

JOHANNESBURG METROPOLITAN MUNICIPALITY

KYALAMI DEVELOPMENT FRAMEWORK 2020

APRIL 2008

VERSION 2.0



a world class African city



APRIL 2008

KYALAMI

DEVELOPMENT FRAMEWORK 2020

Compiled on behalf of the
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SECTION 1: INTRODUCTION

1.1. STUDY BRIEF

The Johannesburg Metropolitan Municipality appointed Maluleke Luthuli and Associated to prepare a spatial development framework for the **Kyalami Precinct** located within Administrative Region A of Johannesburg. The aim of the project was the following:

- To provide a strategic vision for the precinct that is in line with the broad development objectives emanating from the GDS, MSDP and RSDP.
- To address specific developmental issues and challenges facing the precinct.
- To guide development within the precinct in a sustainable and responsible manner.
- To provide a basis for guiding the land use management decision making process.

Specific objectives of the project are:

- Enable an accessible, efficient and sustainable urban environment.
- Enable the development of a quality of urban environment.
- Accommodate the needs of the poor while maintaining and maximizing the value of commercial and retail land.
- Ensure the provision of adequate services and social facilities.
- Provide a variety of residential opportunities for a range of income earners, noting the development directives of the BNG policy.
- Facilitate socio economic development of existing local communities
- Create an environment that promotes the use of an effective public transport system.
- To guide development of bulk infrastructure.
- Preserve and enhance protected environmental areas.

1.2. PROJECT APPROACH

1.2.1. METHODOLOGY

The methodology for the preparation of the Development Framework was conducted in 6 distinct phases. The project was conducted on 2 geographical levels. The situational analysis and spatial development proposals (phases 1 to 4) were prepared on a sub-regional level (Region A was divided into 3 sub-region). The sub-region applicable to this study is referred to as the **Eastern Sub-Region**. The urban design guidelines and land use management framework (phases 5 and 6) were prepared on a precinct level and is referred to as the **Kyalami Precinct**. The methodology phases comprised the following phases:

Phase 0: Data Collation

This phase involved preparing the base information for the compilation of the Development Framework. Primarily, this involved creating GIS base maps, delineating precinct boundaries and requesting Census 2001 data from Statistics South Africa. It also involved acquiring data relevant to the Eastern Sub-Region from various sources, such as the Department of Transport, Gauteng Department of Agriculture, Conservation and the Environment (GDACE) and the Satellite Application Centre (SAC). All relevant planning documents were also obtained, such as the RSDf for Region A.

Phase 1: Situational Analysis

This phase involved the analysis of the information obtained for the Eastern Sub-Region. The situational analysis comprised the following components:

a. Socio-economic analysis

This component involved an analysis of the socio-economic profile of the Eastern Sub-Region population. This profile specifically took into account the socio-economic attributes of households that live within the Eastern Sub-Region, such as household income and age distribution.

b. Spatial characteristics

This component involved an analysis of the spatial characteristics of the Eastern Sub-Region. The spatial characteristics included aspects such as the existing land uses within the Eastern Sub-Region, housing typologies applied within the Eastern Sub-Region and social amenities currently available within the Eastern Sub-Region.

c. Infrastructure network

This component involved an analysis of the existing and planned transportation network within the Eastern Sub-Region. It included identifying the existing public transportation network for all modes of public transportation (BRT, bus, taxi and commuter rail). The existing and planned municipal services network was also determined.

d. Environmental issues

This component involved determining environmental issues affecting the Eastern Sub-Region. In particular, environmental sensitive area, high-potential agricultural soils and geo-technically unsuitable areas was identified. The impact of these elements on urban development was assessed.

Phase 2: Vision Statement and Development Concept

The vision phase involved defining objectives and strategies for the development of the Eastern Sub-Region. These objectives and strategies focused on issues such as urban consolidation and urban infill, nodal and corridor development and land use and public transportation integration. Based on these objectives and strategies, a Development Concept was drafted for the Eastern Sub-Region. This Development Concept illustrated proposed nodes and corridors, urban linkages and aimed promote positive development trends and urban patterns.

Phase 3: Land Use Budget and Development Phasing

The purpose of this phase was to formulate a Land Use Budget for the Eastern Sub-Region. This Land Use Budget was tailor-made for the Eastern Sub-Region and assessed the development potential and development need within the Eastern Sub-Region over a given period. This Land Use Budget provided quantitative projections upon which the spatial proposals were based, thus providing realistic and achievable spatial development goals.

The time-span of the Land Use Budget was divided into 2 incremental periods (e.g. 10-year periods) and the calculation of the Land Use Budget was prepared accordingly. This provided a clear indication of the envisaged development magnitude within each of the Land Use Budget periods. In turn, this allows the planning of bulk infrastructure (roads and municipal services) to service these urban expansion areas.

Phase 4: Development Framework Proposals

The fourth phase involved preparing development proposals for the Eastern Sub-Region. The development proposals were based on the information gathered and conclusion made in the previous phases. Proposals were made with regard to the following:

a. Spatial Development

Proposals were made with regard to land use development to ensure the orderly development of future land uses within the Eastern Sub-Region. It included proposals with regard to residential expansion and housing development, the development of mixed-use nodes, and the infill and intensification brownfield areas.

b. Socio-Economic Development

The proposals incorporated criteria for the provision of community facilities in a spatially equitable manner. This included, for example, proposals for the provision of education facilities, health facilities and recreation facilities. Also, proposals were made with regard to economic issues, such as the development of retail/ office nodes and industrial/ commercial areas.

c. Infrastructure Development

The proposals included guidelines for the development of transportation infrastructure, the promotion of public transport and the integration of land use and transportation. The proposals also guided the development of municipal infrastructure by applying the Land Use Budget, which estimated the extent of future urban development within the Eastern Sub-Region.

d. Open space conservation

Guidelines for the conservation of natural open space and the creation of an open space lattice were proposed.

Phase 5: Urban Design Guidelines for Nodes and Corridors

To enable the creation of sustainable, transit-integrated urban environments, urban design guidelines were formulated for the development of nodes and corridor within the Eastern Sub-Region. These guidelines were applied conceptually too specific nodes and corridors within each of the precincts of the Eastern Sub-Region to illustrate in more detail how such nodes or corridors should develop. For example, these design guidelines illustrate how to create a land use mix, integrate higher-density housing typologies, develop pedestrian connections and public space, and promote public transportation.

Phase 6: Land Use Management System

The development framework set out above, was translated into a land use management system that can be used to implement the framework proposals through applications for land use change. Detailed land use management issues, pertaining to the implementation of the development framework proposals were addressed. For example, it included land use mix, development density and parking requirements. These were presented in the following mutual supporting formats:

a. Demarcated zones

The individual precincts of the Eastern Sub-Region were divided into a number of Land Use Management zones. Each of these zones aimed to promote the development of a specific land use character through the application of land use mix and density.

b. Land use matrix

The land use management system is presented in a matrix format for easy reference and use by municipal planners, developers and property owners. The matrix was linked to the demarcated zones mention above and reads with these zones. The matrix defines the land use mix, density and parking requirements to be allowed within each demarcated zone.

1.2.2. GIS DATABASE COLLATION

The spatial and infrastructure planning information of the Eastern Sub-Region and its precincts were drawn into a GIS database. The electronic mapping and other information was made available to the Municipality for inclusion in their GIS database and is compatible with the Municipality's Geographical Information System. Care was taken to ensure the information presented is as true as possible, legible and user-friendly. The aim was to present a planning tool that will enable municipal planners to manage land use development within the Eastern Sub-Region and its precincts in an efficient and effective manner.

1.2.3. STAKEHOLDER PARTICIPATION

It was considered essential to obtain buy-in into the proposals made for the Eastern Sub-Region. To achieve this, Maluleke Luthuli and Associates consulted with all relevant stakeholders through the Municipal Department: Development Planning and Facilitation. These stakeholders essentially comprised the following 2 groupings:

a. Technical Steering Committee

The Technical Steering Committee included relevant municipal technical representatives from all the relevant municipal departments of the Municipality. Technical meetings were convened and chaired by the Municipality. Provision was made to allow Steering Committee members to review all interim project documents. Typical representation on these committees included:

- Provincial Departments
- Special Provincial Projects
- Dept. of Development Planning and Urban Management
- Relevant Council Departments.
- Relevant Municipal Entities (City Power, Joburg Water etc.)

b. Public Stakeholders and developers

To ensure relevant and needs-accurate inputs were obtained, the consultation process was targeted at public stakeholders and developers that are directly involved in the planning and development of the Eastern Sub-Region and its different precincts. These included:

- Environmental Action Groups
- Property Owners
- Town Planning Consultants
- Ward Committees
- Developers

SECTION 2: STATUS QUO

2.1. CONTEXTUAL SETTING

The study was dealt with on 2 geographical levels. The first level constitutes a sub-regional level, dividing Region A into 3 sub-regions. The sub-region relevant to this study is referred to as the **Eastern Sub-Region**. It borders the Midrand strip to the east, the Tshwane municipal area to the north, the N1 freeway to the south and Dainfern to the west. The Eastern Sub-Region is depicted in Figure 1. Figure 2 depicts an aerial photograph of the Eastern Sub-Region.

The second geographical level constitutes a precinct level and involved the subdivision of the Eastern Sub-Region into 4 precincts. The Precincts are listed below.

a. Blue Hills Precinct

The Blue Hills Precinct is located on the north western boundary of Midrand. General area information and character includes the following:

- Situated west of the N1 Olifantsfontein Interchange
- Located between Midrand and the planned PWV 9 freeway
- Common boundary with Tshwane to the north
- Located in close proximity of the Olievenhoutbosch development Initiative
- Located north of the Kyalami
- Predominantly comprises Agricultural Holdings (Blue Hill, Crowthorne, Erand, Carlswald, Witpoort, Beaulieu) but also includes residential suburbs, e.g. Noordwyk, Country View & Sagewood

b. Kyalami Precinct

The Kyalami Precinct is located on the western boundary of Midrand. General area information and character includes the following:

- Situated west from N1 Allandale interchange
- Located between the Midrand Nodal Area and the planned PWV 9 freeway
- Borders the Blue Hills Precinct to the North and the Sunninghill Precinct to the south
- Comprises a mix of land uses, including residential, business parks and agricultural holdings
- The Kyalami motor race track is a prominent feature within the precinct
- Environmental and Open Space elements include the Jukskei River and Braamfontein Spruit

c. Sunninghill Precinct

The Sunninghill Precinct is located on the south western boundary of Midrand, north of and adjacent to the N1 highway. General area information and character includes the following:

- Interfaces with the Midrand Metropolitan Node, Kyalami Park, Sunninghill Precinct and Leeuwkop Correctional Services
- Predominant land uses include office parks within the Sunninghill nodal area, cluster residential and some agricultural holdings
- Includes a portion of undeveloped Mia Trust land
- Environmental and Open Space elements include the Braamfontein Spruit, Sand River, Megawatt Park sports complex and Rivonia Country Club

d. Witpoort Precinct

The Witpoort Precinct deliberately demarcated along the planned PWV9 route to enable the planning of land use development along this route in conjunction with the planning of this route. In this regard the timing of the PWV9 construction is of specific importance. General area information and character include the following:

- Municipal boundary interface with the City of Tshwane to the north
- Land use is predominantly agricultural
- Leeuwkop Correctional Services is situated within the southern extremes of this precinct
- Surrounded by the Blue Hills, Kyalami, Sunninghill, Diepsloot and Fourways precincts
- Environmental and Open Space elements include the Inanda Country Base and Leeuwkop recreational area

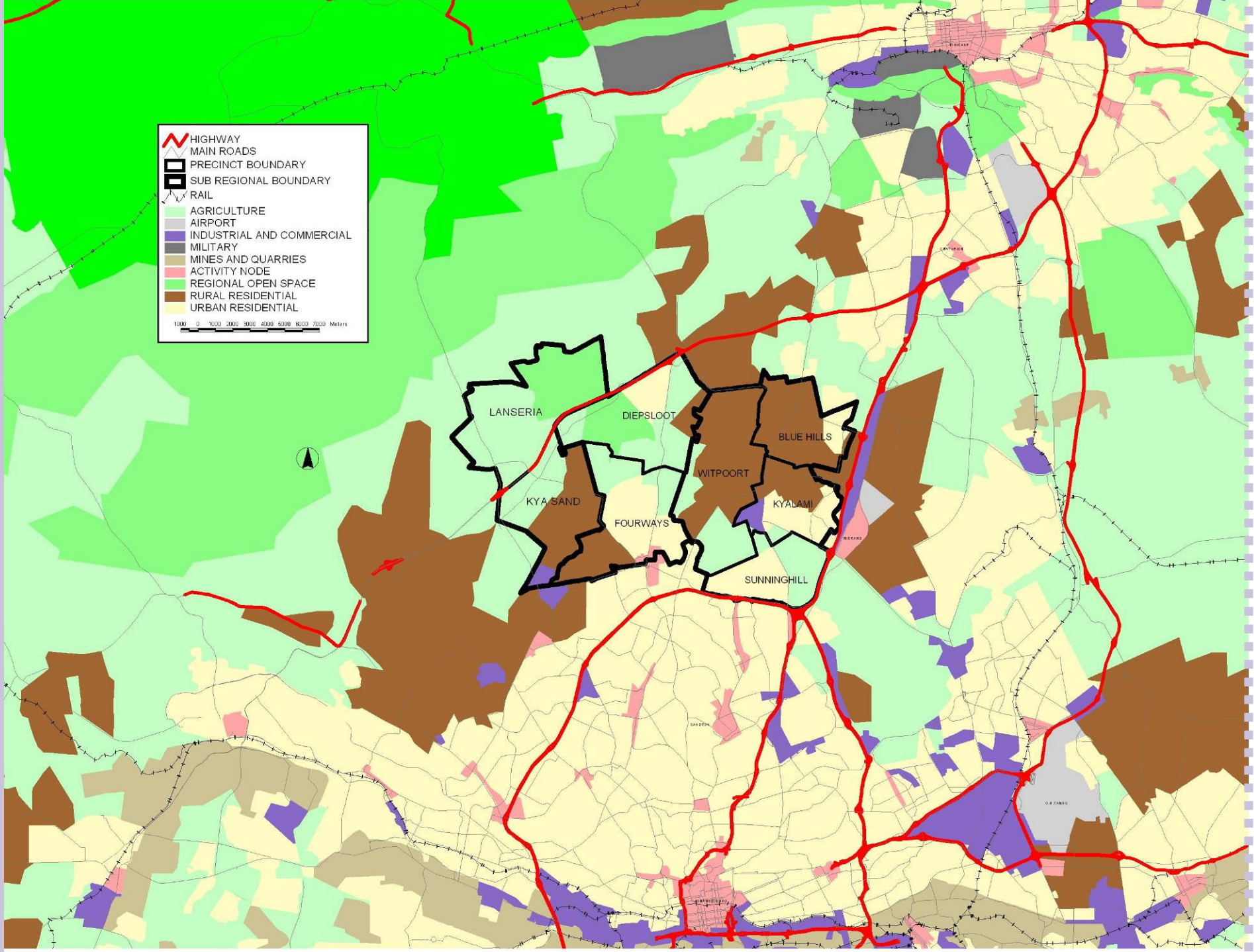


FIGURE 1
STUDY AREA LOCALITY

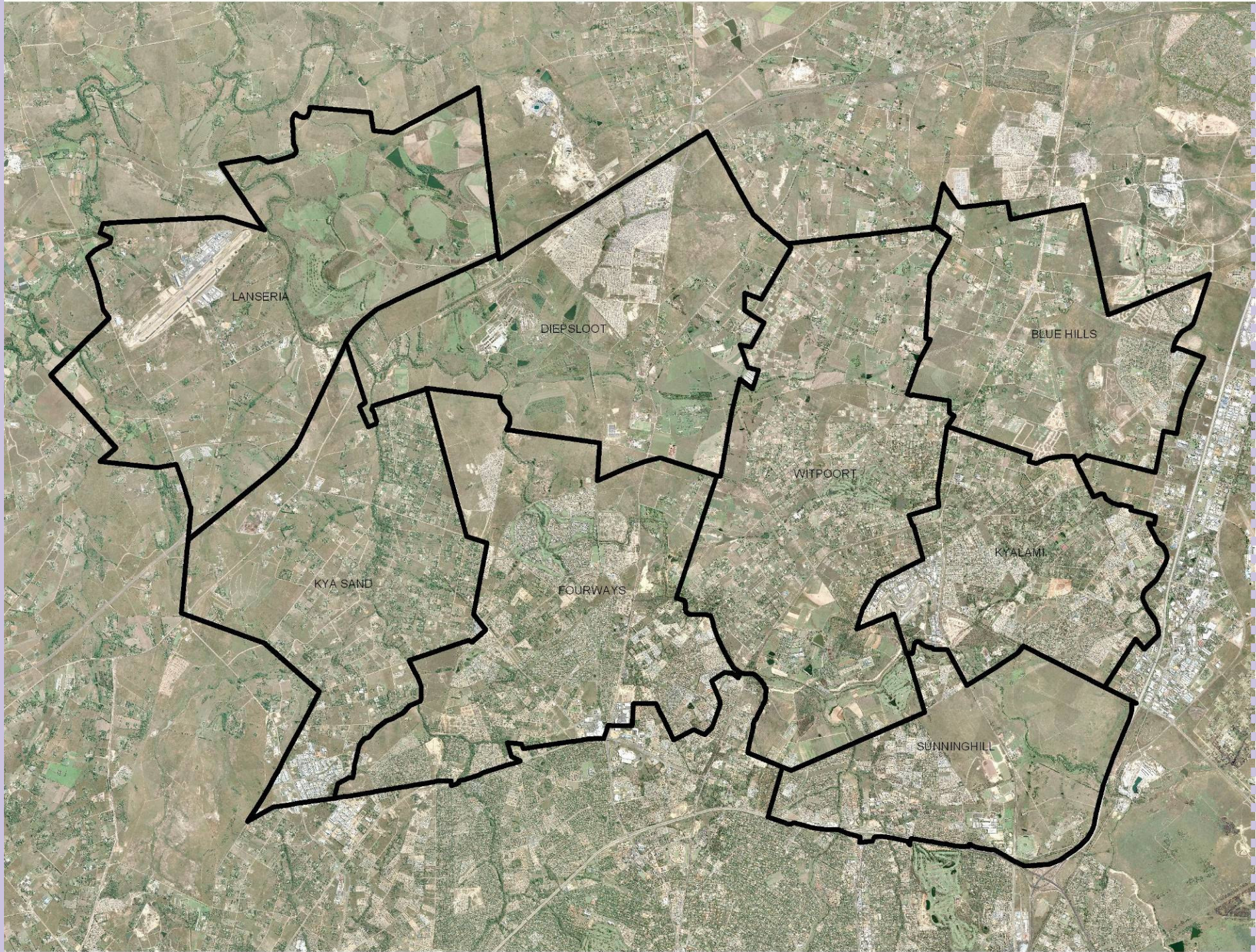


FIGURE 2
AERIAL PHOTOGRAPH

2.2. SOCIO-ECONOMIC

2.2.1. SOCIO-DEMOGRAPHIC PROFILE

The purpose of this section is to provide an analysis of Eastern Sub-Region in terms of its socio-demographic development, particularly with regard to family structure and education.

2.2.1.1. POPULATION AND HOUSEHOLDS

The Eastern Sub-Region population was calculated using Census 2001 figures. As depicted by the Table below, Eastern Sub-Region housed a population of approximately 43000 people by the year 2001. It was estimated that this population had increased to approximately 51000 people by the year 2007. The number of households the lived in Eastern Sub-Region by 2001 was estimated to be approximately 14000. This figure has increased to an estimated 19000 by 2007.

TABLE 1: EASTERN SUB-REGION POPULATION 2007

Item	Census 2001	Estimate 2007
Population	42936	51481
Households	14228	19067
Formal Households	13932	18670
Informal Households	296	397

Source: Estimated from Census 2001 figures

2.2.1.2. AGE PROFILE

The Diagram below reflects the age distribution within Eastern Sub-Region. From this Diagram it can be concluded that Eastern Sub-Region has a predominantly middle-age population with most of the residents between the ages of 20 and 49 years. The relatively low number of children within the Eastern Sub-Region is indicative of small household sizes.

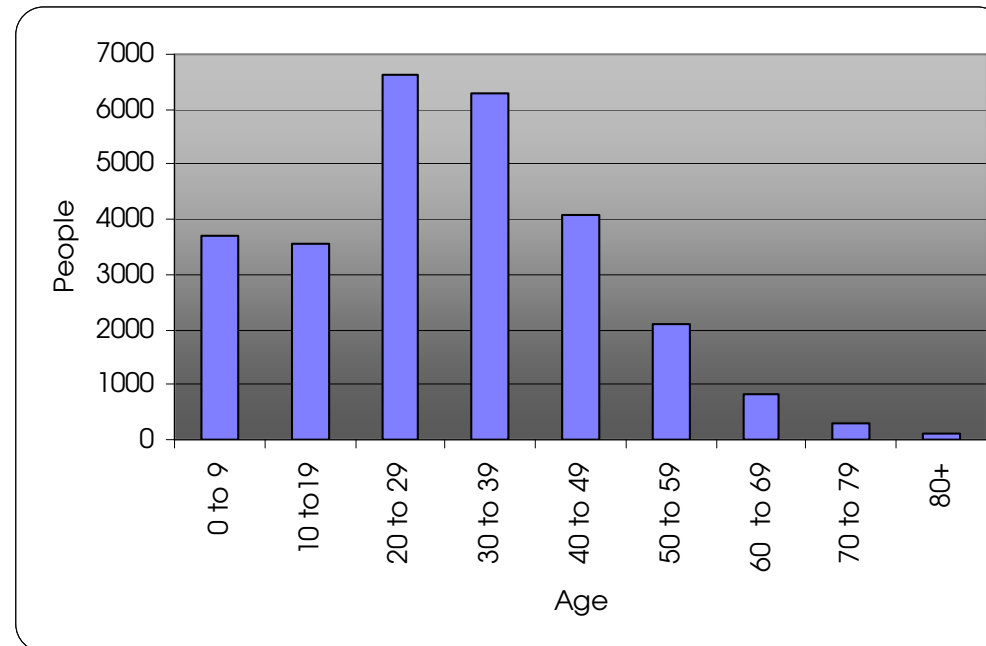


DIAGRAM 1: AGE PROFILE
Source: Census 2001

2.2.1.3. MARITAL STATUS

The Diagram below shows the marital status of persons living within the Eastern Sub-Region. According to this Diagram, single is the predominant marital status within the Eastern Sub-Region, with almost 50% of the people surveyed falling within this category. The low number of children within the Eastern Sub-Region can most probably be linked to the low number of married couples within the Eastern Sub-Region. Only 32% of the population is married, the second largest category, with an additional 5% married the traditional way. A total of 7% of the Eastern Sub-Region population live together.

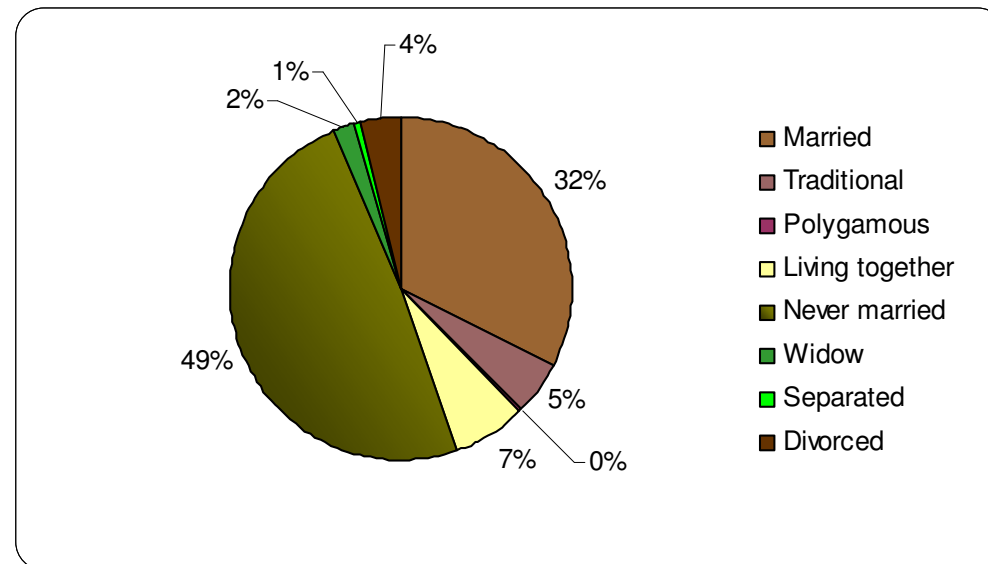


DIAGRAM 2: MARITAL STATUS
Source: Census 2001

2.2.1.4. EDUCATION LEVEL

The Diagram below illustrates the education levels within Eastern Sub-Region. This Diagram shows that 60% of the residents living within the Eastern Sub-Region have completed secondary school education. In total, 18% of the Eastern Sub-Region population only has a primary school education and 14% of the population has completed a degree. The percentage graduates are high compared to a national average. Higher education levels are usually associated with higher income levels and certain employment categories, such as professional and managerial positions.

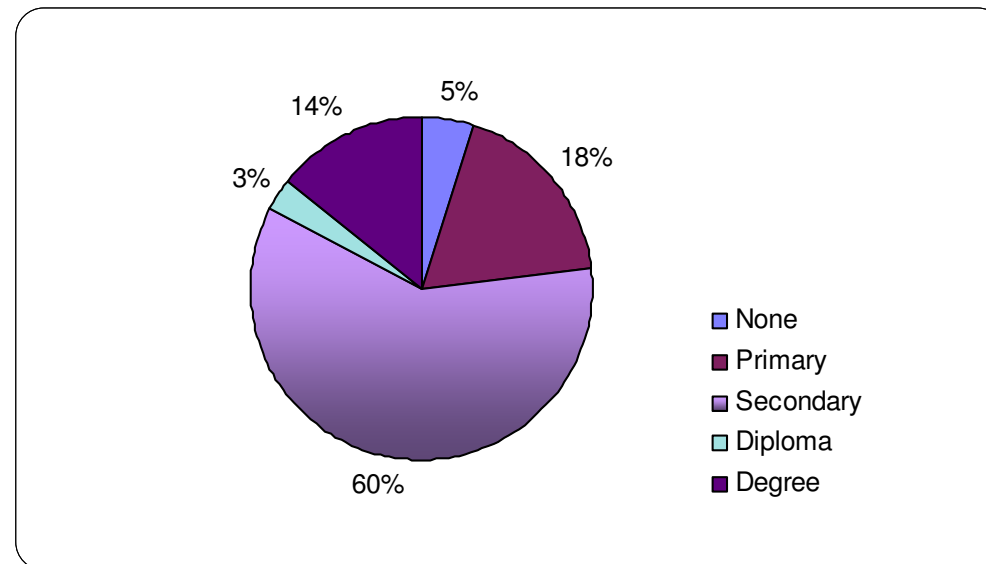


DIAGRAM 3: EDUCATION LEVEL
Source: Census 2001

2.2.1.5. MIGRATION RATE

The Diagram below illustrates the number of people who lived in Eastern Sub-Region for more than 5 years, versus the number of people who lived in Eastern Sub-Region for less than 5 years. It is evident from this diagram that Eastern Sub-Region is a relatively new community, with almost 50% of its residents not having lived within the Eastern Sub-Region for more than 5 years, but have in-migrated from other areas.

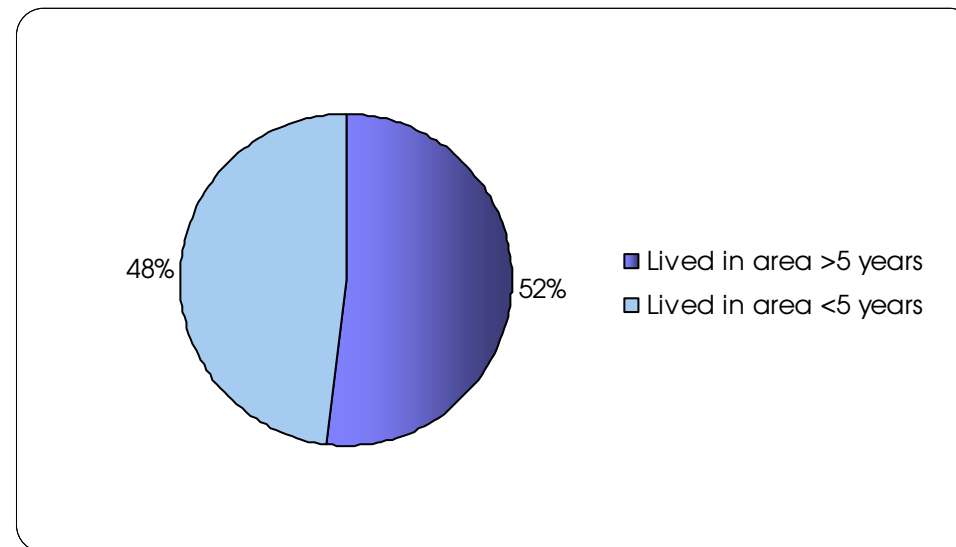


DIAGRAM 4: MIGRATION RATE
Source: Census 2001

2.2.2. ECONOMIC OVERVIEW

The purpose of this section is to perform an analysis of Eastern Sub-Region in terms of its economic development, particularly with regard to employment, income and expenditure patterns.

2.2.2.1. MACRO ECONOMIC INDICATORS

Gauteng Province is the greatest contributor to the national economy, as depicted by the Diagram below. It contributes in excess of 30% of the national GDP. This illustrates the economic strength of Gauteng and labels it the undisputed economic powerhouse of South Africa. It also makes it one of the primary economic entities within Africa, rivalling many of the GDPs of entire countries within Africa.

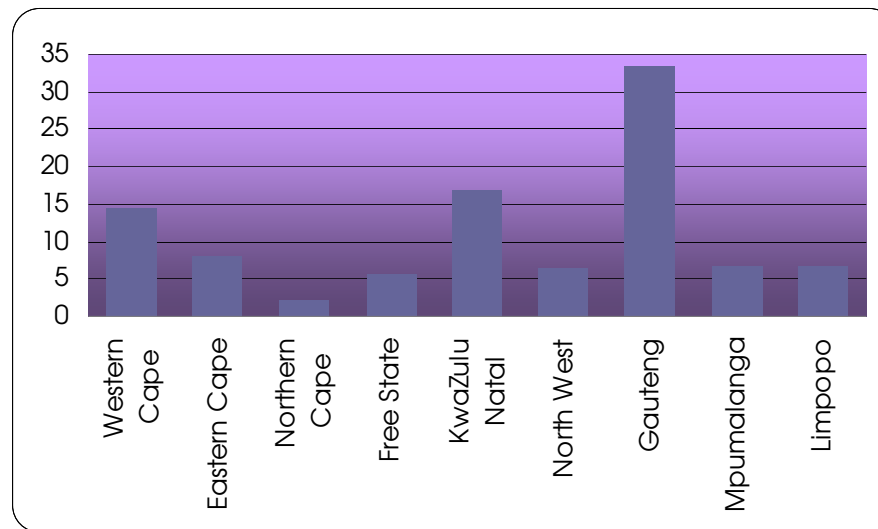


DIAGRAM 5: GAUTENG GDP CONTRIBUTION OF SA ECONOMY
 Source: SA Statistics, 2004

As depicted by the Diagram below, Gauteng Province has a diversified economy and is no longer an economy reliant of the mining sector. In fact, the mining sector is the second smallest contributor to the provincial economy, after agriculture. Gauteng has a strong finance and housing sector, manufacturing sector, retail sector, transport and communications sector, and governmental sector.

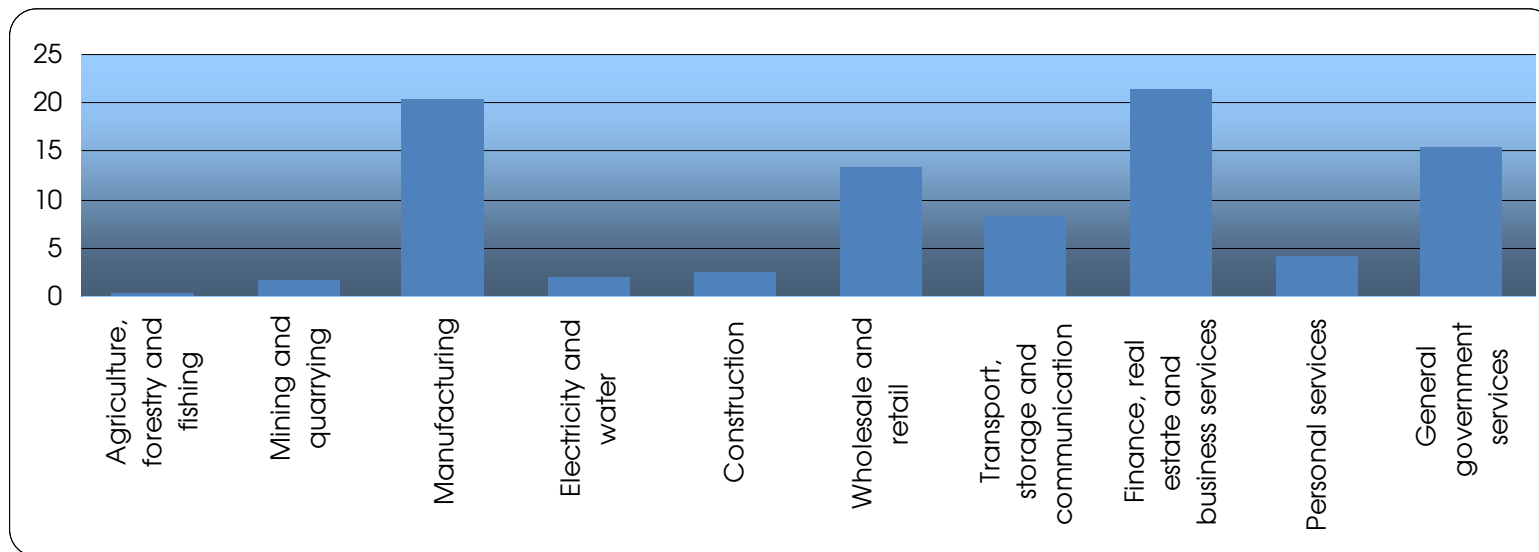


DIAGRAM 6: GAUTENG GDP PER INDUSTRY
Source: SA Statistics, 2004

2.2.2.2. LEVEL OF EMPLOYMENT

The unemployment rate can be expressed as the number of economically active people who are willing and able to work but do not have jobs. Unemployment is one of the major contributors to poverty as unemployed people are not able to provide for their household’s basic needs due to the lack of disposable income. The Diagram above indicates low unemployment levels within Eastern Sub-Region, with only 6% of the economically active population unemployed. The high employment levels (94%) match the high levels of education found within the Eastern Sub-Region.

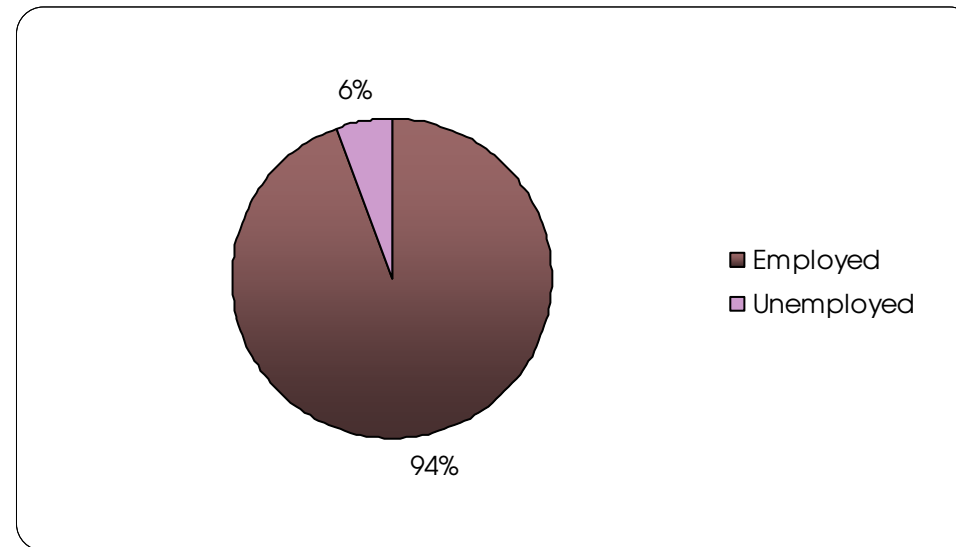


DIAGRAM 7: LEVEL OF EMPLOYMENT
Source: Census, 2001

2.2.2.3. SECTOR EMPLOYMENT

The Diagram below shows major employment sectors that employ residents living within the Eastern Sub-Region. The key sector employing Eastern Sub-Region residents is the financial sector. It can be assumed that neighbouring financial centres, such as Sandton, contribute significantly to this statistic. The financial sector is followed by the retail sector as the second largest employer of Eastern Sub-Region residents.

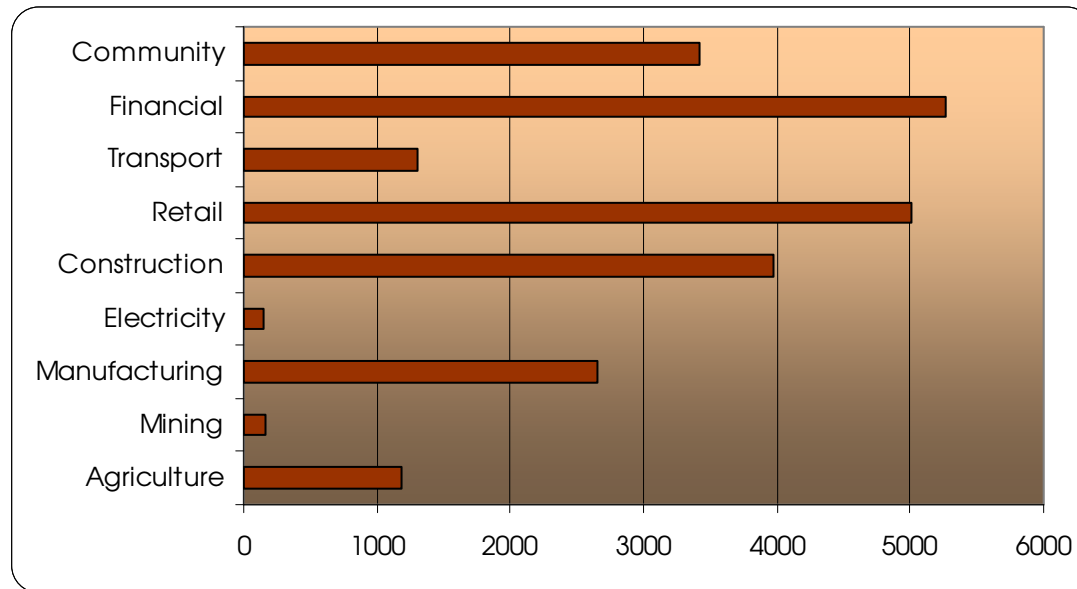


DIAGRAM 8: EMPLOYMENT BY SECTOR, 2001
Source: Census, 2001

2.2.2.4. OCCUPATION

The Diagram below depicts the occupations held by economically active persons within Eastern Sub-Region. Of these, most persons within the Eastern Sub-Region are professionals, followed by officials and technicians. In general, most economically active persons within Eastern Sub-Region do not occupy low-skilled positions. Occupation relates directly to other economic factors, such employment levels and income.

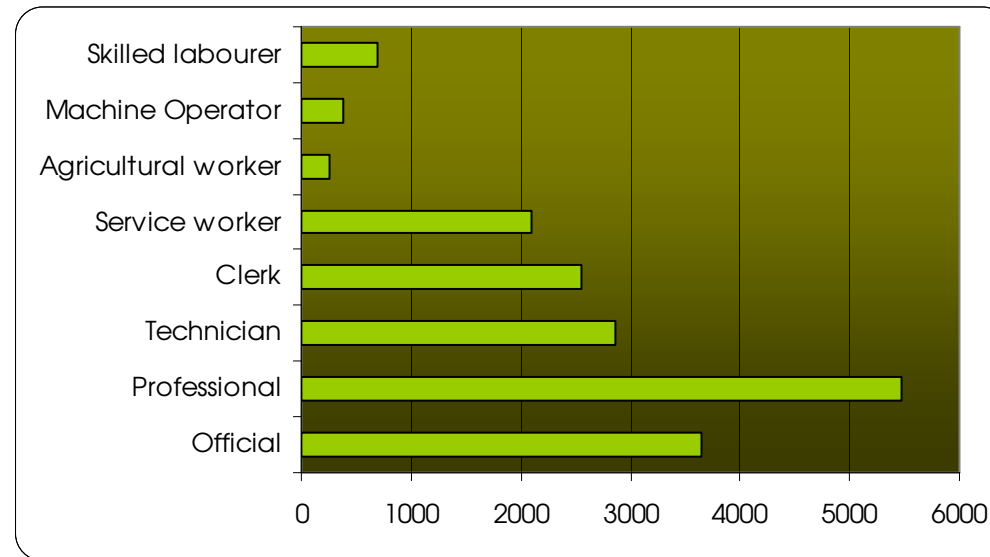


DIAGRAM 9: OCCUPATION
Source: Census 2001

2.2.2.5. ANNUAL HOUSEHOLD INCOME

Household income levels are most generally used as an indicator of the general economic well being of a community. The Diagram below gives an estimate of the annual household incomes within the Eastern Sub-Region. It is clear from the Diagram below that the average annual income of income-earning households within Eastern Sub-Region is high, with most households earning an income of between R150000 and R300000 per year. A significant number of households within Eastern Sub-Region earn more than R300000 per annum.

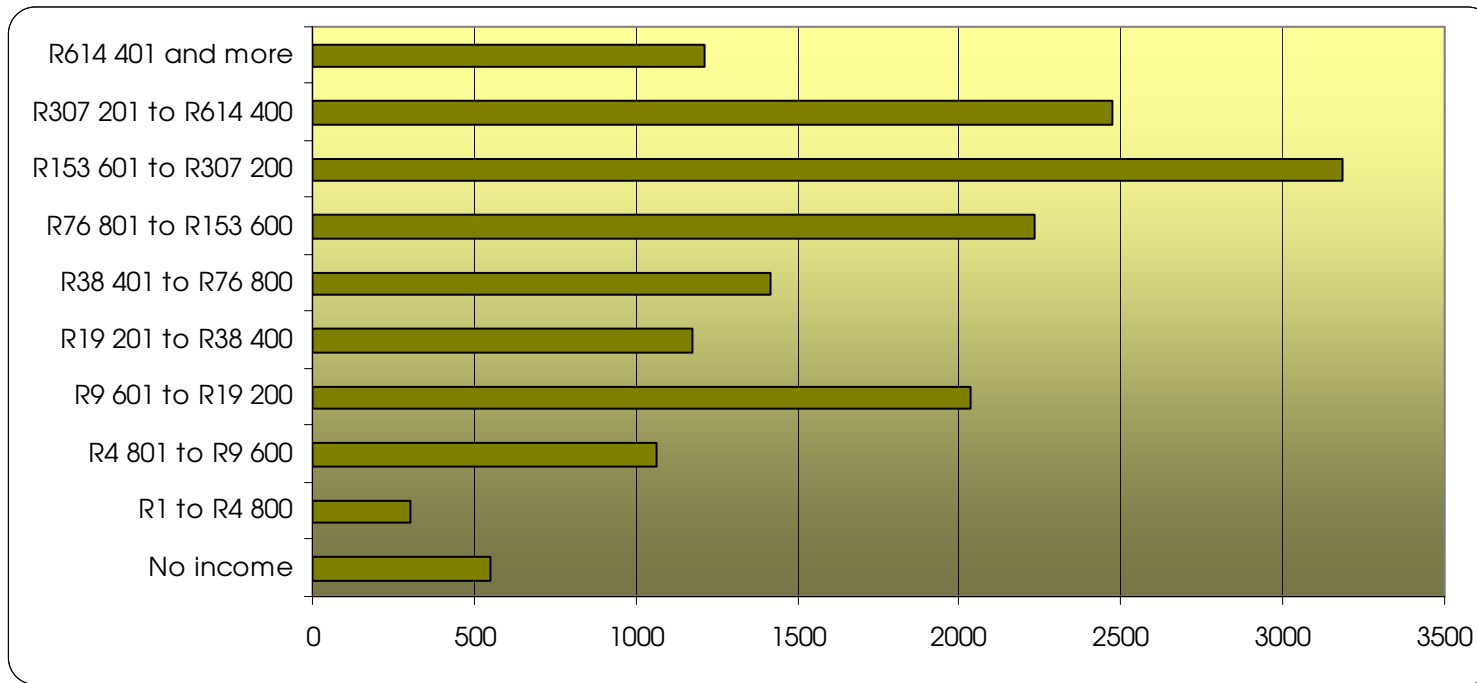


DIAGRAM 10: ANNUAL HOUSEHOLD INCOME
Source: Census 2001

2.2.2.6. INDIVIDUAL MONTHLY INCOME

The Diagram below gives an estimate of the monthly incomes of income-earning individuals living within Eastern Sub-Region. It is clear from the Diagram below that the average income earner within Eastern Sub-Region earns between R12000 and R25000 per month. A significant portion of the Eastern Sub-Region population earns more than R25000 per month.

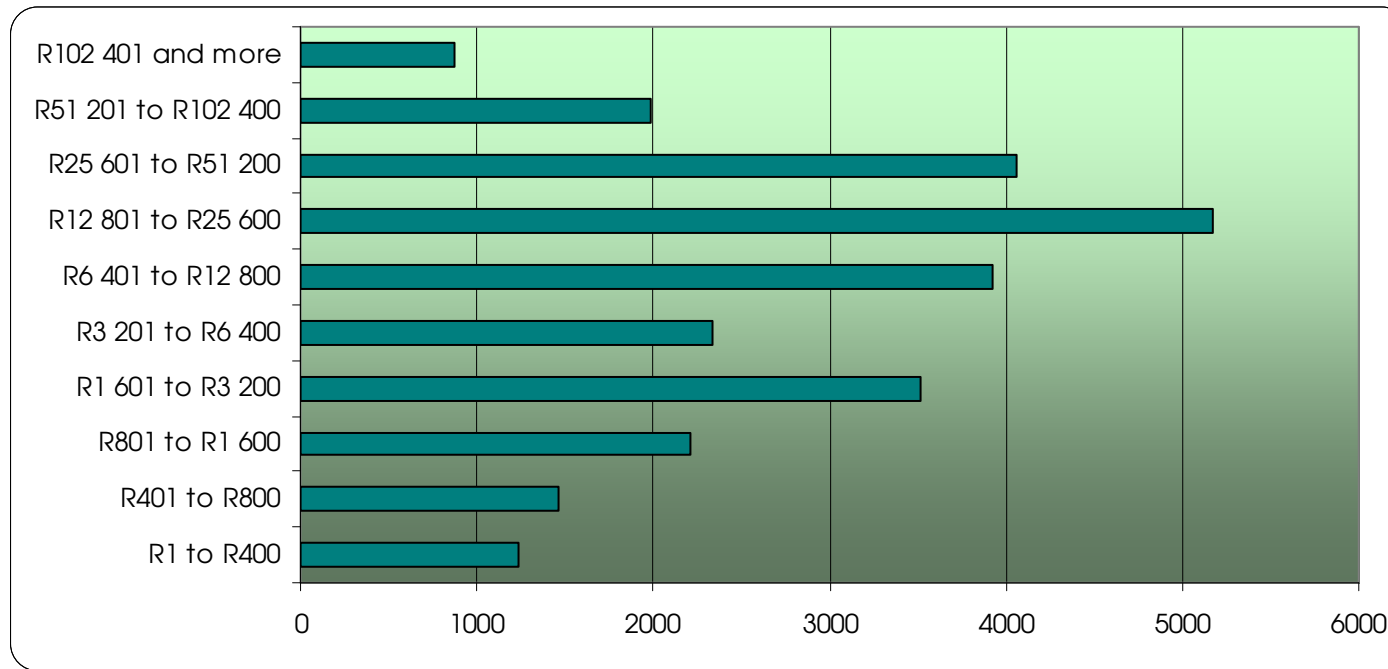


DIAGRAM 11: MONTHLY INDIVIDUAL INCOME
Source: Census 2001

2.3. TRANSPORTATION

2.3.1. MOVEMENT PATTERN

Movement patterns provide an understanding of how an area functions, because it illustrates the spatial relationships between settlements and core areas and the linkages that exist between such spatial entities. The Diagram below depicts the movement

of people between the Eastern Sub-Region region and the neighbouring core areas (employment and shopping areas). Four primary core areas surround Eastern Sub-Region. These core areas are Midrand, Sunninghill, Fourways and Centurion. The strongest movement of people is between the Eastern Sub-Region and the employment and shopping areas of Midrand and Sunninghill (and onwards to Rivonia, Sandton and Rosebank). Strong movement also exists between the Eastern Sub-Region and Fourways, and to a lesser extent between the Eastern Sub-Region and Centurion.

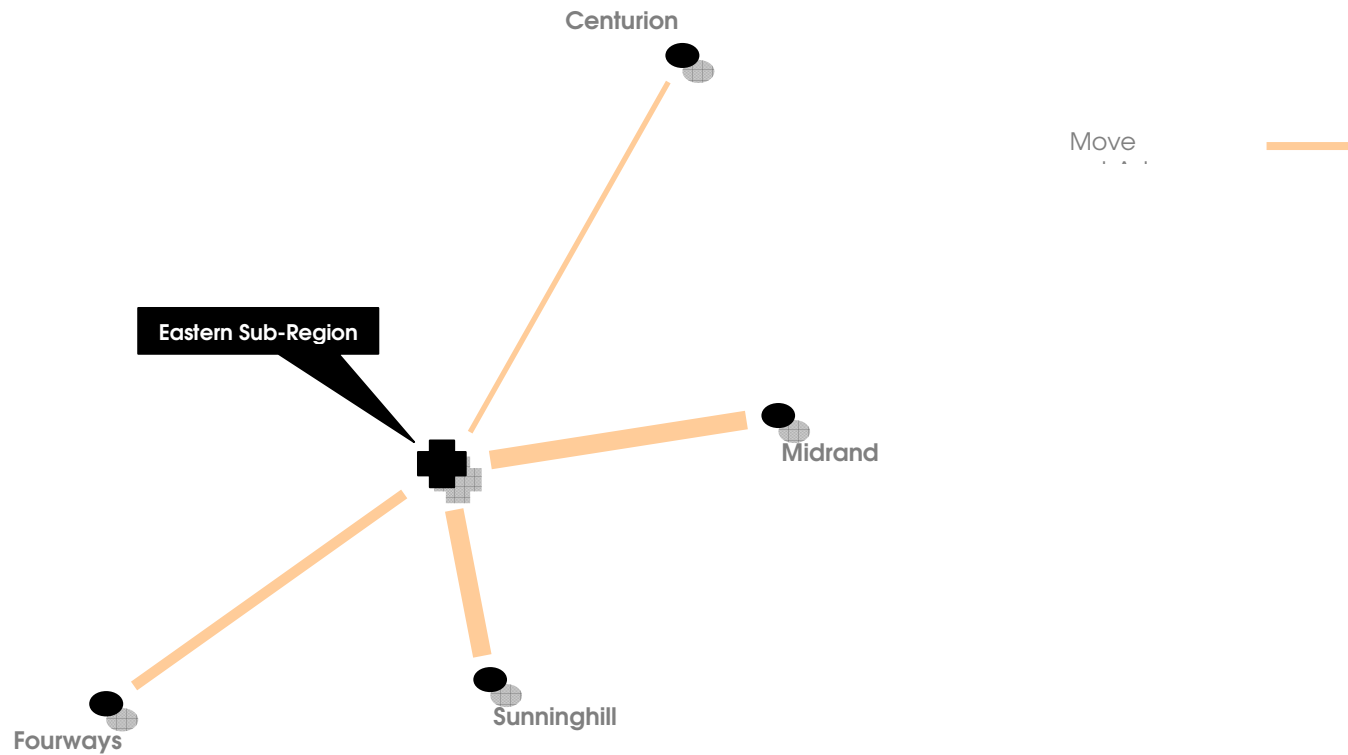


DIAGRAM 12: MOVEMENT AXIS

The Diagram below provides an indication of the modes of transport that commuters within Eastern Sub-Region use to access employment opportunities and social amenities. According to this Diagram, most people within the Eastern Sub-Region access employment opportunities and social amenities by foot. This high pedestrian number can be attributed to farm workers living on the agricultural holdings located within the Eastern Sub-Region. Private vehicles are the motorized mode of transport most used to access employment opportunities and social amenities within the Eastern Sub-Region. Mini-bus taxis and busses make up the public transportation segment, but are not widely used within Eastern Sub-Region.

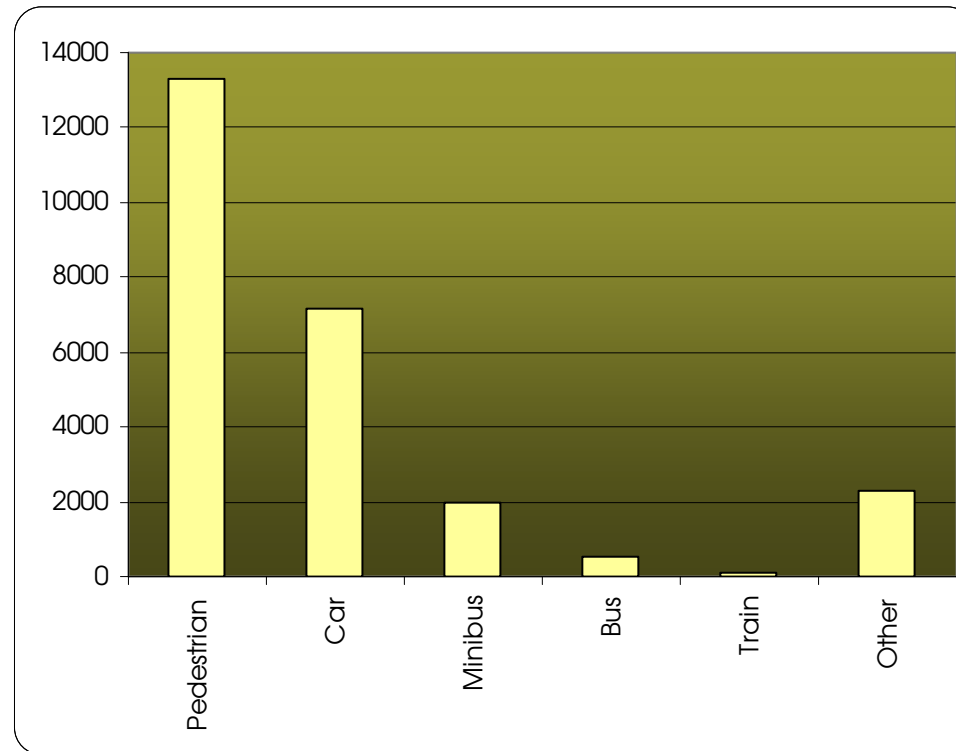


DIAGRAM 13: MODE OF TRANSPORT
Source: Census 2001

The modes of transport used set out above points to a situation where higher-income households are mobile because they own cars, while lower-income households have to walk to access employment opportunities and social amenities because of a lack of public transport serving the Eastern Sub-Region. The provision of public transport within the Eastern Sub-Region will have to be addressed in order to achieve a more equitable and sustainable social environment within the Eastern Sub-Region.

2.3.2. ROAD INFRASTRUCTURE

In South Africa, a typical road hierarchy functions on 4 levels (see Diagram below). The first level contains freeways, consisting of national freeways and provincial PWV roads. These roads provide regional access, connecting an area to neighbouring cities and towns. The second level comprises distributor roads or K-routes, which aim to provide better intra-urban access between suburbs and activity areas. The third level comprises collector roads. These roads connect residential areas to the mentioned distributor road network. On the fourth level, internal streets provide direct access to the land uses and link these land uses to the mentioned collector roads. In essence, freeways and distributor roads are highly mobile and therefore aim to connect people over large distances to activity areas and neighbouring settlements. Collector roads and internal streets provide good accessibility and therefore aim to connect people and land uses to the more mobile roads. Road-based public transportation systems (taxis and busses) mostly use distributor roads and collector roads, as these provide an efficient balance between mobility and land use accessibility.

Figure 3 depicts the road network serving Eastern Sub-Region. As illustrated by this Figure, the N1 freeway passes the eastern and southern boundaries of the Eastern Sub-Region and the P158 freeway the northern boundary of the Eastern Sub-Region. In addition, the PWV9 and PWV5 are planned freeways that will cross the Eastern Sub-Region. The PWV9 will link the Sandton region to Centurion and Soshanguve and the PWV5 will link the Roodepoort region to the Midrand region. The PWV9 and PWV5 will intersect (using system interchange) in the Blue Hills region of the Eastern Sub-Region.

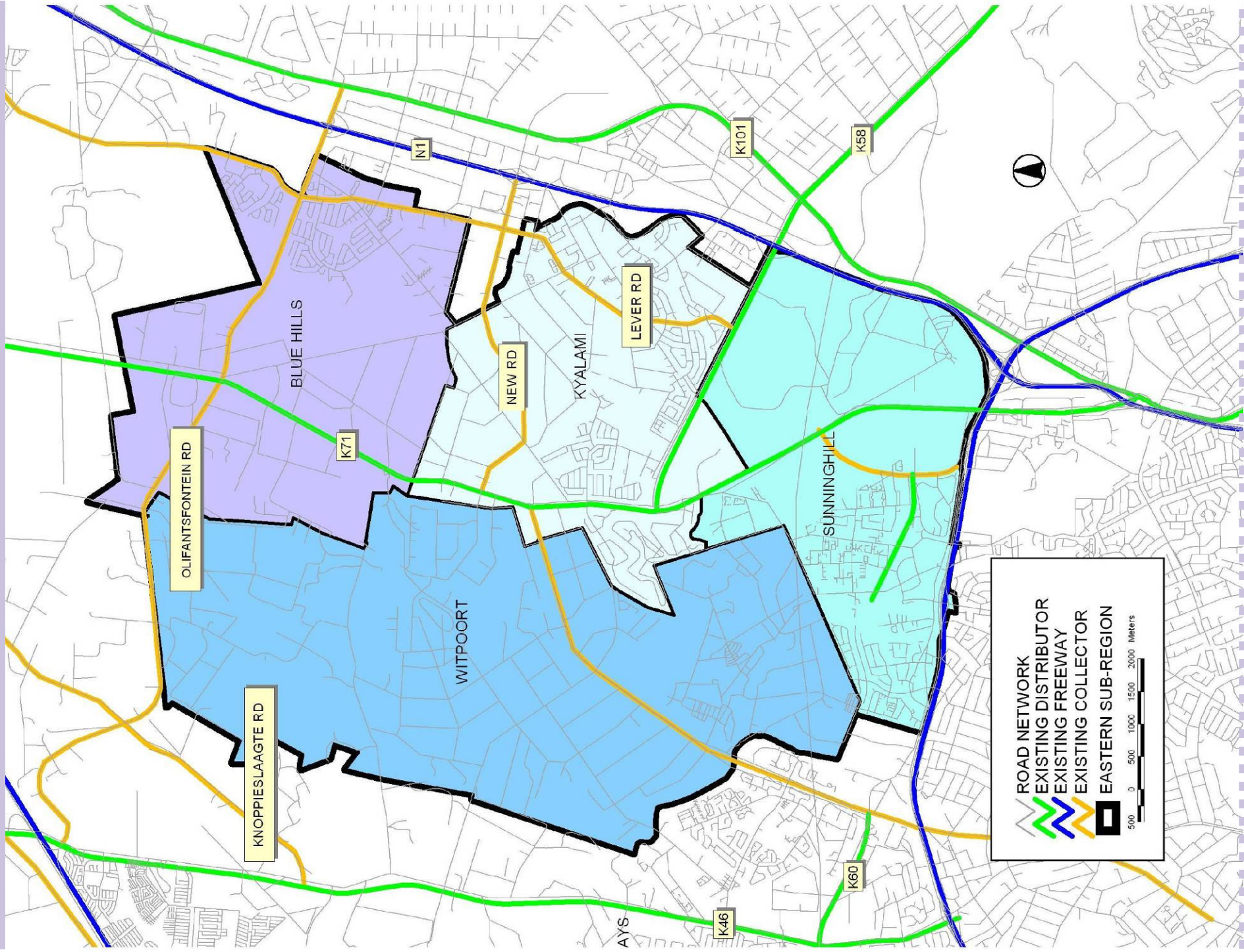


FIGURE 3
TRANSPORTATION INFRASTRUCTURE

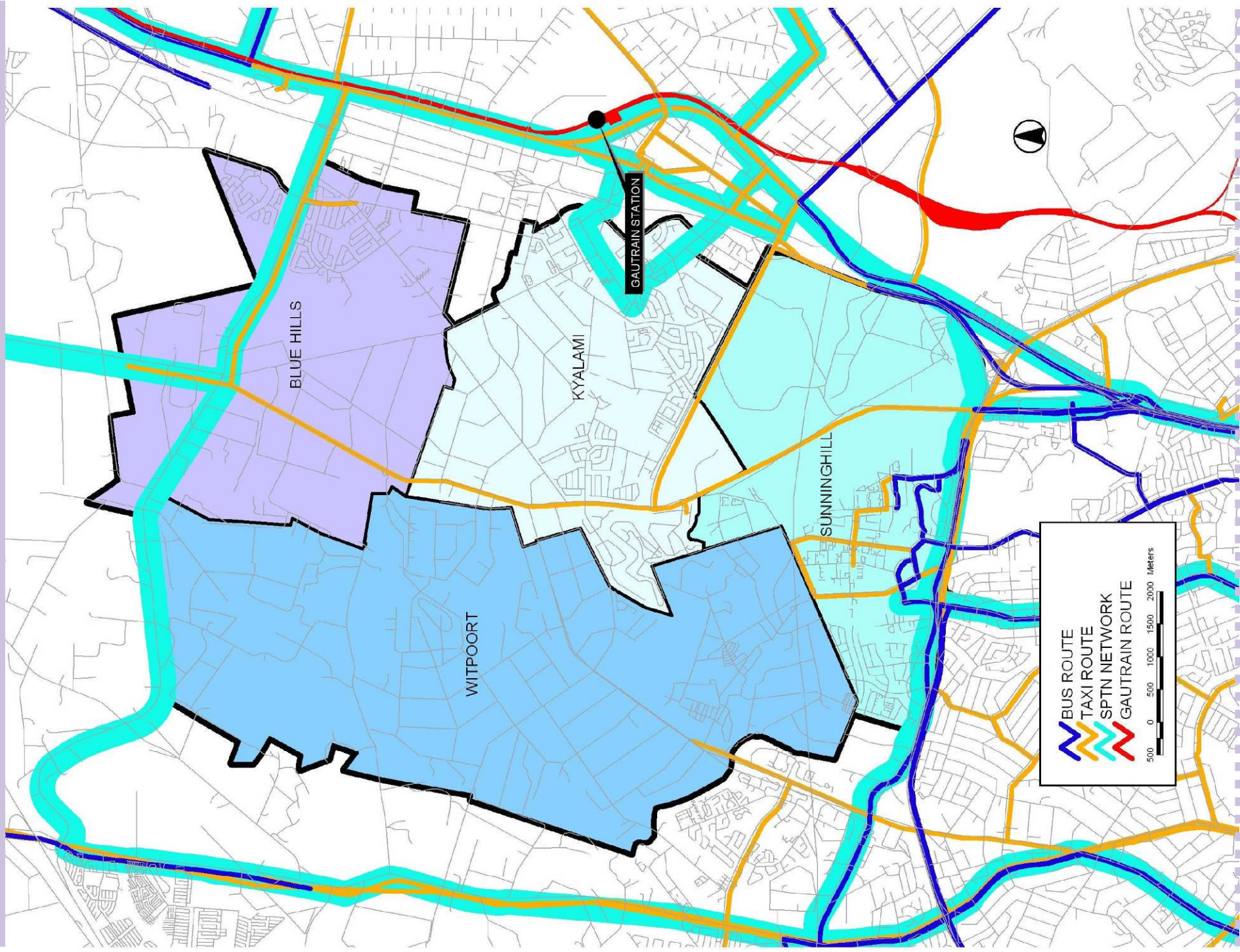


FIGURE 4
PUBLIC TRANSPORTATION NETWORK

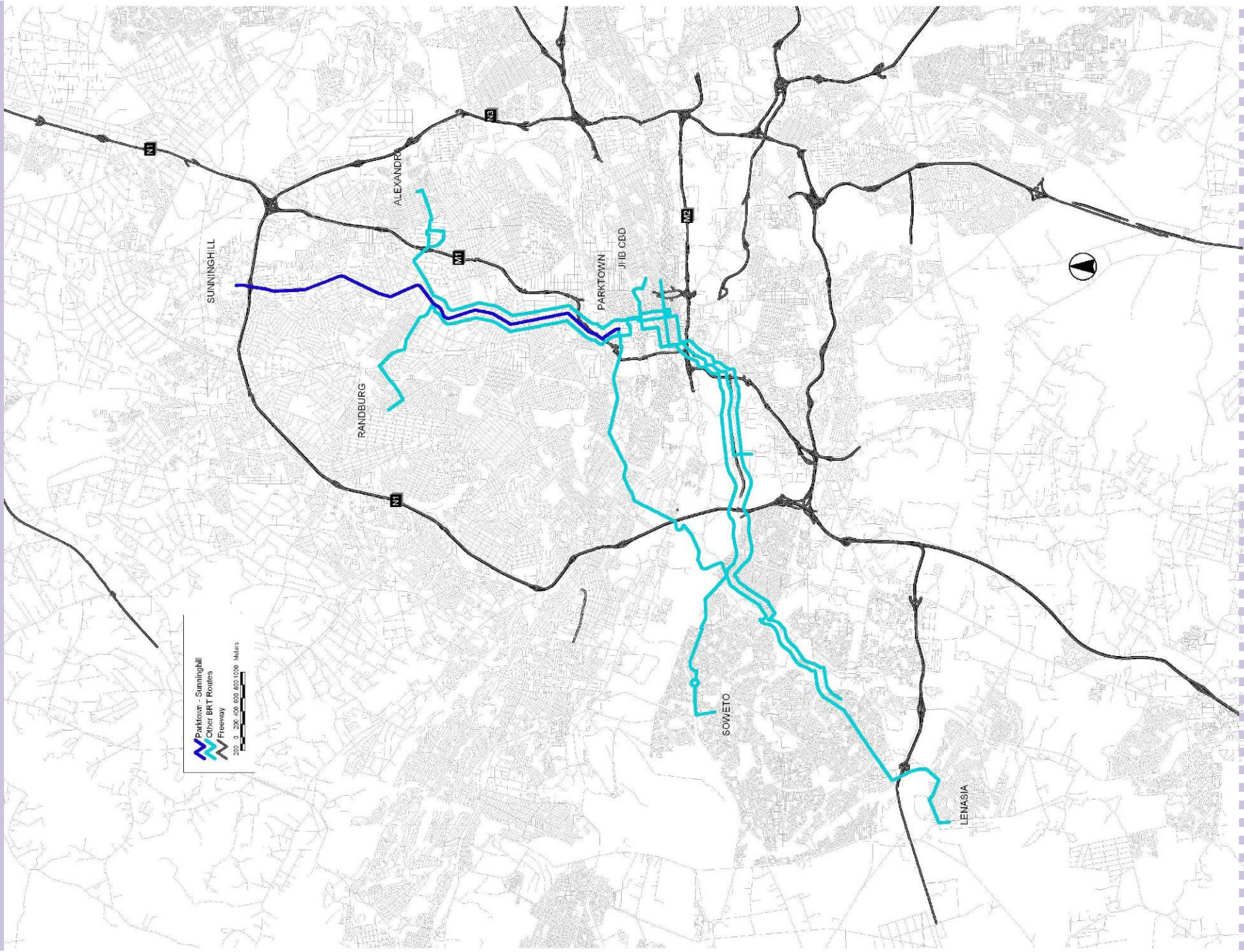


FIGURE 5
BRT PHASE 1 NETWORK

Three distributor roads currently serve Eastern Sub-Region. The first is the K60 (Witkoppen Road), which is a partially-constructed dual carriageway that will ultimately link Sunninghill to Fourways and provides an alternative route to the N1 freeway. A second is the K58 (Allandale Road), which is an east-west aligned distributor road that links Kyalami to Midrand and Ivory Park across the N1 freeway. A distributor road providing north-south linkage is the K71 (Main Road), linking Woodmead and Mia’s Land to Olievenhoutbosch in the north. Planned distributor roads include the K56, K52 and the K73. The K56 will be aligned through the centre on the Eastern Sub-Region and will link Cosmo City and Kya Sand to Midrand. The K52 will be aligned on the northern boundary of the Eastern Sub-Region, and will provide an east-west link between Olievenhoutbosch and Centurion. The K73 will be a north-south link between Sunninghill to the Centurion region.

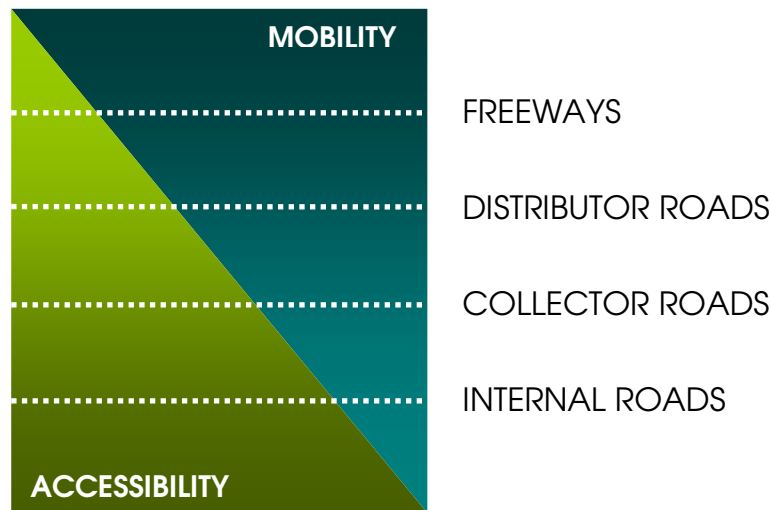


DIAGRAM 14: MOBILITY-ACCESSIBILITY RATIO

Compared to the freeway and distributor road network, the collector road network is poorly conceived and developed. This creates a situation whereby the internal road network designed to serve small holdings is used by high commuter numbers to access employment and shopping areas within the region. The only collector roads of note are Lever Road linking Vorna Valley to Noordwyk, Olifantsfontein Road linking Midrand to Olievenhoutbosch, New Road linking Midrand to the Main Road (K71) and Main Road linking Kyalami to Bryanston.

2.3.3. PUBLIC TRANSPORTATION

As depicted on Figure 4, minibus-taxis and busses currently serve the Eastern Sub-Region. Main Road (K71) currently function as the primary minibus-taxi route traversing the Eastern Sub-Region, with the N1 freeway and the K101 (Old Pretoria Road) being other important minibus-taxi routes affecting the Eastern Sub-Region, but not traversing it. Busses serving the Eastern Sub-Region most use the K60 (Witkoppen Road), as well as the N1 freeway up to Midrand.

Three public transport initiatives, most of which are in planning and construction phase, will impact on the Study Area's public transportation network. These include the Johannesburg SPTN network, which primarily caters for the municipal bus service, the Johannesburg Bus Rapid Transit system, which will provide fixed-line bus service (similar to light-rail), and the Provincial Gautrain initiative. Although all these public transportation systems will only border the Eastern Sub-Region, these provide the opportunity of future public transportation systems within the Eastern Sub-Region to link to. This will give the Eastern Sub-Region access to the hierarchy of public transportation modes servicing different geographic levels (from metropolitan to provincial). This will greatly improve the current public transportation system serving the Eastern Sub-Region and provide strong spatial structuring elements to guide and shape future urban development within the Eastern Sub-Region.

2.3.3.1. SPTN NETWORK

The SPTN network consists on a number of existing and planned road-based public transportation routes serving the Johannesburg metropolitan area and is prepared by the Municipality. To date, the SPTN network reflects the current level on urbanization within the Eastern Sub-Region, thus only serving the existing nodes and residential areas within the Eastern Sub Region. As a result, the SPTN network most straddles the boundaries of the Eastern Sub-Region. to the north, the SPTN network links Diepsloot and Blue Hills to the N1 freeway at the Olifantsfontein interchange. The N1 freeway and K101 (Old Pretoria Road) both form part of the north-south leg of the SPTN network affecting the Eastern Sub-Region. The K60 or Witkoppen Road forms the southern east-west leg the SPTN network affecting the Eastern Sub-Region. What is of particular significance is the fact that the SPTN network does not utilize the K71 or Main Road as part of its network, thus not using the opportunity to link Woodmead, Kyalami and Olievenhoutbosch.

2.3.3.2. BRT PHASE ONE

Bus Rapid Transit (BRT) is a high-quality bus-based transit system that delivers fast, comfortable, and cost-effective urban mobility through the provision of segregated right-of-way infrastructure, rapid and frequent operations, and excellence in marketing and customer service. BRT is simply the idea of creating a modern rail-like performance using road-based public transport technologies that are affordable to most cities.

The Bus Rapid Transit (BRT) network being planned for Johannesburg border and therefore affects the Eastern Sub-Region. The phase one proposal, as depicted on Figure 5, encompasses the same flagship corridors already identified in the Strategic Public Transport Network (SPTN). These include a north-to-south route from Sunninghill to Soweto and an east-to-west route from Alexandra to Randburg. The Sunninghill to Soweto route will link a number of Nodes, including Rivonia, Sandton, Rosebank, Illovo, Killarney and Parktown. This phase one BRT network will also serve as a feeder system to the Gautrain stations located at Sandton and Rosebank. The planning and construction of phase one should be completed by 2009.

BRT stations were strategically placed at points where a potential higher passenger movement would take place. Taking into account that the average distance that people are willing to walk to access public transportation is 400 meters, stations were located 700m apart. In cases where the placement of a station was not required or simply because of physical requirements, this separation of the BRT stations was increased. In business areas, the distances between stations were shorter than the average walking distance because these areas were considered main commuter attraction zones.

2.3.3.3. GAUTRAIN AND MIDRAND STATION

Commuter rail is the most efficient and cost-effective way of moving large numbers of people over longer distances. Despite this, the Eastern Sub-Region does not have access to any commuter rail system. The closest the region comes to commuter rail is the existing Johannesburg to Tshwane freight and commuter rail line running east of and parallel to the N1 Freeway.

Currently, the high-speed Gautrain commuter rail line is being constructed between Johannesburg and Tshwane. The Midrand station will be the station located nearest to the Eastern Sub-Region and it is therefore imperative that the public transportation network serving the Eastern Sub-Region be linked to the Midrand Station once it is constructed to ensure modal linkage and allow modal transfer within the regional public transportation network. In other words, the public transportation system serving the Eastern Sub-Region should become the feeder system to the inter-regional Gautrain system.

2.4. MUNICIPAL SERVICES

The primary municipal services (water, electricity and sanitation) are briefly discussed below. It illustrates the level of municipal services provision within the Eastern Sub-Region, as well as the bulk network serving the Eastern Sub-Region. The level of service is derived for Census 2001 and only shows the existing number municipal services connections. It does not show the capacity of the bulk municipal services network to accommodate urban expansion and densification. Determining capacity involves complex calculations by engineers, thus falling outside the brief of this study.

2.4.1. WATER SUPPLY

According to the Diagram below, the majority of households that live in the Eastern Sub-Region have access to taped water within their house or a tap inside their yard. Thus, almost the entire Eastern Sub-Region population has access to piped water in one form or another, making the provision of water not a desperate need; at worst an inconvenience.

Currently, the areas located on the northern boundary of Johannesburg, including Diepsloot, are served by a Rand Water pipeline running along the N14 freeway. The areas bordering the N1 freeway (such as Kya Sands, Fourways and Sunninghill) are served by the bulk water network serving the Bryanston and Rivonia. Development pressure within Administrative Region A is increasingly placing pressure on the bulk water networks serving this region.

To resolve the above, a regional water reservoir is planned northeast of Dainfern, which will supply water to Administrative Region A. Diepsloot will be connected to this reservoir via a bulk water pipeline that is currently under construction. The southern areas of Administrative Region A, such as Kya Sands, Fourways and Sunninghill, will also be served by the planned reservoir. The new reservoir should solve current water supply problems experienced within Administrative Region A and has the capacity to provide water within the region for many years to come.

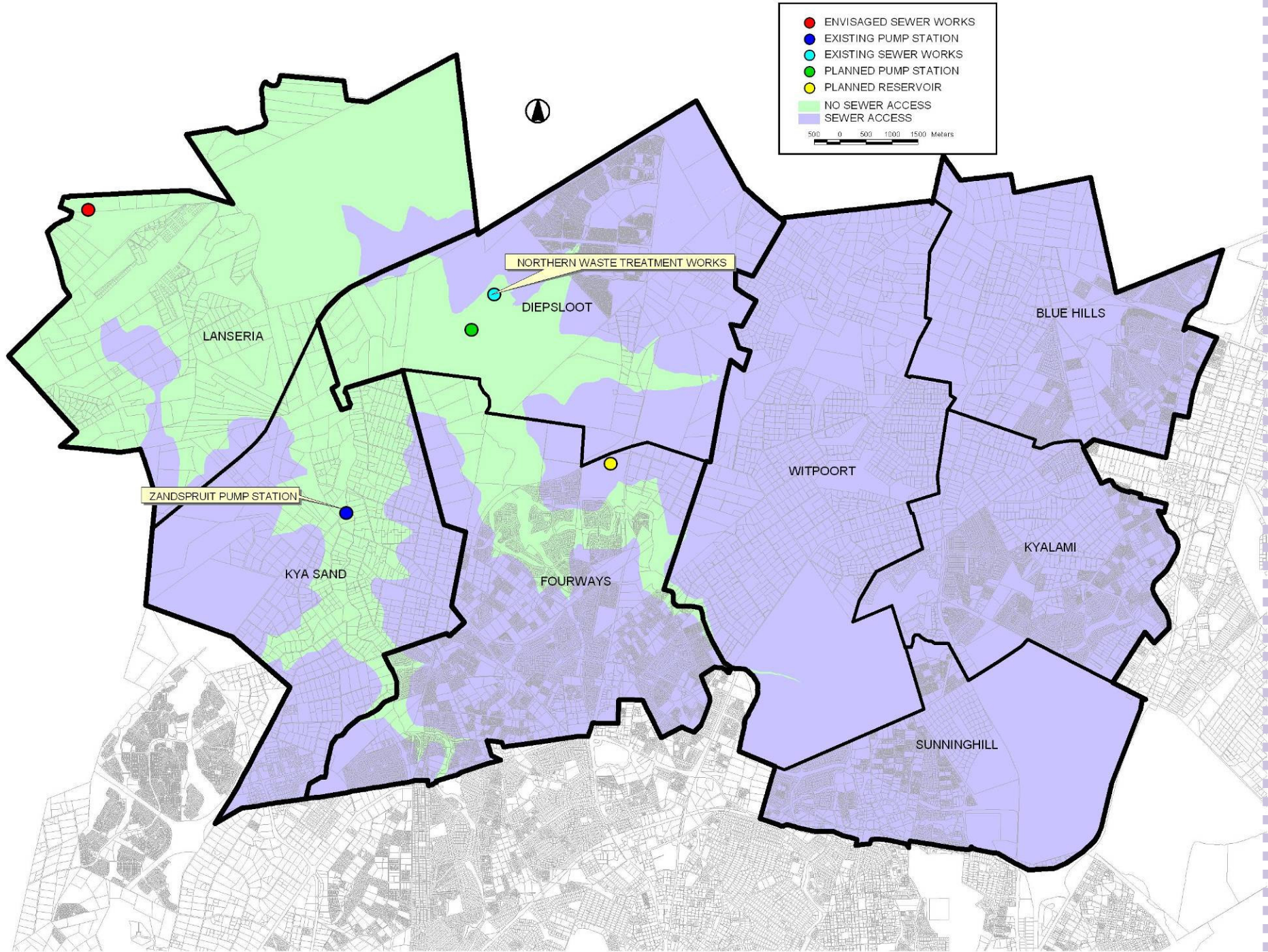


FIGURE 6
MUNICIPAL SERVICES NETWORK

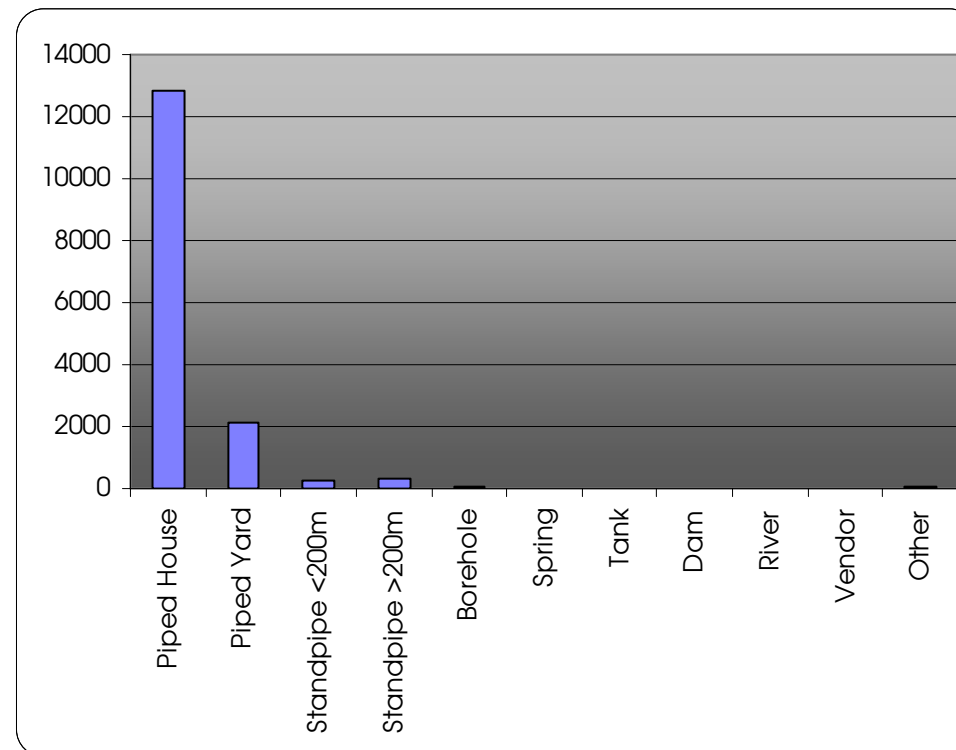


DIAGRAM 15: WATER SUPPLY
Source: Census 2001

2.4.2. SANITATION SUPPLY

Flush toilets that are connected to a sewer network are the most common form of sanitation provision. The only other sanitation system in use in the Eastern Sub-Region is the flush toilet connected to a septic tank. The system is prevalent in the Eastern Sub-

Region due to the high number of small holdings in the Eastern Sub-Region, which are not required to be connected to the municipal services network.

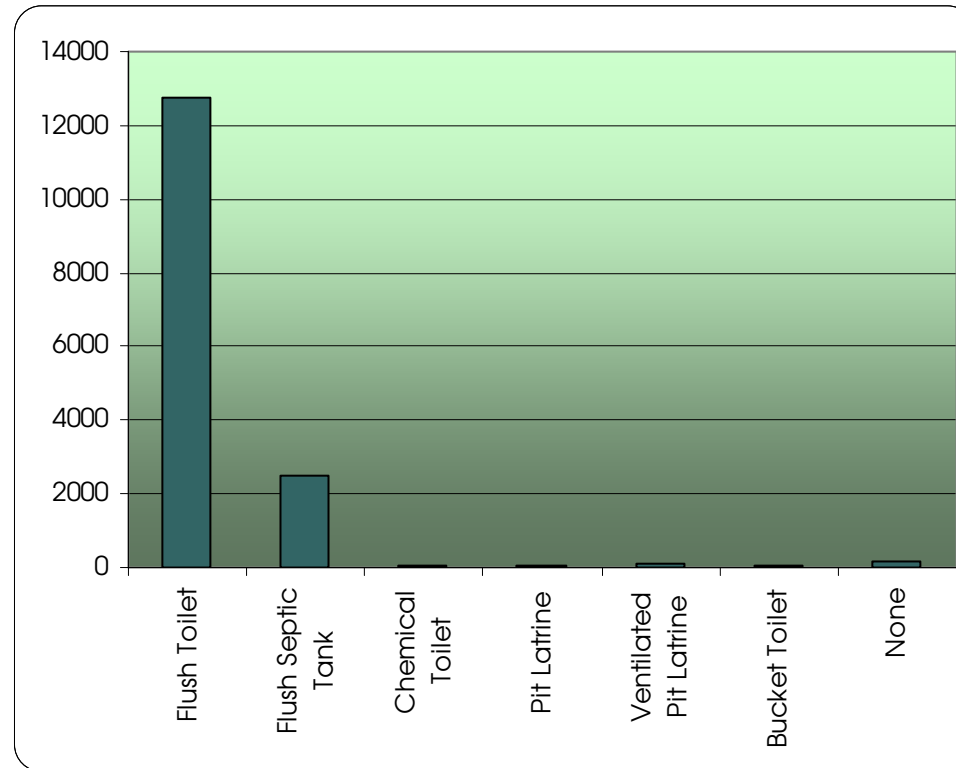


DIAGRAM 16: SANITATION SUPPLY
Source: Census 2001

Currently, all areas east of 1380m² contour, as illustrated on Figure 6, can be drained to the Diepsloot wastewater treatment plant. In addition, certain areas located below the aforementioned contour, such as Dainfern, can be drained to the Zandspruit pump station, located northeast of Kya Sands. A new pump station is planned at intersection of Jukskei and Klein Jukskei Rivers, located west of the Diepsloot Sewerage works. This pump station will significantly expand the serviceable area

westward, towards the N14 freeway. The new pump station holding tanks will increase the capacity of the Diepsloot sewerage works.

2.4.3. ENERGY SUPPLY

As depicted by the Diagram below, the entire Eastern Sub-Region population has access to and uses electricity. This includes both households living within urban areas and households living on small holdings.

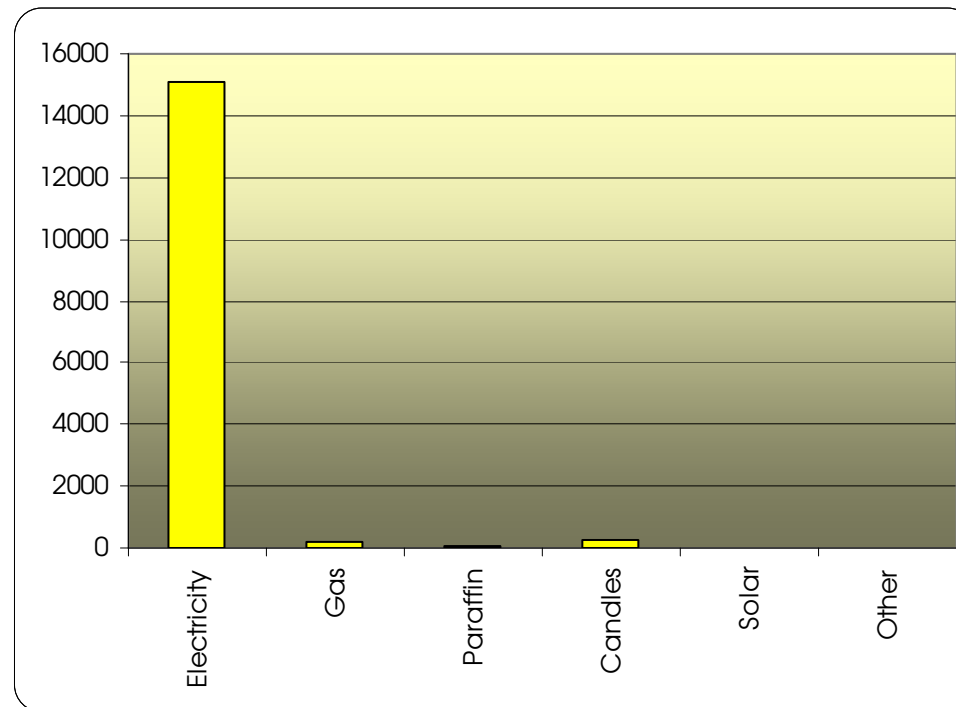


DIAGRAM 17: ENERGY SUPPLY
Source: Census 2001

The ability of Eskom to supply electricity to the northern reaches of Johannesburg is an issue and problem not only faced by the northern reaches of Johannesburg, but by Gauteng and the country as a whole, due to the limited capacity of Eskom to supply the national electricity grid. With regard to the future planning of Eskom, it can only be assumed that priority may be given to high-growth areas, such as the northern reaches of Johannesburg. Currently, the City Power Johannesburg is conducting a study to determine the electricity need that will be generated in future in the greater Midrand area, which includes the Kyalami area and part of its study area.

2.5. NATURAL ENVIRONMENT

2.5.1. TOPOGRAPHY

As illustrated by Figure 7, most of Eastern Sub-Region is relatively flat, with contour heights ranging from approximately 1600m above sea level to approximately 1300m above sea level. The highest areas within Eastern Sub-Region are found in the northeaster quadrant of the Eastern Sub-Region (in the Blue Hills area) and the lowest areas are found in the southwestern quadrant of the Eastern Sub-Region (along the Jukskei River). The 100 year flood-line of the mentioned Jukskei River affects the southern parts of the Eastern Sub-Region.

2.5.2. GEOTECHNICAL SUITABILITY

As is depicted on Figure 8, the entire Eastern Sub-Region has geotechnical conditions that are intermediately favourable for urban development (DPLG, 2002). This implies that, although the Eastern Sub-Region is situated within a dolomite belt, these dolomitic conditions do not prohibit urban development within the Eastern Sub-Region.

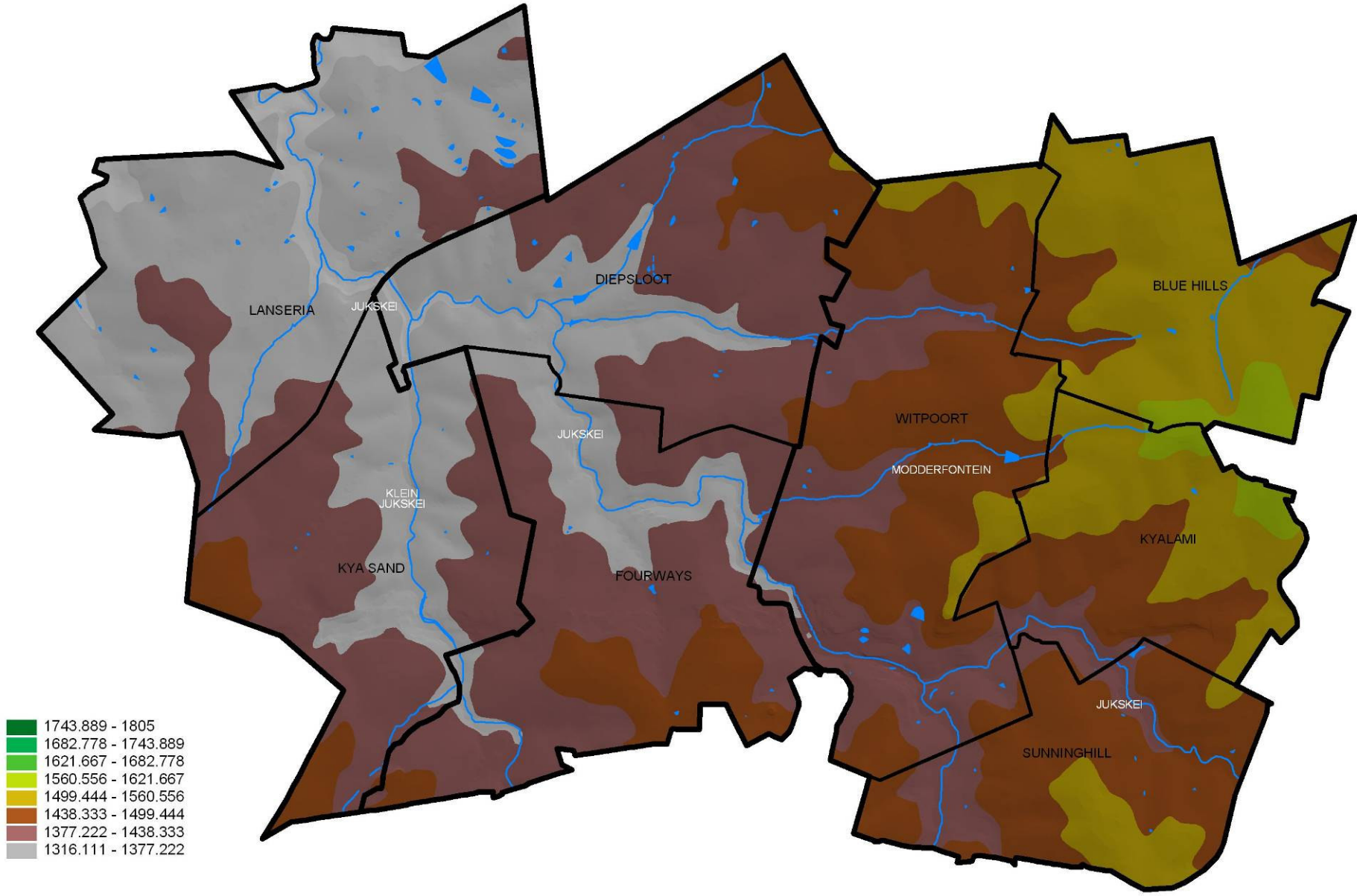


FIGURE 7
TOPOGRAPHY

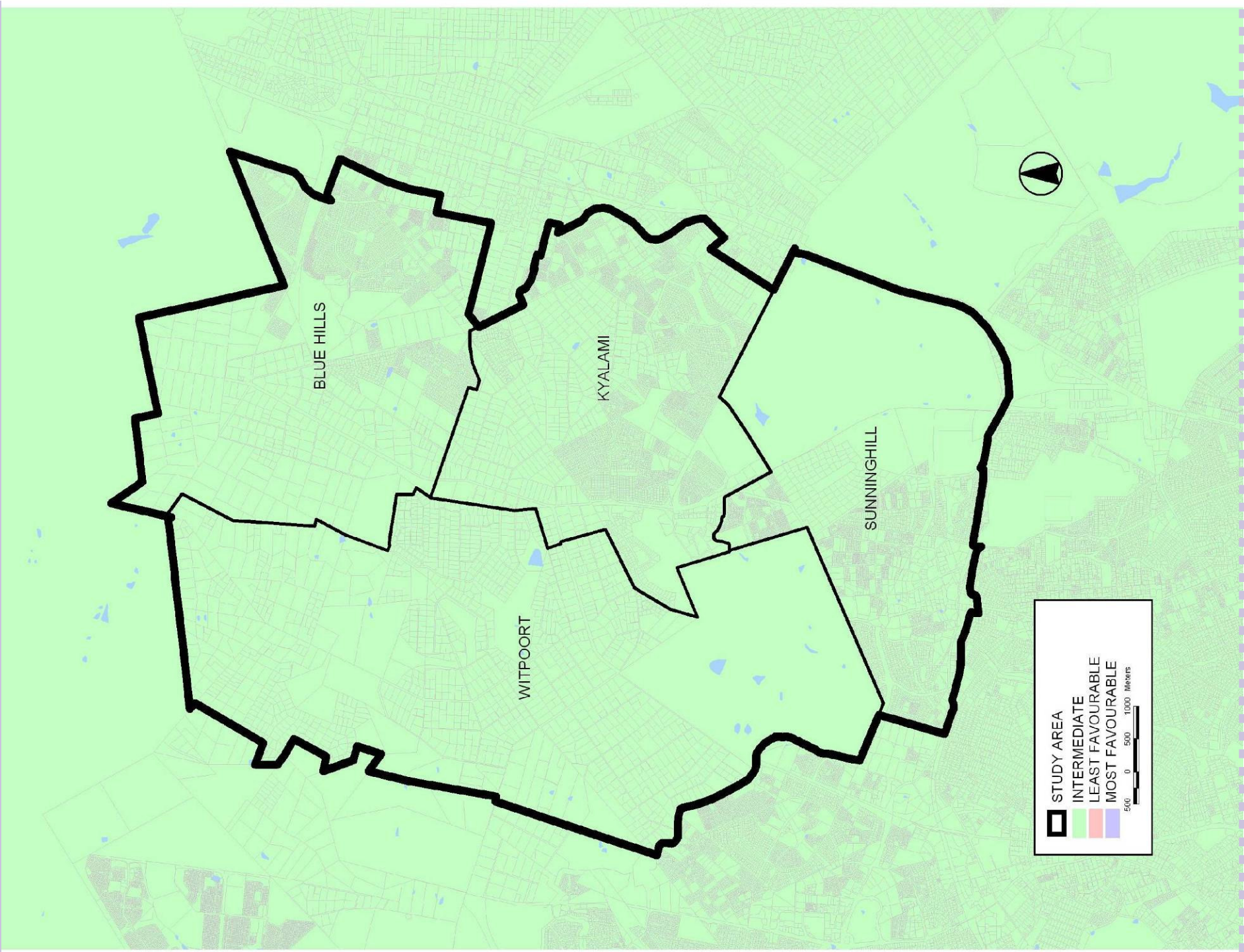


FIGURE 8
GEOTECHNICAL SUITABILITY

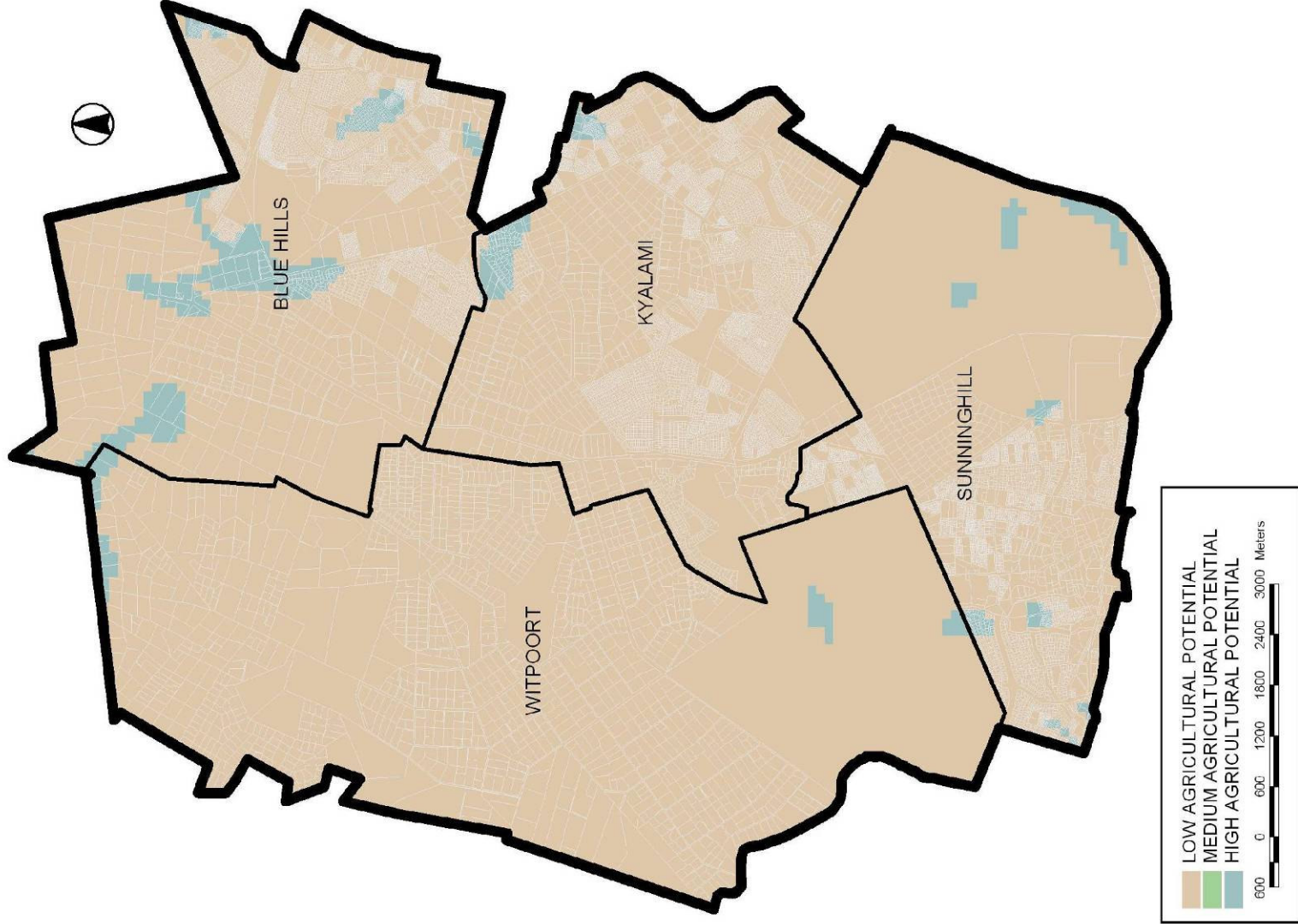


FIGURE 9
AGRICULTURAL POTENTIAL

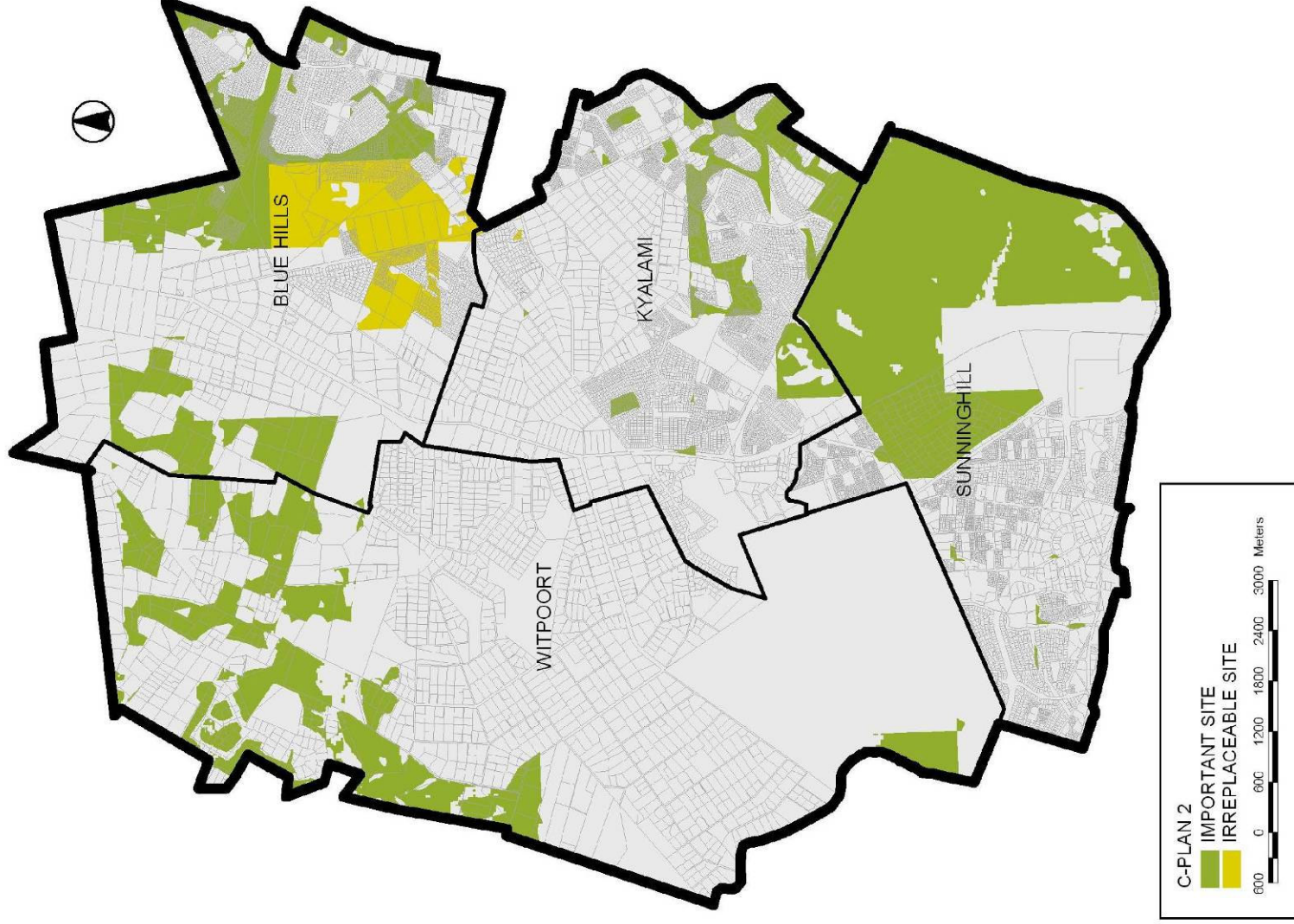


FIGURE 10
C-PLAN ENVIRONMENTAL AREAS

It has to be stressed that the above information is only a broad desktop analysis of the geotechnical conditions affecting Eastern Sub-Region. Consequently, it cannot be determined conclusively whether land parcels within the Eastern Sub-Region are suitable or unsuitable for urban development. A detailed geotechnical investigation is required before considering any site within the Eastern Sub-Region for development.

2.5.3. AGRICULTURAL POTENTIAL

The agricultural potential of the Eastern Sub-Regions varies from high to low potential (GDACE, 2002). As illustrated on Figure 9, most of the Eastern Sub-Region is of a low agricultural potential, implying that the Eastern Sub-Region is suitable for urban development from an agricultural point of view. The only significant high-potential agricultural area affecting the Eastern Sub-Region is located within the Blue Hills area. However, the size of this high-potential agricultural area is small (thus not forming part of an agricultural region) and should therefore not affect urban development within the Blue Hills area.

GDACE requires an agricultural study for areas of moderate to high agricultural potential to determine the viability of the area for supporting certain crops and the expected crop yields. The results of such a study are used to determine whether development on a site is appropriate or whether the site should be set aside for agricultural purposes.

In selected cases, the development of high-potential agriculture areas for urban development should be considered. For example, areas abutting public transportation spines or termini are more suitable for higher-density housing development than for agricultural development. Developing such areas at higher densities will limit urban sprawl and lessen the pressure for urban development on peripheral, high-potential agricultural areas.

2.5.4. ENVIRONMENTAL SENSITIVITY

C-Plan2 (GDACE, 2005) provides an overview of ecologically sensitive sites within Gauteng and is used (in conjunction with site surveys) by GDACE to determine whether a site is suitable for urban development. It therefore provides an indication of the chances of having a township application approved within a specific area. C-Plan2 divides ecologically sensitive sites into two categories: 'Irreplaceable Sites', which contain fauna and flora that are not found elsewhere, and 'Important Sites', which are required for the health functioning of a local eco-system.

According to C-Plan2, which is illustrated by Figure 10, an Irreplaceable Site is found in the Blue Hills area of the Eastern Sub-Region. However, GDACE has indicated that this site has largely been urbanized and is consequently no longer worthy of protection. In addition, Mia's Land is considered an Important Site in terms of C-Plan2. Apparently, this site contains the largest remaining parcel of a particular grassland species. However, the pressure to develop Mia's Land is high, primarily because it is centrally located within the Midrand Strip and is located on the N1-N3 interchange. Smaller pockets of Important Sites are located within the northern reaches of the Eastern Sub-Region.

2.6. LAND USE

2.6.1. LAND USE

The Eastern Sub-Region has a relatively wide range of land uses. The land uses roughly fall into the follow land use categories: residential, business, industrial, institutional, small holdings and agriculture. Of these land uses, small holdings cover the largest portion of the Eastern Sub-Region. The highest densities are achieved by the residential uses, which include cluster housing developments. Figure 11 provides a land use map of Eastern Sub-Region, illustrating the spatial distribution of these land uses.

a. Residential

Generally, the Eastern Sub-Region is characterized by relatively high residential densities, mostly due to the high number of cluster developments within the Sub-Region. These cluster development achieve average densities of between 20 and 30 units per hectare. Although it may be argued that these residential densities are to low to sufficiently support road-based public transportation, they do provide better support than single dwelling developments that typically achieve densities in the order of 10 units per hectare. The cluster developments within the Eastern Sub-Region are mostly concentrated in the Sunninghill and Kyalami areas. Single dwelling developments are largely found in the Kyalami and Blue Hills regions.

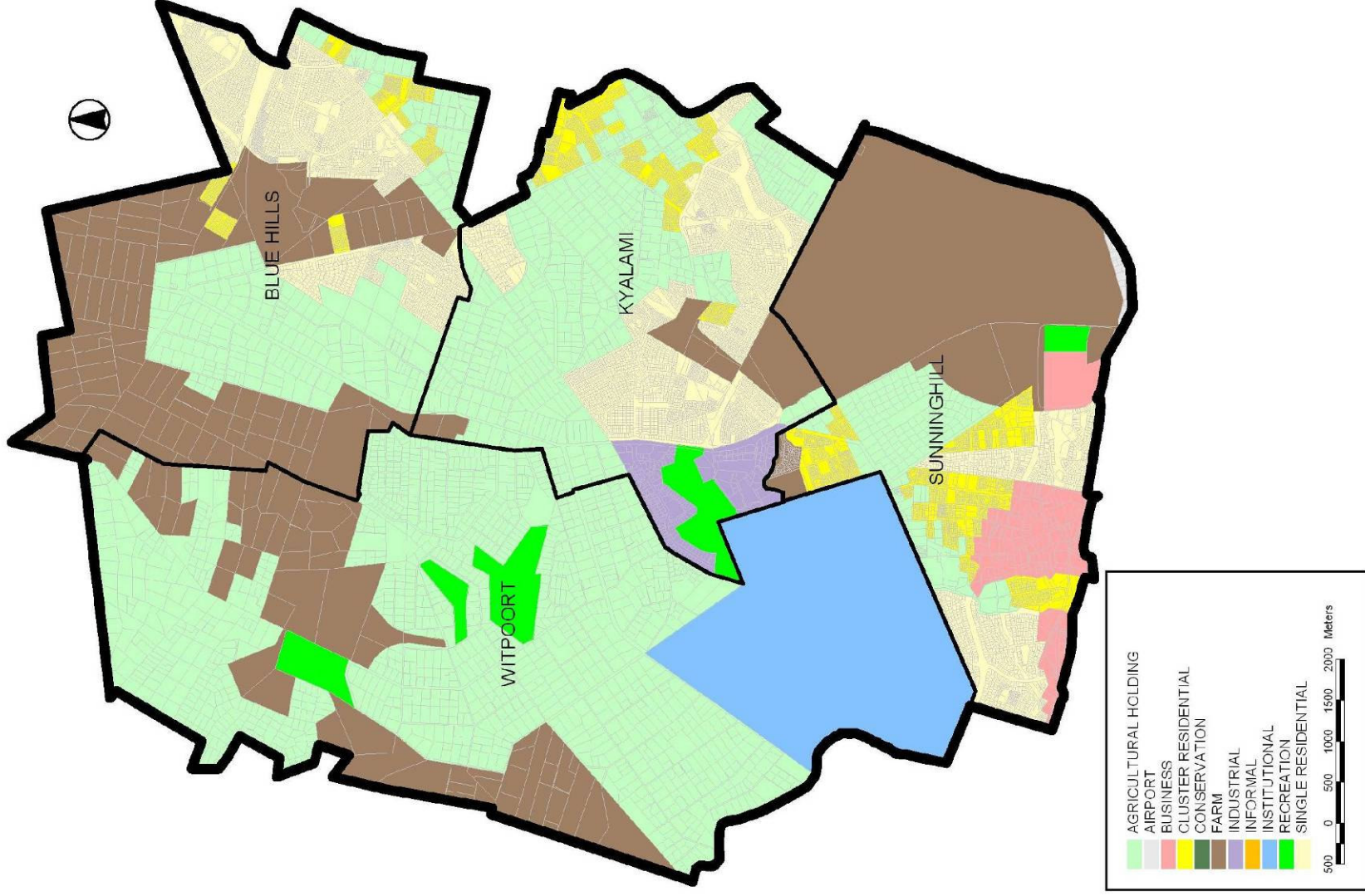


FIGURE 11
EXISTING LAND USE

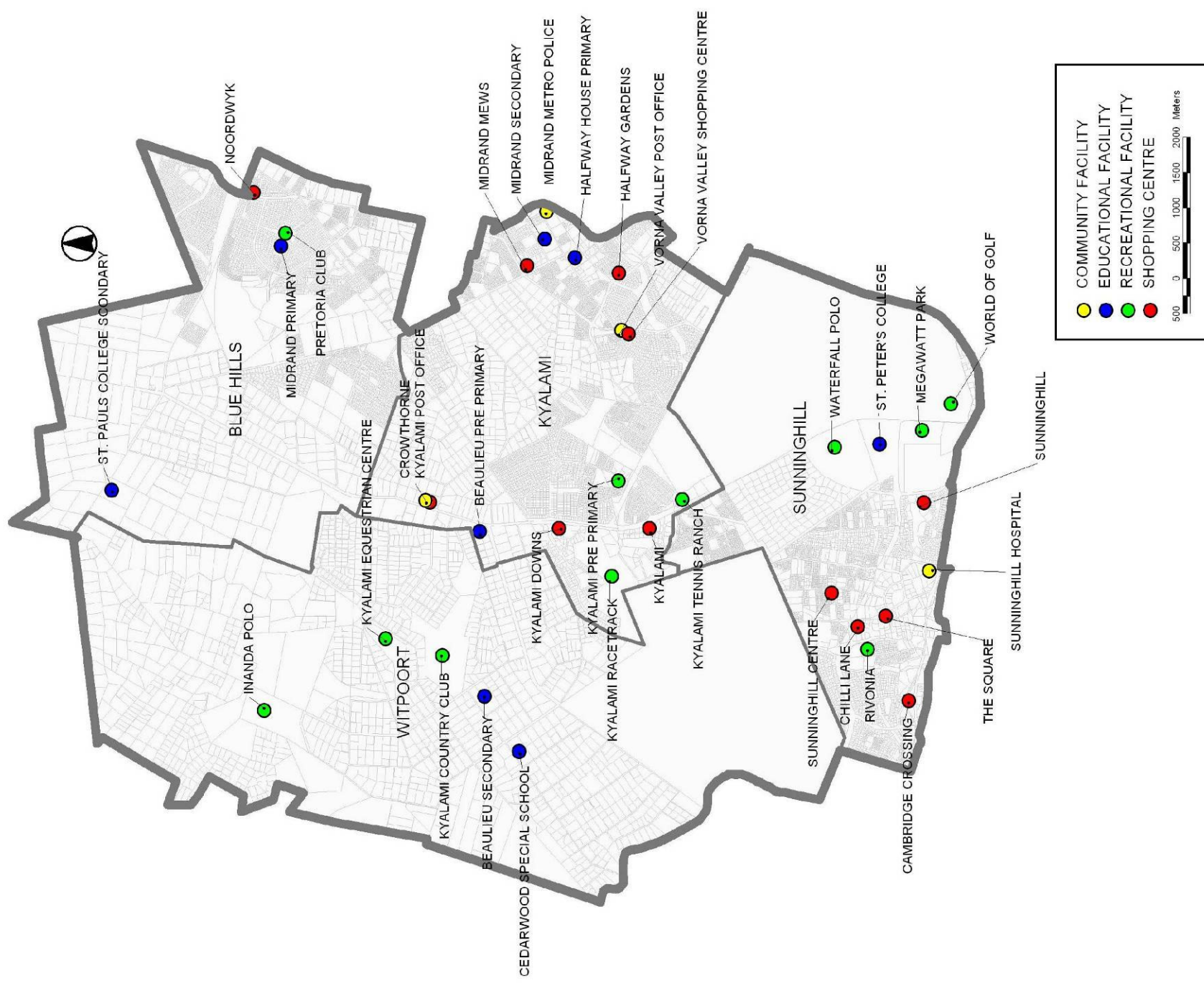


FIGURE 12
COMMUNITY FACILITIES

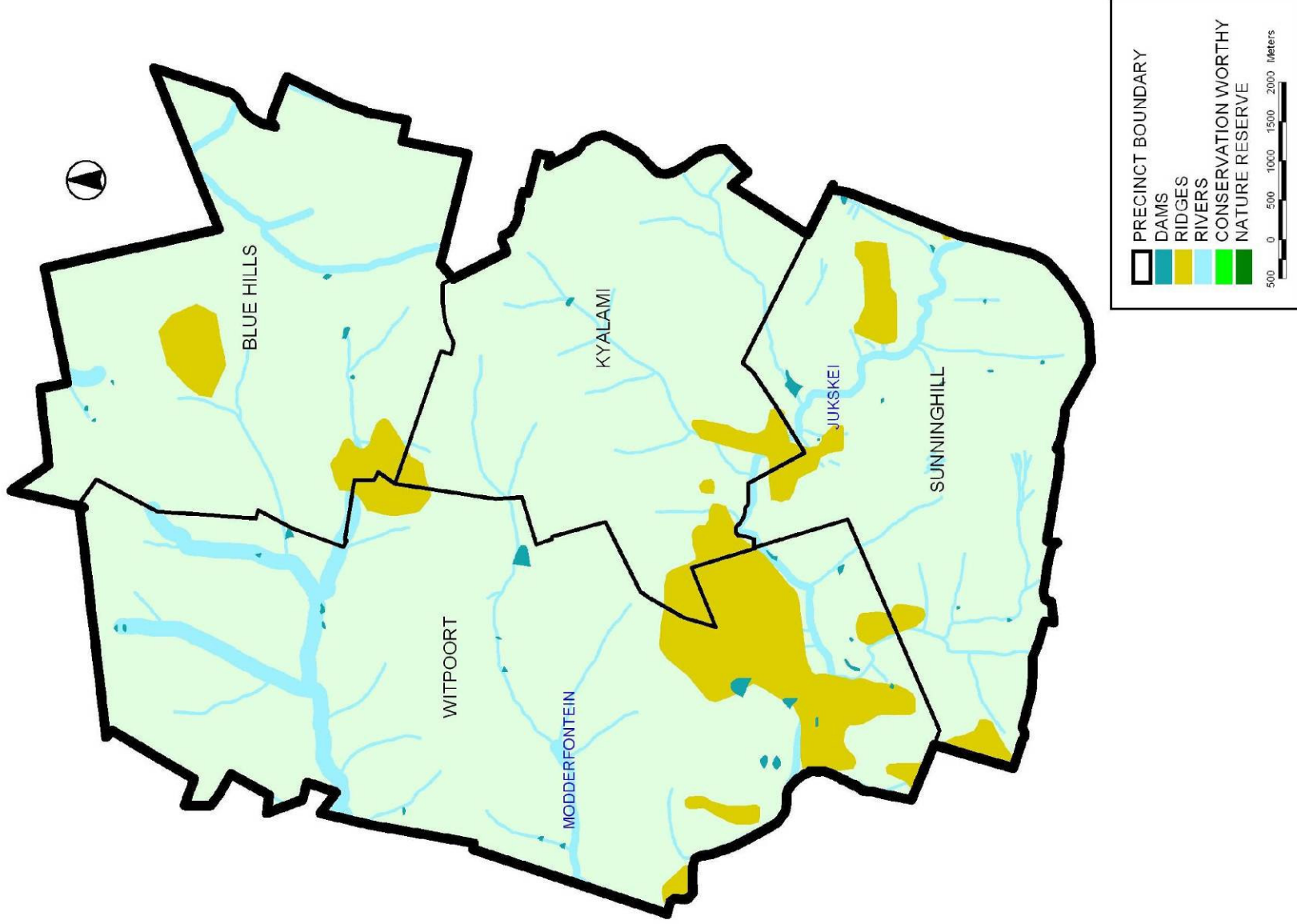


FIGURE 13
OPEN SPACE NETWORK

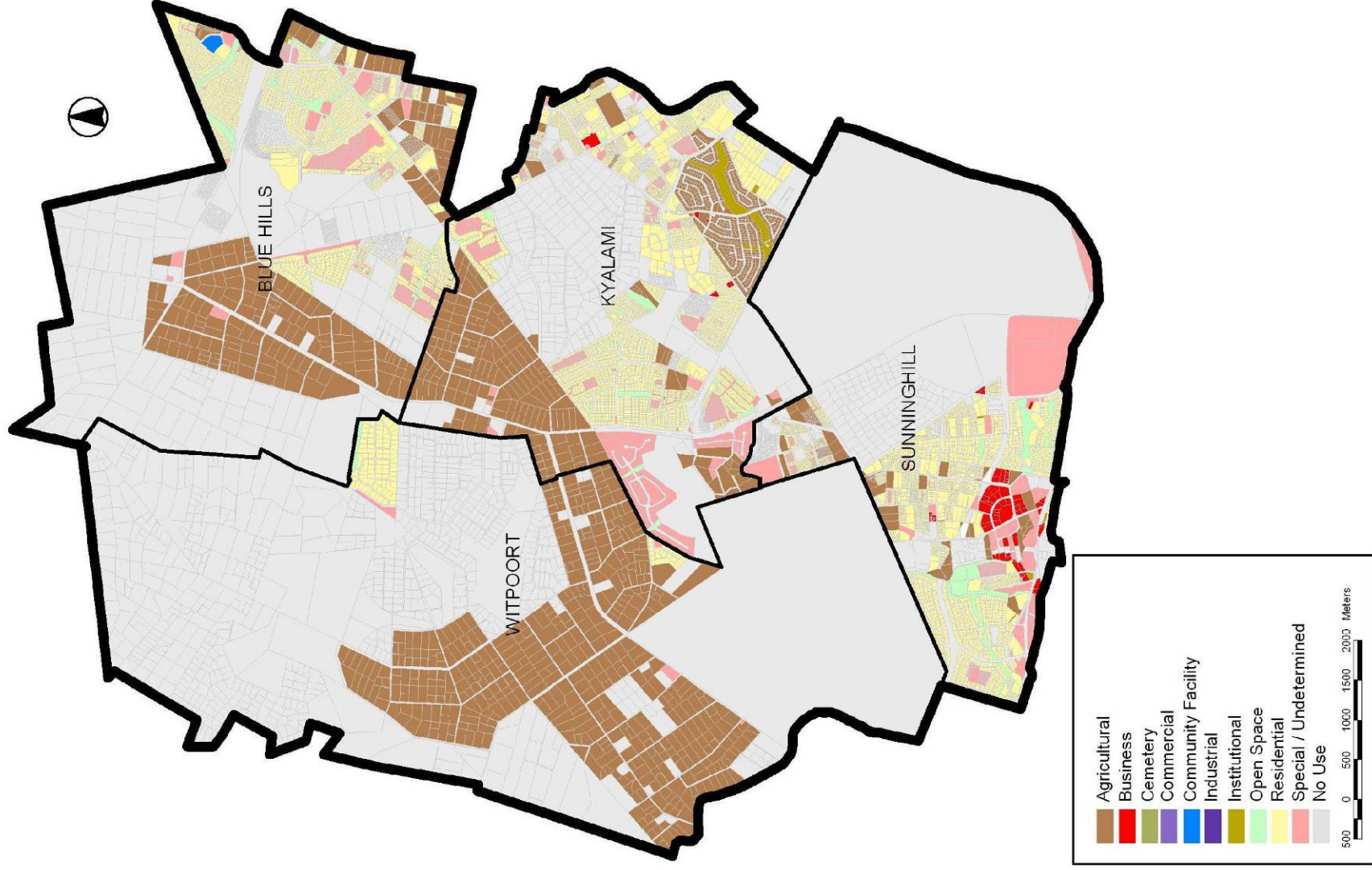
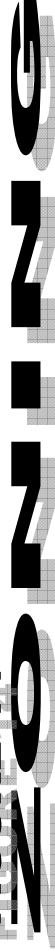


FIGURE 14



b. Small Holdings

Although the Eastern Sub-Region has significant residential development, most of it is still mostly rural in character. This rural character is attributed to the region by farmland and small holdings. Most of the smallholdings are concentrated in the Kyalami, Blue Hills and Witpoort areas, located north of the Leeukop Prison complex. The smallholdings in the Kyalami and Blue Hills areas are systematically being converted to cluster developments. This trend exerts urbanization pressure on the remaining smallholdings in these areas. The smallholdings in the Witpoort area are not subjected to the urbanization pressures that are experienced in the Kyalami and Blue Hills areas.

c. Farmland

Most of the remaining land within the Eastern Sub-Region is farmland, most of which consist of relative small farm portions (they could and often considered smallholdings). The largest parcel of farmland is Mia's Land, located south of Kyalami and east of Sunninghill. This land is not used for agricultural purposes, but is currently earmarked for urban development mostly comprising office and residential uses. The Mia's Land development will essentially be the southward extension of the Midrand Strip towards the Buccleuch interchange. The remaining farmland portions are mostly located in the northern reaches of the Eastern Sub-Region.

d. Social Amenities

The Eastern Sub-Region has a reasonably well-developed community infrastructure network, providing educational, health and other essential social services. Figure 12 illustrates the location of these community facilities within the Eastern Sub-Region.

- Education: The educational infrastructure comprises schools, from primary level to high school level. However, many of these schools are private schools, not catering for lower-income households within the sub-region.
- Health: The sub-region only comprises the Sunninghill Hospital. No provision is made for primary health care through the provision of clinics within the sub-region.
- Community: The sub-region has 2 post offices located in Vorna Valley and Kyalami.
- Safety and Security: A metro police station is located in Midrand. The absence of a police station within the sub-region may result in relatively poor reaction times.

- Recreation: The sub-region has a number of prominent recreational facilities, such as the Kyalami motor race track, the Kyalami Equestrian Centre, the Waterfalls Polo Centre and the Megawatt Park sport stadium. However, all these facilities are privately owned and access to these facilities is therefore restricted.

e. Business

The primary business node within the Eastern Sub-Region is Sunninghill, located on the intersection of the Rivonia Road (K73) and Witkoppen Road (K60). This node is classified a regional mixed-use node within the Johannesburg SDF and contains a large office component and a number of retail centres. There are a number of smaller retail centres distributed throughout the sub-region, mostly concentrated in Kyalami and Midrand (Vorna Valley). To a large extent, these retail centres act a neighbourhood focal points.

f. Commercial

The Eastern Sub-Region comprises an existing commercial area, located at Kyalami. There are roughly 300 buildings located within this commercial area, consisting mostly of warehousing and offices. The northern part of the industrial/commercial area is known as Kyalami Business Park and the southern part as Barbeque Downs Business Park. This commercial area has access to Main Road linking it to Woodmead and Allandale Road linking it to Midrand.

g. Institutional

The Eastern Sub-Region contains the Leeukop Correctional Services ground, located northwest of Sunninghill. This covers a large area which is increasingly located within a built-up area as urban development and expansion is taking place around it in areas such as Sunninghill, Kyalami and Fourways. Most of this site is use for agricultural purposes, but the site also contains a golf course and the prison facilities.

h. Open space

Open space within the Eastern Sub-Region can be divided into passive and active open space. Passive open space consists of land that is unsuitable or undesirable for urban development due to topographical or ecological constraints. Active open space involves the recreational component of the open space system. It provides sport facilities throughout an urban area for use by local clubs, schools, and the community.

The passive open space system is largely made up of the river system traversing the Eastern Sub-Region (see Figure 13). The Jukskei River and the Sand River (which flows into the Jukskei River), flows through the southern parts of the Eastern Sub-Region, affecting Mai's Land, the Leeukop Correctional Services site and the western parts of Sunninghill. The Jukskei River in particular, is a significant natural water sources traversing the Eastern Sub-Region, which is important to the metropolitan area as a whole. Two tributaries of the Jukskei River, including the Modderfontein River, flow through the northern parts of the Eastern Sub-Region, between Kyalami and Blue Hills.

Eastern Sub-Region contains a number of recreation facilities, catering for a number of recreational types. These include the Eskom Megawatt Park sport complex, the Kyalami motor race track, the Kyalami Country Club, the Kyalami Equestrian Centre and the Indaba Country Base. What is significant of the mentioned recreational facilities is that they are all privately owned, and are therefore not accessible as a public facility. No municipal recreational facilities are located within the Eastern Sub-Region to cater for the needs of the general public. Also, the recreation facilities provided within these privately owned facilities (with the exception of the Eskom Megawatt Park sport complex) do not provide for the more common recreational types, such as rugby, soccer, cricket, netball and tennis. Such recreation facilities should be provided by the local authority.

2.6.2. ZONING

Figure 14 provides the zoning profile of the properties within the Eastern Sub-Region. It is evident from this Figure that most of the properties within Eastern Sub-Region are either zoned for residential purposes or agricultural purposes. Most of the properties zoned for residential purposes are concentrated in the Sunninghill area, the Kyalami area and the eastern parts of the Blue Hills area, associated with the Midrand strip. Note that despite the significant residential component; only one stand in the entire sub-region is zoned for education (school) purposes. This shows that the area lacks community facilities to support the residential component. It also points to the fact that there are no stands to build community facilities on, even if the funds were available to construct such facilities.

Small holdings within the Eastern Sub-Region are zoned as agriculture and are mostly concentrated in the Blue Hills area and west of Kyalami. Properties zoned for business uses are mostly concentrated within the Sunninghill area, clearly illustrating the location and size of the Sunninghill regional node. The remaining properties within the Eastern Sub-Region are used for agricultural purposes and do not have a zoning.

2.7. HOUSING & TENURE

2.7.1. HOUSING TYPOLOGIES

Census 2001 provides information with regard to the state of housing within the Eastern Sub-Region. This information is reflected in the Table below. According to this Table, the Eastern Sub-Region has approximately 16000 dwelling units. Of this number, roughly 7900 are detached houses, making it the dominant housing type within the Eastern Sub-Region. The second largest housing type is townhouses, constituting approximately 4200 units. Backyard flats (or granny flats) are also a prominent housing type within Eastern Sub-Region, constituting approximately 1000 units of the total housing stock. These backyard flats indicate a strong rental market within Eastern Sub-Region, with households renting out backyard flats to supplement their household income. The Eastern Sub-Region has almost no informal shacks.

TABLE 2: NUMBER AND TYPE OF HOUSING 2001

SDF Settlement Clusters	House on Stand	Traditional Dwelling	Flat	Town-house Cluster	Backyard Flat	Backyard Shack	Informal Shack	Rented Room	Other (e.g. caravan)	Total Dwelling Units
Airdlin	6	0	0	92	0	0	0	3	38	139
Barbeque Downs	88	0	0	67	9	0	3	3	58	228
Blue Hills AH	503	12	6	3	349	32	14	104	215	1238
Bridle Park AH	129	12	0	3	0	0	3	3	10	160
Carlswald AH	181	12	0	0	79	37	0	19	14	342
Country View	431	15	0	140	3	3	0	3	16	611
Crowthorne AH	116	0	0	0	104	12	0	87	9	328
Erand	193	9	15	587	9	3	3	0	18	837
Erand AH	338	9	9	48	50	6	6	0	27	493
Glen Fernes	25	0	3	9	16	6	3	9	122	193
Glenferness AH	147	0	0	0	20	0	3	6	274	450
Halfway Gardens	33	3	82	321	3	3	0	0	33	478

SDF Settlement Clusters	House on Stand	Traditional Dwelling	Flat	Town-house Cluster	Backyard Flat	Backyard Shack	Informal Shack	Rented Room	Other (e.g. caravan)	Total Dwelling Units
Kyalami	344	6	0	14	102	6	6	43	71	592
Kyalami Estates	922	21	0	12	37	0	9	9	12	1022
Leeuwkop	323	3	3	18	13	3	3	0	74	440
Noordwyk	972	12	9	310	18	3	3	0	27	1354
Paulshof	1044	6	81	707	33	6	0	31	68	1976
Sunninghill	657	15	85	926	138	3	18	24	153	2019
Vorna Valley	1028	35	82	964	55	7	9	12	127	2319
Waterfall	50	3	0	6	6	3	28	0	6	102
Witpoort	354	12	6	3	31	3	0	6	46	461
Total	7884	185	381	4230	1075	136	111	362	1418	15782

Source: Census 2001

2.7.2. TENURE

Tenure involves the type of ownership that people have of the dwelling they reside in. As depicted by the Diagram below, 26% of the households living within Eastern Sub-Region rent properties. It can be assumed that a large portion of these constitute the renting of backyard flats. An additional 16% number of households occupy their properties rent-free. In total, 14% of the households living within Eastern Sub-Region own their property, thus not having a bond registered to the property. Households that have a bond registered on their property amounts to 44% of the households living within the Eastern Sub-Region, constituting the largest tenure category.

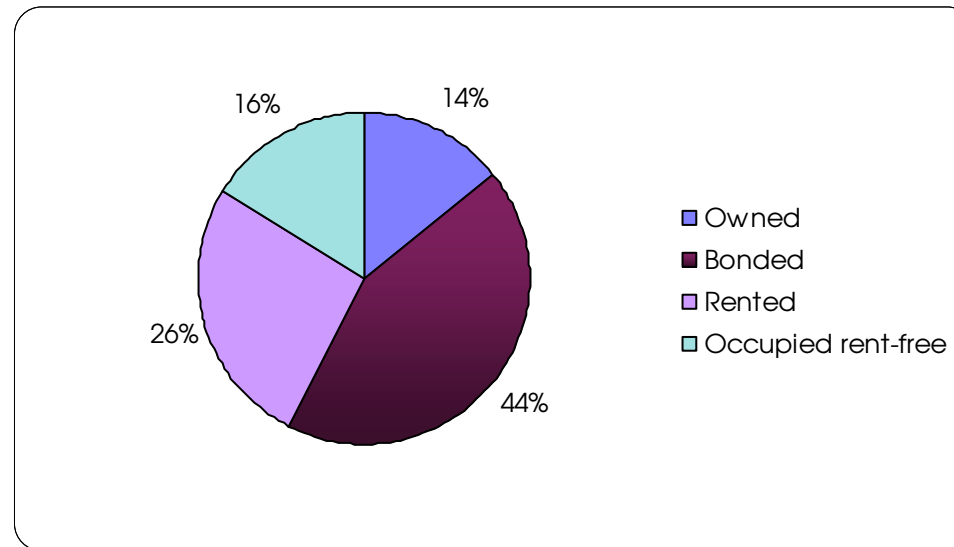


DIAGRAM 18: DWELLING TYPE AND TENURE RELATION
Source: Census 2001

2.7.3. INFORMAL HOUSING

In 2005, the Gauteng Department of Housing initiated the Informal Settlement Registration Study. This project was an extensive process whereby the positions of all informal structures were captured from recent aerial photography. Individual informal dwellings were then visited by field workers that captured socio-economic data using GPS technology and handheld computers and scanners. According to the PMM study, approximately 4400 informal dwelling units are located within the Western Sub-Region, approximately 22000 informal dwelling units are located within the Central Sub-Region, and no informal dwelling units are located within the Eastern Sub-Region. The number of informal dwelling units located within each informal settlement is presented in the Table below.

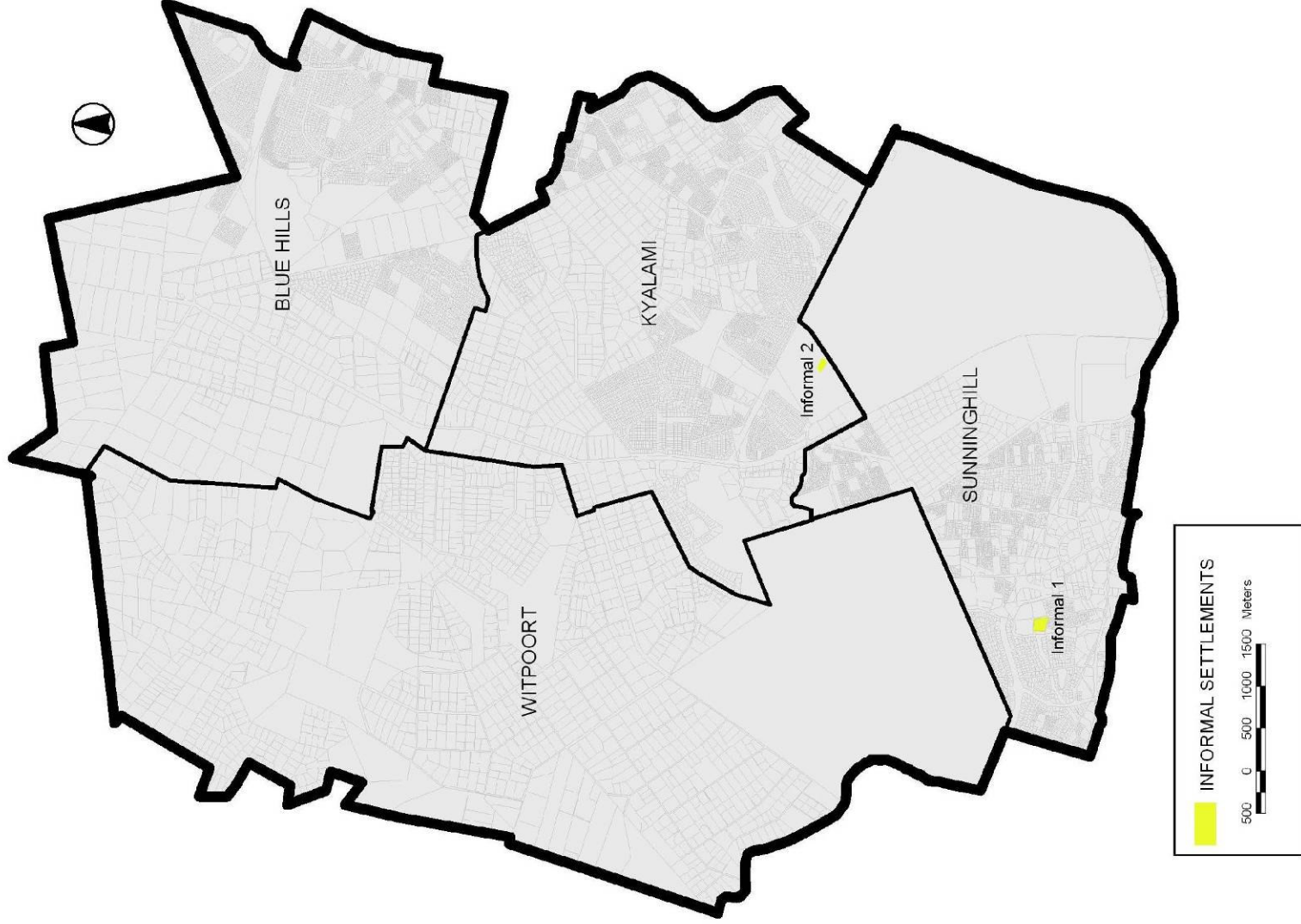


FIGURE 15
INFORMAL SETTLEMENTS

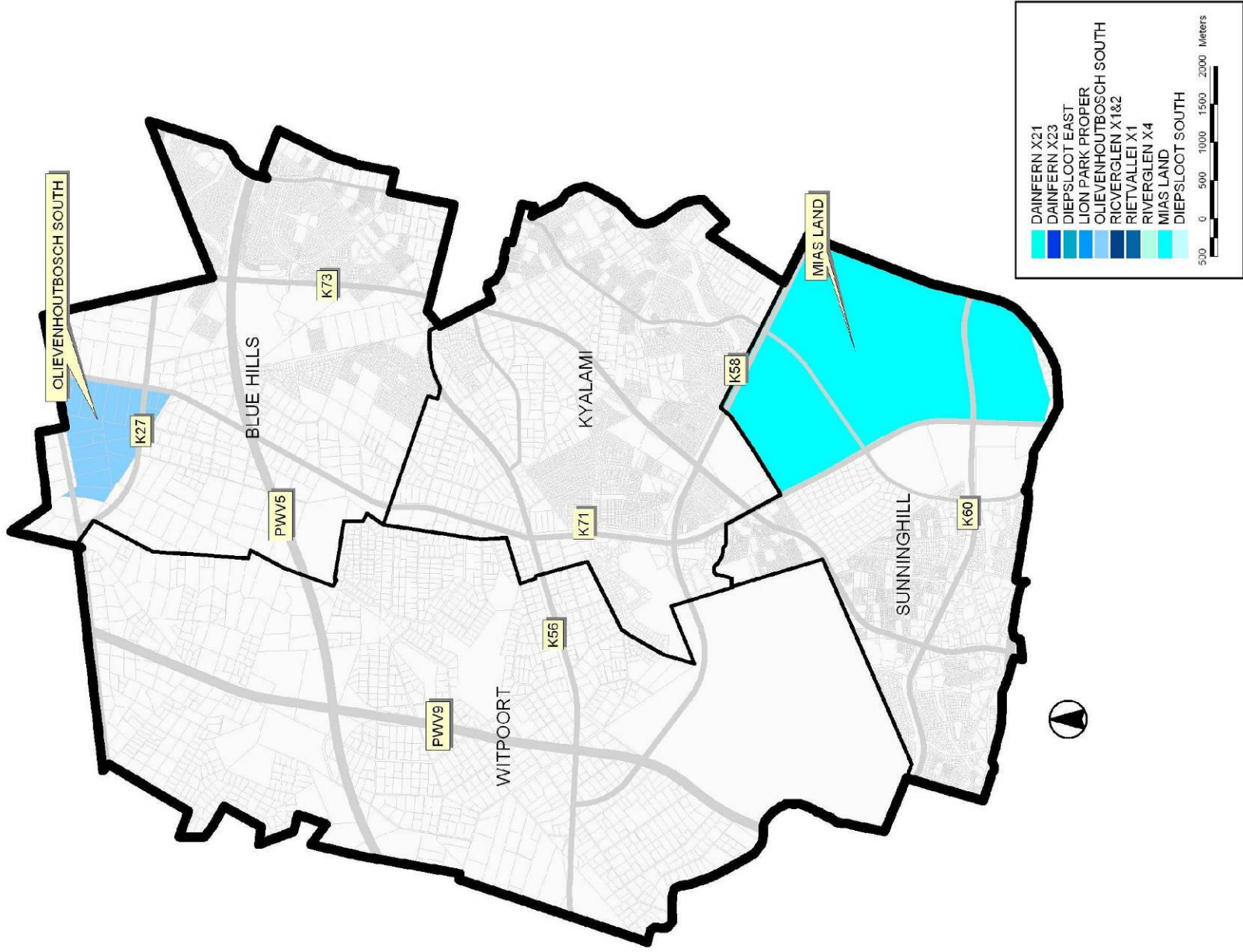


FIGURE 16
PLANNED HOUSING DEVELOPMENT

TABLE 3: PMM INFORMAL SETTLEMENT COUNT 2005

Informal Settlement	Number of Structures	On 96/97 Housing Waiting List
Central Sub-Region		
Diepsloot	17096	336
Zevenfontein	4720	155
Subtotal	21816	491
Western Sub-Region		
Kya Sands/ Houtkoppens Holding	372	0
Kya Sands/ Inandan Holding 37	218	4
Kya Sands	1871	14
Lanseria/ Freeway	113	2
Lanseria/ Lionpark (Nietgedacht)	1049	33
Lanseria/ Lucky 7	119	3
Lanseria/ Methodist	252	5
Lanseria/ Selinapark	65	4
Lanseria/ Tikkieline	48	5
Lanseria/ Zozo	91	1
Lanseria/ Riverbends	206	2
Lanseria	61	2
Subtotal	4465	75

Source: PMM, 2005

The Johannesburg Metropolitan Municipality: Department of Housing calculated the number of informal dwelling units located within the Metro Area on annual bases. The Table below lists the informal settlements located within Region A (east of Midrand) and the number of shacks found within each of these settlements. No informal dwellings were recorded within the Eastern Sub-Region.

TABLE 4: JOBURG INFORMAL SETTLEMENT COUNT 2007

Sub-Region	Settlement Name	No. of Shacks	Action to be Taken	Relocation to Which Project	Property Description	Land Ownership
Central Sub-Region						
	Diepsloot West Ext. 5	2,000	Relocate	Land to be identified	144/388-JR Diepsloot Wes Ext 5	Private
	Diepsloot West Ext. 6 Business Site	2,034		Land to be identified	138/388 -JR Diepsloot 388-JR	Private
	Diepsloot West Reception	25,000	In-situ/Relocate		139/140/141/388 JR	Public
	Zevenfontein	2,251	Relocate	Cosmos City	22/538-IQ Dainfern Ext 21	Private
Subtotal		31,285				
Western Sub-Region						
	Empire	18	Relocate (Private)	Land to be identified		Private
	Freeway (Bridge)	40	Relocate (Private)	Land to be identified	68/ Nietgedacght 535 JQ	Private
	Inadan Plot 37	161	Relocate (Private)	Land to be identified	37 Inandan A.H	Private
	Inadan Plot 38	64	Relocate (Private)	Land to be identified	38 Inanda A.H	Private
	Kya Sands	2,989	Relocate (Private)	Land to be identified	Kya sands	Combination
	Lion Park (Nietgedacht)	1,174	Relocate (Private)	Land to be identified	Re/19/535-JQ Nietgedacht 535 -JQ	Public
	Lucky 7	427	Relocate (Private)	Land to be identified	32/535-JQ	Private
	Malatjie	820	Relocate (Private)	Land to be identified	92/528-JQ Lanseria Ext 17	Private
	Methodist Church	70	Relocate (Private)	Land to be identified	76/533-JQ Chartwell A.H	Private
	Msawawa (Houtkoppen)	1,500	Relocate (Private)	Land to be identified	Houtkoppen Plot 15	Private
	Plot 5 Riverbend AH	220	Relocate (Private)	Cosmos City	110/193-IQ Riverbend A.H	Private
	Tikkie Line	54	Relocate (Private)	Land to be identified	Re/51/528-JR Sunrella A.H	Private
Subtotal		7,537				

Source: Johannesburg Housing, 2007

Both the PMM study and the Joburg counts only provide the number of informal structures in informal settlements. It does not indicate the number of backyard shacks located within areas such as Diepsloot. Figures relating to the total number of informal structures are best obtained from the South African Census 2001. According to Census 2001, the Eastern Sub-Region has approximately 1500 backyard shacks, as depicted by the Diagram below. In addition, the Eastern Sub-Region has approximately 300 shacks located within small informal settlements within the Sub-Region.

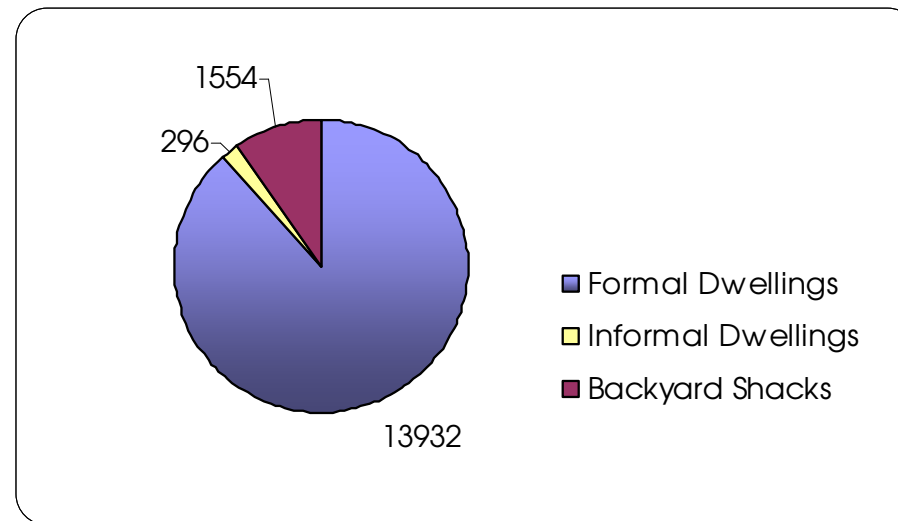


DIAGRAM 19: INFORMAL STRUCTURES

Source: Derived from Census, 2001

The Table below compares the figures of the PMM, Joburg and Census counts and selects the preferred figure to be used. The Joburg figure was used for the Western Sub-Region, as the Census figure appears to be too low and the PMM not a recent count, having to rely on a projection. However, the PMM figure was used for the Central Sub-Region, because the Joburg estimation of the number of structures in the Diepsloot reception area is believed to be too high when compared with the PMM count. The Diepsloot reception area figure is by far the largest figure in the table, thus having a distorting impact. The Census 2001 figure was used for the Eastern Sub-Region due to a lack of data in the other surveys.

The spatial distribution of the informal settlement within Eastern Sub-Region is illustrated on Figure 15. It is evident from this Figure that the existing informal settlements do not cover significant geographical areas and are located within Sunninghill and Kyalami.

TABLE 5: INFORMAL SETTLEMENT NUMBERS COMPARED

Area	PMM Study 2005	PMM Study Projected 2007	Joburg Housing 2007	Census 2001	Census Projection 2007	Figure Used in Development Framework
Western Sub-Region	4465	4923	7537	1301	1743	7537
Central Sub-Region ¹⁾	21816	24052	31285	10487	14054	27668
Eastern Sub-Region	0	0	0	296	397	397
Total	26281	28975	38822	12084	16194	31986

Source: Maluleke Luthuli and Associates, 2008

Notes: ¹⁾ Diepsloot figure used is median between PMM projected figure and the Joburg Housing figure.

2.7.4. PLANNED HOUSING DEVELOPMENTS

TABLE 6: PLANNED LARGE-SCALE TOWNSHIP DEVELOPMENT

Township	Location	Developer	Total Township Area (ha)	Total Number of Residential Stands
Olievenhoutbosch South	Blue Hills Precinct	Private	104.2	Not available
Mia's Land	Sunninghill Precinct	Private (Mia's Land Trust)		Not available
Diepsloot East	Diepsloot Precinct	Private		Not available
Diepsloot South	Diepsloot Precinct	Johannesburg Property Company (JPC)		(433027m ²)
Riverglen Ext. 1 and 2	Diepsloot Precinct	Private	123.5	2385
Riverglen Ext. 4	Fourways Precinct	Private	75.0	1553
Dainfern Ext. 21	Fourways Precinct	Private	108.8	2621
Dainfern Ext. 23	Fourways Precinct	Private	228.5	2836
Rietvallei Ext. 1	Fourways Precinct	Private	233.3	3363
Lion Park Proper	Kya Sands Precinct	Private	195.7	603

Source: Maluleke Luthuli and Associates, 2008

A number of large-scale housing developments are planned within Administrative Region A. However, most of these are not located within the Eastern Sub-Region. In stead, the Eastern Sub-Region is characterized by a large number of smaller developments, mostly comprising the conversion of small holdings into cluster developments.

As illustrated on Figure 16 and depicted by the Table above, the only significant planned large-scale housing projects within the Eastern Sub-Region is Olievenhoutbosch South, located within the Blue Hills area, and Mia's Land, located within the Sunninghill area. The Olievenhoutbosch South development covers an area of approximately 100ha as is primarily earmarked for the development of affordable housing units. To date, this development has not materialized, allegedly due to high land values, which prohibit the development of affordable housing within the Government housing subsidy range. The Mia's Land development plans the development of higher-end bonded housing units on the portion of the property located within the Eastern Sub-Region. Affordable housing units are land on the portions of Mia's Land located in the Ivory Park region, with falls outside of the project Study Area.

SECTION 3: LAND USE ESTIMATES

3.1. POPULATION ESTIMATE

Population estimates need to be based on a base year. In other words, a specific year must be chosen of which the population number is known or can be calculated to a reasonably accurate degree. This base year is used as a platform on which to calculate or project the population growth up to the current year (in this case 2007), as well as the population growth up to certain points in the future. The base year used for the Eastern Sub-Region is the year 2001, which correlates with the Census 2001 year.

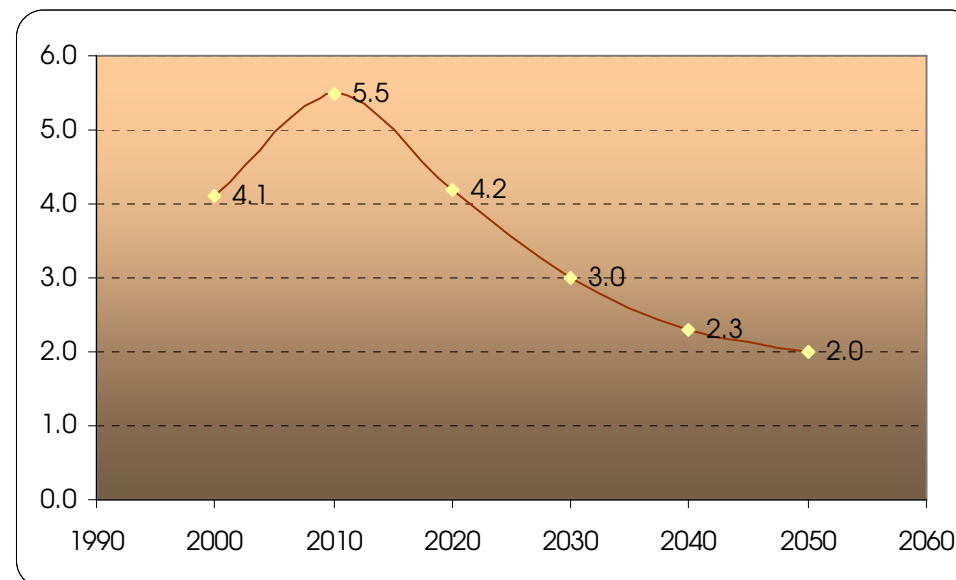


DIAGRAM 20: ASSUMED POPULATION GROWTH RATE

A number of possible population growth scenarios have been considered for the Eastern Sub-Region. The scenarios deemed more likely to occur was chosen based on historic trends, current governmental policies, urban realities and the proliferation of life-threatening diseases such as AIDS. This preferred scenario assumed a strong and positive population growth over the short term, with a gradual decrease in the population growth over the longer term. However, the growth rate for the Eastern Sub-Region will continue to outperform the Provincial growth rate, as the Eastern Sub-Region lies within a high growth area in the Province, and significantly outperform the National growth rate, as Gauteng on average has a higher growth rate than the other provinces within the country.

As depicted by the Diagram above, a population growth rate of between 4.1% and 5.5% per annum was used for the period 2000 to 2020, with the climax reach by 2010. The growth rate reflects a high economic growth rate experience before and immediately after the 2010 Soccer World Cup to be held in South Africa. Thereafter the growth rate is expected to gradually decline to about 2.0% in 2050. The 2050 growth rate is still well above the estimated National population growth rate, which is expected to be below 1% per annum in 2050.

According to the Table below, the population of Eastern Sub-Region in 2001 is estimated to be approximately 51000 people or 19000 households. The Eastern Sub-Region population will grow to a total of approximately 91000 people and 33000 households by the year 2020 and approximately 153000 people and 57000 households by the year 2040.

TABLE 7: EASTERN SUB-REGION POPULATION 2020

Period	2001	2007	2010	2020	2030	2040	2050
Population	42936	51481	60264	90609	121771	152862	186338
Households	14228	19067	22320	33559	45100	56615	69014
Formal Households	13932	18670	22082	33559	45100	56615	69014
Informal Households	296	397	238	0	0	0	0

Source: Estimated from Census 2001 figures

3.2. LAND USE BUDGET

From the onset it has to be emphasized that the following Land Use Budget is only a rough estimate of the number of community facilities, business space and land for housing development needed over a given period. A highly accurate estimate is not possible on the level of detail and time-span that this report is subjected to. The estimates given only serve as guidelines for officials to make land use development decisions from day-to-day. It is not a tool to conclusively prove or disprove the viability of a specific land use proposal for a specific area nor does it take into account the often non-mathematical views and needs of communities.

Land Use Budget Parameters

- Land use estimates were based on estimated population growth
- Retail estimates were based on population growth
- Office estimates were based on 6.3 ratio to retail space (similar to existing nodes in Joburg, such as Illovo and Rivonia)
- Industrial space linked to infrastructure development (e.g. airport or freeways)

The Land Use Budget has been calculated up to the year 2050. This Land Use Budget is attached as Annexure A. The following section, however, only discusses the Land Use Budget up to the year 2020. This is the timeframe used for this study to guide land use development within the Eastern Sub-Region. For easy reference, the Land Use Budget up to the year 2020 is presented by the Table below.

a. Settlement

In total, approximately 230ha of land is needed for settlement expansion between the year 2007 and 2010 and an additional 740ha of land is needed for residential expansion between the year 2010 and 2020. This includes land for residential development, as well as the recreation, social and economic facilities needed to support these residential developments.

TABLE 8: EASTERN SUB-REGION LAND USE BUDGET 2020

Land Use	Census 2001		Existing 2007		Need 2010			Backlog 2007-2010			Need 2020			Backlog 2010-2020		
	no.	no.	ha	m²	no.	ha	m²	no.	ha	m²	no.	ha	m²	no.	ha	m²
Population	42936	51481			60264						90609					
Households	14228	19067			22320						33559					
Formal Households	13932	18670			22082						33559					
Informal Households	296	397			238						0					
Housing	13932	18670	1438.8		22082	1558.2		3412	119.4		33559	2074.4		11477	516.2	
Housing Bonded (target 70%)	13932	18670	1438.8		20978	1551.3		2308	112.5		26847	1938.0		5869	386.8	
Flats	381	511	2.6		1104	5.5		594	3.0		1678	8.4		574	2.9	
Cluster Housing	5667	7594	379.7		8833	441.6		1238	61.9		11746	587.3		2913	145.6	
Detached Housing	7884	10565	1056.5		11041	1104.1		476	47.6		13424	1342.4		2383	238.3	
Housing Affordable (target 30%)	0	0	0.0		1104	6.9		1104	6.9		6712	136.3		5608	129.4	
Walk-Ups	0	0	0.0		1104	6.9		1104	6.9		1678	10.5		574	3.6	
Semi-Detached Housing	0	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	
Detached Housing	0	0	0.0		0	0.0		0	0.0		5034	125.8		5034	125.8	
Educational		5	20.0		17	64.0		12	44.0		26	97.3		9	33.3	
Primary School		2	5.6		11	30.9		9	25.3		17	47.0		6	16.1	
Secondary School		3	14.4		6	26.5		3	12.1		8	40.3		3	13.8	
Tertiary Institution		0	0.0		1	6.6		1	6.6		1	10.1		0	3.4	
Health		0	3.1		5	5.4		5	2.3		7	8.2		2	2.7	
Clinic		0	0.0		4	0.8		4	0.8		6	1.2		2	0.4	
Day Hospital		0	0.0		1	1.0		1	1.0		1	1.5		0	0.5	
Hospital		0	3.1		0	3.6		0	0.5		0	5.4		0	1.8	
Community		3	11.7		11	19.0		8	7.3		17	28.5		6	9.6	
Community Hall		0	0.0		3	3.0		3	3.0		5	4.5		2	1.5	
Library		0	0.0		3	1.2		3	1.2		5	1.8		2	0.6	
Post Office		2	0.4		3	0.6		1	0.2		5	0.9		2	0.3	
Police Station		1	1.0		2	1.5		1	0.5		2	2.3		1	0.8	
Emergency Service Centre		0	0.0		1	0.6		1	0.6		1	0.9		0	0.3	
Cemetery			10.3			12.1			1.8			18.1			6.1	
Business		0	80.1	1089844	0	93.7	1275789	0	13.7	185945	0	140.9	1918189	0	47.2	642399
Retail			37.3	149294		43.7	174766		6.4	25472		65.7	262766		22.0	88000
Private Office			42.8	940550		50.0	1101023		7.3	160473		75.2	1655423		25.2	554400
Industrial		140	36.8	147200	140	36.8	147200	0	0.0	0	140	36.8	147200	0	0.0	0
Light Industrial		129	25.8	103200	129	25.8	103200	0	0.0	0	129	25.8	103200	0	0.0	0
Commercial and Technology		11	11.0	44000	11	11.0	44000	0	0.0	0	11	11.0	44000	0	0.0	0
Open Space			103.0			120.5			0.0			181.2			0.0	
Active			30.9			36.2			5.3			54.4			18.2	
Passive			72.1			84.4			12.3			126.9			42.5	
Transit Station		0	0.0		2	0.8		2	0.8		2	1.1		1	0.4	
Streets			355.6			398.7			39.4			539.4			128.0	
TOTAL AREA			2049.0			2297.1			226.8			3107.8			737.3	

Source: Maluleke Luthuli and Associates, 2008

b. Housing

The Table above illustrates that approximately 3400 housing units will need to be developed within the Eastern Sub-Region to accommodate the population growth within the Eastern Sub-Region by 2010. An additional 11500 housing units will need to be developed within the Eastern Sub-Region to accommodate the population growth within the Eastern Sub-Region up to the year 2020.

c. Community Facilities

The Land Use Budget has calculated the number of community facilities required within the Eastern Sub-Region area to eradicate the backlog in such facilities, as well as provide the additional facilities needed to support the potential population growth within the Eastern Sub-Region. According to the Land Use Budget, Eastern Sub-Region will require 9 primary schools, 3 secondary schools, 4 clinics, 3 libraries and 1 post office to eradicate the existing backlog and support its population growth up to the year 2010. The Eastern Sub-Region will require an additional 6 primary schools, 3 secondary schools, 2 clinics, 2 libraries and 1 post office to support its population growth up to the year 2020.

d. Business

The viable retail and office floor area that can be accommodated within a given area depends on the spending capital of the people living in that area. In turn, the spending capital depends on the socio-economic position of the people living in that area. The potential retail and office floor area to support the current population within Eastern Sub-Region was calculated based on the socio-economic position of people living within the Eastern Sub-Region, as set out in the socio-economic section of this report. Taking into account the above, the additional retail and office development required within Eastern Sub-Region to support its potential population growth up to the year 2010, is approximately 185000m². An additional 642000m² can be allocated by the year 2020.

e. Open Space

Open space can be classified as active and passive open space. The former involves recreation and sport facilities. The latter involves natural areas, such as ridges and river flood areas. According to the Land Use Budget, the Eastern Sub-Region requires approximately 5ha of active open space to support its population up to the year 2010 and an additional 18ha to support its population up to the year 2020.

SECTION 4: DEVELOPMENT VISION

4.1. SUSTAINABLE DEVELOPMENT

Sustainable development is an international concept that is increasingly becoming the measure of the success of urban developments. It is therefore necessary to briefly discuss the concept of sustainability and how it is measured, in order to define the development objectives for the development of the Eastern Sub-Region.

4.1.1. CONCEPT OF SUSTAINABLE DEVELOPMENT

According to the Gauteng Strategy for Sustainable Development (2006), there is a growing worldwide focus and emphasis on the intricate linkages between the **natural environment, economic stability and social well-being**. The concept of sustainable development integrates these inter-dependant components, as depicted by the Diagram below.

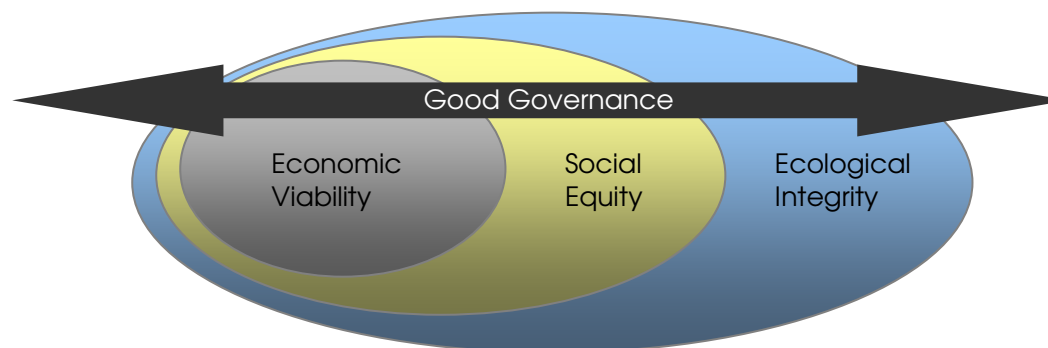


DIAGRAM 21: COMPONENTS OF SUSTAINABILITY

Sustainable development focuses on improving the quality of life for all the Earth's citizens without increasing the use of natural resources beyond the capacity of the environment to supply them indefinitely. It requires an understanding that inaction has consequences and that we must find innovative ways to change institutional structures and influence individual behavior. It is about taking action, changing policy and practice at all levels, from the individual to the international level.

Good Governance is the central pre-condition for achieving sustainable development. It is recognized that without effective governance (i.e. management, control and policing) achieving sustainable development is impossible. Therefore, if long-term sustainable development is to be achieved, government's (national, provincial and municipal) need to integrate the concept of sustainable development into decision-making and governance processes.

SOUTH AFRICA'S ECOLOGICAL FOOTPRINT

Using the increasingly popular quantitative measurement known as "ecological footprinting", it has been estimated that South Africa's footprint is 4,02 hectares per person. "Foot printing" is an accounting tool that measures how much biologically productive land is required to support the living standards of an individual, a city or a country. This includes the land required to produce the physical resources consumed, absorb the wastes generated, and sequester CO₂ emissions associated with energy demand. Using the World Wildlife Fund (WWF) estimate that the global "fair share" is 1,8 hectares per person if we are all to live within the carrying capacity of the planet's ecosystems, this means that we would need two planets if everyone lived like the average South African. This, however, masks gross inequalities. A recent study of Cape Town found that the footprint of Cape Town's middle class suburbs is 5-6 planets (similar to the United States average which is 5,2 planets), and the footprint of the poor suburbs is 0.5 to 1 planet (similar to China and India).

Source: National Framework for Sustainable Development

In South Africa, the primary focus has been on the promotion of economic growth and social equity, rather than on the broader implementation of sustainable development. At present, intensified and unsustainable demand for land, water and ecological resources resulting from the expansion of uncontrolled urbanization has led to an increased degradation of natural ecosystems and loss of high-potential agriculture land. This demand is eroding the life supporting systems that uphold our civilization and is not considered to be sustainable over the long run.

In the context of the above, it is clear that the first and primary focus must be on ensuring the ability of future generations to meet their needs. This implies that any sustainable development strategy must primarily be focused on a resource management

approach. Practically and from a spatial point of view, this implies protecting areas of high environmental importance, protecting high-potential agricultural land, densifying cities to reduce the need to travel and burn fossil fuels, and promoting inward urban development to relieve pressures for urban sprawl.

4.1.2. SUSTAINABILITY INDICATORS

Sustainable development is a complex concept and there are many interconnections between the environment, social sectors and economic activity. For developing countries key areas of sustainability include developing the necessary infrastructure, improve the environment for private sector activity, improving the quality of governance, strengthening capacity in the public sector and increasing effectiveness of the delivery of social services to poor people. However, this accent on social and economic development needs to be done within the context of environmental conservation and resource management. Successful delivery within these areas (environment, social and economic) can be assessed and even quantified using a number of sustainability indicators. These indicators provide some indication of the areas that need to be addressed in order to obtain sustainability within a settlement. These indicators are as follows:

Indicator 1: Economic Strength

Economic growth leads to higher living standards and greater prosperity for individuals, generally improving the quality of life. Giving people opportunities for work is a key objective underlying sustainable development. Levels of employment are closely related to economic activity and enables individuals to improve their living standards and meet their social needs. This requires development that is labor-absorbing and is accompanied by policies and programs that facilitate employment and income generation for the poor. To minimize unemployment in the longer term, people need the right skills to do the jobs available and this requires investment in education and training.

Indicator 2: Competitiveness to Attract Capital

Development requires economic growth. Economic growth occurs when businesses respond to economic incentives. To attract capital, sound economic incentives, backed by policies and capacity building are required in settlements. The exchange of goods and services across boundaries is a primary indicator of a settlement's ability to attract investment capital. For example, are goods bought by the households within a settlement produced and sold within that settlement, or are they purchased in other areas or settlements.

Indicator 3: Infrastructure Strength

Infrastructure investment plays a vital role in reducing poverty, promoting economic development, creating employment and increasing production within a region. Infrastructure development thus plays a crucial role in sustaining and promoting the economic and social development of settlements. When assessing sustainability issues, this indicator must take into account its impact on other indicators. For example, investment in road infrastructure instead of rail infrastructure may impact on the level of energy usage.

Indicator 4: Housing Development

A 'housing for all' approach needs to be followed with the accent on providing housing to the poor. The housing development indicator thus assesses whether a settlement's rental and ownership opportunities are affordable to residents of all income levels. It also assesses whether there are enough houses built to address the housing need within a settlement. Also, the quality housing is also of importance. Poor quality housing is often linked with a number of social problems.

Indicator 5: Social Strength

Social investment constitutes investment in public assets like clinics, schools and recreation facilities. When assessing sustainability issues, this indicator should be considered alongside other indicators. For example, investment in education facilities should be assessed with the standard of education and investment in health facilities should be assessed with the general level of health services provided.

Indicator 6: Energy Usage

Given the close links between economic activity and environmental change, there is a strong argument for developing indicators that integrate the economy and the environment more closely. Some of the environmental conditions that need to be closely monitored include changes in biological diversity, energy use and the emission of greenhouse gases. Climate change is recognized as one of the greatest environmental threats facing the world today, which is largely driven by energy consumption. Levels of energy consumption are related to the mode of transport preferred to access employment opportunities within a community.

Indicator 7: Agriculture Protection

Land resources are finite, fragile and non-renewable, especially with regard the high-potential agricultural land. Sustainable development means maximizing the use of urbanized land in order to protect high-potential agricultural land, which is essential for a region's agricultural economy and a country's food security.

Indicator 8: Environmental Conservation

The conservation of natural areas is a direct indication of the impact of urban development on the natural environment and the effectiveness with which urban development is managed. Specifically, the ability to curb urban sprawl affects natural environments and the ability to balance urban development with the conservation of the natural environment. Urban development strategies, such as infill development and urban densification can greatly reduce the need for land and the associated level of environmental impact urban development.

Indicator 9: Good Governance

Principles of good governance with a pro-poor approach involve a government (national, provincial and municipal) that is transparent, accountable and responsive. Other important elements of good governance include political stability, government effectiveness, regulatory quality, applying the rule of law and the control of corruption.

Indicator 10: Safety and Security

Level of crime is a measure of good governance, but also a direct measure of community stability and sustainability. Crime data on violent crimes, property crimes and other crimes in the settlements provide indications of the level of safety and security enjoyed within a community. In part, safety and security is influenced by infrastructure provision (e.g. police stations and fire stations) and the level of services provides.

4.2. DEVELOPMENT OBJECTIVES

To address sustainability issues, cities have to be guided through planning initiatives toward becoming more sustainable and integrated urban environments. Taking into account the sustainability indicators set out above, the following development objectives have been defined for Eastern Sub-Region:

Objective 1: Efficient Urban Form

Urban efficiency deals specifically with the relationship between the localities of places of work, places of living and the accessibility between them in terms of movement and mobility. It follows logically that the key to urban efficiency is directly related to urban form and structure. The Eastern Sub-Region has a well-planned road network (although only partially developed) and is located close to employment opportunities (such as the Midrand strip and Sunninghill node). However, more can be done to improve the efficiency of its urban form. Measures can include the construction of the planned road network and higher-density, mixed-use development at key transportation access points (road intersection and BRT stations).

Objective 2: Urban integration

Apart from certain areas, such as Sunninghill and Kyalami, the Eastern Sub-Region is a sparsely developed region, providing room for infill development to better integrate the various suburbs within the Eastern Sub-Region. Of specific relevance is the infill and densification of the K71 to create an integrated urban corridor along this route. By doing this, Eastern Sub-Region will form part of a consolidated urban band stretching from Sunning to Olievenhoutbosch. Such an integrated urban structure forms the bases for the efficient use of public transportation infrastructure and providing cost-effective public transportation services.

Objective 3: Equitable access to social services

Settlements located on the outskirts of a municipal area are often located far from the community facilities (such as schools and clinics) provided in the more centrally located areas of the municipal area. This results in high transportation cost for the households living within these areas to access these services. The Eastern Sub-Region is essentially located on the outskirts of the larger Johannesburg metropolitan area. It is therefore imperative that the community facilities needed to serve the Eastern Sub-Region be provided in the Eastern Sub-Region through the development of a hierarchy of

community nodes. Such nodes will place these facilities closer to these households living within the Eastern Sub-Region, thus making them more accessible.

Objective 4: Promote smart transportation

Within the context of global warming, it is imperative that the use of smarter transportation systems be promoted within the Eastern Sub-Region, over the use of less environmentally friendly transportation options. For example, the use of a bus network connecting neighborhoods within the Eastern Sub-Region should be promoted through the structuring of our urban environment to support such a system, instead of further encouraging the use of private vehicles and the urban sprawl it promotes. In addition, pedestrian-friendly design must be promoted within the Eastern Sub-Region, which encourages a greater use of bicycles and walking as daily form of transportation.

Global Warming and Transportation

Global Warming and climate change is threatening the survival of the human race. To a large extent, Global Warming can be attributed to the following:

- The use of fossil fuel modes of transportation
- Traffic congestion that is wasting millions of liters of petrol daily world-wide
- Out of control sprawl that is creating long travel distances

Stabilizing the climate therefore involves amongst other things a dramatic reduction in emission. To accomplish this, requires a rapid conversion of our transportation system, away from fossil fuel inefficiency towards the use of more energy efficient modes of transport, such as commuter rail and Bus Rapid Transit.

Objective 5: Land use and transportation integration

Central to promoting smart transport, is the use of public transport, as these are generally more energy efficient and environmentally friendly than private vehicles. Land use development and public transportation are interlinked, with the one affecting the development of the other. Linear spatial configurations create the optimal land use structure for the cost-effective operation of public transport systems, because public transportation works most effectively in a linear pattern, as opposed to winding its way through sprawling urban areas. It is therefore necessary that such a spatial pattern be pursued within the Eastern Sub-Region in order to foster better land use and transportation integration.

Objective 6: Increase density and compactness

Increasing density is central to curbing urban sprawl and promoting the use of smart transportation. With regard to the latter, increased density places buildings, residences, shops, and services within walking of transit stations, thus increasing access to and the use of public transport. Walkability is also promoted through the development of pedestrian friendly street design, such as placing buildings close to streets, tree-lining streets, providing on street parking, hiding parking lots, and constructing narrow/ slow speed streets.

Objective 7: Create mixed-use environment

Apart from density, creating a mixed-use urban environment promotes the use of smart transportation options. The reason for this is that mixed land use, which is centred on transit station, increases the reasons for being in a specific area or node and therefore the use of that station. A mixed-use environment also creates a one-stop-shop setup, thus limiting the need for additional travel. Mixed-use neighborhoods can be created within the Eastern Sub-Region by mixing shops, offices and range of housing typologies.

Objective 8: Protection of open space

A way to integrate urban areas is to deliberately protect ecologically sensitive areas and high-potential agricultural land. By rigorously protecting such areas, urban areas are prohibited to sprawl freely and are therefore forced into denser urban agglomerations. However, ecologically sensitive areas and high-potential agricultural land must not prohibit the integration of fragmented urban areas. In such cases the integration of urban areas would have greater advantages, such as limiting travel distances, which in turn limits emissions by fossil fuel burning vehicles.

SECTION 5: DEVELOPMENT FRAMEWORK

5.1. SPATIAL STRUCTURE

5.1.1. METROPOLITAN SPATIAL PERSPECTIVE

In order to evaluate and understand the spatial structure of the Johannesburg Metropolitan Area, it is necessary to have an insight into the alternative urban structures that exist. The most common spatial alternatives can be grouped under one of three broad categories: the concentric settlement, the homogeneous settlement and the strip settlement (see Diagram below). These are briefly described as follows:

a. Concentric Settlement

Land uses within concentric cities are evenly distributed at relatively high densities. Development is contained within the boundaries of the existing urban area, with development beyond the periphery discouraged. These cities are largely dependant on public transport and generally support a radial road network that primarily serves a central core. In addition to the radial road network, this configuration can contain a ring road linking the radial roads on the periphery of the urban structure. This type of settlement is characteristic of European cities. Older South African towns and cities, such as the older parts of Johannesburg, represent elements of this spatial configuration.

b. Homogeneous Settlements

Homogeneous settlements are dispersed over a large area and consequently do not have a clear structure and identifiable nodal hierarchy. This spatial structure is supported by a grid road network and is largely dependant of private vehicles for movement. Public transport is difficult to sustain due to the low urban densities. To a large extent the Gauteng urban structure is characterized by this structure, largely because of the grid PWV network that serves it.

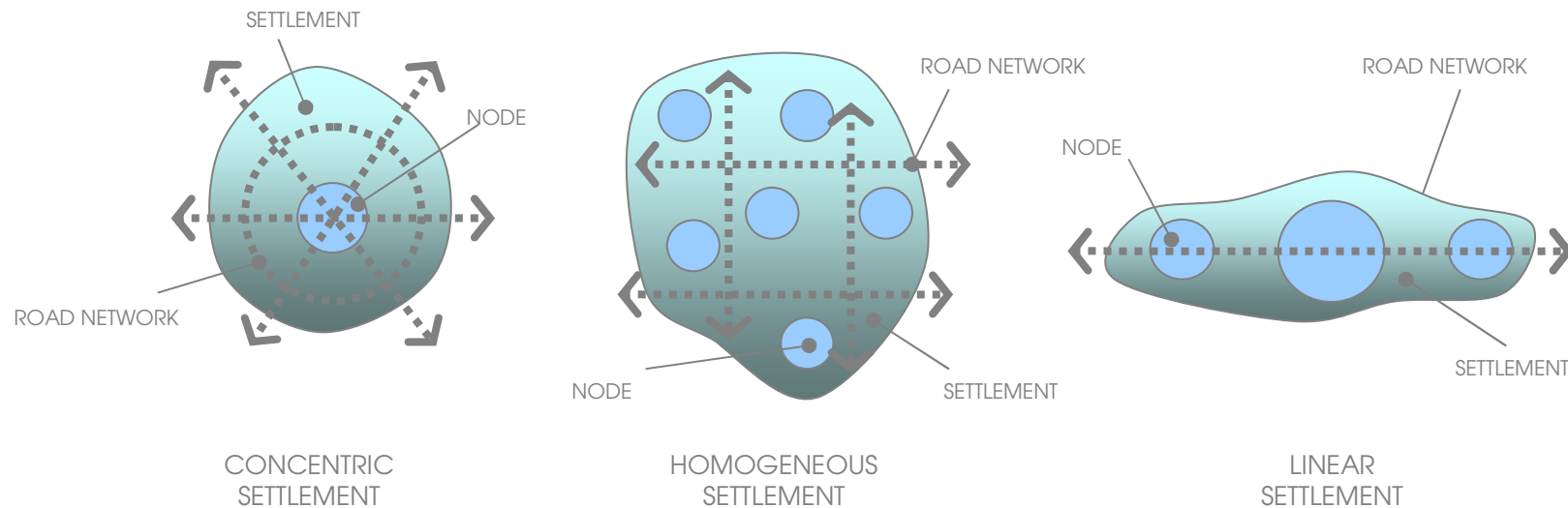


DIAGRAM 22: SETTLEMENT CONFIGURATIONS

c. Linear Settlement

Linear settlements are shaped by a public transportation line or road, or several lines or roads parallel to each other. Development takes place in a strip on both sides of this transport line, with a concentration of development at intersections or transit stops along the line or road. Consequently, this settlement configuration is ideal for the operation of public transportation systems. The scale of this settlement configuration can vary and on its largest scale can extend from one city to another. To a degree, this configuration is evident along the N1 Freeway that links Tshwane, Midrand and Johannesburg.

The settlement configurations defined above represent the typical form of each configuration. Urban areas are rarely shaped in such a pure form. Instead, a mixture of a number of these configurations, leaning more to one configuration than another, is exhibited.

The Eastern Sub-Region consists of a mixture of the radial and homogeneous configurations. It is radial in the sense that the radial network of the older Johannesburg network (comprising routes such as Main Road (K71) extending into the Eastern Sub-Region. This network is ideally suited for the public transportation network serving the Eastern Sub-Region. The homogeneous settlement characteristics are attributed to the Eastern Sub-Region by the planned PWV road network overlying the area. This road network forms a grid pattern across the Eastern Sub-Region and provides strong east-west linkages, which are absent in the older parts of Johannesburg. The homogeneous configuration tends to favour private vehicle usage and the intersections created by east-west and north-south aligned road create numerous opportunities of nodal development.

5.1.2. DEVELOPMENT CONCEPT

The aim of the Development Concept is to guide spatial development on a sub-regional level, based on the metropolitan spatial perspective set out above. In addition, as suggested by the development vision, the aim of the Development Concept should be to promote the development of a sustainable community within the Eastern Sub-Region. The Development Concept, which is illustrated by the Diagram below, guides spatial development within the Eastern Sub-Region through a set of nodes, corridors and infill areas. The Development Concept is made up of the following elements:

a. Transportation structure

The K71 is currently the central road spine linking the Eastern Sub-Region to Woodmead and the rest of Johannesburg. Other significant roads include Lever Road, which runs parallel to the N1 freeway and links the residential areas along the Midrand strip, the K55 (Alandale Road) and the K60 (Witkoppen Road). Two roads in particular will improve accessibility within the Eastern Sub-Region. The K73 will link Sunninghill to the Midrand strip and the K56 will link the Eastern Sub-Region westward to Cosmo City. The K71 and the K56 has the potential to link the Eastern Sub-Region to local and regional employment opportunities, social amenities and shopping destinations and should therefore be development as public transportation spines. Two freeway are planned that will link the Eastern Sub-Region regionally. The PWV9 will link the Eastern Sub-Region to the western parts of Tshwane and the PWV5 will link the Eastern Sub-Region to the northern parts of Ekurhuleni.

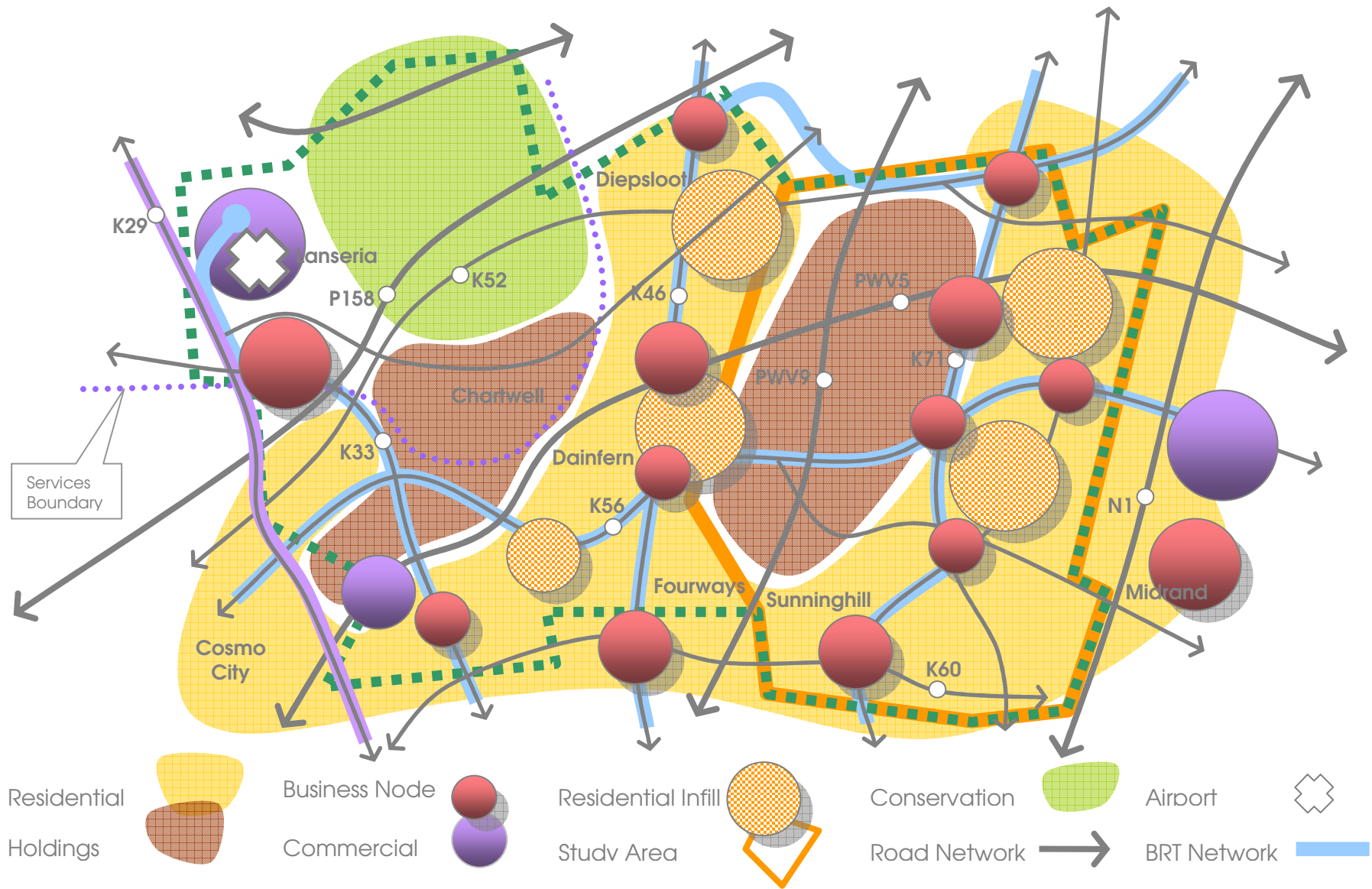


DIAGRAM 23: DEVELOPMENT CONCEPT

b. Nodal structure

A number of mixed-use nodes can be developed within the Eastern Sub-Region along the spines mentioned above. The K71 and the K56 are proposed public transportation spines and are therefore ideally suited as access spines for the nodal structure. It is also important to develop a hierarchy of node, which would provide different levels and a range of services within the Eastern Sub-Region. In addition to the existing Sunninghill regional mixed-use node, a regional mixed-use node would be suited on the intersection of the K71 and the planned PWV5 freeway. The freeway will provide regional and visual access, whereas the K71 will provide the necessary local and public transportation access.

c. Spatial structure

Currently, the Eastern Sub-Region is characterized by a number of fragmented settlements, mostly straddling the Midrand Strip. To achieve urban consolidation and create a spatial structure that would enable better land use and transportation integration, it is proposed that the existing settlements within the Eastern Sub-Region be consolidated through corridor development along the K71. This will require infill development along this corridor, with higher-density residential development being encouraged along the proposed public transportation spines and nodes within this corridor. The areas abutting the planned PWV9 freeway should preferably be left rural at this stage, until the PWV9 is constructed.

5.1.3. DEVELOPMENT SUITABILITY ANALYSIS

Figure 17 illustrates the land parcels within the Eastern Sub-Region that are suitable for urban development. This suitability index was developed taking into account environmental sensitive areas, high-potential agricultural soils and geotechnical conditions. Land categorized by C-Plan2 as irreplaceable or important site were deemed unsuitable for urban development, land with high-potential agricultural soils was considered unsuitable for urban development and land with poor geotechnical conditions were considered unsuitable for urban development.

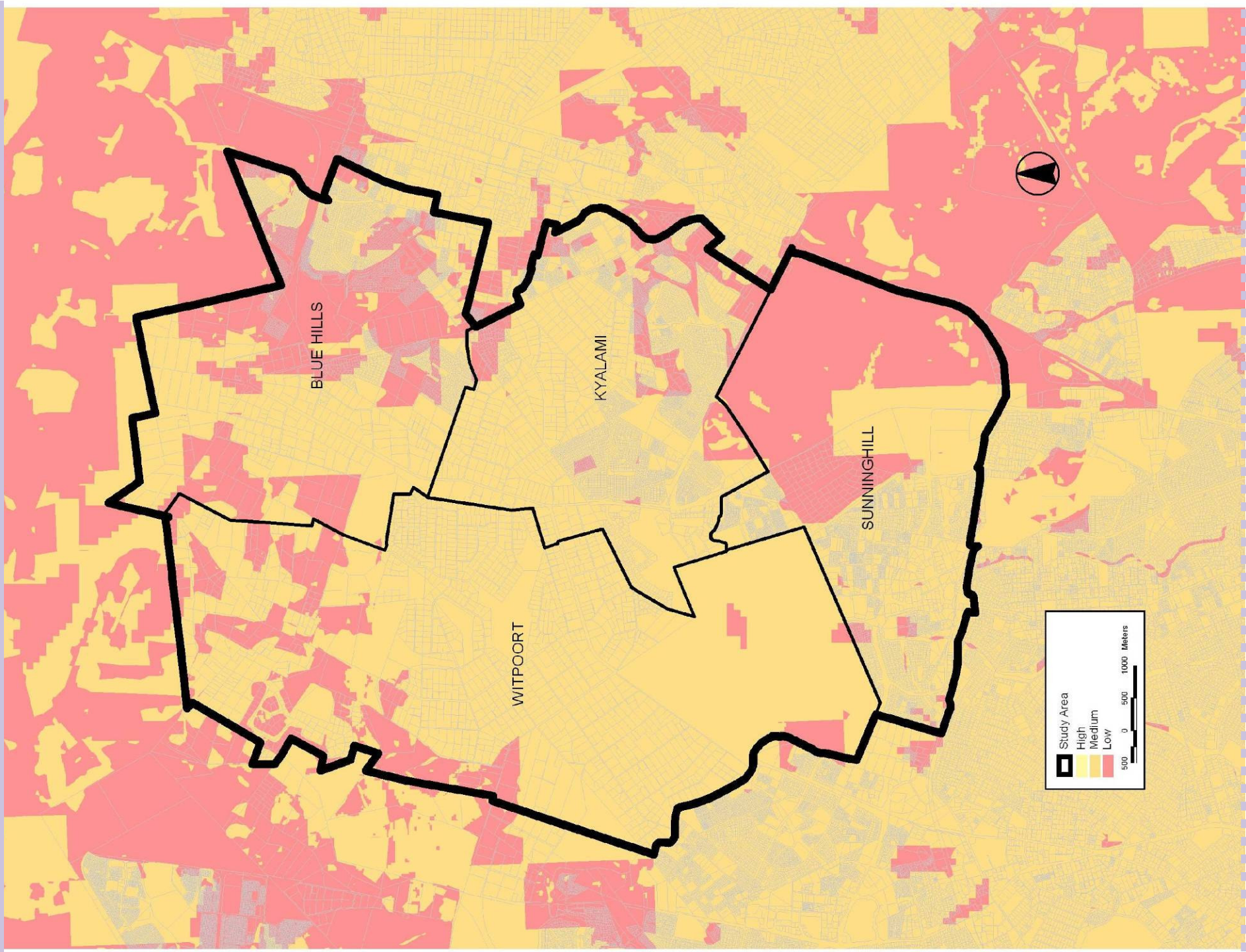


FIGURE 17
DEVELOPMENT SUITABILITY

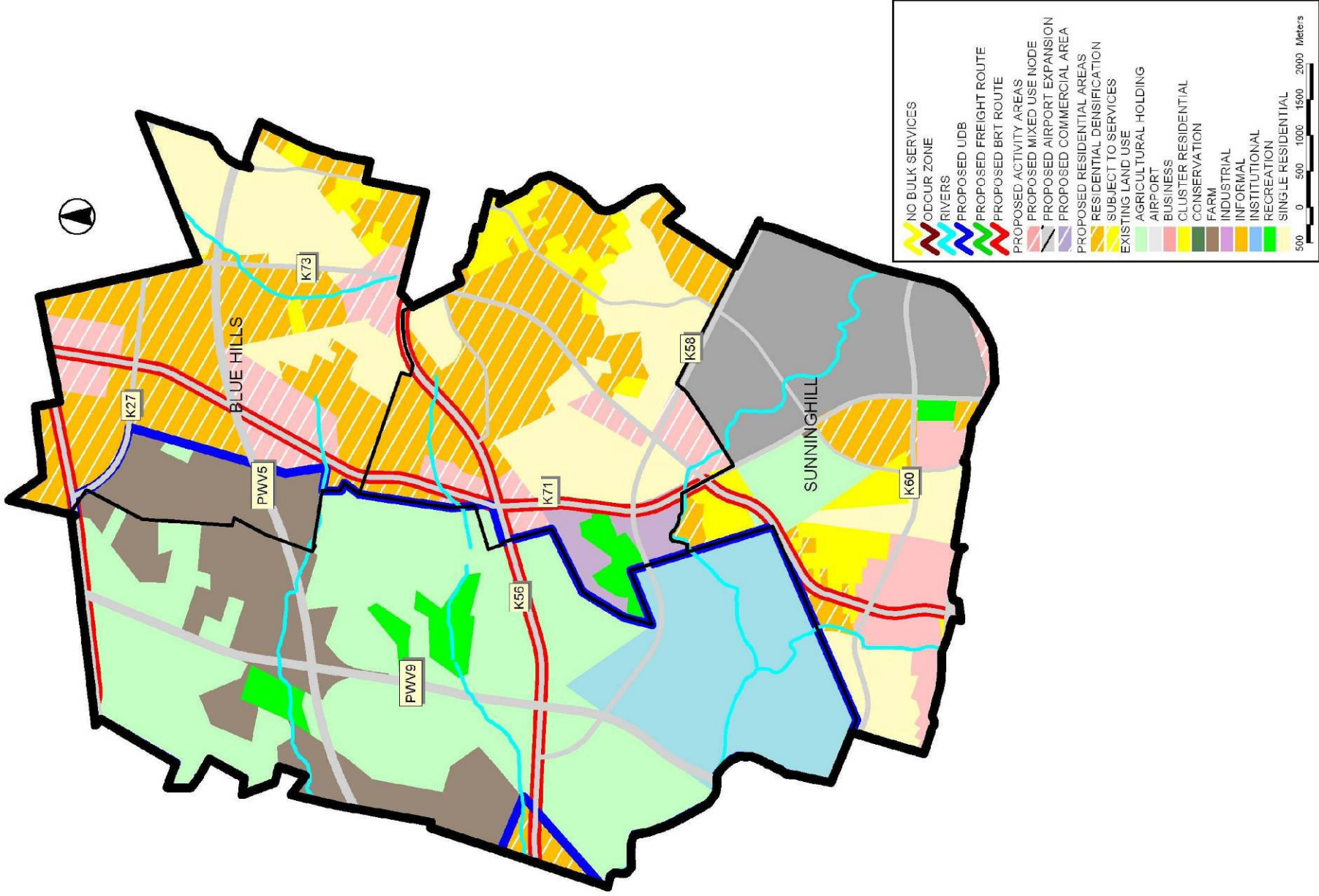


FIGURE 19
DEVELOPMENT FRAMEWORK

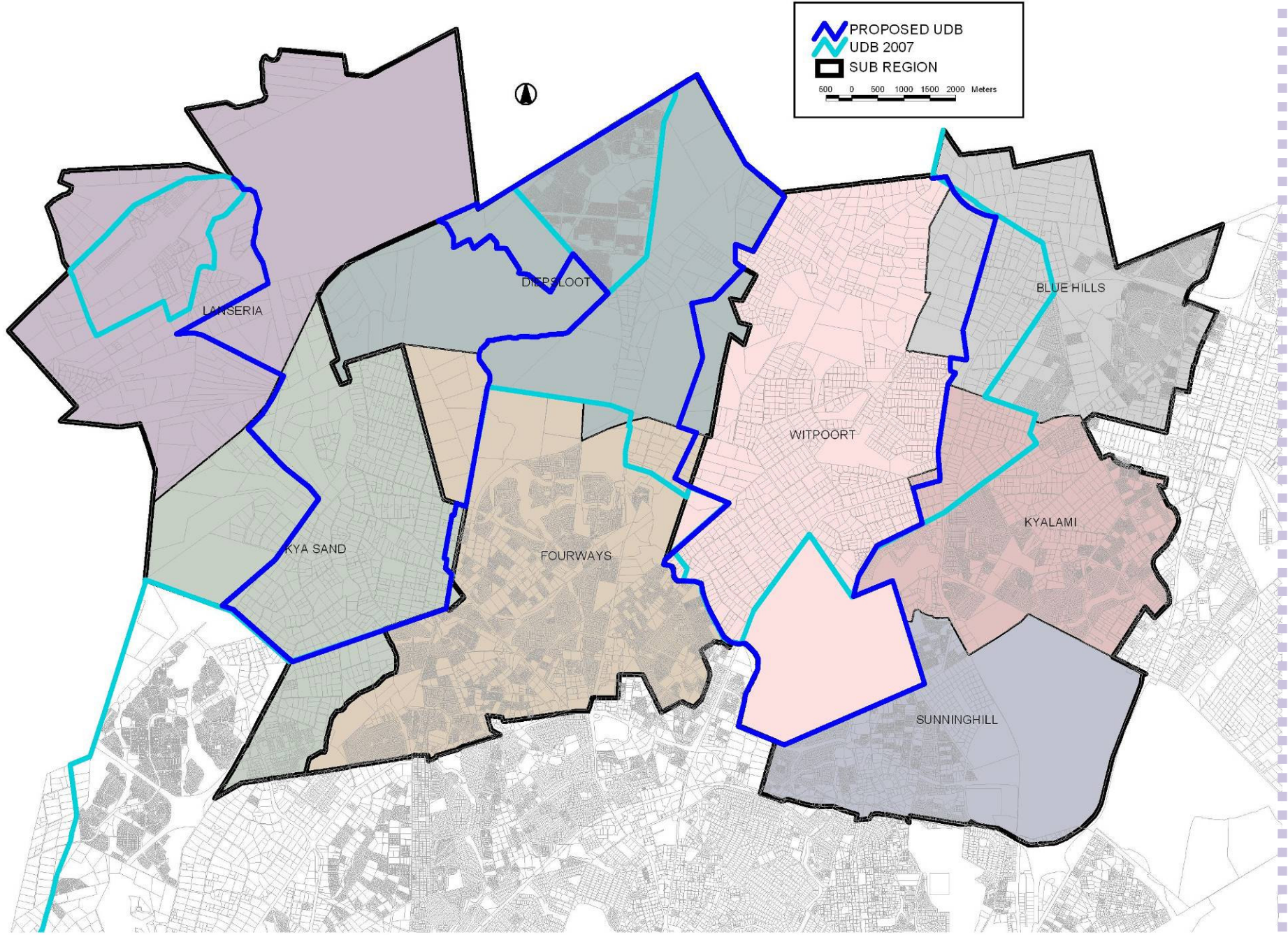


FIGURE 20
URBAN DEVELOPMENT BOUNDARY

Based on the analysis above, most of the Eastern Sub-Region is considered either of medium to low suitability for urban development. Mia’s Land, the eastern parts of Blue Hills and the northwestern part of the Eastern Sub-Region is considered to be unsuitable for urban development, mainly due to environmentally sensitive areas and to a lesser extent high-potential agricultural soils located within these areas. However, GDACE has pointed out that the environmental sensitive areas in the Blue Hills area have already been compromised, thus not providing an incentive to protect this area from urban encroachment. Mia’s Land is dealt with as part of the development plan put forward by the developers of Mia’s Land.

The reason why the remaining land within the Eastern Sub-Region is considered on medium development potential is due to the presence of relatively poor geotechnical conditions. However, these conditions can be overcome by through building and foundation design and does therefore not prohibit urban development within these areas.

5.1.4. SETTLEMENT EXPANSION

The land areas required for urban expansion within the Eastern Sub-Region has been calculated in the Land Use Budget set out in Section 3 of this report. The Land Use Budget calculated the land need in 10 year intervals up to the year 2050, as attached in Annexure A. The calculations have been combined to provide the total land requirements for the periods 2007-2020 and 2020-2040, as depicted by the Table below. According to the Table below, the entire northern region of Johannesburg, stretching from Midrand in the east to Lanseria in the west, requires approximately 4900ha of land for urban expansion up to the year 2020, and an additional 4300ha of land for urban expansion up to the year 2040. The Eastern Sub-Region, which form part of the aforementioned region, requires approximately 1000ha of land for urban expansion up to the year 2020, and an additional 1400ha of land for urban expansion up to the year 2040

TABLE 9: LAND NEEDED FOR URBAN EXPANSION 2020 AND 2040

Area	Period	
	2007-2020	2030-2040
Western Sub-Region	1914.8	465.9
Central Sub-Region	2046.6	2389.8
Eastern Sub-Region	964.1	1397.4
Total Area Needed	4925.6	4253.1

Source: Maluleke Luthuli and Associates, 2008

The land required for urban expansion within the Eastern Sub-Region has been allocated on Figure 18, taking into account the development suitability analysis set out in the previous section of this report. In addition, the land required for urban expansion was allocated to with the aim at strengthening the public transportation spine along the K71, as proposed in the Development Concept. The areas for urban expansion are as follows:

a. Period 2007-2020

The primary aim for the period 2007 to 2020 is to direct urban growth along the K71 corridor, in order to consolidate the fragmented settlement pattern existing within the sub-region and in so doing, creating the opportunity to develop a public transportation spine along the K71, stretching from Sunninghill to Olievenhoutbosch. This spatial configuration will also allow nodal development along the K71 spine. Most of the land required during 2020 (which amounts to approximately 1300ha) will be spent north of Kyalami and in the eastern parts of the Blue Hills area, thus also strengthening the larger Midrand strip.

b. Period 2020-2040

The period 2020-2040 will require the allocation of an estimated additional 1600ha of land for urban expansion within the Eastern Sub-Region. Although the time period extends beyond the lifespan of this study, this land requirement has been allocated for contextual purposes. This land will most probably be spent along the PWV9 freeway, creating an urban corridor along the PWV9 that is tailored to the needs and opportunities presented by the PWV9 freeway. Taking into account the timeframe for the planning, financing and construction of such a freeway, the areas surrounding this freeway are not considered suitable for urban development in the short term.

c. External Growth

In addition to the growth estimated by the Land Use Budget for the periods 2020 and 2040, external growth has also been taken into account. External growth is defined as urban growth potential that is generated by settlements located outside of the Eastern Sub-Region boundary, but which is spent inside of the Eastern Sub-Region boundary. In other words, this growth potential is not created by population growth within the Eastern Sub-Region boundary.

Two areas in particular are considered to have the potential to exert external growth pressure on the Eastern Sub-Region. The first is Mia's Land, which is a large-scale new town development that is tied to the Midrand Strip and in

particular the Buckles interchange, but will use up a significant portion of the available land located within the Eastern Sub-Region. The second is Olievenhoutbosch South, which involves the southward expansion of Olievenhoutbosch over the Tshwane boundary into the Johannesburg metropolitan area. Mia's land will require approximately 800ha of land, whereas Olievenhoutbosch South has the potential to allocate 400ha of land within the Eastern Sub-Region. Both these developments will strengthen the K71 corridor, thus supporting the Development Concept set out in this report.

Although an attempt was made to point out the constraints affecting the Eastern Sub-Region, it has to be stressed that localized constraints could emerge once a site earmarked for development is investigated in more detail. Also, it may be that the constraints are more prohibitive than assumed in this report. Such issues may surface during the EIA process, during the township establishment application process, or during the construction phase, when building foundations are investigated. The following development constraints could emerge during these detailed phases:

- Geotechnical conditions: It is known that moderate geotechnical conditions underlie the Eastern Sub-Region, but that these conditions do not prohibit urban development. However, it may be that localized areas within the Eastern Sub-Region may have geotechnical conditions that are not suitable for building construction, or would require specialized building foundations that will increase building cost.
- Municipal services: Besides the bulk municipal services network capacity (which was not been determined in this study) there may be localized areas within the Eastern Sub-Region that cannot be readily linked to the bulk network due to topographical constraints. There was mention of such areas within the Blue Hills areas. To address this may require, for example the installation of sewerage pump stations, which could possibly become a condition for development in such areas.
- Flooding: Although the protection of the floor areas of river systems within the Eastern Sub-Region has been taken into account by allowing for ample passive open space in the Land Use Budget, it may be that certain rivers within the Eastern Sub-Region have flood areas that exceed the land area provide for it in the Land Use Budget.
- Land ownership: The allocation of the Land Use Budget has not and cannot take into account the ownership of the land within the Eastern Sub-Region. Because most of the land within the Eastern Sub-Region is in private ownership, would imply that the development of these land parcels are up to the owner, which could mean that the land is not developed as proposed in this study, but is rather left as it is used currently.
- Environmental constraints: Although C-Plan2 of GDACE has been taken into account; localized environmental constraints could affect the land available for development within the Eastern Sub-Region. GDACE was clear that they do not only use C-Plan2, but also supplements this data source with site visits when evaluating a specific application for land use change. The proximity of a river system of ridge heightens the changes of finding localized environmental constraints during an application for land use change, typically a township establishment application.

- High-potential agricultural soils: As was determined in this study, high-potential agricultural soils do not significantly affect the Eastern Sub-Region. However, it may be that during township establishment, localized pockets of high-potential agricultural soils are found, which could affect the manner and extent to which a property can be developed.

A development framework was drafted, based on the areas set out for urban expansion for the period 2007 to 2020. This period is considered the lifespan of the development framework. In other words, this document makes proposals for the urban expansion and land use development up to the year 2020. The development framework is presented by Figure 19.

5.1.5. URBAN DEVELOPMENT BOUNDARY

Demarcating an Urban Development Boundary has specific advantages, the primary being to prevent uncontrolled urban sprawl. Urban sprawl is undesirable since it increases pressures on the limited resource of local government, from public transport to water and sanitation infrastructure provision. Demarcating an Urban Development Boundary can also protect valuable agricultural land and ecologically sensitive areas from urban encroachment. But an Urban Development Boundary can also have drawbacks. For example, it can restrict the supply of land for urban development, which could inflate land prices within the boundary. Care should therefore be taken when demarcating an Urban Development Boundary. A balance should be reached between providing enough land for urban development and the need for sustainable and managed urban development.

The latest Urban Development Boundary is the 2007 boundary, as depicted on Figure 20. Within the Eastern Sub-Region, this boundary includes the Leeukop Correctional Services area, Sunninghill, Mia's land and Kyalami, but excludes the western parts of the Blue Hills area. The result of the later is that the northern parts of the K71 is excluded and the potential of developing this road into a corridor. Reasons for excluding this part of the Blue Hills area may be due to problems experienced in connecting localized areas within the Blue Hills area to the bulks sewer network.

A new Urban Development Boundary is proposed by this study, which is illustrated on Figure 20. The proposed Urban Development Boundary was first and foremost demarcated according to the Land Use Budget estimates for settlement expansion up to the year 2020. In other words, the Urban Development Boundary does not allow the Eastern Sub-Region to sprawl beyond the spatial limits required by the population growth of the Eastern Sub-Region up to the year 2020. Other principles used to demarcate the Urban Development Boundary include the following:

- The containment of the urban sprawl and the promotion of infill and densification
- The creation of urban corridors along public transportation routes, such as the K71
- The integration of existing and planned affordable housing projects (such as Olievenhoutbosch South) with other urban settlements
- The cost implications of establishing new infrastructure for new township developments in remote areas
- Taking into consideration unsafe geological conditions where and if applicable
- The conservation of environmentally sensitive areas
- The protection of high-potential agricultural land where and if applicable

Compared to the 2007 Urban Development Boundary, the proposed Urban Development Boundary excludes the Leeukop Correctional Services site and rather concentrates this settlement growth potential along the K71, specifically in the Blue Hills area, to establish the K71 corridor. It was argued that the Leeukop site can rather be developed as part of the PWV9 corridor, which would first require the construction of the PWV freeway.

TABLE 10: LAND USES AFFECTED BY THE URBAN DEVELOPMENT BOUNDARY

Inside Urban Development Boundary	Outside Urban Development Boundary
Urban settlements Business and office nodes Industrial and commercial areas	Extensive and intensive agriculture areas Conservation areas and nature reserves Tourism facilities and related activities Agricultural holdings Governmental uses

Source: Maluleke Luthuli and Associates, 2008

A guideline for the type of land uses to be allowed inside and outside of the Urban Development Boundary are depicted in the Table above. As a rule, the Urban Development Boundary applies to all developments requiring a township establishment application.

5.1.6. LAND USE AND TRANSPORTATION INTEGRATION

Land use and transportation integration forms the backbone of an efficient urban structure. It not only ensures the cost-effective operation of the region's public transportation system, but it also tends to limit urban sprawl by concentrating urban development at higher densities close to public transportation routes. In addition, the mixing of land uses creates a better relationship between areas of residence and employment, which can lead to shorter commuter distances and a better two-way use of transport infrastructure.

5.1.6.1. TRANSIT ORIENTATED DEVELOPMENT (TOD)

The key to successful land use and transportation integration is obtaining higher land use densities and a greater mix of land uses at transit stations, such as bus stations. These are the points where access is obtained to the public transport systems and attempts should thus be made to optimally use these strategic locations. This can be done by locating a mix of work, community and higher-density residential uses at these stations, thus creating a one-stop service area for commuters. These are known as Transit Orientated Development (TOD).

TOD design elements

- Walkable design with pedestrians as the highest priority
- A commuter rail station or bus station or taxi rank as the central feature of the TOD
- A mixture of land uses in close proximity, including office, residential, retail, and community uses
- Higher-density, high-quality housing development within 4-10 minute walk radius (400-1000m) surrounding a commuter rail station or bus station or taxi rank

Of particular importance is the integration of housing development and public transportation. Public transportation is and must be central to housing development, specifically higher-density housing development, simply because households that typically live in higher densities are more reliant upon cheap and efficient public transport to access employment opportunities. Housing densities exceeding 20 units per hectare should be encourage within TODs, with densities exceeding 60 units per hectare encouraged close to transit stations. This will necessitate developing housing typologies that defer from conventional single

dwelling units, towards higher-density housing typologies. Higher-density housing developments need to be located walking distance of a public transportation station, generally accepted to be 400m from a station, which can also be considered the peripheral boundary of a TOD.

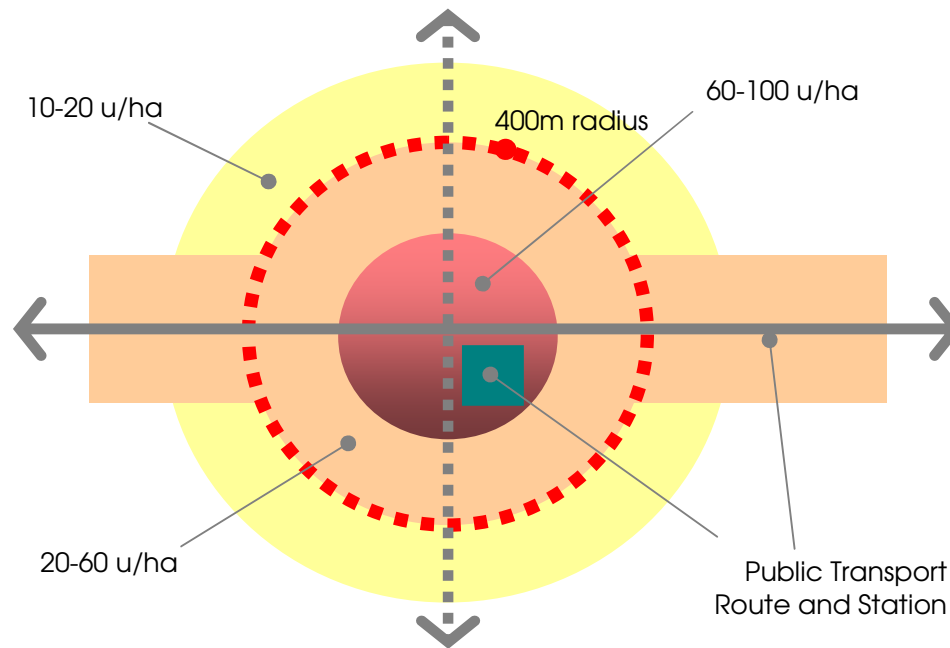


DIAGRAM 24: PROPOSED TOD HOUSING DENSITIES

Public transit is best supported if both higher densities and a land use mix are employed. Simply increasing densities in an area may do less to improve accessibility if not mixed with other uses such as shops and public amenities. Land uses can be mixed horizontally or vertically. Whereas the horizontal mixing of land uses is usually found in predominantly residential areas, the vertical mixing of land uses is predominantly found in business areas, where land is valuable and scarce, not allowing the development of certain uses on ground level. The Diagram below provides a conceptual illustration of the vertical mixing of land uses.

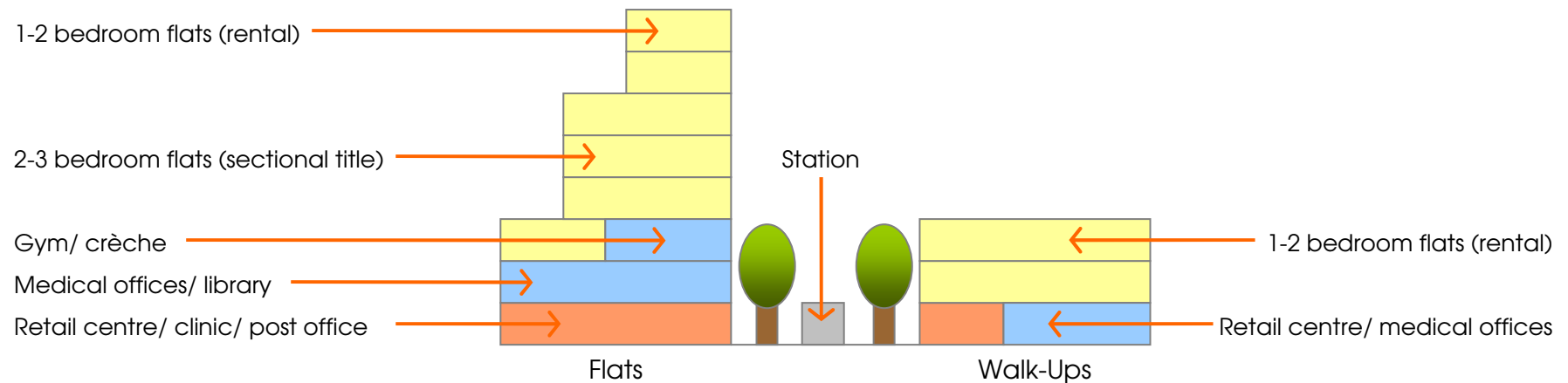


DIAGRAM 25: VERTICAL LAND USE MIXED-USE

Traditionally, certain land uses are not provided as part of a vertical mix within our cities. For example, schools are only provided on ground level and never as part of a vertical mix of buildings. In countries where land is scarce, such as Germany and Japan, schools are often provided as part of the vertical mix of buildings. In other words, excluding certain land uses from the vertical mix of buildings in our cities is often more an issues of perception than a matter of practicality. The need to mix such land uses vertically becomes a consideration when densifying parts of our cities that no longer have land available at ground level. For example, providing dwelling units within dense areas of our cities will inevitable increases the need for accessible community facilities, such as schools, requiring the provision of such land uses on the upper levels of buildings within such areas.

TODs can essentially be implemented in one of two ways: TODs located within an existing township, forming part of a brownfield development, and TODs forming part of a new town development (see Diagram below). TODs located within an existing township will involve the development of vacant stands within walking distance of public transportation termini for TOD-related uses, such as higher-density housing. TODs located within existing townships are ideal for use are part of urban renewal initiatives.

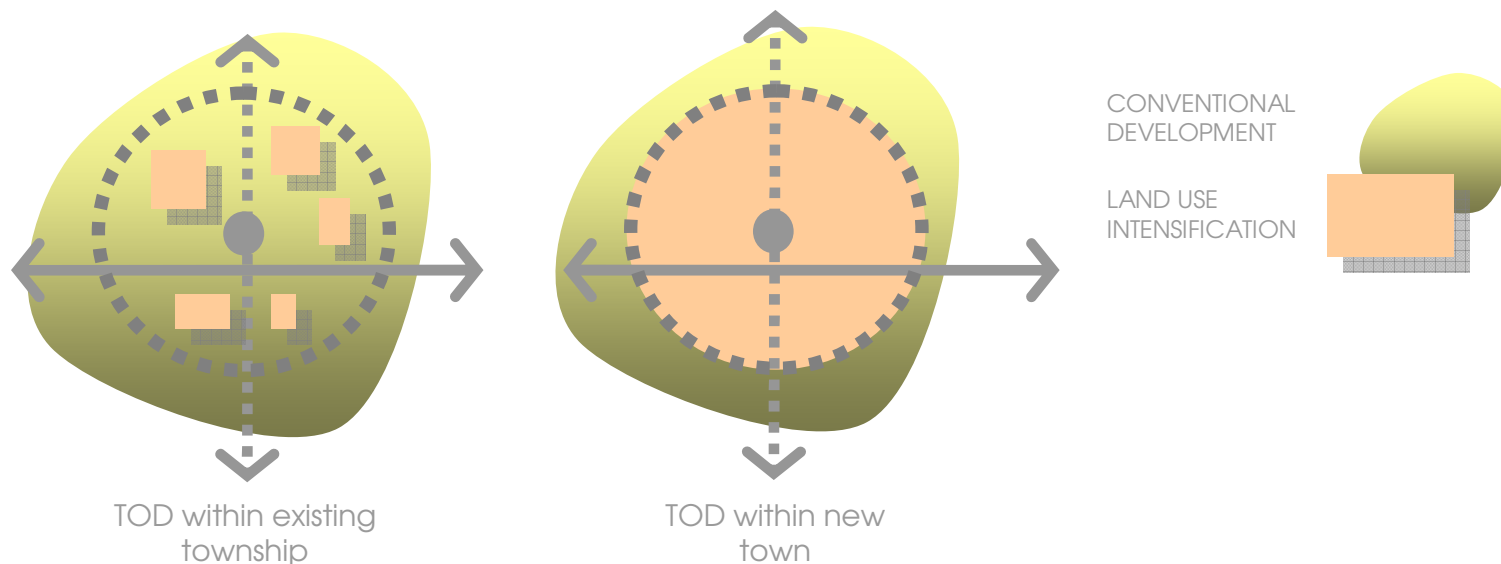


DIAGRAM 26: TOD IMPLEMENTATION ALTERNATIVES

TODs associated with new-town development involve the deliberate planning, design and construction of TOD-structures as part of a new town development. Because these TODs are new developments, the opportunity exist to apply sound TOD principle to the design from the start. Consequently, such TOD will better integrate land use and public transportation than would TOD created within existing townships.

Key to the development of TODs is the manner in which land uses within TODs are integrated with the public transportation system (bus or taxi) serving these TODs. This will involve creating pedestrian-friendly environments within TODs, using pedestrian walkways and public squares, and using these pedestrian environments as the link between the public transport stations and the surrounding land uses. A grid road and pedestrian network best suites pedestrian movement.

5.1.6.2. APPLICATION OF TODs

Transit Orientated Developments or TODs are best applied using a string-of-beads development pattern. A string-of-beads development pattern is usually shaped by a major road or commuter railway line, concentrating development (TODs) at intersections or transit stops along the spine (see Diagram below). Consequently, the string-of-beads settlement configuration is ideal for the operation of public transportation systems.

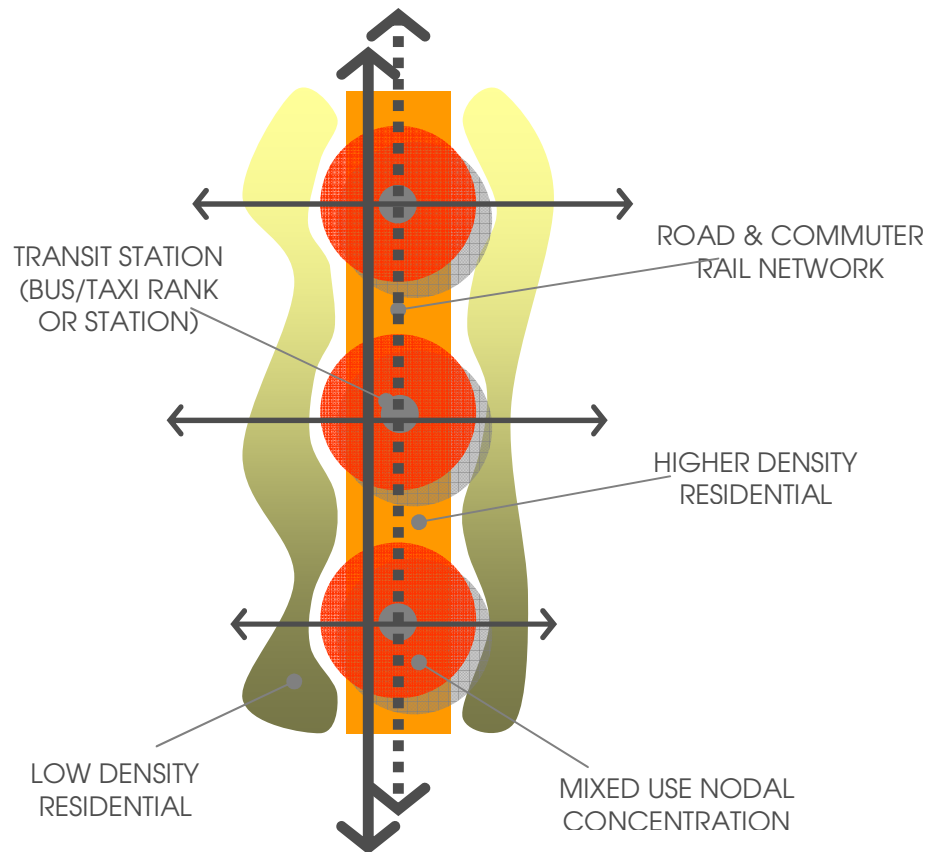


DIAGRAM 27: STRING-OF-BEADS CONFIGURATION

The scale of the string-of-beads settlement configuration can vary. On its largest scale it can extend from one city to another (which is the typical linear settlement mentioned above). The degree to which this development pattern is identifiable within a city is often dependant upon whether it is deliberately promoted through development policies or not. Policies that aim to develop a city that is centred on promoting the use of public transport, often exhibits a more defined string-of-beads development pattern, than a city that promotes the use of private vehicles.

5.1.6.3. PROPOSED TRANSIT ORIENTED DEVELOPMENTS (TODs)

The locations of TODs are governed by specific criteria, because the success of a TOD is largely depended upon its location. Based on the various aspects of TODs set out above, the following guidelines for the location of TODs are applied to determine a suitable location for TODs within Eastern Sub-Region:

- A TOD should be located on or directly connected to a public transportation route.
- A TOD should utilize existing, transit termini, such as commuter railway stations or taxi ranks.
- A TOD should be located on an area with enough vacant (non-urbanized) land for its development.
- A TOD should promote urban infill by using vacant land within existing urban area.
- If possible, a TOD should be located next to existing, planned or proposed non-residential activities. These will provide kick-start facilities for the development of these TODs.

The Diagram below illustrates the TODs proposed within the Eastern Sub-Region. These TOD locations correspond with the mixed-use nodes proposed for the Eastern Sub-Region, and are centred on the BRT stations proposed for the Eastern Sub-Region. Because the proposed TODs use the BRT station as focal points, the TOD and strung along the BRT routes in a string-of-beads pattern, as mentioned at the beginning of this Section of the report. The most notable TODs proposed within the Eastern Sub-Region are the TOD serving the proposed regional mixed use node located south of the planned PWV5 and K71 interchange, the TOD located on the intersection of the K60 and K73 in Sunninghill, and the TOD located on at the proposed commercial areas located on the K56 and PWV9 interchange.

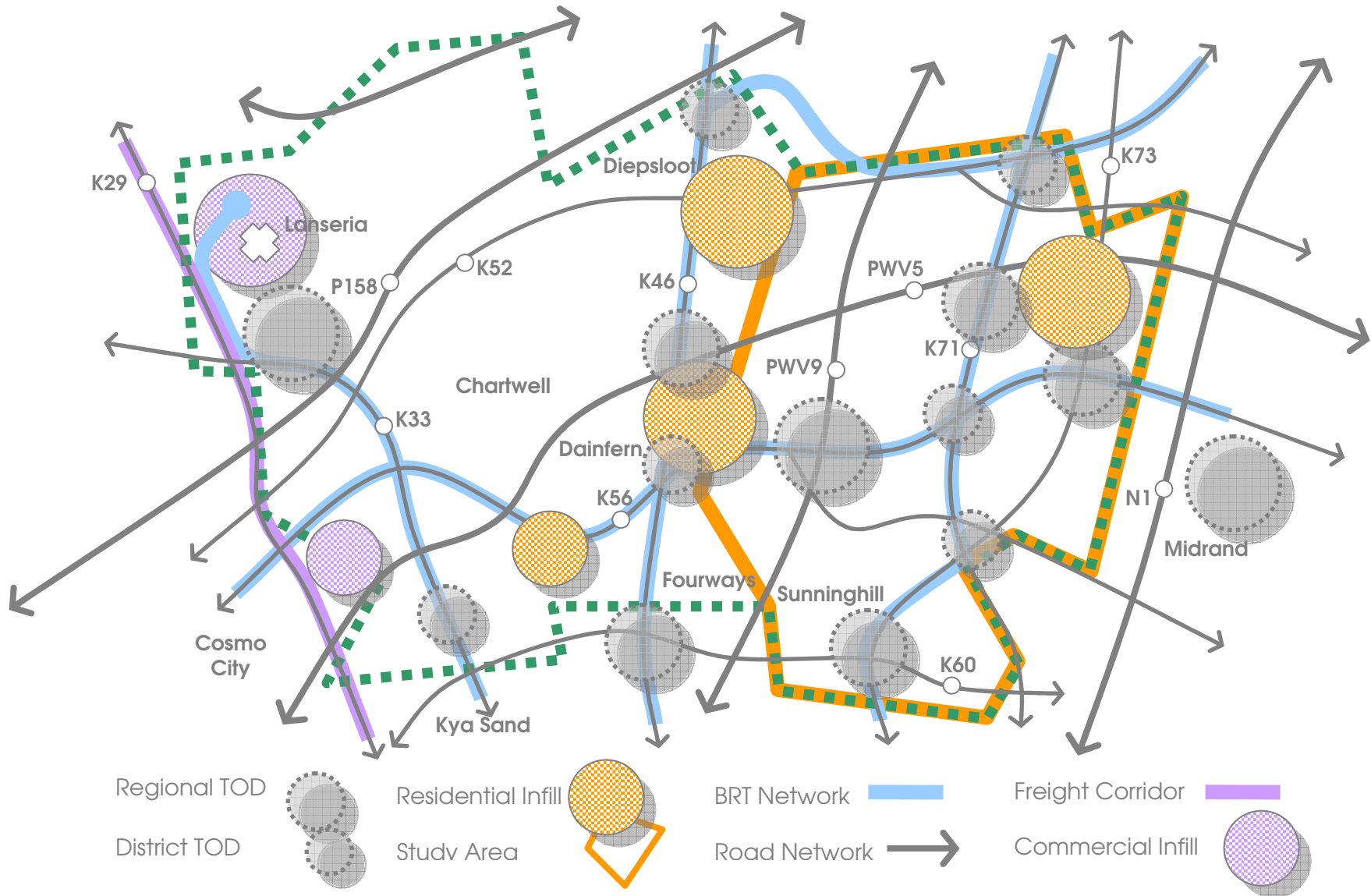


DIAGRAM 28: PROPOSED TOD DEVELOPMENT

TABLE 11: PROPOSED ROUTES, STATION AND INTEGRATION

Proposed BRT Routes	TOD Location	TOD Classification	Type of Land Uses Proposed
Sunninghill to Olievenhoutbosch	K60 and K73 intersection in Sunninghill	Regional TOD	Higher-density residential and business uses
	K73 and K71 intersection south of Kyalami	District TOD	Higher-density residential and business uses
	Directly south of the K71 and PWV5 interchange	Regional TOD	Higher-density residential and business uses
	K71 and K27 intersection south of Olievenhoutbosch	District TOD	Higher-density residential and business uses
Cosmo City to Midrand Gautrain Station	K71 and K56 intersection north of Kyalami	District TOD	Higher-density residential and business uses
	K73 and K56 intersection northeast of Kyalami	District TOD	Commercial and office uses

Source: Maluleke Luthuli and Associates, 2008

It is proposed that the TOD concept be embraced for the Eastern Sub-Region and implemented over the long term. Practically, this will involve identifying TOD area and facilitating the development of land uses that support the TOD concept. Apart from the Municipal Town Planning Departments, institutions that should be involved in developing TODs are the transit agencies (Department of Transport, taxi associations and bus companies), provincial departments (housing, health and education), private developers (e.g. retailers), financiers and the local community. Because the success of TODs requires committed stakeholders, these bodies should be involved in all the planning stages of TODs.

5.1.6.4. DENSIFICATION SPINES

A densification spine is a higher order road, typically used as a public transportation route, accommodating high-density residential development immediately adjacent to it (see Box below). The following densification spines have been identified within the Eastern Sub-Region and should become the focus of high-density residential development:

- K71 (Main Road) and K73 (west of K71): The K71 and part of the K73 is proposed as the primary public transportation (BRT) route through the Eastern Sub-Region and should therefore be densified in support of the BRT system.
- K56: the K56 is a proposed east-west public transportation linkage, which will ultimately link Cosmo City to Midrand and the Midrand Gautrain Station.

- K52: The K52 is an envisaged longer-term public transportation spine linking Diepsloot and Olievenhoutbosch to Centurion.

Densification Spine

A densification spine refers to a major road accommodating high-density residential development immediately adjacent to it. Typically, densification spines are public transportation routes that connected a number of mixed-use nodes within a region. Transit stations are provided at the mixed-use node and along the spine to provide access to the higher-density residential areas abutting the spine.

Land use intensification along the identified densification spines within the Central Sub-Region should be limited to residential densification only, typically involving the development of flats, walk-ups and cluster housing. A mix of land uses (including for example retail and office uses) should not be encouraged along these densification spines, but should rather be limited to the demarcated mixed use nodes. In other words, 'strip development' should not be encouraged along the densification spines. Strip development has many drawbacks: it is esthetically unpleasing, it encourages chaotic vehicular movement and it does not concentrate development sufficiently to enable the creation of pedestrian environments.

5.2. INFRASTRUCTURE DEVELOPMENT

Infrastructure development often forms of backbone of urban development initiatives. The reason for this is the fact that infrastructure development provides the access, the capacity and the opportunities for urban development.

5.2.1. TRANSPORTATION

Developing the Eastern Sub-Region's transportation infrastructure is dealt with in terms of the road network and public transportation network. Whereas the road network primarily refers to provincial and metropolitan roads, transit facilities refer to public transportation routes and stations (bus and rail) that provide access to public transportation systems. Figure 21 illustrates the transportation infrastructure development proposals made for Eastern Sub-Region.

5.2.1.1. ROAD NETWORK DEVELOPMENT

An extensive freeway and distributor road network is planned for the Eastern Sub-Region (as was set out in the Status Quo section of this report), characterized by strong north-south and east-west linkages. However, compared to the planned network, the existing network is poorly developed. The reason for this is probably because the Eastern Sub-Region was mostly rural in nature until recently. However, this situation is rapidly changing as the area is urbanized. Consequently, urbanization is exerting pressure for the development of the planned road network or at least parts thereof. Planned freeway and distributor roads that are currently prioritized in terms of provincial planning and developer pressure as follows:

a. Freeway construction

The PWV 9 will most probably be the next freeway to be built within Gauteng, primarily because it needs to serve as an alternative route to the N1 freeway between Johannesburg and Tshwane. Whether the entire route from Sandton to Soshanguve will be constructed is in question, because the section of the road north of the N14 freeway involves tunneling through 3 mountain ranges, which is costly. However, the stretch of the PWV9 south of the N14, linking the Sandton to the N14 freeway is feasible and will allow commuter to access Johannesburg via the N14 and the PWV9. In addition to the PWV9, the section of the PWV5 stretching from Cosmo City to Midrand is also considered a priority, as this freeway will relieve pressure on the N1 freeway. Currently, the N1 is carrying all the east-west destined regional traffic within the northern reaches of Johannesburg, but was actually only intended as the bypass for national traffic. Both the PWV9 and the PWV5 are at detailed design level, the planning level before construction.

There is great concern amongst the residents of the Eastern Sub-Region, in particular the residents of the small holdings located along the planned alignment of the of the PWV9 freeway, on the impact that the freeway will have on the rural residential landscape of the Eastern Sub-Region. As a freeway, the purpose of the planned PWV9 is first and foremost mobility. In other words, the freeway aims to transport large volumes of traffic efficiently over large distances. This purpose impacts on the design of the freeway; usually involving grade separation and interchanges located at 3km intervals, which makes the freeway largely inaccessible from neighbouring properties. As a result, a freeway tends to cut or split communities, creating a buffer between communities, hence the concerns of the communities of the Eastern Sub-Region.

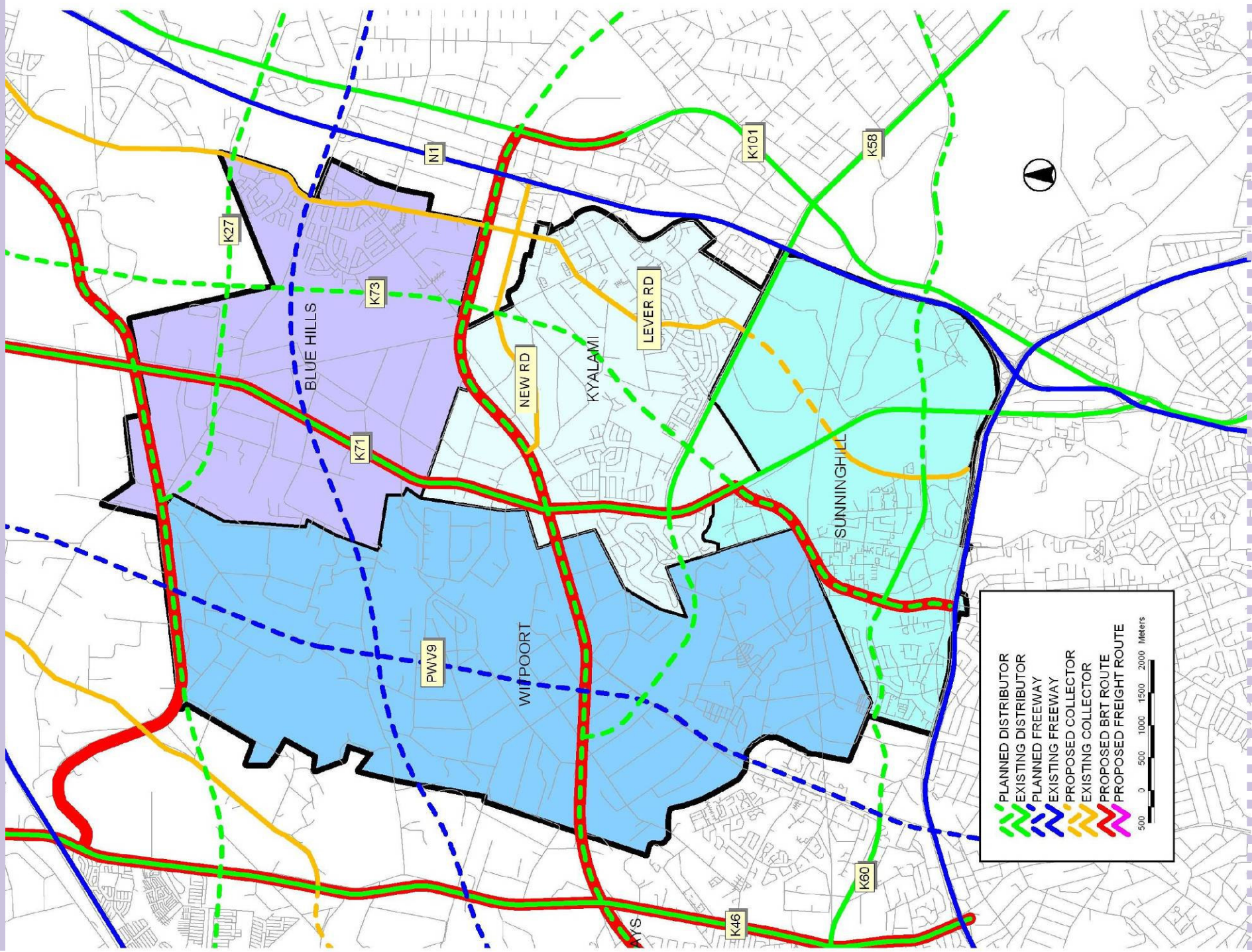


FIGURE 21
PROPOSED ROAD NETWORK

To address the above, it is suggested that the Eastern Sub-Region communities engage with the Provincial Roads Department (Gautrans) to research and considered alternative options for the design and/ or alignment of the PWV9 freeway. Mention was made in the stakeholder meetings that as an alternative, the PWV9 could be replaced by an enlarged K46 (William Nicol Drive) and K71 (Main Road) road design. The proposed BRT routes along these roads can assist in transporting the high commuter volumes. Another alternative would be to maintain the current alignment of the planned PWV9 freeway, but alter its design to negate its impact of the local landscape. For example, it can be developed as a pedestrian-crossable, accessible road, with additional lanes to allow the same traffic volumes and mobility that a typical freeway would be able to accommodate. The additional lanes could be separated to reduce the scale of the road's cross-section in a particular area.

b. Distributor road construction

Two distributor roads in particular are a priority within the Eastern Sub-Region: the K56, the K60 and the K73. The K56 will provide a needed east-west linkage, linking Cosmo City, as well as the northern reaches of Fourways and Kyalami, to Midrand. The development of this road is favoured by private developers as it will open up development within the central parts of the Eastern Sub-Region. The K60 has partially been constructed in the Sunninghill and Fourways regions. The remaining section of this road between Sunninghill and Fourways needs to be completed. This will provide commuters access to alternative interchanges to the N1 freeway, thus better distributing access to the N1 freeway. Also, the section of the K73, linking Rivonia Road to the K71 (Main Road) needs to be constructed. This will enable the construction of a BRT route that will link to the current BRT route on Rivonia Road and stretches up along the K71 to Olievenhoutbosch. This K73 road link is considered a high priority.

c. Collector road construction

Compared to the distributor road network, the collector road network is poorly conceived and developed. This creates a situation whereby the internal road network designed to serve small holdings is used to access employment and shopping areas within the region. To address this, it is proposed that Lever Road be extended southwards to link up with Maxwell Drive in Sunninghill. This will create a north-south collector road serving the strip development abutting the N1 freeway. This linkage will cross Mia's Land and will therefore have to be taken into account in the layout design of Mia's Land.

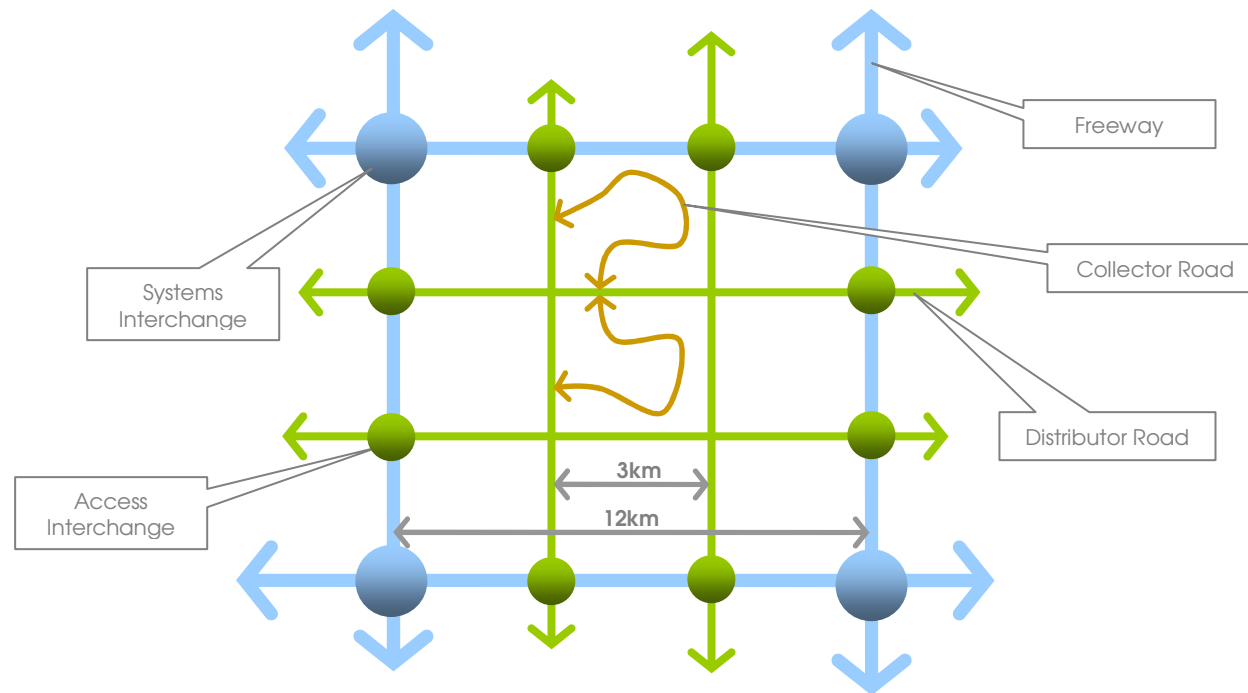


DIAGRAM 29: CONCEPTUAL PWV ROAD GRID NETWORK

Access to the freeway and distributor road network is determined by the PWV road network design parameters. This grid road network was designed with the freeways (PWV roads) spaced 5 to 12km apart and the distributor roads (K-road) spaces 2 to 3km apart (see Diagram above). This implies that access to a freeway can only be obtained at 2 to 3km intervals, via the distributor road network, making freeways inaccessible from neighbouring land uses, except at its interchanges.

If a strip development is envisaged next to the PWV9 freeway similar to the Midrand Strip, this will have to be deliberately addressed using distributor or collector roads, which are more accessible. For example, the Midrand Strip exists because the Old Pretoria Road (K101), which provides access to land parcels abutting the N1 freeway. To enable this, a ring-road is proposed that will encompass a strip of smallholding on either side of the planned PWV9 freeway. This ring-road will provide access (e.g. to trucks) to these smallholding areas, which will allow the smallholding areas to be developed with uses similar to those found along the N1 freeway. Logically, these areas will not be developed before the PWV9 and proposed ring-road are constructed.

TABLE 12: ROAD HIERARCHY AND DESIGN

Road Type	Road Classification	Purpose	Design	Responsibility
Freeway	National road and PWV routes	Links towns and cities	Dual carriageway and grade separating interchanges	National and Provincial Government
Distributor road	K-routes	Links city regions	Dual carriageway with level intersections Allow reserve with for BRT system where applicable	Provincial Government Consultation with Metropolitan Municipality with regard to BRT design
Collector road		Links suburbs	Single carriageway with level intersections	Metropolitan and Local Municipalities

Source: Maluleke Luthuli and Associates, 2008

Basic design plans have been drafted for the design for the freeways and distributor roads planned for the Central Sub-Region. Consequently, the road reserves have been established and are required to be incorporated in the layout plans of township establishment applications. This requirement is enforced by the Provincial government, who is responsible for the PWV road network (PWV and K-routes) implementation.

In addition, it is proposed that the BRT routes (as proposed in this report) be incorporated in the designs of the distributor roads. Usually, a distributor road (or K-routes) has a fairly wide island separating the road surfaces. Such an island can be converted into dedicated bus lanes for the BRT network. To avoid retrofitting a distributor road designs at a later stage, it is recommended that the Johannesburg Metropolitan Municipality consults the Gauteng Province with regard to this matter, to ensure that the BRT network design is incorporated into the distributor road design at an early stage.

The proposed collector roads will not be the responsibility of the Provincial government, but will be the responsibility of the Johannesburg Metropolitan Municipality (see Table above). As such it is recommended that the Municipality prepares basic design plans for the Lever Road link and that the road reserve of this link be protected in the layout designs of township establishment applications affected by this road alignment. This road link needs to be phased and constructed as require by urban expansion within the Eastern Sub-Region.

5.2.1.2. PUBLIC TRANSPORTATION AND STATION DEVELOPMENT

Bus Rapid Transit (BRT) is a high-quality bus-based transit system that delivers fast, comfortable and cost-effective urban mobility through the provision of segregated right-of-way infrastructure, rapid and frequent operations, and excellence in customer service. BRT is simply the idea of creating a modern rail-like performance using road-based public transport technologies that are affordable to most cities.

The BRT system proposed for Johannesburg is expected to revolutionize public transport in Johannesburg. The Johannesburg BRT system will be modeled on the Curitiba Model (see box below), which has also been successfully implemented in countries like China, France and Ecuador. The Johannesburg BRT system will consist of a network of BRT routes and BRT stations located along these routes. Median lanes will be created exclusively for buses, the number and capacity of buses to deal with the expected demand will be drastically increased and there will be a pre-boarding ticketing system. There will be buses every one to three minutes and every 10 minutes in off peak times.

Curitiba Model

The city of Curitiba provides a model on how to integrate sustainable transport with urban development. This model involves making bus travel fast and convenient, effectively creating demand for bus use in the same way that the infrastructure of traditional cities creates demand for private motor vehicles.

Curitiba first outlined its Master Plan in 1965, with the main goal of encouraging growth along two structural north-south transport arteries, radiating from the city center. The plan called for the integration of traffic management, transportation, and land-use planning to achieve its goals. The Master Plan established the guiding principle that mobility and land use can not be disassociated with each other if the city's future design is to succeed. In order to fulfill the goals of the Master Plan, the main transport arteries were modified over time to give public transport the highest priority.

Separating traffic types and establishing exclusive bus lanes on the city's predominant arteries helped to mold the defining characteristics of the city's transport system: a reliable and efficient bus service and densification of development along the bus routes. As a result, Curitiba's petrol use per capita is 30 percent below that of other comparable Brazilian cities. Other results include negligible emissions levels, little congestion, and a pedestrian-oriented living environment.

The phase one proposal encompasses the same flagship corridors already identified in the Strategic Public Transport Network (SPTN). These include a north-to-south route from Sunninghill to Soweto and an east-to-west route from Alexandra to Randburg. The Sunninghill to Soweto route will link a number of Nodes, including Rivonia, Sandton, Rosebank, Illovo, Killarney and Parktown. This phase one BRT network will also serve as a feeder system to the Gautrain stations located at Sandton and Rosebank. The planning and construction of phase one should be completed by 2009.

It is only logical to extend the BRT system into the northern region of Johannesburg. As opposed to the more established areas of Johannesburg, the new or developing areas pose an opportunity to develop and land use structure that will support the BRT system (higher densities and mixed land use) from the start. It will also provide a much-needed public transportation system within the northern region, which is currently lacks (as was determined in the status quo section of this report). The existing and proposed K-route network traversing the Eastern Sub-Region should be used for the proposed BRT system. A K-route design usually allows for a relatively wide median island, which can be used for the two dedicated BRT lanes. **This approach requires a mind-shift that now considers K-routes also to be public transportation spines, as opposed to only being private vehicle spines.** Apart from allowing the K-route median to be used for BRT lanes, more flexible public transportation oriented design parameters will have to be applied along K-routes, especially where such routes traverse mixed-use nodes. For example, pedestrian crossing and land use access intervals will have to be addressed differently within mixed-use nodes.

TABLE 13: PROPOSED ROUTES, STATION AND INTEGRATION

Proposed BRT Routes	Proposed Station Locations	Integration Principles
Sunninghill to Olievenhoutbosch	<ul style="list-style-type: none"> o The intersection of the K60 and K73 in Sunninghill o The intersection of the K73 and K71 south of Kyalami o The intersection of the K71 and K56 north of Kyalami o Directly south of the K71 and PWV5 interchange o The intersection of the K71 and K27 south of Olievenhoutbosch 	<ul style="list-style-type: none"> o Develop higher-density, mixed land uses to support transit facility with required commuter numbers o Design and construct pedestrian walkways to facilitate access to BRT stations
Cosmo City to Midrand Gautrain Station	<ul style="list-style-type: none"> o Directly south of K56 and PWV9 interchange o K71 and K56 intersection northeast of Kyalami 	<ul style="list-style-type: none"> o Integrate BRT station with Gautrain station: preferably a single integrated station o BRT stations to serve major commercial areas

Source: Maluleke Luthuli and Associates, 2008

It is therefore proposed that the phase one BRT route, currently terminating at Rivonia (on Oxford Street) be extended northwards along the K73 (yet to be constructed) and then follow the K71 (at the K71 and K73 intersection) up to Olievenhoutbosch. This route is depicted on Figure 21. In addition to the K71 route, which is a north-south aligned route, two east-west aligned BRT routes are proposed that will traverse the Eastern Sub-Region. The first is a route aligned along the K56, which connect Cosmos City to Midrand. What makes this proposed route of specific importance is its potential linkage to the Midrand Gautrain Station. This will allow the BRT network to function as a feeder system to the Midrand Gautrain station. To ensure optimal modal integration, it would be preferable to design the BRT terminus and Gautrain station as a single integrated station. The second proposed east-west aligned BRT route connects Diepsloot to Olievenhoutbosch along the K52 and has the potential to be extended to Centurion.

The efficient functioning of the public transportation system within the Eastern Sub-Region will not only require a well-developed BRT network, but will also require a well-developed BRT stations that are strategically located along the BRT routes. Well-designed stations are characteristic of BRT system with features such raised platforms for bus-level entry, prepaid ticketing system and the application of modern architecture to design striking facades. With regard to the location of the BRT stations, it is proposed that major stations within the Eastern Sub-Region be located at the intersections set out in the Table above, which correspond with the mix-use nodes identified within the Eastern Sub-Region. Smaller stations can be places at 400-600m intervals along the BRT route.

To ensure the optimal use of each BRT station, it will have to be integrated through competent design with its surround area and the land uses proposed for these areas. This design will involve focusing on pedestrian movement and how pedestrians exchange between the transit facility and the surrounding land uses. Competent building design is also necessary to ensure land use and transportation integration and will have to be applied to the design and layout of existing and planned buildings (clinics, retail centre, walk-ups, etc.) abutting this transit facility.

5.2.2. MUNICIPAL SERVICES

Although this study addresses the primary municipal services (water, electricity and sanitation), it does not assess the capacity of the bulk municipal services network to accommodate urban expansion and densification. Determining capacity involves complex calculations by engineers, thus falling outside the brief of this study. The way this study addresses the issue of bulk municipal services is to (a) ensure areas can connect to the bulk network (specifically the sewer network which is dependant

upon gravitation and therefore topography) and (b) provide an indication of the potential number of dwelling units and supporting land uses that would be development within the Eastern Sub-Region, which would require bulk network capacity.

The issue of access to the bulk network was dealt with as part of the section of this report dealing settlement expansion, because settlement expansion can only occur in areas that have access to bulk infrastructure. **With regard to the potential number of dwelling units and supporting land uses that would require bulk network capacity in future, the Land Use Budget attached as Annexure A provides the estimated numbers up to the year 2050.** Access to bulk municipal services capacity will be required in the following major development areas of the Eastern Sub-Region:

- Mia's Land: Mia's Land west and north of the N1 freeway. This will largely be dealt with under the development framework being prepared by the Mia's Land developers
- Kyalami: North and east of the existing Kyalami cluster and business park developments, to enable infill development between Kyalami and the Midrand strip.
- Blue Hills: In the Blue Hills area, mostly located east of Main Road (K71). Bulk service access will also have to be provided to a strip located on the western side of Main Road. There was mentioned that portions of land abutting the K71 within the Blue Hills area cannot access the Diepsloot sewer network using gravity, requiring the construction of a pump station. if no other solution exists, a pump station should be considered, because the development of the K71 corridor is a spatial priority.
- Olievenhoutbosch South: Bulk services access will be require if Olievenhoutbosch is expanded southwards across the Tshwane boundary. As with Blue Hills, the Olievenhoutbosch South development will form part of the K71 corridor development.

5.3. PUBLIC REALM

Creating a sustainable urban environment involves creating balanced communities in terms of employment opportunities, social amenities and recreation facilities. In other words, it involves supporting residential development with other land use types, such as schools, clinics, retail facilities and parks.

5.3.1. NODAL DEVELOPMENT

The Spatial Development Framework of Johannesburg uses a hierarchy of mixed-use nodes to delineate and contain mixed-use development within the municipal area. The metropolitan mixed-use node occupies the first place in the nodal hierarchy, and is represented by the Sandton and Midrand CBDs. The regional mixed-use node occupies second place in the nodal hierarchy. Sunninghill and Parktown are examples of regional mixed-use nodes. The district mixed-use node occupies third place in the nodal hierarchy and is represented by areas such as Illovo and Killarney.

The mixed-use node hierarchy was applied to the Western Sub-Region. A number of mixed-use nodes were delineated and are illustrated on Figure 22. Each of these nodes are located on land with low development densities (usually farmland or agricultural holdings) allowing the redevelopment of these areas into high-density, mixed-use area. These nodes were also distinguished in terms of existing, proposed and future nodes. Proposed nodes are nodes that are proposed to be developed by the year 2020, thus falling within the timeframe of this study. Future nodes are nodes that are envisaged, but which will most probably only be developed after 2020.

Community, recreation and economic facilities should be clustered within the mixed-use nodes proposed for the Western Sub-Region, rather than dispersed, in order to (a) stimulate the viability of these activities, (b) create strong focal points with which the surrounding communities can identify and (c) create a more ordered spatial structure. The composition of each mixed-use node within the nodal hierarchy must take into account certain key variable, such as its intended function of the node; the size of the population its serves and its geographical location. For example, a higher order mixed-use node will contain higher-order functions, such as a satellite university campus or hospital. Lower-order mixed-use nodes will contain uses that are required on a local level, such as a clinics or library.

5.3.2. ECONOMIC ACTIVITY

It is important that land use strategies are developed that recognize the need to stimulate economic growth and job creation within the Eastern Sub-Region. These land use strategies must focus institutional support and private sector spending to achieve the aforementioned. In turn, this will creates economic potential and provide opportunities for local communities to participate in local economic development.

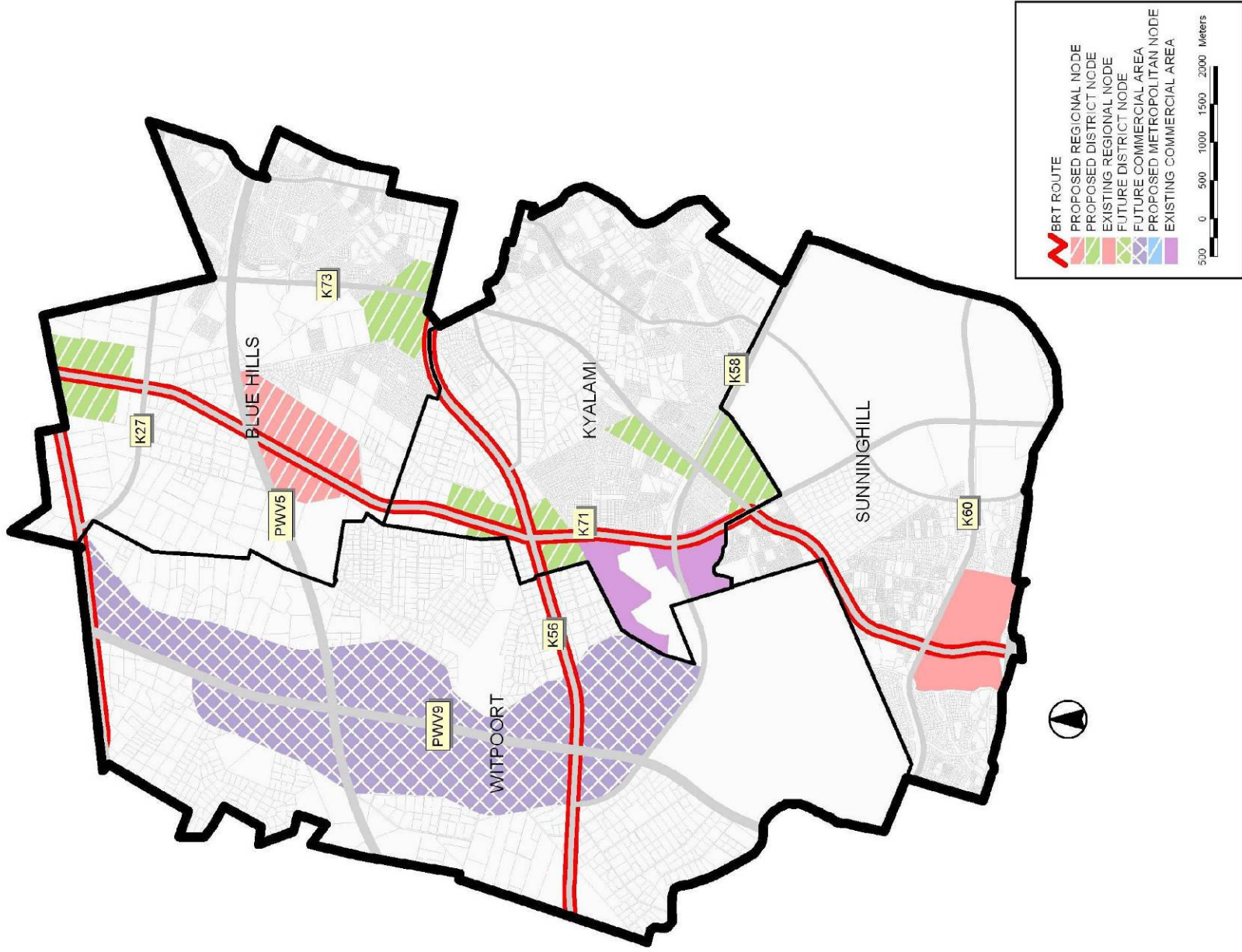


FIGURE 22
PROPOSED NODAL STRUCTURE

5.3.2.1. BUSINESS CENTRE HIERARCHY

Economic activities should be concentrated, rather than dispersed in order to stimulate the viability of these activities. To achieve this, economic activity should be clustered within the mixed-use nodes. The business component linked to each mixed-use node is summarized in the following Table. This Table also provides the proposed business composition suitable for each mixed-use node within the hierarchy. The size of the business component is dependant on the size and spending capacity of the Eastern Sub-Region population. This relation has been established in the Land Use Budget, set out in Annexure A.

a. Metropolitan mixed-use node

A metropolitan mixed-use node is a business node of city-wide significance and can therefore develop a strong retail, entertainment and office component. The retail component can accommodate 2 or more regional shopping centres, similar to Sandton City. The entertainment component should include entertainment venues that cater for national events, such as music concerts and motor shows. This will require venues similar to Gallagher Estates and the Coca-Cola Dome. A metropolitan mixed-use node can accommodate a large office component, comprising for example campus-layout office developments of national and international corporations. Access to an international airport (such as Lanseria Airport) would be a necessity.

b. Regional mixed-use node

A regional mixed-use node can accommodate a regional shopping centre or retail floor area equaling that of a regional shopping centre. In addition, a regional mixed-use node can accommodate entertainment venues of regional significance, such as a cinema complex and casino. The office component can provide office space for businesses operating within the larger Gauteng area.

c. District mixed-use node

A district mixed-use node will require a medium-sized shopping centre or a total retail area similar to that of a medium-sized shopping centre. In addition, a district mixed-use node can accommodate local entertainment venues, such as restaurants and cafes, as well as a cluster of office buildings catering for local businesses, such as medical, law and accounting firms.

TABLE 14: BUSINESS CENTRE SIZE AND COMPOSITION

Node hierarchy	Centre size	Minimum trade area	Minimum access requirements	Composition
Metropolitan mixed-use node	600000-900000m ²	8km	Access to freeway, distributor road and major public transport route Linkage to an international airport	Two or more regional shopping centres Large-scale entertainment venues, catering for national events such as concerts and motor shows Cluster of large-scale office buildings catering for national and international corporations
Regional mixed-use node	300000-600000m ²	4km	Access to distributor road and major public transport route	A regional shopping centre Entertainment venues of regional significance, such as cinemas, casinos, etc. Cluster of office buildings catering for business operating in Gauteng
District mixed-use node	<300000m ²	2km	Access to distributor road	A shopping centre Local entertainment venues, such as restaurants and cafes Cluster of office buildings catering for local enterprises, such as law and accounting firms

Source: Maluleke Luthuli and Associates, 2008

5.3.2.2. BUSINESS CENTRE DEVELOPMENT

To ensure the viability of proposed economic activities within the Eastern Sub-Region, it is important to (a) link the business areas proposed to the Land Use Budget, and (b) develop a retail hierarchy to ensure the orderly and logical development of retail facilities within the Eastern Sub-Region. Two regional business nodes are proposed. The first comprises the existing Sunninghill mixed-use node and the second is proposed within the Blue Hills area, on the intersection of the K71 and the planned PWV5. These nodes can accommodate approximately 300000m² of business space by the year 2020 and can include a sizable office, retail and entertainment component, providing employment opportunities and services to the entire Eastern Sub-Region population.

Four district mixed-use nodes are proposed for the Eastern Sub-Region. These nodes aim to serve local neighbourhoods and are therefore centrally located within the suburbs they serve. All these nodes have been located on proposed public transport routes (BRT routes) and to link and to increase the accessibility of these nodes. Each district node could accommodate approximately 250000m² of business space by the year 2020, comprising a sizable office cluster and retail component.

It is imperative that the development of the proposed regional and district mixed-use nodes coincide with residential expansion within the Eastern Sub-Region. In other words, proposed nodes should not be allowed to develop until residential expansion has reached to boundaries of the proposed nodes. Nodes located on the peripheral areas of the Eastern Sub-Region, such as the proposed Olievenhoutbosch South district mixed-use node (located on the intersection of the K52 and K71), should not be allowed to develop before nodes that are located next to existing residential areas, such as the district mixed-use node proposed in Kyalami (located on the intersection of the K73 and K58).

5.3.3. COMMUNITY FACILITIES

Housing development in particular requires the support of other land use types, such as schools and clinics, in order to create sustainable living environments. As was determined in the status quo section of this report, the Eastern Sub-Region has a poorly developed community infrastructure network, which urgently needs to be addressed. It is imperative that proposed community facilities, as set out in the Land Use Budget, be located in such a way that they are accessible to the communities they serve. This is best achieved using a hierarchy of community nodes.

5.3.3.1. COMMUNITY FACILITY HIERARCHY

The composition of the proposed mixed-use nodes in terms of community facilities have been specifically designed to suite the Eastern Sub-Region and should serve as a guideline for the design and development of these nodes. The proposed composition of each mixed-use node is depicted in the Table below.

a. Metropolitan mixed-use node

A metropolitan mixed-use node, providing higher-order community services, serves a region within the municipal area, comprising of a number of suburbs. With regard to educational facilities, the metropolitan node should accommodate a

region’s tertiary educational facilities, as well as a number of primary and secondary schools. With regard to health care, the metropolitan mixed-use node should provide the region’s hospital(s), as well as other higher-order and specialized medical facilities. Other community facilities to be provided in this node include a large community hall, police station and emergency service centre. These facilities are all highest-order facilities when compared to similar facilities provided in lower-order nodes.

TABLE 15: COMMUNITY FACILITY COMPOSITION

Nodal Hierarchy	Service Area Radius	Size	Proposed composition
Metropolitan mixed-use node	8km	30ha	1 tertiary education facility 1 secondary schools 2 primary schools 1 hospital 1 large-scale post office 1 large-scale library 1 large-scale community hall 1 large-scale police station 1 emergency service centre
Regional mixed-use node	4km	20ha	2 secondary schools 3 primary schools 1 day hospital 1 medium-scale post office 1 medium-scale library 1 medium-scale community hall 1 small-scale police station
District mixed-use node	1-2km	15ha	1 secondary schools 2 primary schools 1 clinic 1 small-scale post office 1 small-scale library 1 small-scale community hall

Source: Maluleke Luthuli and Associates, 2008

b. Regional mixed-use node

A regional mixed-use node should serve one of two suburbs and should provide medium-order community services to the suburbs they serve. A regional node should at least comprise a secondary school, 2 primary schools, a community centre and a library. It can also accommodate a day hospital and a police station, only on a slightly smaller scale than those provided in a metropolitan mixed-use node.

c. District mixed-use node

District mixed-use nodes should provide low-order community services to localized areas within suburbs. A district node should at least comprise a secondary school and a primary school, but can also contain a clinic and a post office. These types of community facilities need not be restricted to district mixed-use node, but can also be clustered within residential areas.

5.3.3.2. COMMUNITY FACILITY DEVELOPMENT

The Land Use Budget set out in a previous section of this report calculated the number of community facilities required within Eastern Sub-Region to support the existing and envisaged year 2020 population within Eastern Sub-Region. These facilities have been divided into a hierarchy of mixed-use nodes (as set out in a Table above), basically comprising regional and district community facilities.

Regional community facilities should be located at the proposed Blue Hills regional mixed-use node, located on the K71 and planned PWV5 intersection. This node would, for example, be suitable for a day hospital, and police station, and other higher-order community facilities. Regional community facilities can also supplement the existing regional community facilities (such as the Sunning Hospital) within the Sunninghill Regional mixed-use node.

A number of district mixed-use nodes have been proposed for the Eastern Sub-Region, requiring district community facilities. The Kyalami District mixed-use node in particular, located on the intersection of the K71 and the K56 requires a number of schools to support the existing higher-density residential component (cluster housing) within the bordering Sunninghill node. In addition, district community facilities can be clustered within existing and envisaged residential neighbourhoods, in order to be within

walking distance of the residential neighbourhoods they serve. Community facilities that are used on a daily basis, such as a primary school, a post office and a clinic, are suitable for such clusters.

As was mentioned, the Eastern Sub-Region has a poorly developed community infrastructure network, lacking the most basic community facilities such as schools and clinics. The primary reason for this is the fact that the most of the Eastern Sub-Region, which comprises small holdings, is being developed into cluster housing developments. Individually, these cluster developments do not reach the threshold for providing any community facilities. However, collectively, these cluster developments are developing large numbers of housing, without any of these cluster developments taking responsibility for providing schools and stands.

To address the situation mentioned above, it is proposed that developers of cluster housing be required to provide contributions for the purchasing of stands for community facilities, much in the same way that developers make bulk services contribution. These funds will have to be ring-fenced and used by the municipality to purchase land (small holdings) for the development of community nodes. Because the availability of land for sale is unknown, the exact location of community nodes can only be determined during the purchasing phase.

In order to develop the community infrastructure required within the Eastern Sub-Region, the Johannesburg Metropolitan Municipality will have to work in close relationship with the provincial governmental bodies concerned with the development and management of community facilities, such as the Gauteng Department of Health and Welfare and Department of Education. The responsibility of the Johannesburg Metropolitan Municipality will be to ensure that the necessary stands for community facilities are provided and that these stands are strategically placed. The construction and management of the relevant buildings will be the responsibility of the provincial government departments concerned.

5.3.4. OPEN SPACE & RECREATION

An open space system fulfils a number of functions. These functions include hazard avoidance, resource conservation, ensuring community well-being and educational. These functions are listed in more detail in the Table below. Open space and recreation within the Eastern Sub-Region can be divided into 2 categories: passive and active open space. Passive open space consists of land that is unsuitable or undesirable for urban development due to topographical, ecological constraints or for flood protection. Passive open space also involves landscape spaces within an urban area, such as parks and pedestrian walkways. Active open space involves the recreational component of the open space system. It provides sport facilities throughout an urban area for use by local clubs and schools.

TABLE 16: FUNCTIONS OF AN OPEN SPACE SYSTEM

Hazard avoidance	Resource conservation	Recreational and psychological	Educational
Open spaces must reserve flood prone areas.	Open spaces must protect water sources.	Developed and maintained open space must be provided for recreational purposes.	Open spaces must be protected for environmental education purposes.
Open spaces must reserve steep slopes and geologically unstable ground.	Open spaces must protect linked areas of conservable indigenous vegetation.	Open space must be provided for community interaction and as symbols of community identity.	Well-equipped and designed open spaces must be provided for sport education.
Open spaces should protect drinking water sources from being contaminated.		Open spaces must be protected for psychological relief from the stresses of urban live.	

Source: Maluleke Luthuli and Associates, 2008

5.3.4.1. PASSIVE OPEN SPACE

The greening of urban areas is of utmost importance for the psychological and physical well-being of a community. To a large extent, ecological areas provide a strong and significant element of greening within an urban area. Apart from the aforementioned, passive open space protects land that is unsuitable or undesirable for urban development due to a number of reasons, such as geotechnical constraints or flood protection. The conservation of passive open spaces that contain watercourses is of specific importance.

The Jukskei River and the Sand River which flows into the Jukskei River, flows through the southern parts of the Eastern Sub-Region, affecting Mai’s Land, the Leeukop Prison site and the western parts of Sunninghill. The Jukskei River in particular, is a significant natural water sources traversing the Eastern Sub-Region, which is important to the metropolitan area as a whole. Two tributaries of the Jukskei River flow through the northern parts of the Eastern Sub-Region, between Kyalami and Blue Hills.

At the very least, the natural drainage channels and banks of the Jukskei River and its tributary must be protected up to the 100-year flood line to protect the Eastern Sub-Region communities from flooding. However, GDACE often requires the protection of river environments wider than the 100-year flood line area, if the 100-year flood line area is narrow due to steep river embankments.

Due to the importance of the Jukskei river system, it is imperative that the ecological integrity of this river system be protected. To date, the upstream parts of this water source has been exploited and damaged due to informal urban development and dumping. To protect this river system, dumping must be strictly prohibited and the pollution of these water sources by sewerage and other harmful effluents avoided at all costs.

5.3.4.2. ACTIVE OPEN SPACE DEVELOPMENT PRINCIPLES

Formulating principles for the development of active open spaces can help ensure that standards of quality and usefulness are achieved in the planning, design and management of such spaces. The following development principles need to be taken into account when developing active open spaces:

a. Linking a use to open space

Open spaces that do not have a deliberate use connected to them are often not of value to a local community and often become dumping ground as a consequence. It is therefore imperative that a use be linked to an open space to ensure the utilization of these spaces. One of the best ways of utilizing open spaces within urban areas is to use these spaces as recreation areas or sport facilities.

b. Type of Facilities Provided

When planning active open spaces, it is important that appropriate recreation facilities are provided. Often recreational facilities are provided that do not fulfill the needs of the community, usually because they are not the preferred recreational types. To prevent the provision of inappropriate recreational facilities, the recreational preferences of a local community must be established before planning and developing a recreational facility.

c. Maintenance of Active Open Spaces

An important factor in determining the success of active open spaces is the maintenance thereof. Past experience has proved that active open spaces that are not maintained often lose their practical value to local residents. Therefore, it can be argued that larger and fewer active open spaces that are maintained are more useful than smaller more numerous active open spaces that are not.

d. Accessibility of Active Open Spaces

When locating active open spaces, it is important to ensure that it is accessible to the community it serves. This implies locating an active open space within walking distance of most of the people living within a community. Locating an active open space centrally will also ensure the continued presence of people in the vicinity of such a facility, which would protect it from vandalism.

e. Urban Form and Function

In order to enhance the mentioned focal function of active open spaces, it is imperative that attention is given to the design of these active open spaces. For example, the planting of trees along the periphery of an active open space will enhance the identity and attractiveness of this space. If active open spaces are integrated through design with surrounding facilities, it will enhance the usage of these spaces. For example, placing an active open space next to or close to a primary school will allow the space to supplement school sport facilities.

5.3.4.3. ACTIVE OPEN SPACE HIERARCHY

The limited funds available for the construction of an active open space network necessitate a critical appraisal of the generally accepted standards and norms applicable to active open space development. An approach based on practical considerations rather than on accepted norms should be followed. One of the most practical ways of utilizing open spaces is to use these spaces as sport or recreation facilities. This connects a deliberate use to open spaces, ensuring they serve a specific community need.

Taking into account the above, a hierarchy consisting of three types of active open spaces is proposed for the Eastern Sub-Region. The composition of these active open spaces should serve as a guideline for the design and development of the active open spaces, but can differ depending on the recreational preferences of local communities. The proposed active open space hierarchy and its composition are depicted in the Table below.

a. Metropolitan mixed-use node

A metropolitan mixed-use node should provide recreation facilities that are significant on a metropolitan level, usually with a stadium making up the central facility within such a node. In addition to the stadium, such a node should contain other highest-order recreations facilities, such as practice rugby or soccer fields, a cricket oval, tennis courts, a swimming pool and a multi-purpose indoor sports centre. In addition, such a recreational facility must include a parking area and must be accessible to and from a large bus and taxi terminus. A metropolitan recreational facility will be the base of city sports clubs.

TABLE 17: ACTIVE OPEN SPACE COMPOSITION

Nodal Hierarchy	Service Area Radius	Size	Proposed composition
Metropolitan mixed-use node	8km	20ha	1 rugby or soccer and athletic stadium 3 practice rugby or soccer fields 1 cricket oval 6 tennis courts 2 netball courts Swimming pool Multi-purpose indoor sport centre
Regional mixed-use node	4km	15ha	1 rugby or soccer field and athletic track 2 practice rugby or soccer fields 4 tennis courts
District mixed-use node	2km	10ha	1 rugby or soccer field and athletic track 2 tennis courts Children’s playground

Source: Maluleke Luthuli and Associates, 2008

b. Regional mixed-use node

A regional mixed-use node should provide regional sport facilities, typically a number of rugby or soccer fields. The rugby or soccer fields can double as a cricket oval. Such a recreational facility can serve as the base for regional sports clubs.

c. District mixed-use node

A district mixed-use node will serve local neighbourhoods and should therefore comprise local recreational facilities, such as a rugby or soccer field and a few tennis courts. As with community facilities, these types of recreational facilities need not be restricted to district mixed-use nodes, but can also be clustered within residential areas. These recreational facilities can supplement the recreation facilities of schools and can therefore be located in close proximity of schools.

5.3.4.4. ACTIVE OPEN SPACE DEVELOPMENT

A regional mixed-use node is proposed within the Blue Hills area. This node must contain regional recreation facilities, as depicted in the active open space hierarchy set out above. As such, this node must cater for the higher-order recreation needs of the entire Eastern Sub-Region. Four district mixed-use nodes are also proposed and are located in accessible location through the Eastern Sub-Region. These nodes should all contain district recreational facilities as set out in the active open space hierarchy above.

Up to date, all recreational facilities within the Eastern Sub-Region have been provided by the private (or semi-private) sector. The Megawatt Park (Eskom) facility is a typical example. Although this is prudent, this should not defer the municipality from providing the necessary recreation facilities required within the Eastern Sub-Region.

One of the reasons why the municipality has not provided the necessary open space within the Eastern Sub-Region to date is due to the lack of stands zoned for recreational purposes. In turn, this lack of stands is due to cluster developments, which usually are not large enough to reach the thresholds required to provide stands for active open space development. **To address this situation, it is proposed that developers of cluster housing be required to provide contributions for the purchasing of stands for active open space, much in the same way that developers make bulk services contributions.** These funds will have to be ring-fenced and used by the municipality to purchase land for the development of recreation nodes. Because the

availability of land for sale is unknown, the exact location of recreation nodes can only be determined during the purchasing phase.

5.4. HOUSING DEVELOPMENT

Affordable housing is a strong form-giving element that can impact substantially of the development of an urban area. For example, housing can be used as an infill land use, which could enable the urban integration of a fragmented urban area. Also, housing can provide the necessary land use densities to support public transport operation and retail centre development.

5.4.1. HOUSING TYPOLOGIES

Housing types can be categorised according to level of attachment. Level of attachment refers to the vertical and horizontal attachment of buildings. There is a tendency, when addressing the housing demand, especially for the low-income sectors of the population, to provide freestanding units with little or no level of attachment. There is little exploration on the benefits of other housing typologies, such as flats, walk-ups, row housing and semi-detached units.

The following discussion on typologies is not exhaustive, but rather focuses on housing and density types that are appropriate for the Eastern Sub-Region. The Table above provides an easy-reference summary of the attributes of the different housing typologies and how it compares with the attributes of other housing typologies.

a. Detached housing



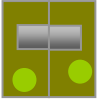

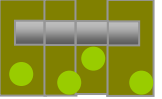

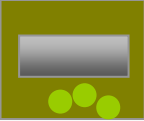

Single, detached units are standalone structures situated on a single, individually registered stand. In addition to cluster housing, this is the most common housing type within the Eastern Sub-Region. This housing type has a private garden and on-site parking. Estate development often uses this housing type, but adds security fencing and communal facilities to achieve some of the advantages that are usually associated for cluster housing developments.

TABLE 18: BONDED HOUSING TYPOLOGIES

Housing Typology	Gross Density	Nett Density	Stand Size	Building Height	Tenure Options	Subsidy Options	Plot layout	Example
Detached housing	5-10 u/ha	10-15 u/ha	800-1000m ²	1-2 storey	Full title	n/a		
Cluster housing	10-20 u/ha	20-30 u/ha	300-500m ²	1-2 storey	Full title or sectional title	n/a		
Flats	100-200 u/ha	200-400 u/ha	n/a	4-8 storey	Rental or sectional title	Institutional subsidy		

Source: Maluleke Luthuli and Associates, 2008

TABLE 19: AFFORDABLE HOUSING TYPOLOGIES

Housing Typology	Gross Density	Nett Density	Stand Size	Building Height	Tenure Options	Subsidy Options	Plot layout	Example
Detached housing	20 u/ha	40 u/ha	250 m ²	1 storey	Full title	Project-linked subsidy		
Semi-detached	40 u/ha	80 u/ha	120 m ²	1-2 storey	Full title	Project-linked subsidy		
Row housing	60 u/ha	120 u/ha	70 m ²	2 storey	Full title	Project-linked subsidy		
Walk-ups	80 u/ha	160 u/ha	n/a	3 storey	Rental or sectional title	Institutional subsidy		

Source: Maluleke Luthuli and Associates, 2008

The densities of this housing type is the lowest of the various housing typologies and, depending on stand size (generally between 800 and 1000m²), has an average gross density of 5 to 10u/ha. Such densities do not promote the efficient use

of land and do not promote the viable operation of public transportation systems. Consequently, this housing type should not be promoted in close proximity of public transportation routes, but should rather be used in peripheral areas of cities.

In terms of infrastructure costs, this housing typology is the most expensive housing option. The low densities and large stand sizes of this housing type result in large street frontages, which result in long infrastructure runs. In terms of the structure, this housing type is the least complicated to construct, resulting in relatively low construction costs, when compared to other housing typologies.

b. Cluster Housing

Cluster housing developments are characterized by housing units located within a housing complex, which shares communal facilities and a perimeter security wall. These housing units can either be detached or attached to one another, thus sharing at least one wall of the unit. This housing type does not exclude a second and third storey. Ground access, a private garden and on-site parking is possible with the housing typology. These housing types can either be

Cluster houses are usually located on stands of smaller size than those used for detached housing. These smaller stand sizes are often achieved through the use of shared walls. Stand sizes typically range from 300-500m² and yield a gross density of approximately 10-20u/ha. The smaller stand sizes translate to substantial infrastructure cost savings, making cluster housing more cost-effective than detached housing units. Shared walls also reduce the construction costs of the buildings, compared to detached housing units.

The smaller stands and higher densities achieved by this housing typology, compared to that of detached housing units, make it more suitable as a public transport related development. Although it does not create the desired densities that would significantly boost public transport patronage, it is a better option than detached units. In a sense, this housing typology creates a balance between creating detached or semi-detached housing units and achieving higher densities that are more transport related. This housing typology is preferably located along public transport routes, but not is next to public transportation termini, which would require higher-density housing options.

c. Walk-ups

Walk-ups provide a low-rise, higher-density housing option. It is only at this level of density that it really becomes beneficial for public transportation and the cost-effective operation of public transport. With densities of approximately

80u/ha, this housing typology places enough commuters within walking distance of public transportation stations to ensure the viable operation of a public transportation system. Also, residents living in walk-up apartments are usually of a household income bracket that uses public transport as their means of transport, which implies a mutually beneficial relationship between walk-up housing and public transport.

This housing type involves individual housing units stacked on top of each other up to 3 storeys high and is located on a single stand. Consequently, full title ownership is not possible. Such units are either sold off as sectional title units or applied as rental units. What distinguishes walk-up from flats is the fact that walk-up units are accessed via a staircase. The gardens surrounding the building are in communal ownership and use. On-site parking is possible in the form of a parking lot and garages.

Although walk-up units cost substantially more than conventional affordable housing typologies, they do provide a means of accommodating government subsidized housing within a mixed-use, primarily bonded residential environment (as is found in the Eastern Sub-Region). This housing typology does is cheaper to built than flats, because it does not require costly lifts or and costly construction methods to construct high buildings. In addition, the higher densities obtained through walk-ups compared to detached and semi-detached housing units, makes substantial savings in infrastructure costs possible. This cost saving not only applies to municipal infrastructure (water, sanitation and electricity), but also to the provision of roads.

d. Flats

Flats are the highest density housing typology. As with walk-ups, this housing typology comprises housing units stacked on top of each other. The difference between flats and walk-ups is the height of the buildings, with flats exceeding 3-storeys and walk-ups not. Consequently, flats have to be served by a lift, whereas walk-up only need be served by a staircase. The configuration of a block of flats excludes full title ownership as a tenure option, leaving sectional title and rental as the only tenure options. The gardens of the building are communal and on-site parking is provided using parking lots and garages.

An advantage of flats is the infrastructure cost savings that is made possible by its high occupation densities. These cost savings are partly negated by the costs involved in the construction of this more structurally complicated building, as was discussed under 'walk-ups' above. This complicates providing and subsidizing affordable housing units within such buildings.

The primary advantage of flats relates to the use and operation of public transportation systems. Because flats place high numbers of people within close proximity of public transportation stations, it can significantly increase the number of commuters living within walking distance of a public transport system, thus boosting patronage of the transportation system. Taking into account that the household that use public transportation are also the household that typically occupy flats, creates an efficient relationship between this housing typology and public transport.

5.4.2. HIGHER-DENSITY HOUSING DEVELOPMENT

One of the critical factors in developing our cities into sustainable urban environments is the development of new residential areas at higher densities than in the past. In this regard, the higher densities are important for several reasons:

- Higher densities lead to a significant saving in land cost per unit, as less land is needed and land is used more efficiently.
- One of the main arguments for encouraging higher densities is the efficient provision of infrastructure. Low density means long infrastructure runs and therefore higher cost per consumer both for installation and for operation.
- Efficient public transport requires medium to high densities to be able to provide frequent and efficient services. Low densities with long walking distances for the poor cannot support good public transport.
- Community facilities, such as schools and health clinics, are difficult to reach for many people at low densities.
- Density is significant for the economic performance of a city. High population density means a high level of access to employment opportunities and to markets.

5.4.2.1. UNDERSTANDING DENSITY

Density is a controversial topic and is often misunderstood, as it is linked to misplaced values. Perception of density is also linked to cultural background. There are some misconceptions on densities that influence the perception of what appropriate densities are because there is a vast difference between perceived and measured densities. The misconceptions regarding densities are:

- Firstly, it is often taken that low densities create high quality environments and high densities create low quality environments. However, high quality environments can be created at both low and high densities and depend more on design considerations than density. Instead, poor living conditions are more a cause of other factors, such as bad

architectural design, a lack of infrastructure and public services, scarcity of open space, poor environmental conditions and poverty.

- Secondly, there is a misconception that only one housing type can be created at a certain density. In fact, a wide variety of housing types can be provided at most densities, except at the lowest end of the scale. For example, similar densities can be achieved by four storey buildings as can be achieved by high rise tower blocks. Thus, a high-density environment does not necessarily mean a high rise environment.
- Thirdly, the misconception exists that high densities are appropriate for low-income groups and low densities are only appropriate for high-income groups, because of the cost implications. This is not true, since all densities can be suitable for all income groups.

5.4.2.2. DENSITIES APPLIED

Given the facts that gross densities in South Africa are generally seen as low and unsustainable on the one hand and that South Africans are not accustomed to living at high densities on the other hand, a range of gross densities between 20 to 100 dwelling units per hectare are seen as suitable for South African circumstances: Low density can be seen as 20-40 units per hectare, medium density as between 40 and 80 units per hectare, and high density as between 80-100 units per hectare. In addition, applying appropriate densities depend on a variety of factors:

- Land availability and costs: If land is scarce and expensive, it would necessitate higher densities. This is typically at points of high accessibility and visibility.
- Location and transport: Localities with high levels of access, specifically access to public transport, should accommodate higher densities to reinforce the use of public transport.
- Social context and household size: Lifestyles and household size can have a marked impact on acceptable densities.
- Environmental considerations: Environmentally sensitive land should be evaluated to determine its carrying capacity and might necessitate lower gross densities and higher net densities.
- Cultural acceptance: Although there may be a preference for low densities and detached housing, a variety of housing types should be explored.

Choosing an appropriate density usually also involves decisions that require a compromise in one form or another. For example, higher densities will either involve having smaller than average stand sizes (250m²) and having full title or going multi-storey which will involve accepting sectional title or rental as an alternative to full title ownership. In short, density should be the result

of a process of design through which the planner must deal dynamically with standards, stand and dwelling sizes, housing typology and spatial planning principles.

It is imperative that at least part of the future residential need within the Eastern Sub-Region be addressed using higher density housing typologies. Not only this, these higher density housing developments need to be linked to existing or planned public transportation infrastructure and promote urban infill and consolidation. In addition, higher-density housing concepts must promote the creation of sustainable communities by incorporating the development of the necessary community facilities and open space to support these higher-density housing developments. This is an integrated approach to development; whereby community facilities and transportation are develop as part and parcel of housing development.

5.4.3. AFFORDABLE HOUSING DEVELOPMENT

5.4.3.1. DEVELOPMENT APPROACH

In the past, the Provincial Department of Housing considered that the best way to address the housing backlog was to adopt a strategy that was based on chasing numbers: a mass housing approach. Through this approach, houses were built where land could be acquired cheaply and this usually perpetuated urban sprawl, undermining economic, environmental and community sustainability. In recent years, realities in the provision of housing have brought about a shift in the housing strategy. Now the challenge is to go beyond the simple provision of houses and build communities and create conditions that promote sustainability. In terms of planning (as depicted by the Diagram below), this new approach is expressed as follows:

a. New town development

Although new town development involves a mass housing approach, the way it is structure today significantly differs from how is was structures a decade ago. Today the emphasis is on providing a mix of housing typologies and tenure types. Also, achieving transportation integration and linking these housing developments with employment, shopping and community nodes is considered a priority.

b. Nodal (TOD) development

Nodal development involves the use of housing (in this case affordable housing) to breathe new life into decaying inner cities and suburban CBDs. Affordable housing can also be included in the mix of new mixed-use nodes in the form of inclusionary housing, ensuring that the pitfalls of the older CBDs (which as associated with a lack of a residential component) are avoided. At the same time, it places affordable housing in close proximity to employment opportunities and social amenities, which are found within these mixed-use nodes.

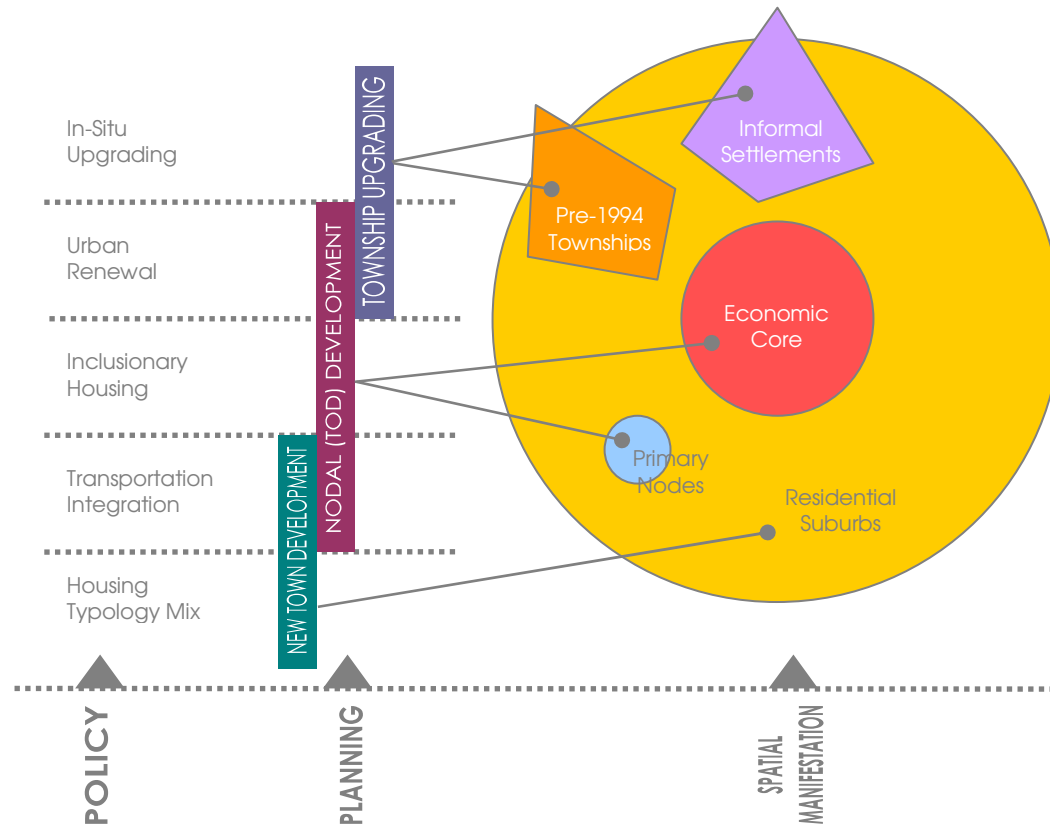


DIAGRAM 30: AFFORDABLE HOUSING DEVELOPMENT APPROACH

c. Township upgrading

With the launching of the Top 20 Priority Township Programme by the Gauteng Department of Housing, recognition was given to upgrade the existing, older townships within Gauteng. This included the upgrading of road and municipal infrastructure within these townships, the use of vacant land within the townships for housing and other purposes, and the in-situ upgrading on informal settlements associated with the townships.

The important point is that no single approach (as set out above) would full address the affordable housing backlog within Gauteng. All three the planning approaches are necessary. For example, the new town approach is necessary because it is the only approach that can address the huge housing backlog within Gauteng, which requires thousands of hectares of land. So too, it is necessary to create more sustainable inner cities and suburban activity nodes, by adding a residential component to these nodes. Affordable housing in the form of inclusionary housing can play an important role in achieving this. This approach can be applied within the Eastern Sub-Region in terms of housing typology mix and geographical distribution, as set out in the Table below.

TABLE 20: HOUSING DEVELOPMENT APPROACH

Development	Tenure	Typologies	Typical Examples	Possible Development Areas
New town	Bonded housing	Detached housing Cluster housing	Dainfern	Dainfern north Fourways Blue Hills Kyalami Sunninghill
New town	Subsidized and bonded housing mix	Detached housing Semi-detached Row housing Walk-ups	Cosmo City	Olievenhoutbosch south Diepsloot East Diepsloot South Cosmo City northeast
Nodal	Subsidized and bonded housing mix	Walk-ups Flats	Melrose Arch	Proposed metropolitan, regional and district mixed-use nodes

Source: Maluleke Luthuli and Associates, 2008

5.4.3.2. INCLUSIONARY HOUSING

Traditionally, affordable housing was seen as a government responsibility and not an area that is suitable for the private sector. The Breaking New Ground policy of the Gauteng Department of Housing floats the idea of requiring private-sector housing developers to invest a percentage in their housing projects at the lower end of the housing market. This housing market typically lies between the housing subsidy market and the bonded housing market, a housing provision band that is currently not covered by either the government or private sector housing initiatives. This approach is known as 'inclusionary housing'.

Internationally (e.g. United Kingdom and the United States of America), a number of municipalities are adopting an inclusionary housing policy with the intent of increasing the supply of affordable housing within their areas of jurisdiction. These municipalities recognize that, in some residential markets, affordable housing would not be produced without government intervention. These inclusionary housing policies aim to:

- Implement the affordable housing goals and objectives contained in the local government's housing plan
- Ensure that critical governmental service workers (e.g., teachers, firefighters, and police officers) can afford to live in communities where they work
- Provide affordable housing for employees that work within up-market areas
- Maintain a balanced community that provides housing for people of all income levels

Currently, ideas on inclusionary housing in South Africa basically involve a mandatory approach, whereby developers are forced to provide affordable housing as part of their up-market housing developments. This approach is contentious for obvious reasons, although larger developers are increasingly committing themselves to the provision of affordable housing in order to obtain approval of their township establishment applications.

Whereas the provision of inclusionary housing in South Africa will most probably be mandatory, the provision of inclusionary housing abroad is mostly incentive based. The incentive based approach encourages the development of inclusionary housing in up-market developments by providing a range of incentives in exchange. These incentives include tax reduction, density bonuses and direct subsidies to entice private sector involvement in affordable housing development. Density bonuses are one of the more common incentives used, especially in the United States of America. The density bonus programme allows private developers to be allocated additional floor area above the permitted zoning if they provide affordable housing (either for sale or rental accommodation) as part of their development. Logic maintains that the additional cash flow from the bonus floor area offsets the reduced revenue from the affordable housing units.

5.4.3.3. LOCATION CRITERIA AND PROPOSED DEVELOPMENTS

It should be evident from the above that the challenge is to go beyond the simple provision of houses and build communities and create conditions that promote sustainability. Central to sustainability is the issue of location, which involves building houses on well-located land that is close to job opportunities and the necessary social amenities. Consequently, housing projects must adhere to very specific location criteria. This will often necessitate housing developments to be located on well-located and expensive land, rather than on cheap land on the outskirts of cities. The following basic criteria for the location of affordable housing projects should be adhered to:

a. Availability of Bulk Services

Affordable housing projects are reliant on access to bulk municipal services. These include water, sewer and electricity bulk infrastructure, of which access to sewer infrastructure is the most important. As a rule, bulk municipal services are available in or next to existing urban areas. This favours infill development as the primary option for affordable housing development and opposes urban sprawl as a form of urban development.

b. Ownership of Land

The ownership of land determines the timeframe and cost of affordable housing projects. Land already in ownership of the municipality avoids the tedious and expensive purchase and transfer of private owned land for affordable housing development. However, to create sustainable communities, land ownership should be viewed in context of the other criteria set out in this section.

c. Access to Social Amenities and Economic Opportunities

Affordable housing projects should be located in a manner that will ensure that these settlements will have reasonable access to social amenities and economic opportunities. This will imply that affordable housing projects should be located close to existing or planned community and economic nodes.

d. Access to Public Transportation

Households that live in affordable housing units are typically dependant on public transport and walking as their mode of transport. It is therefore imperative that affordable housing projects are located next to existing and planned public transport routes (rail, bus and taxi). This is necessary to obtain access to the social amenities and economic opportunities, as was mentioned in the previous paragraph.

e. Integration of Urban Structure

When locating new housing developments, the chosen areas should always be measured against the extent in which they contribute to the establishment of integrated, economically viable and sustainable communities. Practically, this involves promoting infill development, instead of allowing urban sprawl to continue unabated.

f. Land parcel sizes

The size of a land parcel affects the cost of the land. For example, small holdings are more expensive per hectare than farmland. Consequently, affordable housing can be developed more cost-effectively on larger land parcels than on smaller land parcels.

The only proposed large-scale affordable housing development located within the Eastern Sub-Region is Olievenhoutbosch South, located on the northern boundary of the Eastern Sub-Region. The location of this township is included in the development framework, which is depicted on Figure 19, and will essentially involve the southward expansion of Olievenhoutbosch. Two aspects, as defined in the Diagram above, needs to be form the basis of the design and the development of the Olievenhoutbosch South. The first involves creating a housing mix that will cater for a wide range of households and income groups, applying different tenure and housing typologies. The second aspect involves linking the Olievenhoutbosch South development to public transportation. A BRT route is proposed along Main Road (K71) and it is proposed that the design of the Olievenhoutbosch South development supports this proposed BRT system. This implies creating higher-density, mixed-use developments at the proposed BRT stations serving the Olievenhoutbosch South township.

Affordable housing can also be developed as inclusionary housing within the Eastern Sub-Region. Inclusionary housing can effectively be implemented within the mixed-use nodes proposed for the Eastern Sub-Region, such as the regional mixed-use node proposed within the Blue Hills area (on the intersection of the K71 and the planned PWV5 freeway). This will allow affordable housing to become part of the land use mix of such node, thus allowing the residents of such housing units to live within close proximity of their places of employment.

SECTION 6: LAND USE MANAGEMENT

6.1. LAND USE MANAGEMENT CYCLE

The framework proposals dealt with in the previous section of this report provide the platform for the development of Land Use Management System. The Land Use Management System should therefore be informed by the framework proposals and should aim to manage the implementation of the framework proposals.

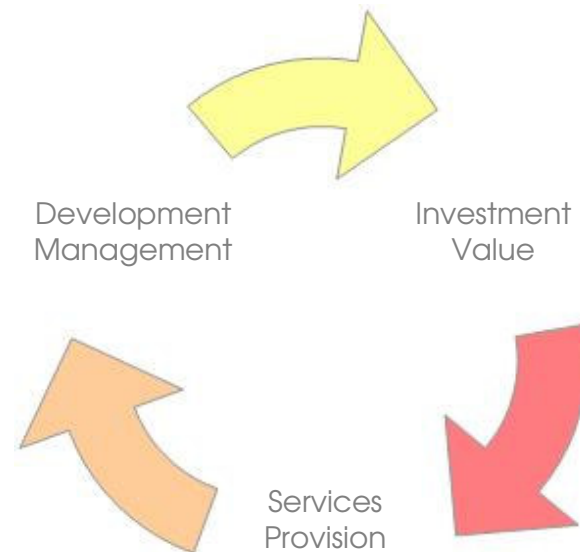


DIAGRAM 31: LAND USE MANAGEMENT CYCLE

The preparation of a Land Use Management System requires an understanding of the Land Use Management Cycle. The Land Use Management Cycle can be described as an interactive relationship between three major components, namely Development Management, Investment Value and Services Provision (see Diagram above). The interactive relationships between these components can be described as follows:

a. Development Management

Development Management aims to manage land use development within an area in order to maximize the development potential of an area. The Spatial Development Framework and Town Planning Scheme is one of the primary tools of Development Management.

b. Investment Value

Investment will only take place and be sustainable when the system regulating development is clear and has a set of rules whereby investors can invest in an area. Development Management provides such a set of rules for investment.

c. Services Provision

Investment in an area will provide the funds necessary for developing municipal services and providing social amenities in the area. In turn, municipal services and social amenities will determine the development potential of an area.

6.2. LAND USE MANAGEMENT ZONES

Land use zones have been identified to operationalise the development proposals of this report. Each of these zones aims to achieve specific objectives, as is set out in the Table below.

Zone 1: Medium-density residential zone

Zone 1 aims to encourage residential densities along public transportation spines that support the viable operation of the public transport system. Consequently these zones are demarcated along the proposed BRT routes. Land uses to be supported and accommodated within Zone 1 include medium density residential development, including alternative

forms of residential accommodation, such as boarding houses, guest houses and hotels. A minimum residential density of 30 units per hectare is encouraged in this zone to ensure that the residential densities developed are sufficient to support the operation of public transportation. Educational facilities, as well as home enterprises, are also to be supported within Zone 1.

TABLE 21: AIM AND OBJECTIVES OF LAND USE ZONES

Land Use Management Zone	Aim and Objective
Zone 1: Medium-density residential zone	Encourage public transport supporting residential densities
Zone 2: Low-density residential zone	Encourage and protect typical residential areas
Zone 3A: Rural residential zone	Protect typical rural residential areas
Zone 4-6A: Mixed-use nodal core	Encourage public transport integration, the development of inclusionary housing and the concentration of business activity
Zone 4-6B: Mixed-use nodal periphery	Encourage public transport integration, the provision of social amenities, the development of inclusionary housing and the concentration of business activity
Zone 7: Commercial and light industrial zone	Provide for non-polluting commercial and light industrial activities
Zone 8: Airport expansion zone	Provide for non-polluting commercial and light industrial activities within future airport expansion area
Zone 9: Institutional zone	Provide for the concentration of institutional uses associated with Metropolitan, Provincial and National government functions
Zone 10: Conservation Area	Protect ecological-sensitive environments and buffer zones

Source: Maluleke Luthuli and Associates, 2008

Zone 2: Low-density residential zone

The aim of Zone 2 is to maintain and enhance the residential character of typical residential neighbourhoods. This involves the management of land use development within these residential areas and curbing the proliferation of informal, noxious and disturbing uses, such as taverns and informal panel beaters. The residential neighbourhoods that fall within Zone 2 are not located close to (or within comfortable walking distance of) public transportation routes and therefore do not require the residential densities that area required by Zone 1 neighbourhoods. A minimum residential density of 10 units per hectare is supported by Zone 2. However, medium-density housing types, such as cluster housing,

are also encouraged within Zone 2. Support facilities to be developed within this zone include schools, religious facilities and active open space.

Zone 3: Rural residential zone

A rural residential zone (Zone 3) is similar to a low-density residential zone (Zone 2) in the sense that it intends protecting a largely residential environment. However, the Zone 3 residential environment is very low density, not allowing residential densities exceeding 1 unit per hectare. Maintaining and enhancing the rural character of these areas are the primary focus. To this end, only rural residential support uses are to be encouraged within Zone 3. Support facilities to be developed within this zone include, schools, religious facilities, and social facilities, such as libraries, police stations and post offices. Non-disturbing home enterprises associated with rural living, such as farm stalls, are to be supported within Zone 3. Subsistence and commercial farming is to be accommodated, as this is linked to rural residential living activities. Industries related to animals and plants, such as veterinaries and nurseries, are allowed within Zone 2.

Zone 4-6A: Mixed-use nodal core

Mixed-use nodal core are Transit Orientated Developments or TODs and are zones center on the proposed BRT stations. Consequently, these zones aim to provide the necessary land use densities and optimal land use mix to support the use of the BRT system. Business development will be the key focus of a Zone 4-6A and can include large ground-level shopping centres and multi-storey office buildings. Entertainment uses can also form an integral part of the land use mix of Zone 4-6A. Another land uses to be encouraged within this Zone 4-6A is high-density residential uses, which must include an inclusionary housing component.

Zone 4-6B: Mixed-use nodal periphery

Zone 4-6B makes up the peripheral regions of a mixed-use node. These peripheral areas are still within walking distance of the proposed BRT station and therefore contribute to supporting this public transportation system. As such, this zone an intense mix of higher-density land uses, but of a lower order than those found in the mixed-use nodal core (Zone 4-6A). In particular, Zone 4-6B can contain land uses support the land use mix within the core area, but which are not of a high-enough density to be provided in the core area. For example the schools and recreation areas needed to support the high-density residential uses in the core area can be provided within this peripheral zone. Businesses associated with the motor trade, i.e. filling stations, showrooms, outlets and services centres, are also to be accommodated within Zone 4-6B. Institutional uses (Government and Municipal), are also to be encouraged within this zone.

Zone 7: Commercial and light industrial zone

The primary aim of Zone 7 is to provide space for commercial and light industrial activities. In particular, commercial developments, for example distribution centres, storage, wholesale and warehousing, linked to airport operations should be encouraged within this zone. Stringent development controls must be implemented within this zone to ensure an acceptable interface between this zone and the airport. For the same reason, heavy noxious industries are excluded from this zone. Other land uses to be encouraged within Zone 7 include motor trade uses, office development and retail development. Formal office developments are also to be encouraged. In addition, institutional uses, such as Government and Municipal depots, are to be encouraged. To allow for the environmental protection of rivers and environmentally sensitive areas, passive open space is accommodated within this zone.

Zone 8: Airport expansion zone

The primary aim of Zone 8 is to allow for the expansion of commercial industries associated with an airport, without impeding on the future long-term expansion potential of the airport. To this end, it must be a requirement for every township establishment, rezoning or consent-use application to provide a written consent from the airport administration that the proposed township establishment, rezoning or consent-use application does not and will not impact on the **long-term expansion potential** of the airport. A distinction has to be made between the 'future development plans' of an airport and the 'long-term expansion potential' of an airport. The latter implies that an airport may need an area for expansion in future, but have not considered these in the future expansion plans as yet. In addition, Zone 8 can accommodate light industries, motor trade uses, office development, retail development and institutional uses.

Zone 9: Institutional Zone

The aim of Zone 9 is to provide for the concentration of institutional uses associated with Metropolitan, Provincial and National government functions. On the one hand these can include uses that provide services to local communities, such as community facilities (e.g. schools, clinics and libraries). On the other hand, these can include uses associated within the technical operations of Metropolitan, Provincial and National government, such as bus depots, prisons or telecommunications workshops.

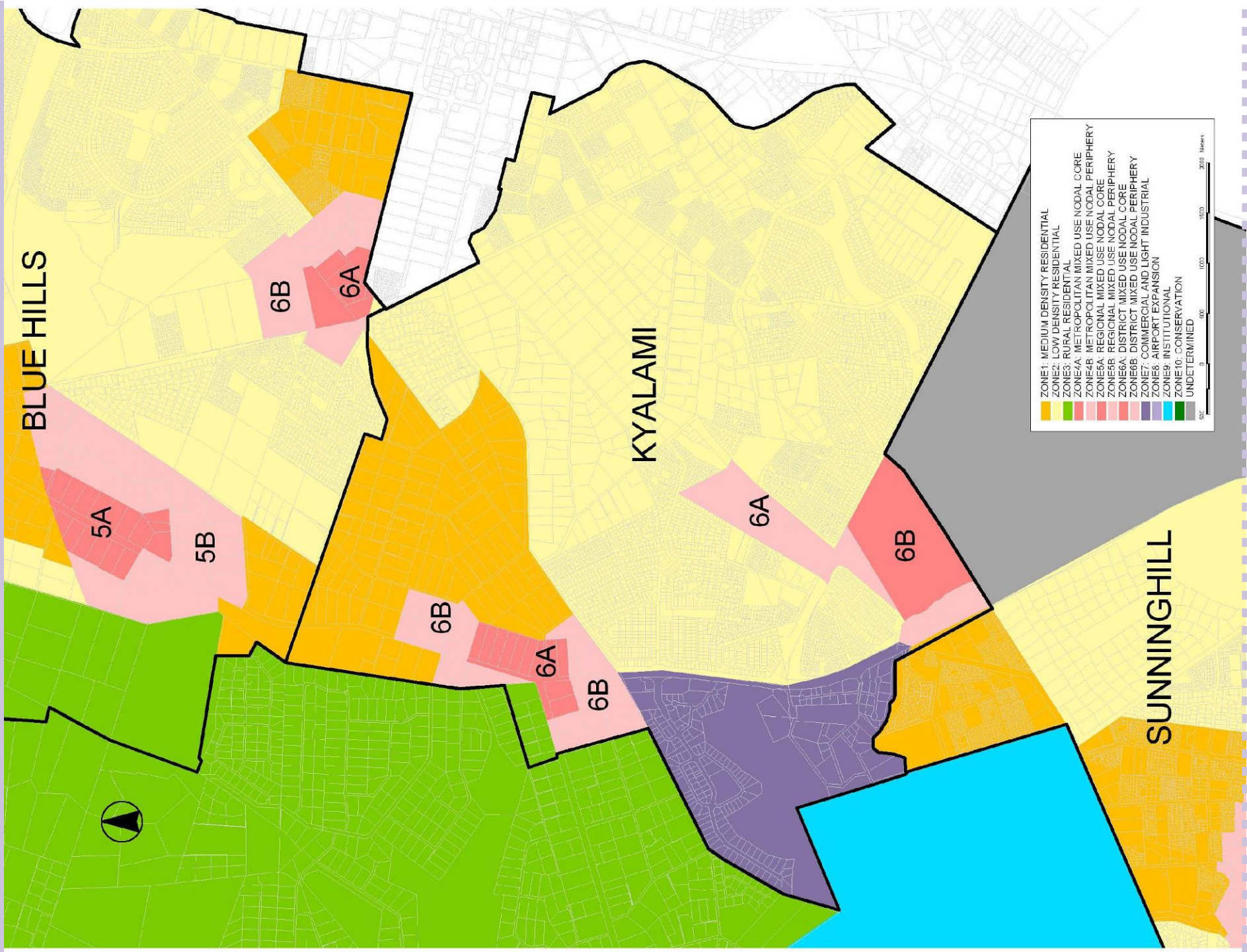


FIGURE 23
LAND USE MANAGEMENT ZONES



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TABLE 22: LAND USE MANAGEMENT SCHEDULE

Broad Land Use Category	Land Use Category	Zone 1	Zone 2	Zone 3	Zone 4A	Zone 4B	Zone 5A	Zone 5B	Zone 6A	Zone 6B	Zone 7	Zone 8	Zone 9	Zone 10
		Medium-density residential zone	Low-density residential zone	Rural residential zone	Metropolitan mixed-use nodal core	Metropolitan mixed-use nodal periphery	Regional mixed-use nodal core	Regional mixed-use nodal periphery	District mixed-use nodal core	District mixed-use nodal periphery	Commercial and light industrial zone	Airport expansion zone	Institutional zone	Conservation zone
Residential	Very low-density			•										•
	Low-density		•											
	Medium-density	•	•											
	High-density	•			•	•	•	•	•	•				
	Accommodation	•			•	•	•	•	•	•		▼		
Community	Educational	•	•	•		•		•		•			•	
	Medical				•	•	•	•	•	•			•	
	Religious	▶	▶	▶										
	Social			•		•		•		•			•	
Business	Retail				•	•	•	•	•	•				
	Office				•	•	•	•	•	•		▼		
	Entertainment				•	•	•	•	•	•				
	Motor trade					•		•		•	▲	▼		
	Micro enterprise	▶		▶										
Institutional	Municipal					•		•		•	▲		•	
	Government					•		•		•	▲		•	
Industrial	Light										▲	▼		
	Commercial					•					▲	▼		
Open space	Active	•	•	•		•		•		•			•	
	Passive	•	•	•	•	•	•	•	•	•	•	•	•	•
Agriculture	Agriculture			•									•	•
Minimum FAR		n/a	n/a	n/a	2.4	0.8	1.8	1.2	0.8	n/a	n/a	n/a	n/a	n/a
Maximum FAR		n/a	n/a	n/a	4.8	2.4	3.6	2.4	1.6	1.2	0.8	0.8	0.8	n/a
Maximum Coverage		n/a	n/a	n/a	60%	40%	60%	60%	40%	40%	40%	40%	40%	n/a
Maximum Height		4 storeys	3 storeys	2 storeys	8 storeys	6 storeys	6 storeys	4 storeys	4 storeys	3 storeys	2 storeys	2 storeys	2 storeys	n/a
Minimum Residential Density		30 u/ha	10 u/ha	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Maximum Residential Density		160 u/ha	30 u/ha	2 u/ha	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1 u/ha

Source: Maluleke Luthuli and Associates, 2008

- ▲ Subject to developers providing own bulk services
- ▼ Subject to not impeding the future long-term expansion of Lanseria Airport
- ▶ Subject to relevant policy document

Development on Portion 119 of the farm Diepsloot (located in Zone 6A) is required to allocate 70% of its floor area for residential use

Zone 10: Conservation Area

Zone 10 largely sets aside areas for the conservation of natural resources or to provide a hazard avoidance function. With regard to the latter, conservation areas protect communities against potential pollution dangers, as potentially caused by land fill sites, waste treatment plants and other similar facilities. In selected cases, it is possible to use these conservation areas for very-low density residential development or for agricultural purposes. However, such uses should only be allowed after careful consideration of all potential negative impacts.

The abovementioned Land Use Management Zones are demarcated on Figure 23 and the proposed land uses linked to these zones are set out in the Table above. The land use zones proposed aim to provide municipal planners with a tool to help assess development applications, such as township establishment, rezoning or consent use applications. As far as possible, these land use zones have given consideration to existing zoning and land use patterns. These land use zones do not affect existing land use rights granted to properties, even if the existing rights have not been exercised or do not correspond with the land uses proposed for the relevant land use zone.

It is important to note that the land use zones presented above do not overwrite the relevant Town Planning Scheme, but only intended to supplement it. As such, it does not attempt to address all the issues that are contained within a Town Planning Scheme, but rather addresses only those issues that are operational to the implementation of the Development Framework proposals. The land use zones proposed within this report can be used as a guide to review the Town Planning Scheme in future.

The Table presented above only provides land use categories to illustrate which basic land use types are to be allowed within each respective land use zone. **Definitions of the land uses that fall within each of these land use categories are presented in Annexure B.**

Zone 1 and 3 allow for micro enterprises. Micro enterprises are defined as a business or enterprise attached to and supplementing a residential component. The residential component remains the primary land use associated with the property. This definition does not cater for the development of neighbourhood shopping centres. Such centres are better suited for the proposed mixed-use nodes, in particular the District Mixed-Use Nodes. District Mixed-Use Nodes have a 2km service radius, making such centres within easy reach for day-to-day shopping purposes.

TABLE 23: MICRO ENTERPRISE FLOOR AREA ALLOCATION

Land Use Management Zone	Zone 1: Medium-Density Residential Zone				Zone 3: Rural Residential Zone
Number of building storeys	1 storey	2 storeys	3 storeys	4 storeys	n/a
Maximum % of building floor area to be allocated to micro enterprises	5%	7.5%	10%	15%	20%
Ceiling building floor area to be allocated to micro enterprises	Up to a maximum floor area of 500m ² per property				

Source: Maluleke Luthuli and Associates, 2008

The Table above provides guidelines for the approval of micro enterprises as part of the township establishment or rezoning application process. The provision of building floor area for micro enterprises is linked to the residential component of the building; requiring the residential floor area to remain the dominant land use associated with the building. The floor area provided for micro enterprises may not exceed 500m² per property. Practically, this translates to the following examples:

- A single storey 120m² house comprising a 6m² hairdresser
- A 2-storey 300m² house comprising a 22.5m² home office
- A 4-storey 1500m² walk-up comprising a 300m² café
- A single storey 400m² rural residential property comprising a 80m² veterinary clinic

6.3. DEVELOPMENT DENSITY

A critical element in developing more sustainable cities is applying higher urban densities than in the past. This has been necessitated by the inefficiency and high costs of existing spatial patterns, especially with regard to providing public transport. Low urban densities result in long walking distances and therefore cannot support public transport effectively. Of particular importance is the integration of higher-density housing development and public transportation. Public transportation is and must be central to higher-density housing development, simply because households that typically live at higher residential densities are generally more reliant upon public transport to access employment opportunities.

Based on the above as a point of departure, land use development densities are proposed for each of the Land Use Management zones dealt with in the Table above. These densities specifically aim to increase densities within mixed-use nodes, which are centred on proposed public transportation systems. The proposed densities are expressed in terms of height, coverage and Floor Area Ratio (FAR) for the mixed-use areas and units per hectare (u/ha) for residential areas.

6.3.1. DENSITY MEASURES

The zoning terminology used in this report needs to be clearly defined in order to clarify what is meant by the zoning terminology used within this report. The following zoning terminology is defined as follows:

a. Building Height

The height of a building can either be measured as the height of the roof of the building or as the number of storeys of the building. In this document, the number of storeys is used as the measurement of building height. A storey is that part of a building between the surface of one floor and the ceiling immediately above. Basement parking is not considered a storey.

b. Coverage

Coverage means the area of a property which may be covered by a building, as seen vertically from the air, excluding roof overhangs. It is expressed as a percentage of the area of the property.

c. Residential Density

Density refers to the intensity of development within a zoning district. In residential areas, density is generally measured by the maximum number of dwelling units permitted per hectare of land (e.g. 20 units/ha). Residential density can be expressed as nett or gross density. Nett residential density (see Diagram below) refers to the density on a specific site, excluding public roads, social facilities and public open space, thus including only the area allocated for residential use. Gross residential density refers to the density of a specific site including the land occupied by infrastructure, social and economic facilities, such as schools, shops, open space and roads.

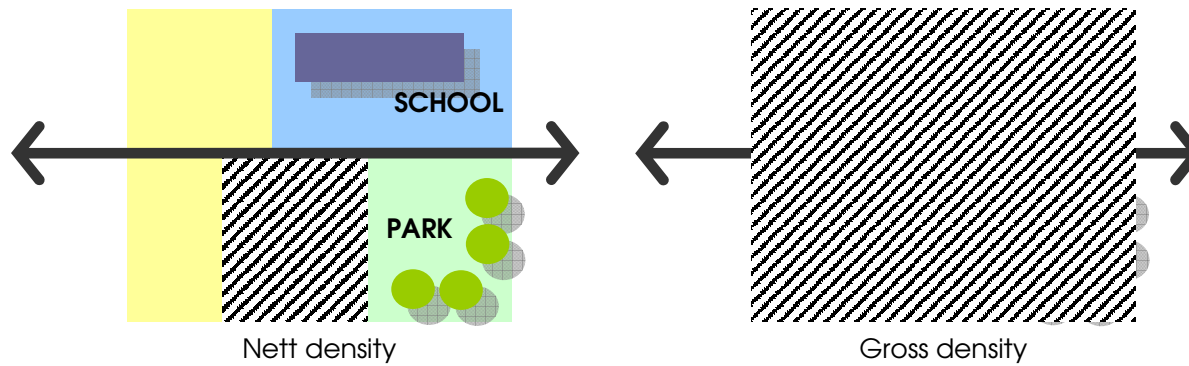


DIAGRAM 32: DENSITY MEASURES

d. Floor Area

The floor area of a building is the sum of the area of each floor of the building, excluding fire escapes, parking space, access passages, lift housing, and balconies.

e. Floor Area Ratio (FAR)

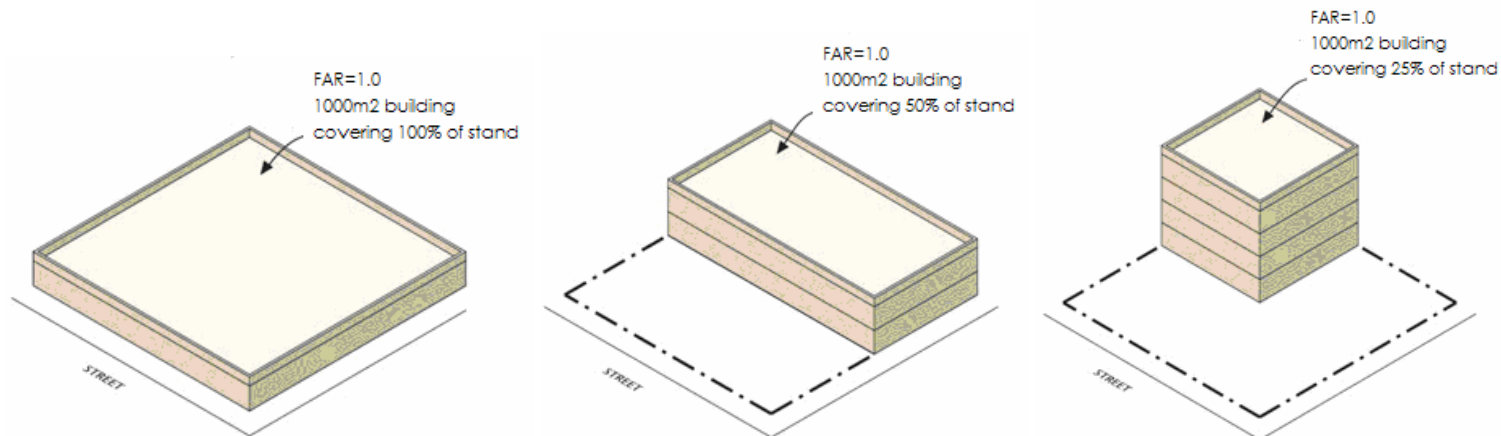


DIAGRAM 33: CALCULATION OF FAR

FAR is a density measure that is applied to mixed-use buildings that contain both residential and other uses. The floor area ratio (FAR) is the ratio of total building floor area to the area of the property. FAR is calculated by dividing the floor area of the building by the total area of the property (see Diagram below).

f. Parking Requirement

Parking requirement is the number of parking bays required for each use or facility provided within a development. Parking requirement is usually expressed as the number of parking bays to be provided per building floor area (m2) covered by the use or facility. Parking to floor area ratios are calculated based on the amount of traffic generated by specific uses or facilities.

6.3.2. DENSITY BONUSES

6.3.2.1. DENSITY INCENTIVES

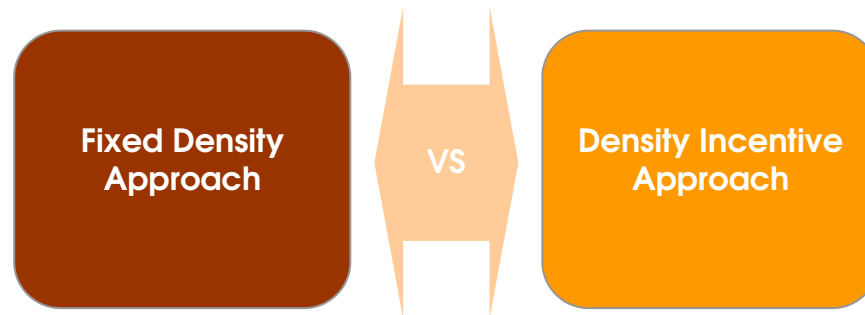


DIAGRAM 34: DENSITY CONTROL ALTERNATIVES

Land use densities allowed within a given area can either be fixed or it can be incentive-based. A fixed density approach involves a maximum land use density for a given area and enforcing that density through rezoning and township establishment

applications. The incentive approach involves a standard maximum land use density for a given area, but allows additional densities for properties that 'earn' these additional densities by complying with certain conditions, as set out by the density incentive programme. The incentive-based approach is also enforced through rezoning and township establishment applications.

The incentive approach is not an approach to be applied to all areas within a city, but rather a tool to be applied to very specific areas within a city where very specific municipal goals and objectives are to be obtained using the incentive programme. The incentive approach is most effective in areas where development pressures are high, as it needs to entice developers to use the density incentives.

6.3.2.2. DENSITY BONUS PROGRAMME

The Density Bonus Programme is a density incentive that can be structured to achieve very specific land use objectives along public transport routes, such as Bus Rapid Transit (BRT) routes. Basically, the goal is to promote the development of a land use structure along a public transport route that will ensure the optimal functioning of a public transportation system. This includes:

- Increasing densities close to public transport stations
- Creating a land use mix and discouraging the development of single-uses building, such office blocks
- Maximizing pedestrian accessibility to public transport stations

The Land Use Management Schedule provides the maximum FAR, coverage and height proposed for the various Land Use Management Zones demarcated on Figure 23. These are the maximum densities that should be granted by the Municipality without a Density Bonus. Compliance with the Density Bonus Programme can earn developers additional density (FAR) within certain Land Use Management Zones, over and above that which is proposed in the Land Use Management Schedule.

The Table below is designed as a user-friendly reference for the calculation of Density Bonuses. Density Bonuses are calculated for a number of Land Use Management Zones, as demarcated on Figure 23. The Density Bonuses earned for a property must be added together, not exceeding the maximum allowable FAR under the Density Bonus Programme (as set out in the Table below). The Density Bonus Program also provides an additional parking reduction incentive. The parking reductions are automatically earned when earning density bonuses, thus not requiring specific conditions to be met to earn such parking reductions.

TABLE 24: DENSITY BONUS PROGRAMME

Category	Definition	Metropolitan Mixed-Use Node		Regional Mixed-Use Node		District Mixed-Use Node	
		Zone 4A Metropolitan mixed-use nodal core	Zone 4B Metropolitan mixed-use node periphery	Zone 5A Regional mixed-use nodal core	Zone 5B Regional mixed-use node periphery	Zone 6A District mixed-use nodal core	Zone 6B District mixed-use nodal periphery
Middle income dwelling units	Dwelling units with a unit floor area not exceeding 80m ² .	15% added to floor area if 10% of floor area is dedicated to medium-income units, with a 1.5% floor area increase for every percentage increase in floor area dedicated to medium-income dwelling units above 10% and;					
Low income dwelling units	Dwelling units with a unit floor area not exceeding 60m ² .	20% added to floor area if 10% of floor area is dedicated to low income units, with a 2.0% floor area increase for every percentage increase in floor area dedicated to low-income dwelling units above 10% and;					
Very-low income dwelling units	Dwelling units qualifying for and accessing the Housing Subsidy and Restructuring Grant within a Restructuring Zone. Zones 1A, 1B, 2A and 2B are considered Restructuring Zones.	25% added to floor area if 10% of floor area is dedicated to very low income units, with a 2.5% floor area increase for every percentage increase in floor area dedicated to very low-income dwelling units above 10% and;					
Community facilities	Including a crèche, primary school, secondary school, tertiary education institution, clinic, day-hospital, hospital, community hall, library, post office, police station or emergency service centre all open to the general public for a minimum period of 15 years.	10% added to floor area if 5% of floor area is dedicated to social facilities, with a 2% density increase for every percentage increase in floor area dedicated to social facilities above 5% and;					
Pedestrian facilities	Including a pedestrian thoroughfare on the property, pedestrian mall on the property, town square on the property or a minimum 2m street-front sidewalk on the property all accessible to the general public for the life-span of the density bonus	0.5m ² added to floor area for every 1m ² dedicated to pedestrian facilities and;	0.5m ² added to floor area for every 2m ² dedicated to pedestrian facilities and;	0.5m ² added to floor area for every 1m ² dedicated to pedestrian facilities and;	0.5m ² added to floor area for every 2m ² dedicated to pedestrian facilities and;	0.5m ² added to floor area for every 2m ² dedicated to pedestrian facilities and;	0.5m ² added to floor area for every 3m ² dedicated to pedestrian facilities and;
Vehicle access	Use of a non-public transport route vehicle entrance, shared vehicle access, service road access or park and ride facility for the life-span of the density bonus	10% added to building floor area for a non-public transport route vehicle entrance or a shared vehicle access or a service road access and 2m ² added to floor area for every 1m ² dedicated to a park and ride facility to a;					
Maximum FAR of:		7.2	3.6	5.4	3.6	2.4	1.6
Maximum Coverage of:		60%	40%	60%	60%	40%	40%
Maximum Height of:		12 storeys	9 storeys	9 storeys	6 storeys	6 storeys	4 storeys
Parking reduction		1% parking reduction for every 0.1 FAR earned using density bonus					
Maximum parking reduction:		8%	4%	12%	4%	4%	3%

Source: Maluleke Luthuli and Associates, 2008

6.3.2.3. ADMINISTRATIVE PROCESS

The Density Bonuses Programme needs to be administered through rezoning and township establishment applications (see Diagram below). Of critical importance is the Site Development Plan. On the one hand, the Site Development Plan will enable the calculation of the Density Bonuses to be awarded. On the other hand, the Site Development Plan needs to be reviewed to ensure that the granting of the density bonus does not have an adverse effect on adjacent properties and that the municipal services network has the capacity to serve these higher densities.

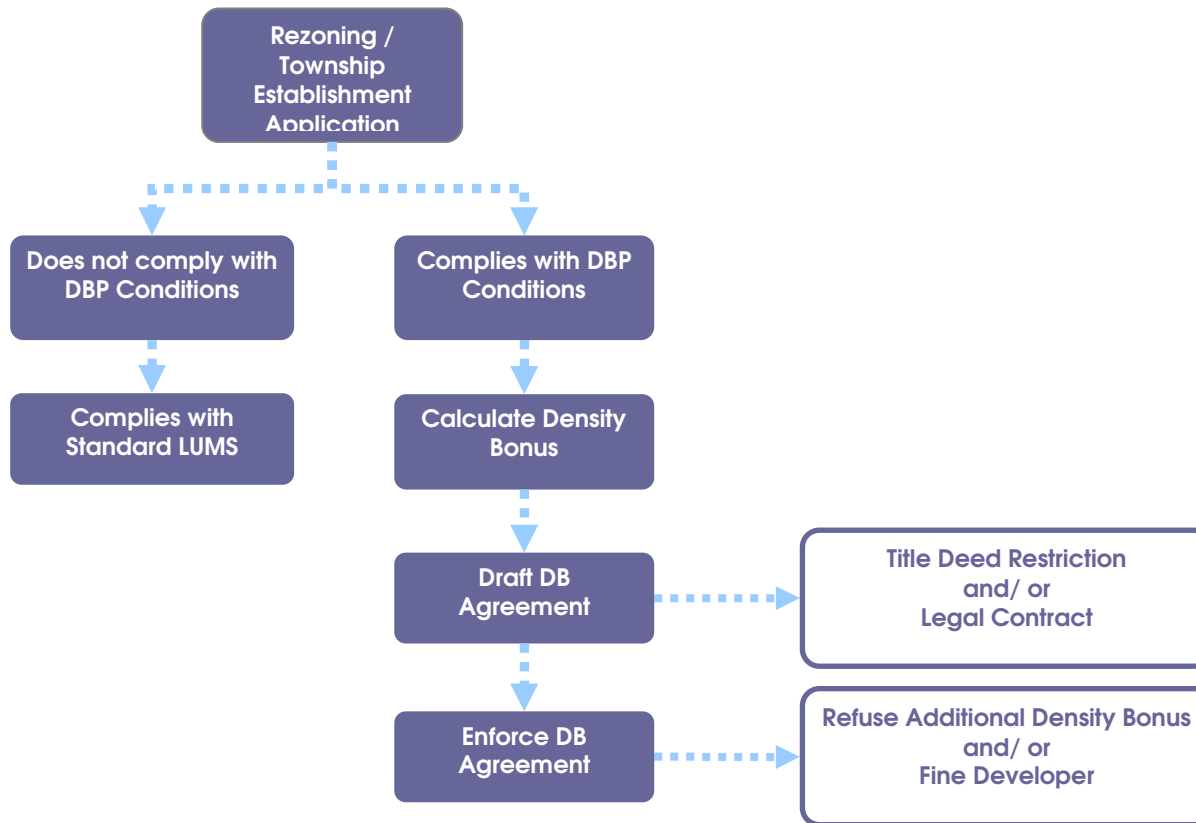


DIAGRAM 35: DENSITY BONUS APPLICATION PROGRESS

Once a density bonus has been granted, the Municipality will have to ensure that the developer complies with the conditions of the Density Bonus Programme. This can involve complying with a once-off condition, such as constructing a number of dwelling units. It can also involve complying with conditions on an ongoing basis, such as making building space available for a public facility as part of the Density Bonus agreement, which remains in affect for the life-span of the density bonus.

The conditions for earning a Density Bonus are best included in the Title Deed of a property (suitable for a once-off agreement) and/or included in a legal contract between the Municipality and the property developer/ owner (suitable for an ongoing agreement). The terms and conditions of the agreement must run with the land/ property to be developed. In other words, the agreement must be binding on any successive owner of the land/ property.

Penalties can be used to enforce compliance. Without a penalty there is little incentive to continue to comply with the rules of the program. For example, the Municipality can refuse to allow the developer any future density bonuses or the Municipality can issue a fine for non-compliance in terms of the legal contract. Whatever mechanisms the Municipality develops, it should make sure the developer understands and agrees to the requirements prior to construction.

6.4. MIXED-USE NODE PHASING

Large tracts of land are set aside in terms of the Development Framework within the proposed mixed-use nodes. This poses the danger that these node develop in a haphazard, fragmented manner, thus not achieving an integrated and consolidated node within the short-term development of the node. As a result, an integrated and consolidated node may only be achieved once the node is fully developed, which may to 15 to 20 years to develop. To ensure development (e.g. retail and office development) within a mixed-use node occurs in a consolidated and integrated manner, it will be necessary to phase the development of these nodes. Each phase will restrict and concentrate development within a demarcated portion of the mixed-use node, not allowing development of the other parts of the mixed-use node until the first portion is developed to a significant degree.

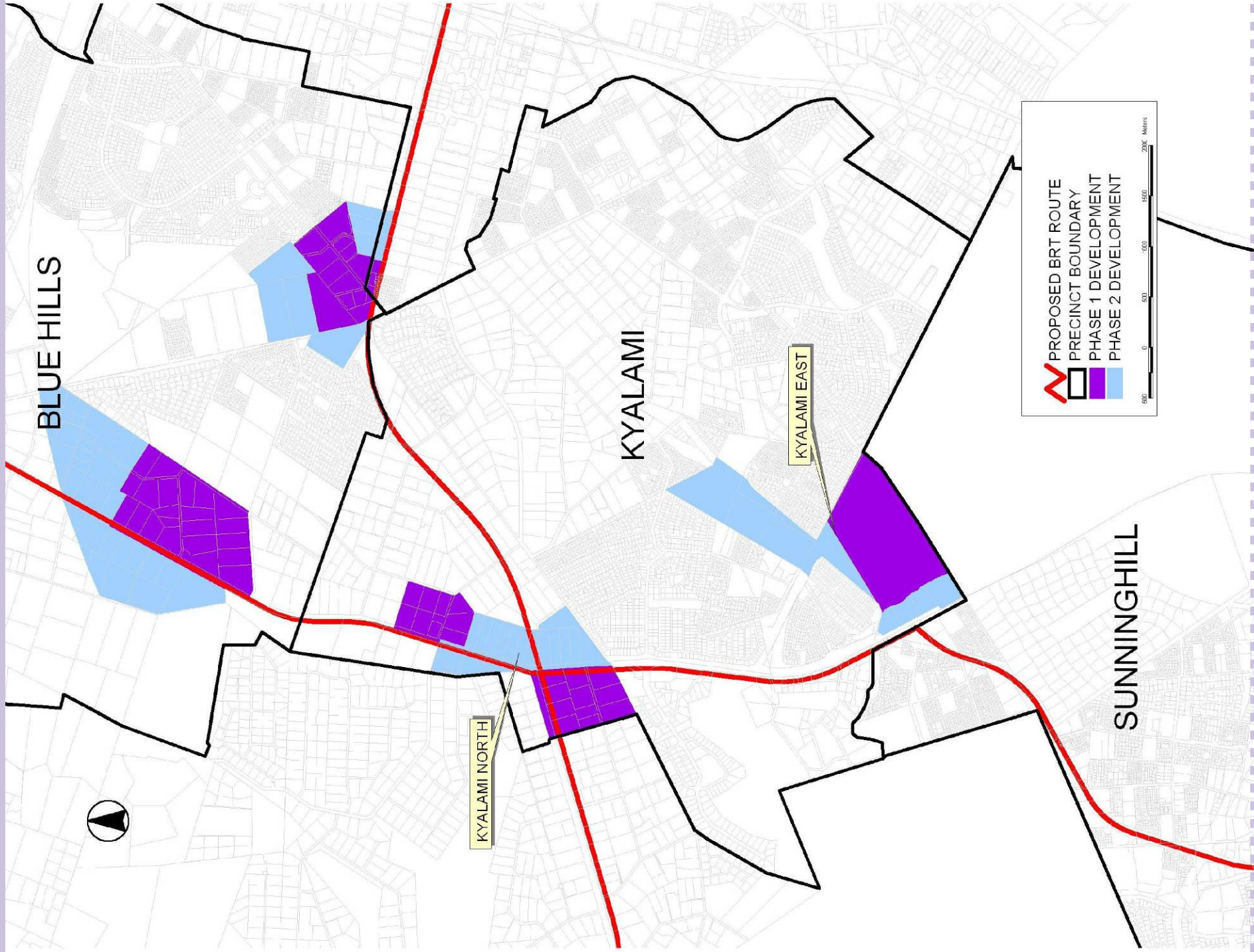


FIGURE 24
MIXED-USE NODE PHASING

Figure 24 illustrates the different phases of the mixed-use nodes located within the Kyalami Precinct. **It is proposed that at least 70% of the land area of the first phase of a node be developed, before the second phase is released for development.** This approach will allow the pace of development within a node to determine when additional land within a node is released for development. This gives recognition to the fact that certain nodes are better located and will therefore receive more developer interest than other nodes within the short-term. There may be circumstances where the second phase of a mixed-use node needs to be released with less than 70% of the nodal area developed. This decision would exclusively be to the discretion of the Johannesburg Metropolitan Municipality.

TABLE 25: TYPICAL MIXED-USE NODE COMPOSITION BY PHASE

Mixed-Use Node	Land Use Zone	Horizontal Land Use Mix	Vertical Land Use Mix	Total		Phase 1		Phase 2	
				Area (ha)	Floor Area (m ²)	Area (ha)	Floor Area (m ²)	Area (ha)	Floor Area (m ²)
Kyalami North District									
	Zone 6A								
		Land Use		18.4		7.4		11.0	
			Retail		50224		20090		30134
			Office		150672		60269		90403
			Housing		93440		37376		56064
		Flood area		2.0		0.8		1.2	
		PWV Roads		5.8		2.3		3.5	
		Internal roads		2.9		1.2		1.8	
		Sub-total		29.2		11.7		17.5	
	Zone 6B								
		Land Use		19.7		7.9		11.8	
			Retail		26118		10447		15671
			Office		52314		20926		31388
			Housing		157680		63072		94608
		Community		15.0		6.0		9.0	
		Recreation		10.0		4.0		6.0	
		Flood area		4.6		1.8		2.8	
		PWV Roads		9.9		3.9		5.9	
		Internal roads		6.6		2.6		3.9	

Mixed-Use Node	Land Use Zone	Horizontal Land Use Mix	Vertical Land Use Mix	Total		Phase 1		Phase 2	
				Area (ha)	Floor Area (m2)	Area (ha)	Floor Area (m2)	Area (ha)	Floor Area (m2)
		Sub-total		65.7		26.3		39.4	
		Total		94.9	279328	38.0	111731	56.9	167597
Kyalami East District									
	Zone 6A								
		Land Use		36.1		14.4		21.7	
			Retail		98556		39422		59134
			Office		295668		118267		177401
			Housing		183360		73344		110016
		Flood area		4.0		1.6		2.4	
		PWV Roads		11.5		4.6		6.9	
		Internal roads		5.7		2.3		3.4	
		Sub-total		57.3		22.9		34.4	
	Zone 6B								
		Land Use		13.4		5.3		8.0	
			Retail		8280		3312		4968
			Office		16584		6634		9951
			Housing		135360		54144		81216
		Community		15.0		6.0		9.0	
		Recreation		10.0		4.0		6.0	
		Flood area		3.9		1.6		2.4	
		PWV Roads		8.5		3.4		5.1	
		Internal roads		5.6		2.3		3.4	
		Sub-total		56.4		22.6		33.8	
		Total		113.7	419088	45.5	167635	68.2	251453

Source: Maluleke Luthuli and Associates, 2008

The Table above provides a typical proportional allocation a mixed land uses within each mixed-use node located within the Kyalami Precinct. **This use-allocation provides the ‘ideal’ land use mixed required within a node and can serve as a guideline for the approval of development applications within a mixed-use node.** However, it has to be stressed that this Table is only a guideline. The actual development of the node may be influenced by a number of factors, such as the volumes of retail and

office space that can actually be absorbed by the local property market. The rule of thumb is not to allow certain land uses to develop disproportionately to the other land uses within a mixed-use node, as set out in the Table above. For example, developers should not be allowed to cover the entire node with office and retail space; not allowing the development of any housing units or community facilities.

6.5. PARKING

This section attempts to provide some guidelines in the provision of parking, in particular with regard to supporting public transport and parking provision within nodal areas.

6.5.1. PARKING AND PUBLIC TRANSPORT

The level of parking provision within a node directly impacts on the use of public transport within that particular node. Thus, when providing parking within a node, it has to be viewed within the context of public transportation and not in isolation of public transportation. For example, providing ample parking within a node encourages the use of private vehicles and consequently discourages the use of public transport within a node. In contrast, limiting parking provision within a node increases traffic congestion within a node, making the use of public transport more attractive. With the above in mind, guidelines for the development of parking within a mixed-use node are as follows:

- In areas where pedestrian and public transport accessibility is good, parking ratios should be reduced.
- Reductions in parking should go hand-in-hand with improvements of pedestrian facilities and the improvement in the quality of public transportation.
- On-street parking should be encouraged where the road reserves are wide enough to allow on-street parking.
- Where practically possible, multiple-use of available parking facilities should be encouraged, e.g. the parking facilities of an office block could be used by an adjacent sport complex on weekends.
- The identification of appropriate sites for park and ride garages and bicycle-storage facilities should be done within the context of the broader land development proposals of an area and specifically the location of transit stations.
- The provision of parking spaces within a node should frequently be reviewed to determine whether it should be reduced in support of public transport usage.

6.5.2. PARKING AND NODAL DEVELOPMENT

Providing parking within a node should be done within the context of the node hierarchy. Metropolitan nodes and to a lesser extent regional nodes would require large numbers of parking bays, most of which would have to be provided in parking garages. By contrast, neighbourhood nodes or district nodes requires far less parking, most of which could be provided as on-street parking. The Diagram below illustrates a hypothetical increase in on-street parking provision related to nodal size. Parking requirements must be determined as part of the traffic impact study, which needs to be conducted during the planning and design phase of the mixed-use node.

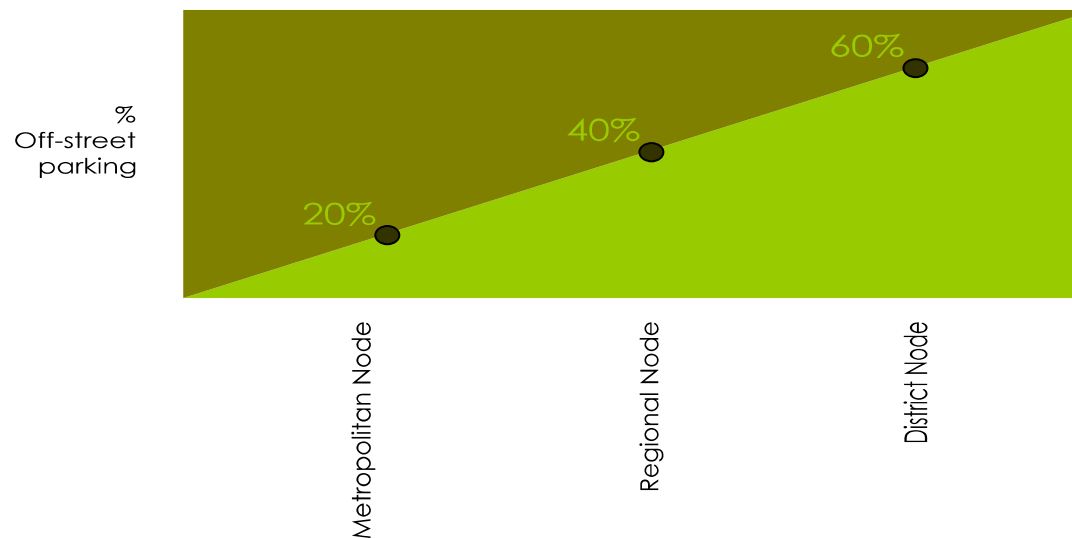


DIAGRAM 36: ON-STREET PARKING PROVISION

Most of the proposed nodes within the Fourways Precinct do not have a high-capacity public transportation system currently in place, such as the proposed Bus Rapid Transit system. This implies that these nodes will be private vehicle oriented at first, until such a public transit system is constructed. Therefore, whereas the initial stages of nodal development must allow for the parking requirements of a private vehicle-based transportation system, the design of the parking areas within such a node should be flexible enough to allow a shift from a private vehicle-based system to a public transport based system in future. Practically, this

implies that a parking area should be designed to allow its conversion to another use, such as an urban square or park and ride facility.

SECTION 7: URBAN DESIGN GUIDELINES

7.1. CONCEPTUAL APPROACH

From the onset it has to be stated that the following designs illustrated within this section of the report are only conceptual and does not aim to provide a detailed layout plan for the development of areas or nodes. Instead, these illustrations aim to provide a vision for the development of such areas of nodes by applying a range of urban design guidelines. It is therefore attempted to illustrate how these principles can be employed, rather than proposing a specific layout or design that has to be adhered to. The intention is to influence the manner in which the proposed areas or nodes is ultimately developed.

7.2. DENSITY INTERFACE

The primary objective of a residential interface zone is to ensure that higher intensity (mixed-use) and density development does not have adverse impacts on adjoining or nearby residential zones, in terms of noise, odour or visual pollution. Practically, this deals with the relationship between the mixed-use nodes (Zones 4 to 6), higher-density residential areas (Zone 1) and the lower density residential areas (Zones 2 and 3) within the Study Area. The following guidelines can be applied to achieve good residential interface and is applied to the Kyalami Precinct conceptually on Figure 25:

- a. Increase densities towards public transportation routes and station

The integration of residential development and public transportation is necessary, simply because households that typically live in higher-densities dwelling units are more reliant upon public transport. In turn, higher residential densities provide the necessary commuter numbers to support the viable operation of public transport systems. This will necessitate locating vertically attached housing typologies (e.g. walk-ups) achieving densities of between 160 and 80 u/ha within easy walking distance of a public transportation (BRT) stations, generally accepted to be a maximum distance of 400m of a station. These densities can be tapered down to 80 to 30 u/ha at between 400 and 1000m distances of a station.

LEGEND

- MIXED USE NODE
- HIGH DENSITY RESIDENTIAL (80 - 160 u/ha)
- MEDIUM DENSITY RESIDENTIAL (30 - 80 u/ha)
- LOW DENSITY RESIDENTIAL (10 - 30 u/ha)
- RURAL RESIDENTIAL (< 10 u/ha)
- RIVER BUFFER ZONE
- BRT STATION

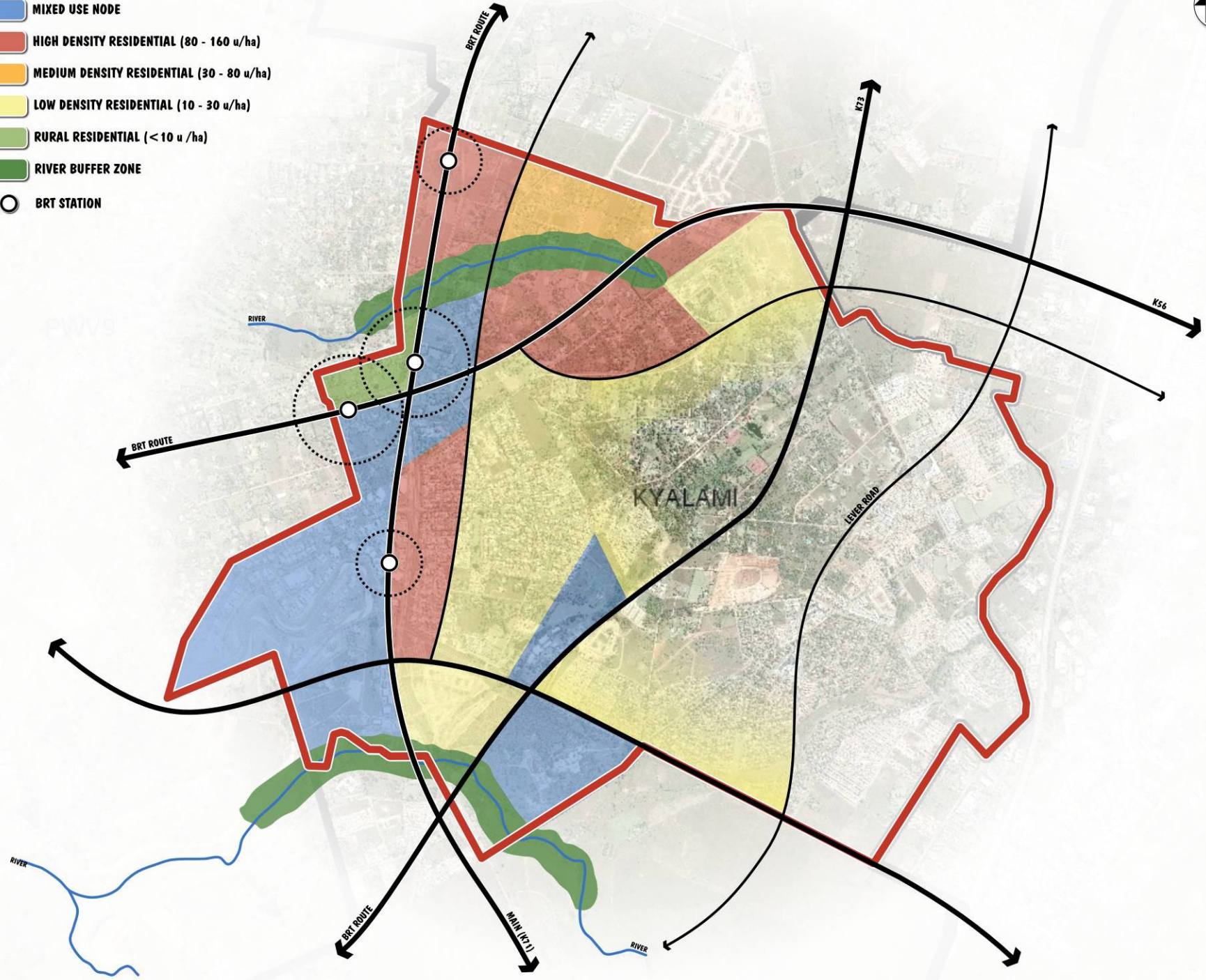


FIGURE 25
KYALAMI RESIDENTIAL INTERFACE

b. Exchange height and density

As was presented in the previous section of this report, minimum residential densities are proposed for Zones 1 and 2. This was done to encourage urban densification in order to curb urban sprawl and more importantly, ensure the necessary densities are achieved to support the viable operation of public transport. In this regard, Zone 1 is more affected than Zone 2, because zone one requires a relatively high minimum residential density of 30 u/ha. On average, this minimum residential density will require the development of duplex housing (independent housing units built on two storeys) on a single property. However, the application of various housing typologies on a single property can overcome this 'average' limitation, as depicted by the Diagram below.



DIAGRAM 37: DENSIFICATION ALTERNATIVES

'Alternative 1' on the Diagram above illustrates a residential density of 30 u/ha applied across an entire property using duplex housing which yield a density of approximately 30 u/ha. 'Alternative 2' provides the option of increasing the residential density on one part of the property using walk-ups (which yield densities of between 80 and 160 u/ha), leaving the remainder of the property for cluster housing (yielding the density of approximately 20 u/ha). In both cases the average density of the property remains above the minimum 30 u/ha density requirement. It will be the responsibility of

the municipality to ensure that this principle is applied, using the 'Site Development Plan' submitted by developers for the development of such properties.

c. Step-down building height and density

Step-downs densities should be provided to make mixed-use developments compatible with adjacent, lower density residential areas. For example, duplex housing and walk-ups can provide a transition between higher-density mixed-use developments and surrounding lower-density residential areas. In addition, varying design, height and orientation will create an interesting and aesthetically pleasing urban environment. The Diagram below conceptually illustrates the application of varied building design in a mixed-use node and its interface with neighbouring residential areas.

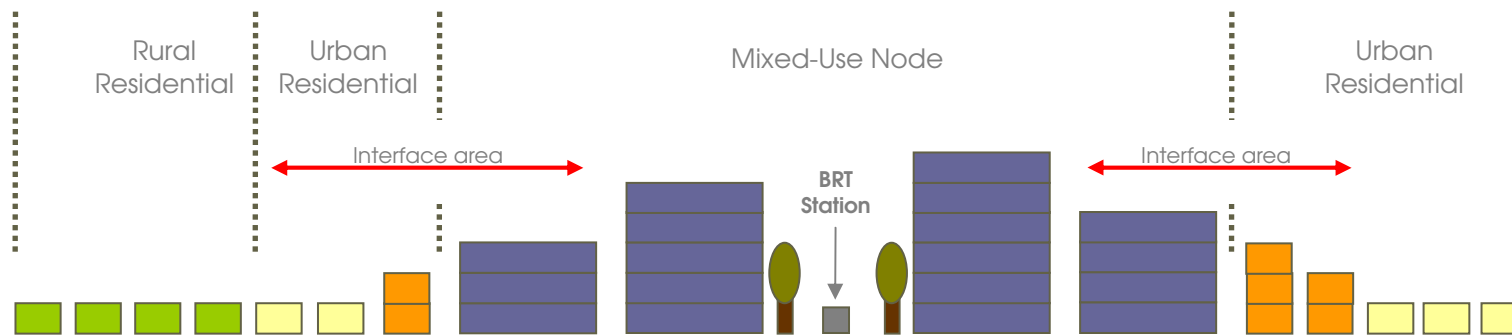


DIAGRAM 38: BUILDING HEIGHT INTERFACE

d. Apply sensitive buildings design

Appropriate and sensitive buildings design can do much to enable land use interface on a detailed level and is most probably the most effective way of dealing with residential interface. For example, mixed-use buildings adjoining residential zones must ensure the loading areas, drive-ways, rubbish, storage areas, and roof top equipment are not located adjacent to residential zones. Mixed-use buildings that are designed to accommodate restaurants must provide ventilation facilities to ensure that no odour is emitted in a manner that adversely impacts upon a residential zone. External lighting must be positioned to avoid light spillage to adjoining residential zones. An acoustic report may be used

to inform the design the mixed-use developments to limit its impact on adjacent noise sensitive land uses, such as places of worship or child care centres.

7.3. NODAL DESIGN

7.3.1. NODAL FOCUS

Nodes are one of the primary spatial elements that provide an urban area its character. Nodes provide a mix of land uses, which provide a 'vibe' and a 'sense of place', and nodes differ in height from surrounding residential neighbourhoods, thus providing urban form and legibility. Therefore, applying development (urban design) guidelines to nodal areas will best obtain an integrated, livable and sustainable urban environment, impacting on the urban environment as a whole (including surrounding residential areas). In addition, focusing on nodal areas will:

- Ensure planning is conducted in a structured and focused manner, enabling the setting of clear development goals linked to a specific geographical area.
- Limited resources will be focused within a specific area, thereby making it a focal area for providing public facilities, such as schools and clinics.
- Enhance the visibility of delivery by concentrating development initiatives, thus providing surrounding communities with a greater sense of achievement and progress.
- Direct public funds (such as the Neighbourhood Development Partnership Grant) towards specific areas.
- Provide developers with security over the Municipality's intentions with regard to development within an area (the location, geographical extent and land use mix of nodal areas), thus attracting private investment to an area.
- Better utilize existing infrastructure through the more intensive use of the nodal area, as nodal areas tend to employ higher densities than residential (suburban) areas.

The Blue Hills Precinct contains 2 proposed district mixed-use nodes. The first proposed district mixed-use node is located on the intersection of Main (K71) and the planned K56 located directly north of the Kyalami motor race track. The second proposed district mixed-use node is located on the intersection of Main (K71) and the planned K73, mostly of the old mushroom farm. The

proposed district mixed-use node located north of the Kyalami motor race track was chosen to illustrate the application of urban design principles relevant to mixed-use nodes in general.

7.3.2. NODAL DESIGN

From the onset it has to be stated that the design for the proposed Kyalami north district mixed-use node is only conceptual and does not aim to provide a detailed and final layout plan for the development of this node. Instead, it aims to provide a vision for the development of this node by applying a range of urban design guidelines. It is therefore attempted to illustrate how these principles can be employed in a given area, rather than proposing a specific township layout that has to be adhered to. The intention is to influence the manner in which the proposed Kyalami north district mixed-use node is ultimately developed. The conceptual design of the proposed Kyalami north district mixed-use node is depicted on Figure 26.

7.3.2.1. MOVEMENT

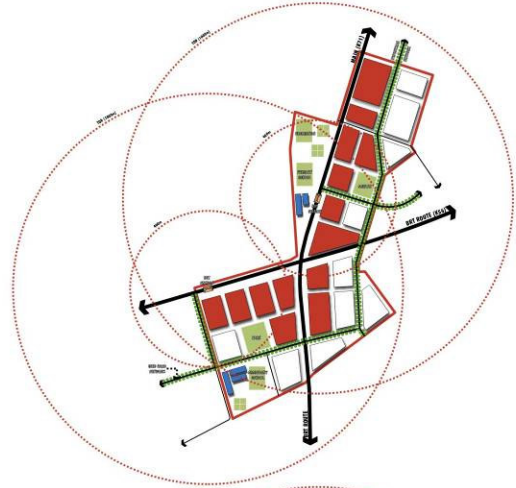
Movement and connectivity are central to the development of a mixed-use node. This is simply true because a concentration of residential, social and economic land uses require good access, which is provided by a node's transportation network and in particular its public transportation network. A Bus Rapid Transit (BRT) route is proposed along Main Road (K71), which will link to the proposed Kyalami north district mixed-use node to Sunninghill to the south and Blue Hills to the north. The following guidelines are proposed for the proposed Kyalami north district mixed-use node with regard to movement and transportation:

a. Give preference to pedestrians

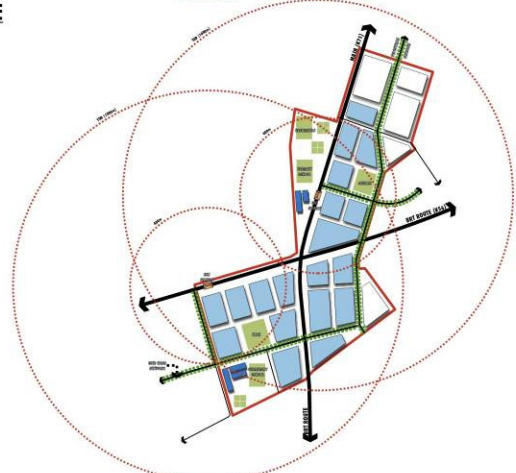
The design of the mixed-use node should not be about movement of vehicles, but about pedestrians and accessibility. A mixed-use node is an intense land use environment, attracting pedestrians and enabling the efficient movement of large numbers of pedestrians. This that implies that, instead of placing an overemphasis on movement of vehicles, planning for pedestrians and public modes of transportation must receive priority. Linked to pedestrian oriented transportation planning is limiting the speed of vehicular traffic within mixed-use nodes. Techniques to reduce the speed of vehicular traffic include jogging traffic lanes, roundabouts or circles, repaving and raising crosswalks, reducing traffic lane widths, paving traffic lanes with cobble stones, etc.



RETAIL



OFFICE



HIGH DENSITY RESIDENTIAL

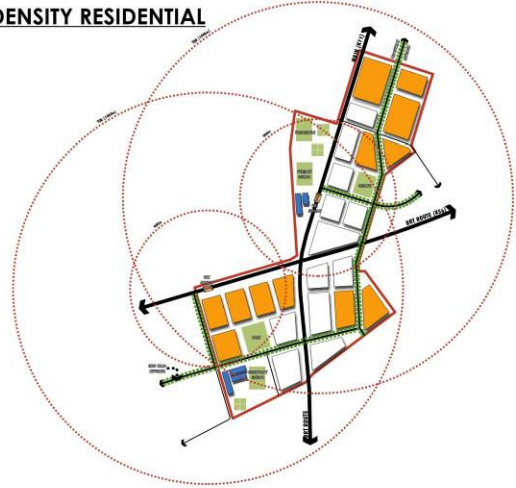


FIGURE 26
KYALAMI NORTH MIXED-USE NODE

b. Promote a grid internal road network

In terms of road network planning, as way to promote pedestrian access is to promote the development of a grid road network within the mixed-use node. A grid road network is open-ended, allowing pedestrian to walk in different (four) directions, as opposed to a loop road or a cul-de-sac, which limits the number of directions a pedestrian can walk. **A grid road network must be promoted by designing the road network for the mixed-use node as a whole and establishing the road reserves at a cadastral level. These road reserves can then be enforced as part of the township establishment process, much the same way as the provincial road network (PWV and K-routes and road reserves) is enforced through the township establishment process.** An Urban Designer would best be suited to undertake such a design exercise and should be timely contracted by the Johannesburg Metropolitan Municipality to do so.

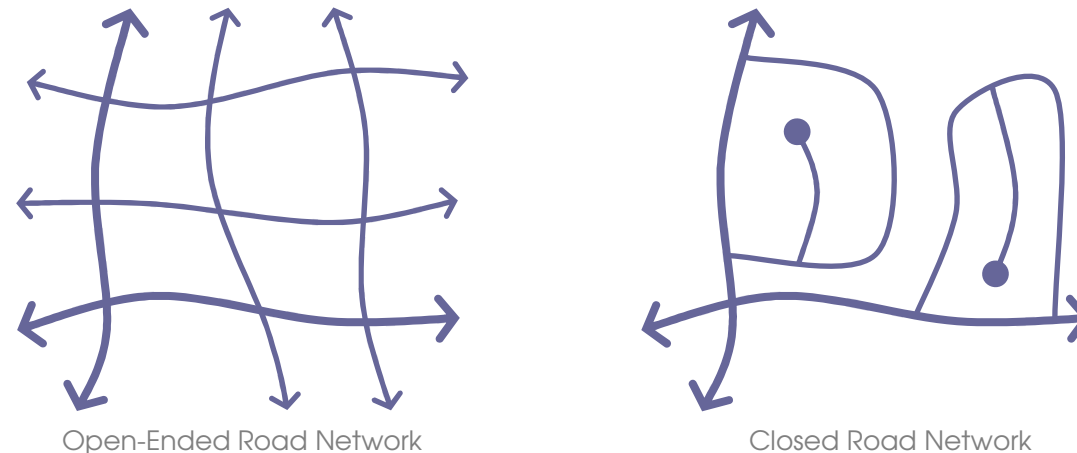


DIAGRAM 39: OPEN VERSUS CLOSED ROAD NETWORK

c. Design for multi-modal integration

Central to the successful use and operation of the proposed BRT system will be multimodal integration. The use of public transit will not reach critical mass if proper provision is not made for the safe parking of cars and bicycles. To ensure

modal integration, it will be necessary to link bicycles and private vehicles to BRT stations and stops within the mixed-use node, allowing transfer between the various modes of transport. This can be achieved through the construction of a multi-modal facility, which can include a multi-storey park and ride garage and bicycle storage area. The way this multi-modal facility is designed and integrated with the BRT station and pedestrian walkways will be critical to the functioning of the multi-modal transfer facility.

d. Pedestrian and bicycle connections

The development of mixed-use areas must allow the opportunity for commuters, residents and school children the opportunity to walk and bike to in a safe and pleasant environment. This will require that suitable provisions are made for pedestrians and bicycles as part of any development proposal within the mixed-use node. This type of movement can be accommodated in a variety of ways, but a combination of sidewalks and paths may be the best approach.

7.3.2.2. LAND USE

Providing a land use mix within a mixed-use node and how this land use which this mix is obtained is important. This relates to a number of issues. For example, does the land use mix achieve public goals, such as provide the necessary social amenities to support housing developments within a mixed-use node? Does the land use mix contain land uses that best support the use of public transit? Does the land use mix cater for people that use public transit? The following urban design guidelines for creating an optimal land use mix within the proposed Kyalami north district mixed-use node are presented:

a. Create a vertical mixed land use environment

Modern planning proposed the concept of 'single function zoning', separating the varied functions and activities of an urban area. This principle (except for extreme situations of industrial contamination) has now been shown to have negative consequences for community development and transportation integration. The close proximity of living, working, socializing realms is what makes communities hospitable, socially healthy and eliminates unnecessary travel.

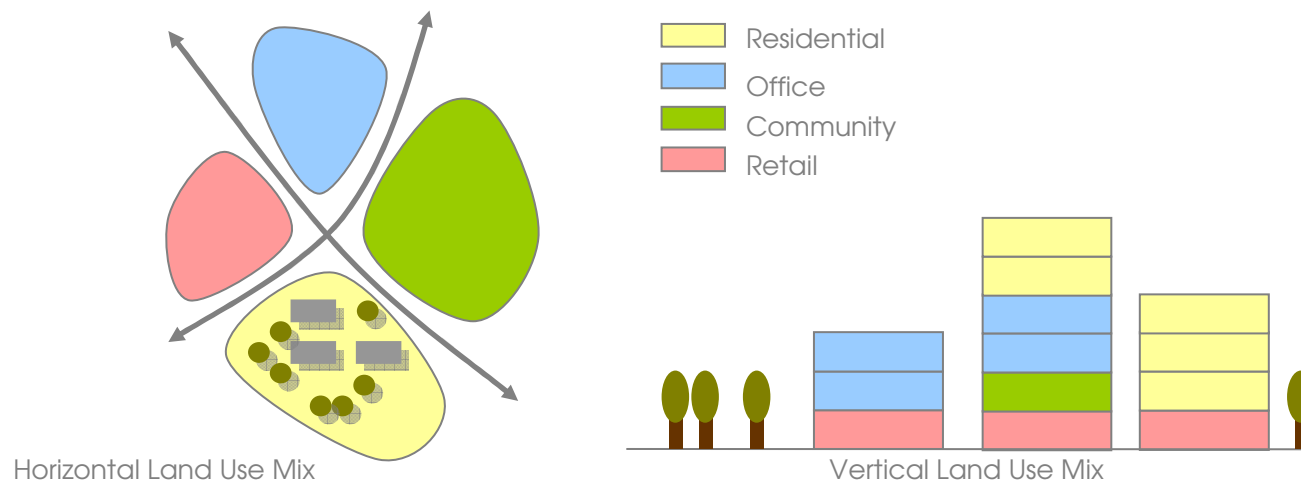


DIAGRAM 40: VERTICAL LAND USE MIXED-USE

Land uses can be mixed horizontally or vertically. Whereas the horizontal mixing of land uses is usually found in predominantly residential areas and the vertical mixing of land uses is predominantly found in nodal areas (mixed-use nodes), where land is valuable and scarce. The Diagram above provides a conceptual illustration of the vertical mixing of land uses. Encouraging a vertical land use mix within mixed-use node has been built into the Land Use Management System presented in the following Section of this report.

b. Provide a housing typology mix

Apart from 'single function zoning', the strict separation of communities by income groups also has an impact on community development. This separation causes people to live and work in separate areas, simply because many of these people cannot afford to live where they work. Typically, professions affected are teachers, nurses and policemen. To address this issue it is necessary to strive at providing a range of housing typologies within a given area, catering for all income groups. As opposed to common believe, such a housing typology mix does not necessarily have to imply poor building design and esthetics. Different housing typologies can be integrated using building design and positioning.

c. Include social amenities

The mixed-use approach should be more civic minded than merely providing a mix of retail and office developments. Providing a range of housing typologies is a step in the right direction. However, increasing housing densities inevitably increases the need for community facilities within a given area. Ironically, higher densities leave less land available for community facilities. To address this, a more flexible approach needs to be adopted in catering for community facilities within a mixed-use node. Measures include allowing the inclusion of community facilities in the vertical mix of buildings and the sharing of facilities, such as sports ground and parking lots.

7.3.2.3. PUBLIC REALM

It is important to know how the specific design of walkways, urban squares and parks can encourage a rich public life and how the form of buildings and their relationship to these public elements can support this. The following development principles need to be taken into account when developing the public realm within the proposed Kyalami north district mixed-use node:

a. Develop walkable nodes

A pedestrian-oriented mixed-use node is one that is compact, with buildings that are connected by pedestrian walkways and public spaces. The network of pedestrian walkways and public spaces must not apply to only one geographic level, but should rather be developed on a number of geographical levels in order to be most effective. These geographical levels can range from mixed-use node level, comprising a number of buildings linked with pedestrian walkways and public space, down to a single building level, comprising a pedestrian mall and urban square.

b. Design for pedestrians

Pedestrian network design should incorporate wide and detached sidewalks and paths, seating, low-level lighting, and signs that are scaled for pedestrians. Accommodate pedestrians in a safe manner separating pedestrian and vehicular movement. Where pedestrians and vehicles cross this network it is the pedestrian who must be given priority using raised crossings at sidewalk height. Paving design is also important in pedestrian areas: pedestrian appreciates a paving that has texture and design, and that distinguished the pedestrian walkway from the street.

c. Create open and accessible buildings

Office parks provide safe and beautiful environments. However, they fail in the sense that they exist as mini business areas that are isolated from its surrounding urban environment. To create more open and accessible business areas, buildings should be open and mixed-use. Residential apartments and other uses, such as cafés and shops, should be introduced. A mixed-use environment will require that these developments are open to the public and pedestrians. Building orientation can be effectively used to 'open up' buildings to the public and pedestrians. Building design can also effectively be used to deal with security issues in 'softer' ways than erecting walls of fences, such as designing certain parts of buildings to be off-limit to the general public.

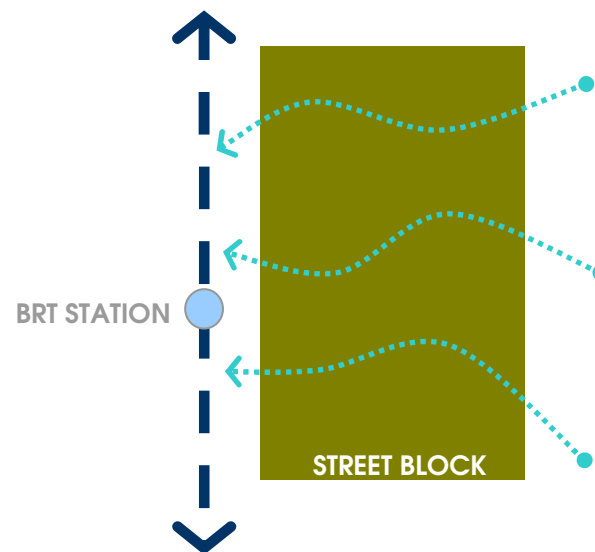


DIAGRAM 41: PEDESTRIAN PERMEABILITY

In particular, walls and fences prohibit the flow of pedestrians through developments, such as office parks (see Diagram above). In turn, this restricts pedestrian access to public transit stations. New residential areas should be encouraged to provide cut-throughs, linking streets so that bicyclists and pedestrians can have direct access to public transit stations.

d. Include urban squares and parks

Urban squares function as the center of civic life and human interaction and should be included in the design of a mixed-use node. An urban square can function as a market place, a place for outdoor cafes and restaurants, a civic stage, and a playground for children. Creating an urban square that fosters community and civic engagement involves not only the competent design of the space, but also the integration of the buildings surrounding it. At the same time, urban squares can function as part of a larger open space network, linked via walkways and bikeways along drainage ways and streams to parks and open space within the city.

ANNEXURE A

DETAILED LAND USE BUDGET

EASTERN SUB-REGION LAND USE BUDGET 2007-2040

Land Use	Census 2001	Existing 2007			Need 2010			Backlog 2007-2010			Need 2020			Backlog 2010-2020		
	no.	no.	ha	m ²	no.	ha	m ²	no.	ha	m ²	no.	ha	m ²	no.	ha	m ²
Population	42936	51481			60264						90609					
Households	14228	19067			22320						33559					
Formal Households	13932	18670			22082						33559					
Informal Households	296	397			238						0					
Housing	13932	18670	1438.8		22082	1558.2		3412	119.4		33559	2074.4		11477	516.2	
Housing Bonded (target 70%)	13932	18670	1438.8		20978	1551.3		2308	112.5		26847	1938.0		5869	386.8	
Flats	381	511	2.6		1104	5.5		594	3.0		1678	8.4		574	2.9	
Cluster Housing	5667	7594	379.7		8833	441.6		1238	61.9		11746	587.3		2913	145.6	
Detached Housing	7884	10565	1056.5		11041	1104.1		476	47.6		13424	1342.4		2383	238.3	
Housing Affordable (target 30%)	0	0	0.0		1104	6.9		1104	6.9		6712	136.3		5608	129.4	
Walk-Ups	0	0	0.0		1104	6.9		1104	6.9		1678	10.5		574	3.6	
Semi-Detached Housing	0	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	
Detached Housing	0	0	0.0		0	0.0		0	0.0		5034	125.8		5034	125.8	
Educational		5	20.0		17	64.0		12	44.0		26	97.3		9	33.3	
Primary School		2	5.6		11	30.9		9	25.3		17	47.0		6	16.1	
Secondary School		3	14.4		6	26.5		3	12.1		8	40.3		3	13.8	
Tertiary Institution		0	0.0		1	6.6		1	6.6		1	10.1		0	3.4	
Health		0	3.1		5	5.4		5	2.3		7	8.2		2	2.7	
Clinic		0	0.0		4	0.8		4	0.8		6	1.2		2	0.4	
Day Hospital		0	0.0		1	1.0		1	1.0		1	1.5		0	0.5	
Hospital		0	3.1		0	3.6		0	0.5		0	5.4		0	1.8	
Community		3	11.7		11	19.0		8	7.3		17	28.5		6	9.6	
Community Hall		0	0.0		3	3.0		3	3.0		5	4.5		2	1.5	
Library		0	0.0		3	1.2		3	1.2		5	1.8		2	0.6	
Post Office		2	0.4		3	0.6		1	0.2		5	0.9		2	0.3	
Police Station		1	1.0		2	1.5		1	0.5		2	2.3		1	0.8	
Emergency Service Centre		0	0.0		1	0.6		1	0.6		1	0.9		0	0.3	
Cemetery			10.3			12.1			1.8			18.1			6.1	
Business		0	80.1	1089844	0	93.7	1275789	0	13.7	185945	0	140.9	1918189	0	47.2	642399
Retail			37.3	149294		43.7	174766		6.4	25472		65.7	262766		22.0	88000
Private Office			42.8	940550		50.0	1101023		7.3	160473		75.2	1655423		25.2	554400
Industrial		140	36.8	147200	140	36.8	147200	0	0.0	0	140	36.8	147200	0	0.0	0
Light Industrial		129	25.8	103200	129	25.8	103200	0	0.0	0	129	25.8	103200	0	0.0	0
Commercial and Technology		11	11.0	44000	11	11.0	44000	0	0.0	0	11	11.0	44000	0	0.0	0
Open Space			103.0			120.5			0.0			181.2			0.0	
Active			30.9			36.2			5.3			54.4			18.2	
Passive			72.1			84.4			12.3			126.9			42.5	
Transit Station		0	0.0		2	0.8		2	0.8		2	1.1		1	0.4	
Streets			355.6			398.7			39.4			539.4			128.0	
TOTAL AREA			2049.0			2297.1			226.8			3107.8			737.3	

Source: Maluleke Luthuli and Associates, 2008

EASTERN SUB-REGION LAND USE BUDGET 2007-2040 (CONTINUED)

Land Use	Need 2030			Backlog 2020-2030			Need 2040			Backlog 2030-2040		
	no.	ha	m ²	no.	ha	m ²	no.	ha	m ²	no.	ha	m ²
Population	121771						152862					
Households	45100						56615					
Formal Households	45100						56615					
Informal Households	0						0					
Housing	45100	2534.1		11541	459.7		56615	3039.5		11515	505.5	
Housing Bonded (target 70%)	31570	2266.3		4723	328.3		39631	2703.4		8061	437.1	
Flats	2255	11.3		577	2.9		2831	14.2		576	2.9	
Cluster Housing	13530	676.5		1784	89.2		19815	990.8		6285	314.3	
Detached Housing	15785	1578.5		2362	236.2		16985	1698.5		1200	120.0	
Housing Affordable (target 30%)	13530	267.8		6818	131.5		16985	336.2		3455	68.4	
Walk-Ups	2255	14.1		577	3.6		2831	17.7		576	3.6	
Semi-Detached Housing	2255	28.2		2255	28.2		2831	35.4		576	7.2	
Detached Housing	9020	225.5		3986	99.7		11323	283.1		2303	57.6	
Educational	35	130.8		9	33.5		44	164.2		9	33.4	
Primary School	23	63.1		6	16.2		28	79.3		6	16.1	
Secondary School	11	54.1		3	13.8		14	67.9		3	13.8	
Tertiary Institution	1	13.5		0	3.5		1	17.0		0	3.5	
Health	10	11.0		2	2.8		12	13.8		2	2.8	
Clinic	8	1.6		2	0.4		10	2.0		2	0.4	
Day Hospital	1	2.0		0	0.5		1	2.5		0	0.5	
Hospital	0	7.3		0	1.9		1	9.2		0	1.9	
Community	22	38.4		6	9.8		28	48.2		6	9.8	
Community Hall	6	6.1		2	1.6		8	7.6		2	1.6	
Library	6	2.4		2	0.6		8	3.1		2	0.6	
Post Office	6	1.2		2	0.3		8	1.5		2	0.3	
Police Station	3	3.0		1	0.8		4	3.8		1	0.8	
Emergency Service Centre	1	1.2		0	0.3		1	1.5		0	0.3	
Cemetery		24.4			6.2			30.6			6.2	
Business	0	189.4	2577885	0	48.5	659696	0	237.8	3236085	0	48.4	658200
Retail		88.3	353135		22.6	90369		110.8	443299		22.5	90164
Private Office		101.1	2224750		25.9	569327		126.9	2792785		25.8	568035
Industrial	140	36.8	147200	0	0.0	0	140	36.8	147200	0	0.0	0
Light Industrial	129	25.8	103200	0	0.0	0	129	25.8	103200	0	0.0	0
Commercial and Technology	11	11.0	44000	0	0.0	0	11	11.0	44000	0	0.0	0
Open Space		243.5			0.0			305.7			0.0	
Active		73.1			18.7			91.7			18.7	
Passive		170.5			43.6			214.0			43.5	
Transit Station	3	1.5		1	0.4		4	1.9		1	0.4	
Streets		668.9			116.5			808.0			126.0	
TOTAL AREA		3854.4			671.1			4655.9			726.3	

Source: Maluleke Luthuli and Associates, 2008

ANNEXURE B

LAND USE DEFINITIONS

Broad Land Use Category	Land Use Category	Land Use Definition	Typical Land Uses
Residential	Very low-density	Land use allowing rural living on agricultural holdings using single dwelling units	Single dwelling unit
	Low-density	Land use allowing traditional suburban living using single dwelling units	Single dwelling unit
	Medium-density	Land use allowing the horizontal and vertical grouping of dwelling units up to 3 storeys in height	Group housing Second dwelling unit Backyard rental unit Semi-detached housing Commune Retirement village Children's home
	High-density	Land use allowing the horizontal and vertical grouping of dwelling units up to 4 storeys in height	Row housing Walk-up apartments Flats
	Accommodation	Land use for the purpose of letting individual rooms for residential accommodation	Boarding house Hotel Guest house Resort Hostel
	Community	Educational	Land use where child-care service are provided and where children, adolescence and adults receive formal education
Medical		Land use where patients are given medical treatment or advice	Clinic Community hospital Day hospital Medical consulting rooms
Religious		Place of worship and religious education	Church Mosque Temple

Broad Land Use Category	Land Use Category	Land Use Definition	Typical Land Uses
	Social	Land use that provides municipal or social services to local communities	Community hall Library Post office Pension pay-point Customer care centre Police station Fire brigade Emergency services
Business	Retail	Land use that allows the trading of retail goods	Hypermarket Supermarket Specialist retailers (e.g. clothing and furniture) Banking branches
	Office	Land use for the performance of administrative or professional functions	Professional offices Conference facility
	Entertainment	Place of entertainment that is usually associated with the retail industry	Entertainment centre Restaurant Fast food outlet Tavern
	Motor trade	Land use that allows the retail, repair and maintenance of motor vehicles	Filling station Vehicle service centre Vehicle showrooms
	Micro enterprise	Business or enterprise attached to and supplementing a residential component. The residential component remains the primary land use associated with the property.	Home office Home-based medical consulting room Non-disturbing home enterprise (e.g. hair dresser or day care centre) Mini market Coffee shop Farm stall
Institutional	Municipal	Land use associated with the daily operation and functioning of the municipality	Administrative offices Parking garage Taxi holding and or parking area Municipal training facilities Bus depot Electrical purpose Equipment stores
	Government	Land use associated with the daily operation and functioning of the national or provincial government	Administrative office Railway reserves and stations Telecommunication

Broad Land Use Category	Land Use Category	Land Use Definition	Typical Land Uses
Industrial	Light	Land use for non-pollution industries used for manufacturing purposes	Non-noxious factories Maintenance and repair workshops Engineering works Builders yard
	Commercial	Land use for the handling and storage of cargo and the wholesale of goods	Distribution centre Wholesale trade Warehousing Cartage and transport services
Open space	Active	Open space that has a recreational function linked to it	Public park Play ground Sports field Sports club Cultural heritage site Amusement park Recreation area
	Passive	Open space that has a hazard avoidance or natural resource conservation function	Private open space Conservancy Protected area River flood areas Geological unsuitable land Topographically unsuitable land Hazardous zones (e.g. pollutions areas)
Agriculture	Agriculture	Land use that is intended of subsistence of commercial farming purposes and uses generally associated with plants and animals.	Subsistence farming Commercial farming Communal agriculture Agriculture skills training facilities Nursery Veterary clinic Animal kennel