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)

APPENDICES

08.01.3 The History of Boxer Pipe Tobacco

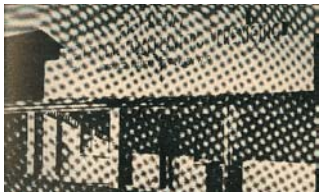
Historically, Piet Retief was the home of Boxer Pipe Tobacco. (figure 08.01) After the Second World War, the tobacco industry experienced a downturn. But in 1942, the already existing Piet Retief Co-operative Tobacco Planters Association (figure 08.02) received fresh stimulus by the appointment of Mr. 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)*

Flg:08.01


Flg: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	*Virgilia 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 viridiflorum*	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

Flg: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.

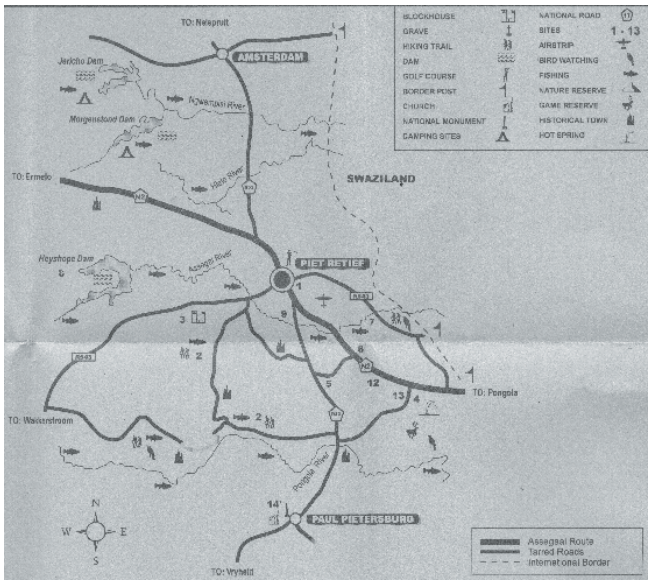


Fig: 08.04 Tourist activities in the Piet Retief vicinity

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

APPENDICES

08.01.6.6 The tourism cycle

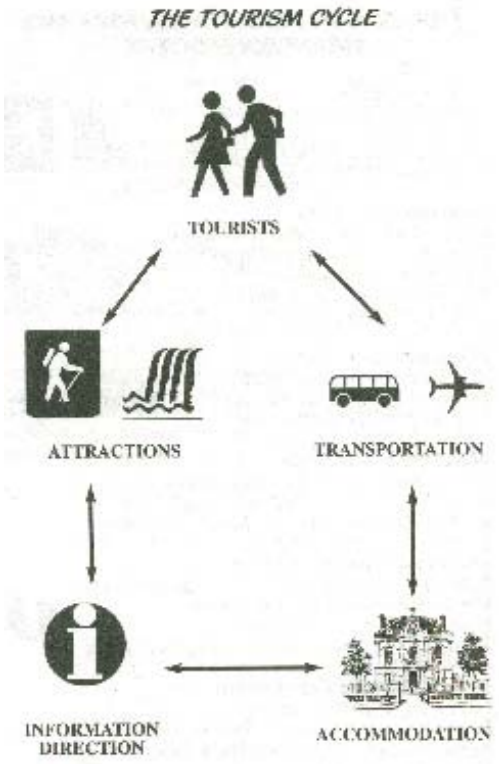


Fig:08.05

08.01.6.7 The benefits of tourism

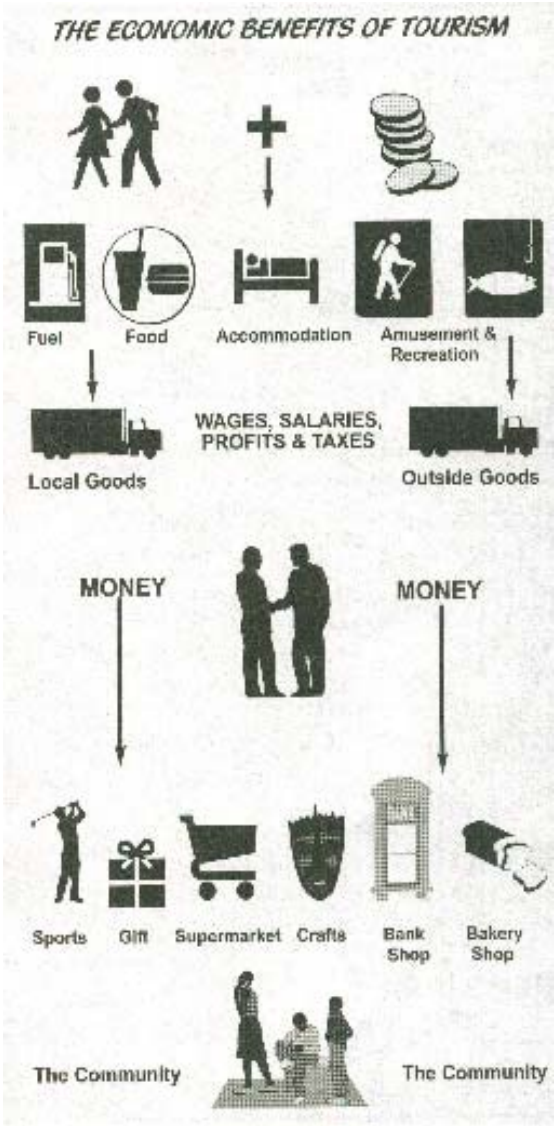


Fig:08.06

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.

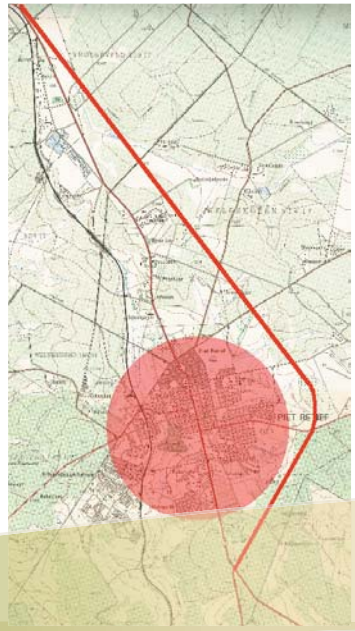


Fig:08.07

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 - 27°C
Min temperature: 21 - 22°C
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)

APPENDICES

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 (4mx 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 (4mx 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
Professional 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 Cottage		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/m² 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) / m²:	R 169 394 / Total Rentable Accommodation space	
	R 169 394 / 1680 m²	**R 101 / m²**

Final monthly cottage rental rates:	Cottage 1	(60m²)	@	R 6 060	/month
	Cottage 2	(65m²)	@	R 6 565	/month
	Cottage 3	(80m²)	@	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	(60m²)	@	R 6 060	/18days	(approx) **R 340 / day**
Cottage 2	(65m²)	@	R 6 565	/18days	(approx) **R 365 / day**
Cottage 3	(80m²)	@	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