD:						
Pre-contract period						**4 months**
Land has already been bought, therefore no additional time needed for buying of land, transfer fees or re-zoning						
Allow for pre-feasibility study, detailed design and sufficient tender period						
Construction period						**15 months**
Ground Works - slightly sloping terrain & fair amount of ground works needed to create terraces						1 month
Foundations - made from local stone & concrete; very labour intensive						1 month
Structure - timber main structural frame (4 months); straw bale infill (3 months); flooring & timber deck (2 months)						9 months
Finishing						4 months
Total Construction Period						**19 months**
CONSTRUCTION COST:						
Accommodation - Resort Style				R 750 000	/cottage	
(has a ratio of 35m² of public areas, conference rooms,						
entrance foyers lounges & restaurants per room)						
Farm Factory (incl all equipment)				R 4 500	/m²	
Residential house / Manager's Cottage				R 3 500	/m²	
Landscaping				R 3 500	/m²	
Open Parking				R 3 500	/m²	
Timber Decking Area				R 300	/m²	
Swimming pool (4m x 11m)				R 55 000		
Bulk services				R 531 900		
BUILDING COST ESCALATION:						
Pre-contract period				8% per annum		
Construction period				9% per annum		
Non-adjustable element (Haylett formula)				0.85		
Cash flow factor				0.6		
CALCULATION OF BULK SERVICES:						
Electrical						
4 Distribution boards:	2		@	R 2 000		R 4 000
	2		@	R 4 500		R 9 000
500m Cable feeds			@	R 45	/m	R 22 500
182 light points			@	R 200	/light point	R 36 400
Total Electrical Cost						**R 71 900**
Water connections						
104 water points needed			@	R 2 000	/water point	**R 208 000**
Sewerage						
(Septic tanks & French Drain - built on site)						
26 Cottages	@	R8000		/cottage or house (4-5people)		R 208 000
1 House	@	R8000		/cottage or house (4-5people)		R 8 000
3 Sets Public Toilets	@	R12 000		/set of public toilets		R 36 000
Total Sewerage cost						**R 252 000**
TOTAL BULK SERVICES COST						**R 531 900**
FINANCIAL COSTING:						
Land cost (incl. transfer fees) - size 130ha						
Market Land Value	1 300	m²	@	R 180	/m²	R 234 000
Municipal Land Value	75%		x	R 234 000		R 175 500
Proffessional fees (12.5%)				R 3 147 241		
Sundry fees:						
Legal fees				R 30 000		
Plan approval fees				R 15 000		

Table:08.06a

CALCULATING TOTAL DEVELOPMENT COST						
ESTIMATED CURRENT BUILDING COST (excl. VAT)						
Conventional BC (Structure, skin & finishes of buildings)						
Accommodation - Resort Style	26		@	R 750 000	/cottage	R 19,500,000
Farm Factory (incl all equipment)	1 200	/m²	@	R 4 500	/m²	R 5,400,000
Residential house / Manager's Cottag	120	/m²	@	R 3 500	/m²	R 420,000
Total Conventional BC						**R 25,320,000**
Straw Bale&Earth Construction Cost = 45% of Conventional BC				45% of	R 25,320,000	= **R11,394,000**
Landscaping	955	/m²	@	R 3 500	/m²	R3,342,500
Open Parking	2 181	/m²	@	R 3 500	/m²	R 7,633,500
Timber Decking	646	/m²	@	R 300	/m²	R193 800
Swimming pool (4m x 11m)				R 55 000		R 55 000
Bulk services				R 531 900		R 531 900
Total current Building Cost						**R23,150,700**
ESCALATION						
Pre-contract escalation (4 months) :						
Pre-contract escalation:	R 23 150 700			x 8%	x 4/12 months	R 617 352
Building cost at start of construction:						**R 23 768 052**
Construction period escalation (15 months) :						
Adjusted with Haylett factor & cash flow factor:						
	R 23 768 052			x 0.85	x 0.6	R 12 121 707
Escalation during construction:	R 12 121 707			x 9%	x 15/12 months	R 1 363 692
Estimated total escalated building cost						**R 25 131 744**
FINANCIAL COSTING						
Land Value						R 234 000
Final Escalated BC						R 25 131 744
Proffessional fees (12.5%)						R 3 147 241
Sundries						R 295 000
Rates & Taxes						R 14 479
Total						**R 28 822 464**
Pre-contract financial cost:						
Land value	R 234 000			x 12%	x 19/12 months	R 44 460
Professional fees (60%)	R 1 888 345			x 12%	x 15/12 months	R 283 252
Total pre-contract financial cost						**R 327 712**
Construction period financial cost:						
Final Escalated BC						R 25 131 744
Professional fees (40%)						R 1 258 896
Sundries						R 295 000
Rates & Taxes						R 14 479
Total balance						R 26 700 119
Adjusted with cash flow factor:	R 26 700 119			x 0.4		R 10 680 048
	R 10 680 048			x 12%	x 15/12 months	R 1 602 007
Total construction period financial cost						**R 1 602 007**
Plus: Bond Costs	R 28 822 464			x 2%		**R 576 450**
Total Financial Costing						**R 31 328 633**
TOTAL DEVELOPMENT COST (TDC)						**R 31 328 633**

Table:08.06b

RETURN ON INVESTMENT (FIRST YEAR OF OPERATION)

CALCULATING RENTAL RATES

No specifications were given regarding rental fees, therefore an estimated Gross Income has to be determined							
& divided by the Total Rentable Area in order to determine a monthly R/m^2 rental rate for the cottages.							
In order to achieve 13% ROI:							
TDC x 13% = Net income / 0.8							
Thus: Net income (Estimated) = R 31 328 633 x 13% x 0.8							R 3 258 178
Annual Net income:							**R 3 258 178**
Annual Gross Income:		Nett income x 1 / 80%		=	R 3 258 178 x 1.25		R 4 072 723
Monthly Gross Income		R 4 072 723	/	12			**R 339 394**
but							
Monthly Gross Income is generated by:							
	Restaurant & Bar	@			(say) R 90 000	/month	
	Conference facilities	@			(say) R 80 000	/month	
	Accommodation (26 cottages)						
Therefore, Accommodation needs to provide a monthly Gross Income of:							
		R 339 394	-	R 90 000	-	R 80 000	**R169 394**
Monthly Rental Rate(cottages) / m^2:		R 169 394	/	Total Rentable Accommodation space			
		R 169 394	/	1680 m^2			**R 101 / m^2**
Final monthly cottage rental rates:		Cottage 1	(60m^2)	@	R 6 060	/month	
		Cottage 2	(65m^2)	@	R 6 565	/month	
		Cottage 3	(80m^2)	@	R 8 080	/month	
Allowance of Vacancy factor (60%)							
	month = 30days (average)						
	thus, 60% of 1 month = 18 days						
Thus:							
Final monthly cottage rental rates that allows for vacancies:							
	Cottage 1	(60m^2)	@	R 6 060	/18days	(approx)	**R 340 / day**
	Cottage 2	(65m^2)	@	R 6 565	/18days	(approx)	**R 365 / day**
	Cottage 3	(80m^2)	@	R 8 080	/18days	(approx)	**R 450 / day**

Table:08.06c

RISK / SENSITIVITY ANALYSIS						
INCREASING RETURN ON INVESTMENT						
Required rates/tariffs for cottages are currently relatively low. By increasing rates with 80%, the ROI will be increased:						
New tariffs (including vacancies):	Cottage 1	(60m²)	@	**R 612 / day**		
	Cottage 2	(65m²)	@	**R 657 / day**		
	Cottage 3	(80m²)	@	**R 810 / day**		
ROI =	**(Gross Income - Operating Expenses) / TDC**					
Annual Gross Income:	R 4 072 723					
80% Increased annual GI:	R 7 330 901					
Annual Operating Expenses:	R 814 545					
Annual Net income:	R 3 258 178					
TDC:	R 31 328 633					
ROI (without 80% increased GI)	=	(R 4 072 723 - R 814 545) / R 31 328 633			=	**11%**
ROI (80% increased GI)	=	(**R 7 330 901** - R 814 545) / R 31 328 633			=	**21%**
Therefore higher rental rates will cause an increase in Return on investment (ROI)						
In the same way, **decreasing** Operating Expenses and **increasing** TDC will cause an **increase** in ROI						
DECREASING RETURN ON INVESTMENT						
Total building costs can be increased when for example:						
	- using more expensive finishes					
	- cost of construction materials are more expensive due to transportation costs & availability					
	- more labour is needed than accounted for					
Annual Gross Income:	R 4 072 723					
Annual Operating Expenses:	R 814 545					
Annual Net income:	R 3 258 178					
TDC:	R 31 328 633					
30% Increased TDC:	R 40 727 223					
ROI (without 30% increased TDC)	=	(R 4 072 723 - R 814 545) / R 31 328 633			=	**11%**
ROI (30% increased TDC)	=	(R 4 072 723 - R 814 545) / **R 40 727 223**			=	**8%**
Therefore higher Building Costs will cause a decrease in Return on investment (ROI)						
Similarly, unforeseen vacancies in accommodation will decrease the annual Gross Income&cause a **decrease** in ROI						

Table:08.06d

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