Nairobi
Metropolitan Expansion in a Peri-Urban Area

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Executive Summary

The UN estimates that within the next five years, more than half of the world's population will be living in urban areas. The global population is rapidly increasing and the majority of this growth is occurring in less developed countries whose economies are dominated by agriculture. The combination of explosive urban growth pushing outward into predominantly agricultural land has led to a new trend of development on city fringes known as peri-urban areas.

Peri-urban areas are intersections of urban expansion into rural land and are distinguished by a number of distinct characteristics. Land is overtaken by unplanned and often informal development. Basic infrastructure and other services are inadequate. Administrative responsibilities between local governments are often unclear. Local and regional inequalities are intensified. Limited fertile land is quickly being subdivided and replaced with other uses. Cities have expanded into the country since the beginning of time; however, the enormous pace of today's expansion in less developed areas has led to this unique set of patterns. Nairobi, Kenya is one of the largest cities in Africa and one of the fastest growing areas in the world. Over 80% of the Kenyan workforce is employed in agriculture and over 50% of people live below the poverty line. These forces have affected the Nairobi metropolitan area, including the satellite town of Ruiru. With rapid growth and inadequate planning, it exhibits the characteristics of a peri-urban area.

Unlike most cases, this rapid urbanization in Africa is also occurring without a correlating increase in employment opportunities. As most urbanization in the next century will take place in agriculturally dominated developing countries, it is crucial to understand how to better plan for peri-urban places like Ruiru now and in the future. Spatially, the urban cores of both Nairobi and its satellite city of Ruiru are expanding, as is the growth area of the peripheral areas due to a combination of both natural population growth and rural/urban migration. The current growth rate reported by most centers within greater Nairobi is twice as much as the national population growth rate, at an estimated rate of 7.3%. Additionally, the proportion of Kenyans in urban centers of 2000 or more residents has jumped to 30% in 1999 from 18.3% just ten years earlier in 1989. Of the 194 urban centers in Kenya, an estimated 45% of the national urban population resides in Nairobi (Olima 2001). The implications of the rapid, uncontrolled urbanization of the area has led to unguided and improper development on the urban fringe. There has thus been a shift in land use on the periphery of Nairobi that is exemplified in Ruiru. Ruiru has thus assumed the role as a peri-urban satellite town within the greater Nairobi context and exhibits many of the detrimental effects of such a growth model.

Client

Though this was ultimately a pedagogical exercise within the Columbia University Urban Planning Department, the primary client for this studio was the Ruiru Municipal Council.

Studio Goal

To analyze and make a series of select recommendations for the regional planning challenges of Ruiru in the context of the rapidly growing Nairobi metropolitan area.

Team Approach

In order to best meet the goals set forth by both the studio advisors and the Ruiru Municipal Council, the Nairobi studio team adopted the following approach:
1. Identify current situation of Ruiru in the metropolitan context
2. Illustrate consequences of current trends
3. Develop strategic sectoral recommendations based on an understanding of current trends, challenges, and opportunities.
Key Findings:

Governance
- Trend toward decentralization impacting governance on a national, regional and local level
- Lack of municipal capacity and funding
- Lack of enforcement
- Unclear delineation of responsibility between local, regional and national governments
- Lack of community participation in the governance, and planning process within Ruiru municipality

Land Use
- 80% of land privately owned
- Only five major landowners in Ruiru municipality
- Lack of enforcement of land use regulation
- Subdivision and loss of agricultural land
- Unauthorized and informal land use

Economic Development
- Agriculture employs 80% of workforce and is the second largest producer of GDP
- Limited local industry includes steel, textiles and food-processing
- Agricultural production includes coffee farms, horticulture and ranching
- Lack of relationship between all businesses and municipal council
- Infrastructure constraints hindering productivity: roads/transport, electricity and water/sanitation

Transportation
- Lack of viable public transportation system
- Poor and inadequate road conditions
- High rates of traffic mortality and poor pedestrian safety
- Increasing presence of Non-Motorized Transit (NMT) particularly bicycles and boda-bodas
- Road infrastructure and existing paratransit system (matatus) offer significant opportunities for efficiency improvements

Public Health
- Inadequate sewage and waste disposal system
- Significant air quality issues specifically in relation to transportation emissions
- Lack of public health facilities
- High incidence of respiratory and waterborne diseases

Key Recommendations:

Government
- Enhance community participation to increase accountability and transparency
- Increase information dissemination, knowledge sharing and networking
- Provide monitoring, evaluation and community feedback regarding municipal programs
- Create Rights Accord between Council and community

Land Use
- Create land use zoning map
- Develop a site and services program for informal developments
- Design a process to integrate all stakeholders in land use decisions
- Integrate Ruiru land use with Nairobi Metropolitan plan
- Promote mixed-use, higher density development

**Economic Development**
- Develop multi-sectoral business association
- Incorporate a voluntary, non-voting Business Advisor on municipal council
- Tax incentives for infrastructure provision
- Designate an industrial park via land consolidation and infrastructure provision
- Institute a more inclusive policy towards informal development

**Transportation**
- Evaluation of Alternative Modes Analysis
- Develop and implement a Matatu Rapid Transit System (MRT)
- Classify and improve local roads
- Encourage community prioritization of local roads
- Develop alternative fuel production, in particular investigate methods of biodiesel cultivation

**Public Health**
- Improve conditions of public and private pit-latrines
- Establish a community-led sanitation system
- Future air-quality monitoring
- Develop and finance sewage infrastructure
Introduction

1.1 Metropolitan Context
The United Nations estimates that within the next five years, more than half of the world’s population will be living in urban areas. The global population is rapidly increasing and the majority of this growth is occurring in less developed countries whose economies are dominated by agriculture. The combination of explosive urban growth pushing outward into predominantly agricultural land has led to a new trend of development on city fringes known as peri-urban areas.

Peri-urban areas are intersections of urban expansion into rural land and are distinguished by a number of distinct characteristics. Land is overtaken by unplanned and often informal development. Basic infrastructure and other services are inadequate. Administrative responsibilities between local governments are often unclear. Local and regional inequalities are intensified. Limited fertile land is quickly being subdivided and replaced with other uses. Cities have expanded into the country since the beginning of time, however, the enormous pace of today’s expansion in less developed areas has led to this unique set of patterns.

Nairobi, Kenya is one of the largest cities in Africa and one of the fastest growing areas in the world. Over 80% of the Kenyan workforce is employed in agriculture and over 50% of people live below the poverty line. These forces have affected the Nairobi metropolitan area, including the satellite town of Ruiru. With rapid growth and inadequate planning, it exhibits the characteristics of a peri-urban area. Unlike most cases, this rapid urbanization in Africa is also occurring without a correlating increase in employment opportunities. As most urbanization in the next century will take place in agriculturally dominated developing countries, it is crucial we understand how to better plan for peri-urban places like Ruiru today and in the future.
Urbanization

Kenya is located in Eastern Africa, directly on the equator, and Nairobi is in the south-central area of the country. The town Ruiru is located 15 km to the northeast of Nairobi. Spatially, the urban cores of both Nairobi and its satellite city of Ruiru are expanding, as is the growth area of the peripheral areas due to a combination of both natural population growth and rural-urban migration. The current growth rate reported by most centers within greater Nairobi is twice as much as the national population growth rate, at an estimated rate of 7.3%. Additionally, the proportion of Kenyans in urban centers of 2000 or more residents has jumped to 30% in 1999 from 18.3% just ten years earlier in 1989.

Of the 194 urban centers in Kenya, an estimated 45% of the national urban population resides in Nairobi (Olima 2001). Given the growth and urbanization forces being exerted from the major growth pole of Nairobi and the also expanding center of Thika, Ruiru has been experiencing correlative growth trends. KIPPPRA data illustrates the almost tripling of Ruiru’s population by 2030 and the more than tripling of greater Nairobi’s population in the same timeframe.

The implications of the rapid, uncontrolled urbanization of the area has led to unguided and improper development on the urban fringe. There has thus been shift in land use on the periphery of Nairobi that is exemplified in the Ruiru experience. Ruiru has thus assumed the role as a peri-urban satellite town within the greater Nairobi context and exhibits many of the detrimental effects of such a growth model. For instance, Ruiru continues to suffer from a general lack of infrastructural services from no water provision to a poor transportation network; informal and inadequate housing structures; and poor regulatory avenues for improved services and land use control.

Peri-urban Ruiru

The pressures exerted upon Ruiru in terms of rapid growth and subsequent uncontrolled development can be characterized under the general categorization of Ruiru as a peri-urban area of Nairobi. Under this model Ruiru can be described as a transitional zone in which there is a unique sectoral interaction between both
rural, agricultural functions and urban, industrial functions. In this way, Ruiru assumes a more complicated role within the greater urban fabric in that it must reconcile its current and historic dominant functions, such as coffee production, against the needs of the metropolitan area that are now pushing against it, such as housing, industrial relocation, and transportation.

The persistent uncontrolled and informal development of Nairobi, as well as a complicated land market have produced a condition of real or perceived build-out, thus pushing development into the formerly rural areas of current satellite cities, such as Ruiru. Ruiru has thus become an example of urban fringe development “where not only flows of people, but have capital, labor, commodities and information leave the central urban context for a restless and place-less periphery.” Several characteristics of the urban fringe and peri-urban condition are present in the Ruiru-Nairobi context. For instance, Ruiru displays a variety of land uses across its connection to both urban and rural identities. It is also transitional in that its patterns of uses radiating outward from the urban center become increasingly agrarian, but that these agricultural uses and other rural linkages are disintegrating in favor of more urban economic and socio-political activities and structures. Ruiru also exhibits “heterogeneous patterns of growth” in that existing farmland has been and continues to be taken over by metropolitan growth. This has primarily taken the form of suburbanization processes in which middle and upper income Nairobi residents have sought the relatively inexpensive and abundant land of subdivided agricultural fields (Iaquinta 2000).

Ruiru can be viewed as an example of a “chain peri-urban” area, in that it is geographically a part of the urban fringe and forms from chain migration, such as via and along Thika Road (Iaquinta 2000). This characterization of Ruiru as a peri-urban area within the greater Nairobi area bears significance when analyzing its future. The continued spillover of residents and industry into the urban fringes alter the social and economic dynamics of a formerly rural place. Physical and economic planning according to these new stresses and demands upon the natural and economic resources of Ruiru are ultimately necessary for the area to achieve order and efficient functionality within its peri-urban role. The sources of chain migration and patterns of development along those arteries must also be managed in order to guide future development. However, future planning for the municipality must acknowledge the multiple identities and functions of Ruiru and its place within the greater Nairobi context.

**Contextual role of Ruiru**

Analyzing the role of Ruiru in relation to Nairobi is necessary in order to envision the future growth of the municipality. Its characterization as a peri-urban area presents dichotomous rural and urban biases that must be reconciled in the plan for Ruiru. For instance, while one side of the argument proposes regional integration through continued urbanization (the urban bias), the other envisions a distinct separation between rural development and the parasitic nature of encroaching cities (the rural bias). It is clear that urbanization has already shaped the current development of Ruiru and new visions for the future of the municipality cannot wholly ignore its connection to Nairobi. Both urban and rural forces are clearly exerting development pressures upon the municipality creating a place (Ruiru) that serves a mediating role between urban and rural functions (Iaquinta 2000). There must be a balance between the municipal needs of the current land users (agricultural, industrial and residential) and the realities of urbanization and encroachment.

For instance, according to the central place theory- inspired development policies of the 1970s, rural market towns were promoted to “fill the gap between the ‘evil city’ and the countryside” (Iaquinta 2000). The desire for one’s own plot of land outside of the increasingly congested city characterizes a growing aspect of Ruiru’s identity and must thus be planned accordingly. Ruiru’s role of providing housing for urban fleers also highlights transportation considerations with regard to its connectivity to the central place. The contextual role of Ruiru as a peri-urban area within Nairobi is dependent upon the nature of its residents’ connection to Nairobi, such as for employment and other commuting purposes. The peri-urban classification of Ruiru explains and contextualizes the other aspects of urban planning that must be addressed, such as environmental quality and economic development.
1.2 History

Nairobi, Kenya

East Africa is a place of global historical significance. It is home to the Rift Valley, where archeologists Mary and Louis Leakey unearthed the first hominid fossils indicating the discovery of the origin of human species. These fossils trace human development as far back as 20 million years ago and place hominids in East Africa almost 2.6 million years ago (Library of Congress, Country Profile: Kenya).

The history of human development in Kenya may date back millions of years, but comparatively, Nairobi’s own history is quite young; the city is a little over 100 years old. Nairobi’s history can be traced back to three important phases: Pre-colonial, Colonial and Post-Colonial. The most significant aspect of pre-colonial rule in Kenya is that tribal communities governed land through informal rule. Land was owned by whole communities and never by individuals. Land ownership is an important concept in understanding the role that colonial forces had in developing Nairobi. For the purpose of this report, this history will focus on the last two phases.

Colonial

In 1895 the East African Protectorate was established in Nairobi and British colonialists began to impose foreign laws on Africans. It marked the beginning of individual land ownership, settler incursion and settler agriculture. The construction of the Kenya Uganda Railway (KUR) in 1899 by the British Colonial Government established Nairobi as a commercial and business hub. In 1900, The Nairobi Municipal Community was established and its urban boundaries were defined. In 1906, with its urban center becoming more developed, new socio-spatial patterns began to take shape. “… the Europeans mainly occupying the cooler Westlands, the Indians in the north, and the African workers mainly concentrated on the periphery” (Obudho 1997).

Over the next 10 years, Nairobi became the capital of Kenya and its role as a central hub was further solidified. British colonial Kenya was characterized by spatial segregation with the rich (White/Europeans) on one side and the poor (Africans) on the other. As their colonial government gained power and political control, the British continued to take extensive tracts of the most fertile land away from Africans and reserve them for white settlers for large-scale farming. With many of these fertile farmlands along the site of the Kenya Uganda Railway, the British looked to make the railway profitable by encouraging settlement by European farmers. Forced off of their lands, Africans found themselves restricted in many ways. They were denied political participation and the ability to cultivate cash crops such as coffee. Unable to make a living, they were often forced to work on the farms of settlers. During this time the colonial government also “maintained a ‘white highlands’ policy that restricted the Kikuyu, one of the largest tribes, to overcrowded reserves” (Library of Congress). Though socio-spatial segregation would remain a part of Nairobi’s physical and social landscape, it wasn’t long before the majority of Africans started to demand better treatment and living standards.

In 1919, The Nairobi Municipal Council took over and the city boundaries were extended to include many peri-urban settlements. As urban populations continued to grown, the city boundaries were extended again in 1927 to cover around 30 square miles. This boundary would not be extended again until the independence of Kenya in 1963. Until about 1926 planning had been implemented in an ad-hoc manner and it wasn’t until the 1948 that a Nairobi Master Plan was completed. “In 1950, permanent residential zones had already been demarcated, very much along the lines first established in the early years of the century” (Obudho 1997).

The 1920s was a also a period of growth and development of Nairobi and it marked the beginning of a period of protest by the Africans which eventually led to the 1956 “Mau-Mau” Insurrection, where armed Kikuyu retaliated against British colonial rule and resulted in the imprisonment of many nationalist leaders. From this point on until there was an African majority, the British were forced to increase African representation in the colony’s legislative council. Jomo Kenyatta, one of the leaders imprisoned as a result of the “Mau-Mau” uprising, would go on to become Kenya’s first president in 1964.
Post-colonial
On December 12, 1963, Kenya gained its independence from British colonial rule and in the following year became a republic and joined the Commonwealth. Kenyatta was elected president and became head of The Kenyan African National Union (KANU). By 1969, KANU was the only political party in a “de facto one-party state.” (Library of Congress, Country Profile: Kenya). During his presidency, Kenyatta relied on largesse to help ward off political opposition and ethnic conflict. He supported a pro-Western approach by implementing free-market and capitalistic economic policies. Initially, Kenyatta was successful at improving living standards while maintaining strong government support. One of his key contributions was the distribution of white settler land to native Africans. “This ‘Africanization’ of land included the transfer of more than 6,070 square kilometers of land to a group of well-connected Kenyans, mainly Kikuyu, and fostered the emergence of a new privileged class of African plantation owners” (Library of Congress).

As president, Kenyatta led the country into one of its more optimistic economic periods. At the time Kenya was experiencing a rate of economic growth that was unheard of amongst other continents. But most of this wealth remained solely in the hands of Kenya’s most elite and most powerful and was not funneled down into the hands of the country’s most needy citizens. The living standards that had just begun to improve suddenly became much worse as the disparity between rich and poor grew wider. Nairobi’s colonial legacy of socio-spatial segregation which had forced Africans to crowd together in settlements on some of the country’s worst land was now resulting in the development of informal settlements, as the need to be closer to jobs became more imperative.

As mentioned previously, Nairobi’s city boundaries were last extended in 1963 but due to a rapidly growing population, infrastructure development was unable to keep pace with this growth. A lack of strategic planning in a city marked by haphazard growth and development led to the formulation the 1973 Nairobi Metropolitan Growth Strategy.

After Kenyatta’s death in 1978, Vice President Daniel arap Moi became the acting president of Kenya. Taking over power in a rapidly deteriorating economic and social landscape made Moi a popular candidate with his promises to end corruption. Moi’s presidency, characterized by a desire to strengthen political control, only further exacerbated the corruption and graft that had plagued Kenyatta’s reign. With such tightened political control and rampant corruption, international aid organizations such as United States Agency for International Development (USAID) and the World Bank began to pressure Moi and the Government of Kenya to reform. Unwilling to cooperate, Moi resisted this pressure and in protest, international aid organizations began withdrawing financial contributions ultimately slowing Kenya’s economic growth.

Moi remained in power until 2002 when he was constitutionally unable to seek another term in office. His four decades of governance had led to such strong political opposition, corruption and economic decline. In response, the National Rainbow Coalition (NARC) was formed and Vice President Mwai Kibaki was elected President, Kibaki received an overwhelming sixty percent of the vote. Though Kibaki pledges to end governmental and civic corruption, he has come under increased political scrutiny and been the source of controversy as many of his top officials have resigned from office. Though Kenya is leagues ahead of other countries plagued by these same issues, due to the continued existence of corruption, poverty and low standards of health and living, Kenya has a long way to go.

Ruiru, Kenya
Ruiru’s growth and development can be traced back to the late nineteenth century and early 1900s. Like Nairobi, Ruiru’s development can also be attributed to railroad construction. Growth began when the colonial government constructed the Nairobi-Nanyuki railway line and international trunk road A-2, the Nairobi Addis Ababa highway, which passes through Ruiru, Thika and Nyeri en route to Northern Kenya. The road was built as a means of linking the settler capital of Nairobi to Thika, Murang’a and Nyeri. The agriculturally rich hinterlands beyond Ruiru were populated with coffee and sisal farms which helped to provide an economic base for Ruiru as well as establish the area as a service center for the settler population and native Africans who lived on reserves nearby. Because of this Ruiru was able to develop into more than just railway sub-station. With its strategic position and close proximity to Nairobi, Ruiru
was included in the 1973 Nairobi Metropolitan Growth Strategy as a possible satellite city. Under the 1974-1978 National Development Plan, Ruiru was designated as an urban centre and no longer fell under the rule of the Nairobi City Council. Control over Ruiru was then transferred to the Kiambu County Council and then finally was passed over to the Thika District where it was granted its own municipal status.

1.3 Demographics

This demographic analysis of Kenya, Nairobi and its environs, in particular the Ruiru municipality, aims to provide a contextual basis for how to measure and compare development in Africa at the local, regional and national scale. By providing insight into population characteristics, this demographic analysis also sets the stage for how planning can better meet the needs of its people and enhance living standards and quality of life. This is particularly important in Kenya, where economic growth and infrastructure development have failed to keep up with a rapid rate of population growth.

Population

Kenya has an estimated current population of about 33.8 million people with an annual growth rate of 2% or less. The national growth rate for Kenya is consistent with the average growth rate of other less developed countries. The capital city of Nairobi, located in the southern region of Kenya, has an estimated population of 3.24 million people.

In 2001, there was an estimated 1.5 million people living and working in squatter settlements – 60% of the municipality’s population (Mitullah, 2001). The United Nations projects that by 2020, Nairobi will be home to 5 million people, of which almost 3 million will live in informal settlements (Nairobi Situation Analysis).

The 1999 census documented that 1.2% of the total population were international migrants, twice as many as the .6% who migrated in 1989. Many of these migrants were from other African countries, Asian countries, Europe and America (Central Bureau of Statistics). According to United Nations Refugee Agency (UNHCR), by the end of 2001, Kenya was host to 220,000 refugees from neighboring countries.
including: Somalia 145,000 and Sudan 68,000 (2005 est.). Based on the 1989 and the 1999 Nairobi Census populations counts, growth rates and associated estimated populations for 2015 were calculated and derived. The growth rate for Nairobi was found to be 4.8%, double the national average and a considerably high rate according to national and global standards. This is representative of the rapid rate of urbanization that is affecting Nairobi and its environs. Projecting to 2015, using this 4.8% growth rate, Nairobi’s estimated population will rise to 4.62 million. Population growth is occurring without the necessary infrastructure to support such a large and predominantly poor population, thus leading to a culture of informality.

1999 was 8.2% per year. Assuming a growth rate of 8.2%, it will take only 8.4 years to double the population in Ruiru. It is expected that by mid-2007 the population will have doubled to approximately 220,000. Projecting to 2015, using the 8.2% growth rate for Ruiru, the population will rise to 406,913. The high rate of growth in Ruiru can be attributed to a variety of possibilities including the expansion of council boundaries and migration from Nairobi. These population changes have significant implications for the future economic, built, environmental and social condition of Ruiru and Nairobi.

<table>
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<tr>
<th>Year</th>
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<tr>
<td>1945</td>
<td>612</td>
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<tr>
<td>1962</td>
<td>1,624</td>
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<tr>
<td>1969</td>
<td>8,783</td>
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<tr>
<td>1979</td>
<td>22,359</td>
</tr>
<tr>
<td>1989</td>
<td>48,739</td>
</tr>
<tr>
<td>1999</td>
<td>109,574</td>
</tr>
<tr>
<td>2005 (est.)</td>
<td>140,000</td>
</tr>
</tbody>
</table>

Nairobi’s population density reflects the different land use patterns that make up the complex surface structure of the city. The city has a population density of 3,089 persons per square kilometer (More Than A Shelter paper). Population density in the municipal council of Ruiru, which covers an area of 292 square kilometers has a population density roughly about 377 persons per square kilometer. But calculating population density in Ruiru is not that simple due to the diverse topography of the land and land uses within the municipality. The distribution of people in Ruiru differs from the low-density agricultural (coffee farms) areas to the higher density housing estates.

**Ethnicity and Religion**

Kenya is home to over 70 distinct ethnic groups and 40 different indigenous groups. People of African descent comprise roughly 99% of the population. The majority of the population is Kikuyu (22%), followed by Luhya (14%), Luo (13%), Kalenjin (12%), and Kamba (11%). Additional groups include the Kisii (6%), Meru (6%) and other African (15%). Non-Kenyans, mainly Whites, Europeans, Arabs and Asians account for only 1% of the population. English and Swahili are the official languages of Kenya, though many people also speak indigenous languages that stem from the Bantu, Cushitic and Nilotic linguistic families. Kenya’s ethnic diversity is both a national asset and a source of conflict.
The religious breakdown of the population is as follows: Protestant (45%), Roman Catholic (33%), Indigenous beliefs (10%), Muslim (10%) and other (2%). Sikhs and Hindus make up only 1% of the population (CIA/WorldFact Book). According to the CBS, “about three-quarters of Kenyans profess some form of Christianity, although fewer are affiliated with a church.”

Age and Sex
According to the 1999 Census, Kenya has a very youthful population with 44% of people below age 15. Currently, 53% of the population aged 15-64, which is important because it implies that more than half of Kenya’s population is of active working age. Those above the age of 64 make up only 3% of the population. In Ruiru, 34% of the total municipal population falls under the under the 0-15 year age cohort and 65% of the population is between 15-64. Though 65% of the population is classified as of active working age, employment opportunities are scarce in Ruiru and a large majority of that population is unemployed.

Nairobi’s population is made up of 1,153,828 males and 989,426 females. Although the numbers of women and men have become somewhat more even, the continued predominance of men in Nairobi’s population can be attributed to the fact that the majority of rural-urban migrants are men (Rakodi 1997). The 1999 census for Ruiru municipality indicated that there were 56,982 males and 52,592 females (total: 109,574 persons), consistent with Nairobi’s gender distribution trends.

According to the CBS, “Kenya was the first sub-Saharan country to adopt a national family planning program and one of a small handful to undergo a demographic transition to much lower fertility.” Kenya has a fertility rate of about 5.0 and a birth rate of 40 per 1,000 persons, which has been steadily declining since the 1980s. In 2005, Kenya’s death rate was estimated at 15 per 1,000 and the infant mortality rates range from 62 to 74 deaths per 1,000 live births. The Human Development Index (HDI) ranked Kenya as one of the world’s six worst performers in infant mortality. The majority of these deaths can be attributed to the high prevalence of HIV/AIDS in Kenya, where roughly 70 people die per day from the disease (CBS, Kenya). The infant mortality rate in Ruiru is 47 deaths per 1,000 live births, considerably lower than the national average. Ruiru municipality has a fertility rate of 3.2, signifying that the average woman living in Ruiru gives birth to three children during her reproductive life.

Life expectancy is another important indicator of human development within a country. For Kenya, the average life expectancy is about 48 years. In Ruiru life expectancy falls somewhere in between 59 and 65.8 years of age. Life expectancy overall in Kenya and most of Africa is considerably lower than in other countries due to high rates of HIV/AIDS and other diseases related to a lack of appropriate health care and sanitation measures. Kenya’s high birth rates and low life expectancy levels signify that Kenya’s population is predominantly young.

Households
In Kenya there is a significant lack of data with regard to households. Though many different studies have tried to document basic household data, quantifying the conditions of such high rates of people living informally has proved to be a challenge for researchers. The 1999 Population and Housing census states that there were roughly 6 million households in all of Kenya. The average household size in Kenya is about 4 persons per household. Most heads of households were aged 25-29 years, with female-headed households accounting for 36.7% of all households. The census revealed that a large majority of 74.9% of urban households are renters as compared to rural areas where 87.3% of people own their own dwellings. At the national level only 4% of all available housing is public housing, typically only found in urban areas. The 1999 census documented Nairobi as having around 642,906 households. However, because of the challenges of quantifying the number of households within the slums, this number may not be an accurate reflection of the total number of households in Nairobi. In terms of household heads, Nairobi’s numbers are consistent with the national average. Nairobi has the lowest percentage (24.3%) of female-headed households in the country. This is often the result of the trend of more men migrating to urban areas in search of work. Though recently there has been a noticeable increase in the number of women migrating to Nairobi due to a shift in the job opportunities available for women. The 1999 census listed the number of
households in Ruiru at 34,274. Given the size of the population this means that there is an average of 3 persons per household. But due to boundary changes and the rapid change in population growth that the Ruiru municipality is currently facing, the current number of households are getting harder to quantify, thus contributing to a lack of approximate data.

**Education**

Education is one of the key indicators of human development. The education system in Kenya was re-established in the 1980s to replace the system that existed under British rule. The current system consists of eight years of primary school, four years of secondary school, and four years of higher education. The Kenyan education system mandates that children be schooled for a minimum of 8 years. As of 2003, primary education has been free, but students and families have the responsibility to pay for books, uniforms and other school-related fees. Roughly 96% of school-age children attend the first four years of primary school but cost, poor performance and inadequate facilities often deter students from continuing on to secondary and tertiary schools (CBS, Kenya). According to the 1999 census, 35% of the population ages 5 years and above were attending school, 47% had left school and 18% had never attended school. 58% of the population had completed primary level of education, 17% had attained secondary level and less than 1% had completed tertiary and university level of education (CBS, Kenya). Though the fact that less than 20% of the population has completed secondary schooling may be common throughout the developing world, it does have a significant impact on a country’s employment and income levels. With barely 1% of the population completing a University level education, the future social and economic development of Kenya is a stake.

Another area that has a significant impact Kenya’s economic growth is literacy. According to the WorldFact Book, in Kenya, literacy is defined those people age 15 and above that can read and write. In 2003, the literacy rate in Kenya is about 85.1%, with men (90.6%) averaging slightly higher literacy rates than women (79.7%). In Ruiru, the literacy rate is about 42%, which is considerably low.

**Employment**

As of 2001, 86.3% of people between the ages of 15-64 were actively employed. Although the majority of the economic activity comes from the informal sector (which has grown by 176%), the urban formal sector comprises 29.3% of the active population (Mitullah 2001). Agriculture is the population’s main occupation and source of income. The Kenyan Bureau of Statistics computes unemployment rates based upon the proportion of unemployed persons to the economically active population. According to the 1999 census, on the national scale, urban unemployment rates were listed at 17.7% and rural unemployment rates at 7.9%. In Nairobi, unemployment rates were slightly higher at around 18.5%. In 2004, about 15% of the labor force was considered unemployed, but other estimates range up to 50% unemployment. Not factored into the census statistics are the percentage of people who are self-employed and the percentage of people who are seeing work. The lack of representation of these two important factors has resulted in relatively low rates of documented unemployment as compared to other studies that state that an overwhelming 50% of the country is unemployed.

**1.4 Methodology**

The studio is a collaborative effort with SIPA, CSUD and The University of Nairobi.

The studio’s first task was to conduct extensive background research in order to gain a more comprehensive understanding of the current situation in Kenya and the Nairobi metropolitan area. This included a literature review of issues pertaining to history and demographics, land use, geophysical conditions, public health, transportation systems and housing, as well as sector specific studies completed by outside agencies and the Kenyan Government. The diagnostic analysis established a solid foundation for the studio and highlighted areas for further study.

The studio traveled to Ruiru and Nairobi for ten days in February of 2006. Visiting Nairobi gave the team the opportunity to gain first-hand understanding of local conditions and metropolitan issues. During the site
visit, the team interviewed and surveyed local residents, business owners and farmers. In addition, the team attended stakeholder meetings comprised of senior and national-level government officials currently working on national and metropolitan issues in various sectors. The team also had several meetings with the Ruiru Municipal Council (RMC), in which the council expressed their concerns regarding local development and shared their perspective as to how these challenges may or may not be addressed. The fieldwork methodology began with a mixed-method approach, which given ten days on the ground, allowed the team to maximize data collection and knowledge sharing. Based on the site visit, the studio team identified five areas of study.

The rationale behind this choice given the limited amount of data specific to Ruiru and the time frame of the studio, the team could not accurately conduct a comprehensive analysis of Ruiru and the Metropolitan region. The studio, instead sought a strategic approach, focusing on five sectors. The sectors include land use, economy, public health, transportation and governance/institutional framework.

In collaboration with the University of Nairobi, the studio conducted surveys of business owners and officials regarding service provision and the business environment to better understand the challenges facing business in Ruiru. Approximately 60 owners/officials of local industry, small business and informal business operations were surveyed. The studio team visited public and private health clinics, interviewed staff and reviewed clinic records. The team examined the local and regional transportation infrastructure, measuring roads, margins and medians and noting opportunities for expansion and improvement. The team also met with the Ruiru Matatu Association to gain a first-hand understanding of the issues facing the Matatu operators. Prior to leaving Nairobi, the team presented initial reactions, findings and areas of further study to the University of Nairobi studio team.

Upon returning to New York, the team examined a wide variety of development literature and statistics specifically addressing the five sectors. Given a strategic planning approach, the studio devised recommendations that would promote the development of a poly-nucleated form of metropolitan development. The studio team developed a list of recommendations for each of the five sectors that could be incorporated into a poly-nucleated form of metropolitan development. In a poly-nucleated scenario, Ruiru would be one of many nuclei, and the focus of development would be to promote economic activity, equity and efficiency within the municipality. These recommendations are organized by sector and are located in the recommendation section of the paper.

The studio has continued to collaborate with the SIPA students, who are also conducting a workshop in Ruiru, focusing on water and sanitation. Interaction with faculty and students of the University of Nairobi during the site visit as well as continued contact throughout the semester has been an integral component of the team’s research.
Sectoral Background

2.1 Land Use

The metropolitan area of Nairobi is the country's principal economic center and one of the largest and fastest growing cities in Africa (Lamba 1994). Kenya as a whole is the fastest urbanizing country in Sub-Saharan Africa. Since the 1970s Nairobi has experienced a huge growth in population and has expanded its boundaries to accommodate this growth within its jurisdiction.

As the country’s major hub of economic activity in a nation that largely lacks basic infrastructure and services, Nairobi attracts huge masses of people from rural areas seeking economic opportunity and an improved quality of life. Nairobi's population has increased from 500,000 people in 1970 to around 3 million people. The estimated annual rate of growth of the urban population in Kenya was 7.1% between 1995-2000. By comparison, the average for African cities was 4.4% and for the world 2.6% (Stren and White 1989). Unfortunately for a majority of these new residents, the city has been increasingly unable or uncommitted to providing these developing areas with the most basic of services and facilities.

This explosive growth in population has brought with it an increase in industrial development, new businesses, cars, growing informal economic activity, and the development of slums and persisting poverty. In response to these challenging circumstances of development, the land use resources of the city are being exploited in an unsustainable fashion, without a clear vision or a future plan for development. The last Master Plan for the development of Nairobi, released in 1978 and thus written for a city nearly unrecognizable from Nairobi today, expired in 2004, leaving the city without a clear mandate to guide future development. While city officials have begun to labor on a new metropolitan development plan for the Nairobi area, accomplishments thus far have amounted to vague definitions of what the goals, objectives and means of implementation of this new metropolitan development plan will include.

Land use planning in Nairobi is almost non-existent, and where standards do exist, they have not been adequately enforced. The only basic land use plan for Nairobi, which was created in 1948, was designed to guide the growth of Nairobi. It's recommendations, however, were not effectively implemented, thus allowing irregular and unplanned land use to become the predominant features of the land use pattern of Nairobi today. The uncontrolled urban growth has led the city to expand into a star-shaped pattern, in which the center is the Central Business District (CBD). Characteristic of many developing countries, much of the development has occurred linearly along major roads and close to transportation services. Housing has also emerged on cheaper land. Much of this housing development has been informal housing, which is usually located near industrial areas and places of employment. The government's practice of ad hoc land use planning measures has given rise to urban sprawl, uncontrolled expansion into natural areas, negative socio-economic impacts and environmental problems (Bubba and Lamba, 1991).

Since the colonial period, spatial segregation based on race and class has defined development in Nairobi. This pattern of development has continued to the present, as today the city is clearly divided between rich and poor, gated communities and slums. This land use development pattern of racial and social class segregation has tended to occur in the rest of Kenya as well.

Nairobi's expansion has mostly developed along the length of Mombasa Road to the south-east, and along Thika Road to the north. The driving forces for this development are transportation infrastructure and the availability of inexpensive land. Land use and expansion research done in 1999 by C. N. Mundia and M. Aniya for the Graduate School of Life & Environmental Sciences, University of Tsukuba Ibaraki found the following key factors the influence Nairobi’s metropolitan growth.

Rapid economic development

One of the main driving forces of rapid urbanization has been the economic development of industries and informal business as well as the increase in overall employment in Nairobi. “Nairobi's gross domestic product (GDP) was about sterling £254 million in 1975, £645 million in 1985 and £1.1 billion in 1995” (Kenya 2002).
Urban Population Growth
Nairobi has gone from 500,000 people in 1970 to 3 million in 2000, where 52% of the resident of Kenya live in urban areas, and 42% of the migrants come from rural areas. The government has not been able to provide the necessary services for all of these people. As a result agricultural land is being misused and there is very little infrastructure causing serious health and environmental problems.

Traffic Infrastructure
The built up areas usually respond to the layout of the roads. Although Nairobi was in fact founded due to the rail line, it use has been mainly left to freight and thus doesn’t present the pattern described before.

Topographical and Geographical Factors
Nairobi’s growth is also representative of the physical environment. The western part of Nairobi is characterized by steep slopes which restrict its growth. The northeast and west expansions have been established around the flat areas. To the east, where it is relatively flat, the roads are in poor conditions as they are comprised of black and red clay which is not suitable for construction.

As for the constraining factors, the soils are a major influence in Nairobi’s growth pattern, the western and northern lands are “deep well drained red soils of volcanic origin,” promoting expansion along this direction. Eastwards of the city the soils are brown and black clay on which it is very difficult and expensive to build. As a result, the soils have worked as a natural barrier to stop the urban growth. Nairobi’s National Park is located south of the city and by Nairobi’s major international airport.

The parkland has been respected to some extent and is viewed as a source of pride for the citizens. As previously stated, the master plan for Nairobi was completed in 1948 and revised in 1978. The plan intended to concentrate growth around the already built up areas of the periphery and densify the center. Instead expansion has gone towards the north, east and west. Nairobi’s land use has uncontrollably expanded by 300% from 1970 to 2000, and the population keeps growing at a 4% rate per years which means a major challenge for the people in this country.

Current Conditions

Rapid Growth Along Thika Road and Ruiru Road
Due to the rapid growth of the Nairobi metropolitan area, Ruiru is experiencing increased, competing demands for its land and resources. Located 16 km from Nairobi’s city center, Ruiru is situated along Thika Road, one of Nairobi’s major transportation routes and main arteries of new growth. Ribbon development is quickly increasing along Thika Road, as well as along Ruiru Road, a main route leading through Ruiru’s CBD that continues on into the farmlands. A bypass, projected to be completed in the near future, will cross through Ruiru municipality and will likely contribute to increased development and demands for basic social services in the area.

Land Division and High Demand for Plots
Because of its close proximity to Nairobi and its cheaper land, larger landowners are beginning to take advantage of the increased demand by subdividing their land for sale into smaller plots. Land surveyor companies and plot sale signs are prevalent in Ruiru’s central business district where several companies buy land, divide it into plots and sell them individually. Other company’s act as agents for land owners who wish to develop their land themselves. There is high demand for this subdivided land. One real estate company recently purchased twenty 40x60 ft2 plots in Muerrea, two miles from Thika Road, and sold four of these plots for 70,000 Ksh each within a week, which is roughly 985 USD.

Increasing Residential Developments
Residential developments are appearing along Thika Road and within the agricultural lands, including the coffee plantations northwest of the CBD. Residential developments are distinguished by income and follow patterns of segregated development as seen in Nairobi. Kahawa Sukari (KS), a high-income community located in the southwest of Ruiru municipality, consists of large homes surrounded by private walls. The
fastest growing areas are around Thika Road near the CBD and in Githurai, also located on Thika Road. Towards the western border of the municipality is the site of a large transportation node and informal market settlements located on Thika Road. Owned by many real estate agents, it is the fastest subdividing area of Ruiru.

Problems

Lack of Land Use or Zoning Plan
One of the major problems in Ruiru is the lack of a land use or zoning plan to regulate and structure the future growth and development of the area. In the absence of a land-use plan, Ruiru is experiencing a number of negative impacts, including unauthorized uses of the land, inadequate infrastructure and uncontrolled land division.

Unauthorized Uses of the Land
New developments are often occurring haphazardly and without public oversight. Developments can be seen in the rise of informal markets along Thika Road, Ruiru Road and secondary arteries along Ruiru Road. One of the major sources of revenue for the municipality is the collection of fees for business licenses, which increased from 9 million Ksh in 2003 (126,671 USD) to 11 million Ksh in 2004 (154,820 USD). While the municipality has been able to increase its revenue from business licensing, they are unable to capitalize on an increasing informal economy. This increase is also causing them to lose control over their land. Githurai is the leading example of this problem, featuring the most congested informal market area on Thika Road and costing the municipality 50,000 Ksh per day in unattained fees.

Such informal development is also occurring in areas surrounding Ruiru’s CBD, where many vendors disregard the formal market, located across from the council building and opt instead for informal settlements along Ruiru Road. After interviewing sellers in the formal and informal markets along Ruiru Road and secondary streets, it became evident that the 20 Ksh per day it costs to sell in the formal market, which is less than .20 USD, was in fact not the reason they abandoned the formal market. These informal businesses simply wanted to be located in the most highly trafficked areas. Without some method of controlling this development, however, these informal markets will continue to sprawl and Ruiru will not be taking full advantage of the land’s development potential.

Inadequate Infrastructure
Ruiru lacks adequate infrastructure for water, sewerage, and sanitation services. Open drainage and disposal trails of waste are common throughout the CBD and surrounding residential areas. As the population continues to increase, demands for these basic services will escalate. The team conducted field studies and observed one low-income apartment complex in the CBD that had a broken sewage pipe which disposed waste along the building’s front entrance. Rivers of waste lead out of housing areas and onto major streets. The Ruiru Public Works Officer stated that the lack of adequate water and sewerage infrastructure are the two most pressing issues for the municipality and believes the lack of such services has prevented new businesses from considering settlement in the area.

With no current zoning, new housing developments are beginning to appear throughout the farmlands, including the coffee plantations northwest of the CBD. If residential developments continue to scatter across the agricultural lands, the cost of building infrastructure will increase substantially and will make it increasingly difficult for the municipality to develop this necessary infrastructure.

There is also no appropriate dumping site for solid waste. The current landfill is a wide, uncontrolled surface dumping location, located closely to new residential developments, as well as near coffee and maize farms. A proposed relocation of the landfill directly east of the CBD poses another problem due to westerly winds directing waste residue and odor towards the most populated area of Ruiru.

Current Uses Beyond Capacity
The CBD is one of the fastest developing areas and existing uses are in need of additional space. The bus park, located within the CBD, is beyond capacity and is causing a high amount of congestion within its limited boundaries. With the increase in transportation services between Ruiru and Nairobi, the demands of
this bus park will only increase in the coming years.

Lack of Framework for Planning of Land Dominated by Private Ownership
As land is quickly being subdivided into plots, another major problem is the implementation of planning over land dominated by private ownership. Only 20% of the land in Ruiru is publicly owned, including the CBD, the future bypass, a military training school, and the current and future landfill areas. The other 80% of the land is privately owned.

The land use and ownership in Kenya is defined as either leasehold or freehold depending on whether the land is publicly or privately owned. Under leasehold ownership the government owns the land and rents it for renewable leases of 99 or 999 years. The renter is required to pay a tax to both the central government and the municipality based on an area ratio that, at the time of the team’s fieldwork in February 2006, was still in the process of being defined. Under freehold ownership, the land is privately owned and can be subdivided into smaller plots, an issue that has become problematic in Ruiru’s land development.

Uncontrolled Land Division Encroaching on Agricultural Lands
The 1996 Land Control Act requires landowners to obtain authorization from the district and the Land Control authorities in order to subdivide land. With 65% of Ruiru divided into lots before the Land Control Act, however, current divisions are considered legal subdivisions without need for further authorization. Much of Ruiru’s farmlands are consequently in jeopardy of division and development often without any space allocated for the provision of basic public services and spaces. This development additionally constitutes the permanent loss of what in some areas is highly fertile agricultural land.

Implementation of policies
With or without a framework for land planning, Ruiru also suffers from inadequate resources for implementation. The council members expressed difficulty in enforcing building regulations and informal markets with a limited number of employees. Part of this problem also stems from a lack of community participation, involvement and ownership of planning decisions. Residents and workers voiced their distrust in the government due to existing corruption and bribery. The threat of higher income areas dictating service development is problematic and is demonstrated by KS, in that the community that formed a citizen-led planning initiative designed solely for their benefit.

Assets
Rich agricultural lands
Our team considers the rich agricultural land coupled with the area’s good climate as one of Ruiru’s greatest assets. The land is distinguished by rich, fertile soils in the northwest, comprised mostly by coffee plantations and maize farms. Drier lands are located in the southeast, consisting of stone quarries, dairy farming, and ranching. These lands provide significant economic opportunity that can be further tapped as major resources of revenue and job creation for the municipality.

Location along major transportation route
Located on Thika Road, Ruiru is situated on a major transportation artery and is easily accessible by public transportation. According to a study from Kenya Institute for Public Policy Research and Analysis (KIPPRA), 51% of the vehicles on Thika Road are public vehicles, which carry 86% of the total passengers, compared to overall roads in the metropolitan area, where 36% of vehicles are public and carry 78% of total passengers.

Location directly between two major cities
Ruiru is located directly between Nairobi and Thika, the next largest city in the area after Nairobi. Ruiru could become a stronger node of residential and economic development by capitalizing upon its location between these two cities.

Number of large private landowners
Although 80% of the land in Ruiru is privately owned, there are five major landowners who could be
targeted to work in collaboration towards future development plans:

1) Kenyatta Family: the ex president’s wife owns a large cattle ranch which is not yet subdivided.
2) Nyankinya Women’s cooperative: this group used to plant coffee but due to the low prevailing market prices, this group is starting to sell their already subdivided plots, around 6000 units of 15x30 meter plots
3) Githunguri: this party is subdividing and selling rapidly as their land is situated in a fast growing area
4) Mrembo Mwalimi-Sacco: a teachers’ cooperative not yet selling.
5) Unidentified British landowner: most of the coffee plantations are owned by the same British individual who the team has yet to identify.

Receptive municipal council
The RMC has acknowledged many planning problems within the municipality and has welcomed analysis, feedback and proposals towards establishing future plans and improving the planning process.

2.2 Economy

Background

Kenyan National Economy
Kenya, in comparison with other African countries, is a mid-sized economy and can boast of its status (or, more accurately, of its primate city Nairobi’s status) as a regional hub for trade and finance in East Africa. Kenya’s estimated GDP of US $39.45 billion in the year 2005 translates into a GDP per capita of US $1,200 (The World Factbook 2006). Over 700 medium and large-scale enterprises, 200 of which are foreign multinationals, mostly from the United Kingdom, the United States of America, Germany and the Far East, are located in Kenya (Nairobi City Council 2006). The country’s main trading partners include the following: in exports: Uganda (13.2%), UK (11.3%), US (10.5%), Netherlands (8.1%); imports: UAE (12.5%), Saudi Arabia (9.1%), South Africa (8.7%), US (7.7%) (The World Factbook 2006).

Agriculture
While services contribute most of the value of Kenya’s GDP, agriculture contributes the majority of national employment, with approximately two-thirds of the economically active population employed in this sector (The World Factbook 2006). Thus, the state of agriculture in Kenya, in terms of its viability as a rural livelihood as well as in regards to the increasing pressures placed on agricultural land surrounding rapidly urbanizing areas, deserves significant attention and analysis in the development of any planning efforts.

Agriculture, including the production of coffee, tea, cut flowers and ranching for dairy and meat, play a significant role in the economy of Kenya as well as Ruiru. The agricultural sector in Kenya is just now showing signs of recovery and growth after nearly twenty years of decline. World supply gluts and localized droughts have been particularly hard on traditional crops such as coffee. The last major drought occurred in 1992, however recent weather conditions signal the potential for disastrous drought over the next year. As a result of Kenyan government policy, losses in the agricultural sector fall most heavily on the producer. With little or no savings, no insurance and little or no access to financing, agricultural producers are at a heightened risk of being forced to subdivide and sell their land during times of economic hardship (Krivonos 2004).

Approximately 20% of all Kenyan land is fertile and arable, but only 1/5 of all irrigable lands are actually irrigated (Kirwa 2005). Agriculture in Kenya currently contributes to about 17% of the monetary GDP (KPSA 2005). Traditionally, coffee producers have been forced to sell their produce via auction, managed by a government sponsored coffee union. However, the Coffee Act of 2001 partially liberalized the market and made more direct sales possible via coffee agents. The Act also established the Coffee Development Fund to support coffee producers in times of economic need. The potential of this fund has not been fully exploited, particularly with respect to the procurement of insurance for coffee producers (Kirwa 2005).
Despite the overall agricultural decline, the cut flower industry continues to grow in Kenya. Today, Kenya is the world’s second largest cut flower producer, just behind Holland. Kenya supplies nearly 62% of all roses in the European Union (KPSA 2005). Kenya has several competitive advantages in the world cut flower market due to its favorable climate conditions, low wage requirements and high productivity levels. The cut flower sector does not suffer from the lack of capital investment and low productivity of other agricultural activities. Rather, many horticultural firms have direct international financial backing and their workers are surprisingly productive (World Bank / KIPPRA 2004). The number one problem facing the entire agricultural sector, including the cut flower industry, is inadequate infrastructure provision. In particular, electricity and road infrastructure have been identified by the Kenya Private Sector Alliance at the top two infrastructure concerns facing producers (KPSA 2005).

Informal Economic Activity

Another defining characteristic of Kenya’s economy is the increasing importance of the informal sector. According to Government of Kenya statistics, informal sector employment in the country grew over 176% from 1998-2001, while formal sector employment fell -0.43% during the same period (Mitullah 2003). The Government attributes the sector’s growth in part to its diversity, high labor intensity and ease of entry, combined with external conditions such as the removal of legal barriers, the gradual shift of workers from subsistence agriculture to the informal sector due to the economy’s transition to a market-oriented economy and the slow-down in modern sector activities (Muraya 2004).

Informal business activity is a major component of the local economy of Ruiru, as it is in the rest of Kenya and across the developing world in general. As mentioned previously, the informal sector has been growing rapidly in the past years in response to a decline in formal sector employment opportunities. In light of the importance of the informal sector in regards to the jobs it provides to so many people, and its growth that is predicted as current economic conditions persist and population grows, the following sections address this informality and makes recommendations for the municipality to best address its role in the local economy. The first section reviews academic analysis that strives to prove the value and benign nature of the informal sector. The second section includes argument that the current combative approach to informal development should be changed to one of acceptance and accommodation. The third section provides recommendations specifically to address the informal sector within Ruiru.

Analysis of Informal Sector Reveals Minimum Negative Impacts on Local Environment

Many local- and national-level governments claim that the informal sector has negative effects on the local urban environment by increasing congestion, certain types of pollution, and otherwise reduces local efficiency. However, urban planners, environmental scientists and others agree that to blame on the informal sector for such local problems in the local environment is not justified. In its defense, an analysis of the environmental impacts of informal businesses in Colombo, Sri Lanka revealed the following main findings regarding its effects on the local environment: (1) informal businesses do not generate as many negative effects on the local environment as commonly believed, and (2) locally appropriate planning efforts can enable the development of informal activity that coexists with other urban interests, thus contributing to, rather than inhibiting efficiency (Perera & Amin 1996).

Perera & Amin (1996) concur in their research with others that the environmental conflicts, hazards and pollution effects blamed on the informal sector are largely a manifestation of unresponsive physical planning systems rather than inherent attributes of the sector itself. Their findings suggest that accommodating the informal sector in physical terms is a remedial measure that will curb associated environmental problems and improve environmental management.

In their analysis, informal businesses overall contributed the largest negative impact on pedestrian routes, where many businesses were found to encroach on access routes due to lack of space within their premises and sometimes in order to in an advantageous position to attract customers. Perera and Amin suggest that a compromise between the two interests should be made by granting sufficient space to the enterprises, which locate in these areas in the first place because they are frequented by the people who use these routes. They also found that accommodated businesses generated significantly fewer environmental hazards that their un-accommodated counterparts, suggesting that providing better market facilities or other improved space to informal businesses is an effective tool to reduce congestion and risk of collision and...
other risks measured.

**Argument to Revalue and Reform Current Approach to Informality**

Amin (2000) argues that because of its essential and beneficial role in national economic and social development, the informal sector must be accommodated, not penalized, pushed-out or artificially formalized in some manner. He states that such accommodation will first necessitate convincing government and policy makers of this valuable contribution of the informal sector, jointly achieved by overcoming well-known doubts and concerns leading to changed attitudes regarding the sector. He suggests that physical planning is ill-equipped to deal with economic and social forces and makes a case for the accommodation of the informal sector in the urban economy by bringing about changes in attitude and urban planning paradigms which have mostly been defined by western values and technological and development experiences (Amin 2000).

Amin outlines the following four major sequential steps in adopting an appropriate accommodating approach to the sector:

1) Changing the attitude towards the informal sector from hostility to acceptance;
2) Moving away from a restrictive to an accommodating approach;
3) Viewing accommodation as an enabling strategy; and
4) Utilization of the enabling condition to raise resources for service-rendering regulations.

Many cities in the developing world have developed new practices of physical accommodations of the informal sector, such as significantly widening walkways along main road sides to accommodate their operations, or by providing improved structures to existing IS operators, illustrating the application of many of the principles outlined above. Amin specifically advocates this ‘service rendering’ method as an alternative regulatory approach to the IS. Instead of adopting the traditional regulatory approach, he argues cities should instead adopt a service-rendering approach, which in addition to the provision of services for meeting shelter needs, also should include improving access to credit as a means of increasing productivity and income (Amin 2000). A conducive institutional environment for the informal sector can be ensured by simply removing restrictive practices and expanding access to public institution-created services such as shelter, health, water, electricity, etc. to informal sector workers on the basis of equity and willingness to pay (Amin 2000).

**Current Conditions**

The Nairobi Metropolitan Area contributes heavily to Kenya’s overall GDP—the bulk of diversity in economic activities located within the metropolitan area. The majority of the economically active population in the metropolitan area is employed in the Social and Personal Services sector, which provides more than two times the formal employment of any other sector. The breakdown of total formal employment in Nairobi is displayed in Table 1 below.

<table>
<thead>
<tr>
<th>Formal employment</th>
<th>% total employ sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social &amp; Personal services</td>
<td>43%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>19%</td>
</tr>
<tr>
<td>Trade, Restaurants &amp; Hotels</td>
<td>16%</td>
</tr>
<tr>
<td>Business Service</td>
<td>12%</td>
</tr>
<tr>
<td>Finance and Other</td>
<td>10%</td>
</tr>
<tr>
<td>Building and Construction</td>
<td>10%</td>
</tr>
</tbody>
</table>

Much of the description provided for national economic activity was derived from the description of conditions in Nairobi, because, as mentioned, this area is responsible for a large proportion of this total. Therefore, the description provided previously of national economic conditions can also serve to accurately illustrate those of the Nairobi Metropolitan Area.
Recent Economic & Political Development
The Kenyan economy has suffered low growth rates for several years from the instability surrounding the end of Daniel Arap Moi’s rule in 2002, compounded by the effects of severe national droughts occurring at this time. Widespread concerns about high levels of corruption during this period resulted in a decline in the quality of the nation’s business climate. This decline was quantified by Kenya’s relatively lower levels of foreign direct investment as compared to other African nations of its size, its higher perceived political risk and decline in competitiveness rankings such as those produced by The World Economic Forum and The Institutional Investor (Morisset 2000).

With the election of Mwai Kibaki on the NARC platform to fight corruption, prospects for economic growth have improved, and indeed, growth rates of recent years constitute significant improvements over those past. The 2003-04 period was particularly strong for the Nairobi Stock Exchange (NSE), during which market capitalization jumped from Ksh83bn ($1.1bn) from September 2002 to Ksh335bn ($3.31bn) in January 2004. The NSE 20 share index has climbed over 3000 points from its level just above the 1000 mark in the year 2000 to present levels of around 4000. GDP grew approximately 5% in 2005 (World Factbook 2006).

Recent increased economic growth should not be attributed directly to central government policy and direction, however, as the current administration has failed to take as aggressive a stance against corruption as it promised it would upon election. President Kibaki appointed Mr. John Githongo, to investigate potential graft among government officials. Mr. Githongo, currently in self-imposed exile in England, recently released several inflammatory reports uncovering new scandals involving the illicit use of government funds for personal gain and implicating top government officials. Concerns over endemic corruption have thus officially returned to cloud any prospects for ambitious future economic growth in the country.

Strategies for Future National Economic Growth
While Kenya does face significant challenges to promote economic growth, the country has recently made sound policy decisions that suggest it may otherwise be able to further expand its economic capacity. A sector that has gained increasing importance in the Kenyan economy is that of trade, restaurants, hotels and tourism, which today is the country’s top foreign exchange earner and accounts for nearly 12% of the total annual national output (Nairobi City Council 2006).

Tourism Development
Kenya has additionally undertaken significant investment in infrastructural facilities to promote the hotels and tourism component of this targeted sector, including hotels of international standard and roads connecting the national parks and the main urban centers. The International Finance Corporation (IFC) agreed in 2005 to lend US $20 million to Kingdom Hotel group for the remodeling and refurbishment of five Kenyan hotels and lodges, and additionally supports investments of The Aga Khan Development Corporation in this sector (IFC 2006).

East African Customs Union Treaty
Significant future growth in trade will likely result from Kenya’s recent and future participation in The East African Customs Union Treaty. Signed into law into March of 2004, the Treaty defines a system of tariffs to remove the major obstacles to increased trade within the three member countries of Kenya, Uganda and Tanzania. The focus of the treaty is largely to promote manufacturing and processing enterprises, and although the customs treaty has been signed, the free trade area will be phased in gradually and a truly common market is unlikely to come into being for several years (Ford 2004). Government officials of the three member countries believe that this regional trade holds the key to Eastern Africa’s economic prospects (Ford 2005).

Ruiru local economic development
Ruiru’s economic base primarily consists of agriculture, fewer than one dozen large-scale industries, and a plethora of small and informal businesses. Not all residents are employed in local economic activity, as many commute to work in Nairobi. The team’s understanding of the Ruiru local economy was developed
through interviews with members of management of local industry, owners of area farms, and with small and informal business owners. The following description focuses on existing local economic conditions: agriculture that is both thriving and struggling depending on the crop, and local industrial and small business development that is largely in a state of stagnation. Recommendations to promote the growth of each of these sectors follow these sections.

Coffee
Coffee plays an important role in the economy and land use patterns of Ruiru. The majority of the coffee farms in the area can be found in the hilly, fertile land in the west-northwest section of the municipality. This area includes both small-scale producers and larger operations, such as Ruiru Coffee.

While in the field, the team had the opportunity to speak with a small producer located on the north side of Ruiru Road, just before the Prison College. This man and his brother own 300 acres as freehold property and use approximately 130 acres for coffee cultivation. The remaining area is used for the homestead, the slaughterhouse or is left fallow. The brothers own one more farm outside Ruiru Municipality. They grew up on this land in Ruiru and the farm was passed down from their father to them. For the past 15 years, the farm has posted monetary losses, although they have never been approached by residential developers about subdividing and selling their land. However, in order to offset continued losses incurred in coffee production, the brothers have diversified their operations to include slaughter services for local ranchers. They presently slaughter about twenty cows daily at 400 Ksh or 5.64 USD per cow.

Originally, the farm was able to secure loans from the local coffee union, called the Kenya Planter’s Coop Union or KPCU. However, many farms have been unable to payback their debt and the union has recently ceased granting loans. In the past, they have been able to sell a 50 kg bag of grade one coffee for about 35,000 Ksh at auction. Today, they receive between 1,000 and 5,000 Ksh for the same product. The farm once produced 80 tons of coffee per season. Due to drought conditions, the farm is currently producing less than half that amount, only 35 tons. The farmers’ chief concerns include:

1) Cheaper electricity
2) Subsidized fertilizer prices
3) Assistance with maintenance costs for road infrastructure
4) Marketing and direct sales of their products

The farm has an adequate water supply, obtained from their river frontage. The farmer would be wary of switching to local water service if Ruiru did become a water service provider, because of general distrust between farmers and the council. Despite plentiful access to water, the farmer is unable to irrigate his fields due to the high price of electricity. On an average month, the farm spends about 15,000 Ksh on electricity, provided by a Nairobi service provider. If they were to run the pump which supplies river water to the fields, that expenditure would increase nearly 500%, to 700,000 Ksh per month. Thus water for irrigation is cost prohibitive not because of the cost of water itself, which in this case is minimal, but because of the high cost of electricity.

Cut Flowers
The cut flower industry flourishes in Ruiru. Both Redlands Roses and Pollen Flower Farm are located along the north side of Ruiru Road, just west of the Prison College. Redlands Roses has posted profits every year for the past ten years. The farm occupied about 30.3 HA, 15.3 of which is productive. Redlands produces 29 varieties of roses for export primarily to the European Union, Middle East, Australia and Japan. The company located in Ruiru because of the readily available land and direct access to maram, a stone used in their hydroponic rose cultivation method. Maram deposits are located directly on their property. The business is backed by Swiss, Dutch, German and Kenyan investors who set strict safety and environmental standards. Redlands provide on-site healthcare to all its employees and uses a wetlands-style wastewater treatment system. The plastic covering the greenhouses is also made of recycled materials. In addition to healthcare, Redlands provides its employees with extensive training, daily lunches and a bicycle upon hire. Their workforce is over 60% female.

Within Kenya, rose cultivation is a cutthroat industry, where pricing and transport are key issues. Redlands
has only four hours to transport its roses from the plant, through an elaborate sorting production line, to the airport and onto a plane bound for market. Any more time and the company runs the risk of spoiling entire shipments. Thus transport, both within Ruiru and within the larger metropolitan context, is a top priority for these producers. Redlands Roses looks forward to the completion of the bypass, which will offer much more direct access from Ruiru to the airports.

Redlands Roses receives its water from a dam about 3 km away, owned by a coffee plantation, known as Socfinaf. This coffee plantation is a shareholder in the flower farm, and as a result Redlands is only required to pay for the electricity used to procure their water. The farm is not interested in procuring water from Ruiru Municipality should they become a water service provider, however they welcome the opportunities water service provision will bring to their employees—particularly the opportunity for improved health conditions. Redlands is also particularly concerned about crime in the area and the safety of its employees beyond the farm, as recent incidents have resulted in loss of life. The farm currently provides free borehole access to the surrounding community and plans to set up an onsite daycare facility for its employees in the near future.

**Industrial and Small Business Development**

Several firms employing between a few hundred and 1,200 employees dominate industrial activity in Ruiru. The services of these industries range from steel manufacturing to food-processing, and the majority of these firms have strong linkages with regional East African suppliers and markets, as well as with the greater international market, especially the United Kingdom. The main industries and their function include the following: Devki Ltd, steel manufacturing; Bogani Industries, food-processing; Brookside Dairy Ltd, dairy food-processing; Spinners & Spinners Ltd, textiles; Kenya Clay, roofing tiles; Alpha Knits, textiles, along with a few other smaller industries, with whom our team was unable to speak. Each of these firms had located and begun operations in Ruiru over a decade ago, with the exception of one firm that had opened more recently yet utilizes the site of a former industrial tenant that located in Ruiru in the 1970s. Because we were unable to find or learn of any firm recently locating and building its own facility in Ruiru we were led to believe that the local business climate for industry had deteriorated beyond what could be accurately attributed to the economic decline of the late 1990s-early 2000.

Small businesses as well as informal businesses provide a large source of local employment in addition to providing the bulk of resident services. Small formal businesses in the area include several hotels, restaurants and bars, gas stations, banks, hardware stores, borehole drillers, septic tank exhausters and others. Informal businesses sell everything from clothing to cosmetics to household goods and food—primarily fresh produce. Several small business owners we spoke to shared that their businesses had not been profitable in recent months or years, and expressed concern for their future operational viability. Much of these business’ inability to provide competitive products and services stems from the challenges to be described in the following paragraphs.

Local industry and small businesses in Ruiru suffer from inadequate infrastructure provision. Some industry and small businesses may have been willing to provide their own solutions to the inadequacies of local infrastructure while land prices were lower and other factors existed that made doing business in Ruiru more competitive. Other parties, especially small businesses, initially opted to set up alternative schemes of service provision under the assumption that these services would be provided by the RMC in the near future. The lack of local services has now persisted, and is having a significant dampening effect on the development of the local economy.

Ruiru does not currently provide water or sanitation services to local business interests or to residents. While some industry that settled in the area several decades ago does enjoy access to piped water provided by the Nairobi City Council, this expansion in provision was halted many years ago, thus prohibiting newer industries or businesses to take advantage of these connections. Those that have located in the area more recently have dug boreholes or pipes to rivers at their own expense in order to address this lack of services. Other challenges to local business development include a lack of investment in road infrastructure, which increases wear and tear on vehicles and lengthens supply and final product delivery, all eroding profit margins. The local transportation network also affects the ability of employees to arrive promptly at work, reducing productivity. Brookside Dairy Ltd, for example, a dairy processing plant employing 1,200 people,
avoids potential losses to be incurred from the local unreliable transportation network by providing company buses for its employees to travel to and home from work. The company sends two full-size buses daily back and forth to Nairobi, and additionally provides vans and other shuttle services for door-to-door transport. Many employees would spend at least two hours per day in and/or waiting for transit if the company did not otherwise provide such services.

2.3 Transportation

Background

The transportation problems and the cyclical effects upon land use, housing, economic development, etc, that Ruiru currently suffers from must be understood within the broader context of Kenya and Nairobi. Given that Nairobi serves as an economic hub for the region, as well as for the rest of the country, there is a high degree of activity centered in a relatively constrained space. Within the metro area, the average person makes 4.29 trips each day, with a total of over 11 million trips made each day (KIPPRA Report 2006). The current development patterns of rapid urbanization and the dispersal of activities is a direct reaction to the prevalence of this problem, which has manifested itself in housing patterns, commercial/industrial movement, and in the congestion of traffic throughout the Nairobi metropolitan area. For instance, the dispersal of higher income residential developments to accommodate lower density preferences has allowed the proliferation of private car use, thus contributing to a majority of the area’s congestion problems. The overall percentage of private cars represented on the streets of the Nairobi metro area is 64%, while the proportion of passengers carried is only 22% (KIPPRA Report 2006).

The historical context of post-colonial Nairobi must also be considered when analyzing the spatial separation of socio-economic classes and races and the existence and placement of informal settlements. The intentional placement of Asians and Europeans in specific locations, while neglecting land provision to Africans, presumed to be nomadic, can still be witnessed in the current spatial divisions within Nairobi. Persisting, widespread poverty largely resulting from colonial and post-colonial policy and the continued lack of investment in basic human development has added the primary question of affordability of transport to the metropolitan transport debate. As previously mentioned, a majority of Nairobi’s population resides in informal settlements. Therefore, a dominant development pattern consists of informal settlements sprouting in adjacent locations to employment sources, primarily industry, in order to take advantage of the only free transport mode, walking. This can be seen throughout Nairobi and Ruiru itself and is clear when analyzing the household modal split for the metro area of which 49% of trips are made by walking (KIPPRA Report 2006).

Previous transportation development processes, such as the Metropolitan Growth Strategy of 1973, provided the origins of Nairobi’s current conditions. Within this plan, Nairobi was linked to other regions of the country via three major roadways: northeast to Kisumu, northwest through Ruiru to Thika, and south via the Uhuru Highway to Mombasa. Aside from these primary connections, there are a multitude of local streets and the primary roadway extending from Mombasa into Uganda. The dominant street pattern of the Nairobi metro area is a three-point star, in which there is a single core focusing the activities of the area (Grava 2006). The congestion caused by this centrality is extreme. It is felt throughout Nairobi and all the way out to its satellites, such as Ruiru.

The current urbanizing nature of the region and the issues of affordability surrounding transportation make public transit a central element for discussion. Within Nairobi, city buses operate on fixed routes with fixed fares, provided by the Kenya Bus Service (KBS). The routes of the public transit clearly reflect the street pattern, with a central focus. KBS operates 420 vehicles but suffers from disinvestment, lack of maintenance, and inadequate service (Grava 2006). It does not operate between Ruiru and Nairobi, which is an important satellite connection for motorized service given the distance and commuting necessities of Ruiru residents.

City Hoppa is a relatively new service operating within Nairobi that also operating on fixed routes with fixed fares. It is privately owned and operated but utilizes the same routes and stops as the public buses,
These services are thus limited and highlight the inadequacy of public transportation given the issues of affordability throughout the region and the dispersal of development. Much of the reasons for the public transportation void are the policies regarding public vehicles. There are stringent regulations and taxes instead of the transport ideology seen in developed countries where public transit is often subsidized in some form. The mass transit gap was thus filled by matatus, which is discussed in further detail later in this report. The regional connections are also maintained through limited passenger rail, also later discussed.

The congestion issue felt within the center of Nairobi and radiating outward has been recently addressed via the construction of three bypasses. There will be Eastern, Southern and Northern bypasses making regional connections to the Nairobi area without passing through the city center for the purpose of relieving some traffic congestion (KIPPRA Report 2006). These bypasses will have transportation and development impacts throughout the region given the increased access to outlying areas, such as Ruiru. All of the above mentioned characteristics of Nairobi’s transportation system have direct effects upon the development of Ruiru, for transportation and beyond.

Current Conditions

Road Supply
The existing transportation infrastructure is plagued with a variety of structural and maintenance problems. For example, most roads are in a state of disrepair and few roads are paved. There are also few places where pedestrians and bicycles are safely separated from other modes of transportation. These problems are not only evident within the local roads of Ruiru Municipality, but also along the primary Ruiru-Nairobi connection of Thika Road. However, amongst these issues are significant assets and great opportunity for improvement.

In conjunction with the RMC, the transportation team identified several priority roads within Ruiru Town, each serving a critical role. These roads exist in varying conditions and do not feature standard dimensions. Hospital Road forms a ring around the central business district and serves important institutions including the public hospital and several schools and textile factories. The east end of the road demonstrates the best conditions of the entire Ruiru road network. Branching from Kwa Miko Road, Hospital Road is a wide (24'), unpaved road lined with trees, which provides aesthetic quality. As the road passes the Hospital, it narrows to (16') and the trees end abruptly. This northern segment of the road is in disrepair with deep troughs. While only (16') wide, it has ample reserves on both sides and could easily be widened. Where Hospital Road encounters the Alpha Knits factory, the road widens (24') and is better maintained. The textile firm itself installed barriers to delineate the roadbed and thus prove the current and potential expanded role of industry in infrastructure provision and improvement. This entire road should be paved with a designated portion for pedestrians, bikes, and handcarts.

Baptist Road is another priority road that connects Ruiru Road to Hospital Road at its midpoint. The road serves RMC, the Ruiru Market, and a school. It provides the only entrance to the market and is heavily trafficked on the leg between Ruiru Road and the RMC. This portion of the road is (22') wide, has been paved (though the paving is badly potholed and buried below dirt), and features cobblestone delineated curbs. The northern portion is less traveled and is (16') wide. This road should be paved adequately to accommodate truck traffic for the market with designated space for handcarts. Gravel strips should be installed on the opposite side of the curb for pedestrians.

Mathigu Road is the third priority road, which provides a connection from Ruiru Road across Hospital Road to Kwa Miko Road. This road is of importance due to its service of the Ruiru Town CBD. The roadbed is (18') and allows for parallel parking along the sides of the road. The road is in poor condition with deep potholes and should also be paved with designated space for pedestrians and bicycles. The team also identified an unnamed road that branches from Ruiru Road just east of the western end of Hospital Road. This unnamed road is a commercial strip that leads to low-income housing and thus provides access
to the CBD. The road is in very poor condition with very deep potholes, open sewers on the north side of the road, and is about (18') wide, though the width varies every few feet. This road is heavily trafficked by pedestrians and bicycles. The residents of the low-income housing use this road for access to Ruiru town and the matatu station therein.

Ruiru Road, Kwa Miko Road, and Thika Road provide the greatest connections within the municipality. Both Ruiru Road and Kwa Miko Road are paved close to Ruiru town and are in relatively good condition although they lack lane delineation and designated space for pedestrians and bicycles. Ruiru Road serves the industrial area of Gitothua and will ultimately connect to the Eastern Nairobi Bypass. It leads to Kiambi Town to the west. Kwa Miko provides access to Murera and the Coffee plantations and dumpsite held within.

Thika Road serves as the primary connection between Nairobi and Ruiru. This road receives heavy traffic from personal automobiles, matatus, and trucks. There are no lane markers and though there are beaten paths along the length of the road, there is no formal space for pedestrians, bicycles, or handcarts. The roadbeds are approximately (25') in each direction and lack sidelines in many places. Though the widths vary, there is approximately (20-30') of reserve on both sides of the road and the median is approximately (40') wide. The corridor averages (150') wide. In certain places, the paving is badly potholed.

Along Thika Road, there are (10-15) matatu stops between Nairobi and Ruiru town, which are often unsafe with only informal turnouts. The road encounters four roundabouts between Nairobi and Ruiru Town. In these roundabouts, the right-of-way is poorly defined or completely lacking, creating significant safety concerns. As the regional population increases and rapid rates of urbanization continue, traffic along this route will only increase.

Construction has begun on the Eastern Nairobi bypass. The bypass enters Ruiru Municipality at its southeastern end around Kahawa Sukari and follows west/northwest along Cattle Track road. It encounters Ruiru Road approximately 5Km southwest of Ruiru Town. At this intersection, the south side of the road is the suburban fringe of Nairobi with low-density houses. On the North side of the intersection, the area is industrial, home to the cut flower industry. While the bypass is paved in some places, most construction is currently in the grading phase. The bypass crosses Thika Road approximately 1Km north of the Githurai 44 roundabout.

Non-Motorized Transport
Non-Motorized Transport (NMT) is the most used form of transportation in the Nairobi Metropolitan Area. NMT includes walking, bicycles, and the use of handcarts to transport goods. Nearly one third of households in the Metropolitan Area spend less than 10% of their total household expenditure on transportation (KIPPRA Report 2006). This is likely due to low wages and the necessary minimum expenditures on needs such as food, as the poor simply do not have money to spend on transportation. In order to facilitate this trend, the urban poor live close to their places of work be it formal factory jobs or informal markets.

The largest share of transportation takes place on foot. The Nairobi Urban Public Transport Survey found that 49% of households relied on walking for their primary mode of transport (KIPPRA Report 2006). This represents the poorest 49% of Nairobi households as it is the urban poor that cannot afford motorized modes. These walkers make use of unpaved footpaths that follow most motorized transport routes.

Bicycles have also come to constitute an important mode for the poor residents of the Metropolitan Area. KIPRRA's report on Nairobi Urban Transportation found that 9.5% of households in the area own at least one bicycle (KIPRA Report 2006). Bicycles are not produced domestically but are imported, largely from India. In Ruiru, a used bicycle averages 3000 Ksh (approximately $40 USD). A veritable cottage industry has arisen to maintain and repair these bicycles. These roadside repair stations generally charge 20 Ksh (.25 USD) or less for minor repairs including patching of inner tubes or tightening of brakes.

These bicycles have also supported an informal bicycle taxi industry. Owners outfit their bicycles with padded seats over the rear wheel. These bicycle taxis, called boda-boda, constitute the most affordable form
of public transportation. The boda-boda operators congregate at informal stations in areas of high pedestrian traffic. They do not operate with a fixed rate but rather adjust the fare based on distance, difficulty of ride and relative wealth of the passenger. This mode, both in the form of boda-boda and as private bicycle holds a social stigma due to its lower class association.

Matatus
The matatu industry in Kenya represents the growing trend toward informal development of various types throughout the region. In the absence of adequate public transportation in the form of rail, bus service, etc, matatus have emerged as the primary mass transit service to fill this void. The industry began in the late 1960s by those who specifically sought to rebel against both society and the KBS. Owners initially bought old military trucks in order ferry people across the Nairobi area. The cost at the time was three cents, which means “matatu” in Swahili. Jomo Kenyatta, the Kenyan president at that time, allowed the industry to grow without regulation and to thus assume its current informal structure (Kimutai 2006).

The industry is privately run by individual owners, but operation by these individuals is often organized into companies. The average owner operates two or three private vehicles, of a total of 55,000 matatu vehicles operating throughout Kenya and 13,000 in Nairobi itself. The service is run informally in that it is privately owned and operated and provides an often chaotic form of mass taxi service. There are four main types of vehicles: the 14 seaters, which are primarily Nissans and Toyotas; converted pick-ups, which are built locally and are currently being phased out; the 7 seaters, which are Peugeot station wagons; and the minibuses, which are 25, 29 and 33 seaters. The fleet are all second hand in that they are purchased from Japan via Dubai and Singapore. They are initially used as cargo vans and then converted for passenger travel once in Kenya. The vehicles imported cannot exceed eight years in age (Kimutai 2006).

The vehicles operate on fixed routes as determined by the Transportation Licensing Board (TLB) that are regulated through the purchase of specific licenses corresponding to the permanent route of the vehicle. They stop at generally fixed termini, which are set by the Nairobi City Council, but generally correspond to old bus stops. The fares are set according to distance traveled by the local matatu associations and range from 50 Ksh to 10 Ksh for short distances with an average of 30 Ksh. The service is operated informally in that vehicles are filled as much as possible at starting points (such as the Ruiru Town bus park) and then pick up passengers along the way, not necessarily according to formal bus stops. Matatus in the past were often filled to the point of dangerous overcrowding, however there now exist new regulations to curb this practice, such as the seatbelt mandate (Kimutai 2006). Other regulations to ensure greater safety and order within matatu service include the requirement of two operators on board at all times, one to collect fares and the other to operate the vehicle.

Operation between Nairobi and the satellite of Ruiru is far more frequent that the other commuter option of rail and thus service is widely used. There are four routes passing through both Ruiru and Nairobi, each making four trips per day. The main points along these routes are the bus park in the Ruiru CBD, which is the primary hub for routes passing through Ruiru, the Githurai roundabout, which is a chaotic, informal and congested transportation hub, and the periphery of Nairobi’s center, as matatus are banned from the interior of the CBD (Ruiru Matatu Drivers 2006).

The matatu industry continues to proliferate intensely given the decline of KBS, which services a small portion of Nairobi both socially and spatially. The lack of commuter options coupled with the increased urbanization and the dispersal of residential and commercial uses, has given rise to the matatu—“an African invention.” Therefore, as the annual rate of daily passenger trips rises from the current estimate of almost 6%, a better integration of the entire transportation network will need to be achieved (Rakodi 1997).

Rail
The Nairobi-Nanyuki rail line operates one commuter train from Ruiru to Nairobi each day. One train leaves for Nairobi at 6:25 am and one trains returns to Ruiru in from Nairobi at 7:00 pm. The total capacity of the rail is 25 coaches, one of which is for commuters, accommodating 200 people per coach. Thus, in terms of capacity, rail service is the dominant mode. According to Philip, the Ruiru rail station manager, the rail is currently operating at full capacity and 200 people board the train in Ruiru each morning. While the issue of efficiency is debatable, rail service proves to be a true provider of mass transportation.
The cost of rail service is 30 Ksh, which is less than matatu service to Nairobi. However, the trip duration is significantly longer due to the curvilinear route. The rail station manager felt strongly that rail service is a viable transportation mode to Nairobi, as it is safer and more comfortable than matatu service. However, the trip duration is a disincentive for many riders. In addition, there was much confusion over the current status of commuter rail service among community residents, the municipal council, and national transportation experts alike.

In October of 2005, the Kenya government signed rail operations over to the South African Rift Valley Consortium led by Sheltam Rail Company. Details of the concession are as follows: The Rift Valley Railways Consortium will pay an initial fee of $3 million to Kenya and $2 million to Uganda for railway operation, an annual concession fee of 11.1% of the gross revenue generated in each country and $1 million per year for the passenger services concession in Kenya. The concession is expected to improve efficiency of freight transport and is an opportunity to increase passenger and commuter rail to provide efficient transportation systems within the Nairobi Metropolitan region.

Private Automobiles
There is a strong automobile presence along Thika Road and within the Nairobi municipality. The presence of automobiles within the Ruiru Municipality is less striking. This contrast may be attributed to the fact that many of the roads in Ruiru are not paved and the use of the private automobile in the Nairobi metropolitan region is stratified by income. Private vehicles are almost exclusively reserved for the middle- and upper-income groups because of the high cost of purchase and maintenance (Rakodi 1997).

The private automobile is a highly desirable mode among the metropolitan population, as it is a symbol of status and provides flexibility, convenience, and enhanced mobility. Currently, private automobiles account for 49% of the vehicles but only 14% of the passengers along Thika Road (KIPPRA Report 2006). This statistic indicates that private automobiles are the predominant users of this publicly provided road infrastructure, which does little to benefit those who cannot afford to travel along it in light of the absence of subsidized public transport. Other developing country cities, such as Bogotá, Columbia, have used gas taxes to subsidize mass transit. While there is a gas tax (VAT) in place, the studio team at the present time is unclear as to the amount and allocation of the revenue generated from this tax.

Problems
Non Motorized Transport
There are several critical problems that revolve around NMT. First, the heavy use of this form of transportation is indicative of the poverty within the area. Walking, while free, is slow and allows for a very limited range of mobility. As a result, there are reduced opportunities for economic development and cost the economy considerably in terms of lost production. A comprehensive approach to dealing with the problems of NMT will act to reduce the reliance on this mode with the provision of affordable public transport.

The greatest issue that users of NMT face on the road is safety. Dangerous motorized vehicle driving practices are a problem for all modes, however, pedestrians bear the most significant risks of injury or death. The lack of separation for modes on Nairobi Metropolitan roads is a source of frequent vehicular/pedestrian conflict. In fact, the neglect of designated pedestrian space is responsible for pedestrians representing the greatest number of road casualties on the road and the second greatest cause of accidents (Chitere, 2005). Unpaved roads additionally cause dusty conditions and respiratory problems plague many NMT users.

Matatus
The problems facing the matatu industry highlight several major areas requiring attention from both the operators themselves as well as the local and central government. These areas include environmental concerns, affordability and accessibility, capacity, condition of equipment, nature of the industry, and institutional relationship. The lack of emissions testing and fuel inspections at petrol stations throughout
Kenya has created a metropolitan condition of poor air quality. The matatu operation exemplifies the fundamental roots of this problem. For instance, vehicle inspections do not include emissions testing because of a lack of testing equipment (Kimutai 2006). There is also an alleged mixing of kerosene with diesel at the petrol pumps that not only increases polluting fuel emissions, but also additionally degrades the vehicle’s engine at a more rapid rate. The lack of environmental regulation is clearly an issue that not only has detrimental effects upon the environmental and human health of Nairobi but also upon the economic health of the matatu industry.

Because matatus are the only feasible mode of transport for longer commuting distances, the affordability of service is a central issue. Currently matatu service from Ruiru Town to Nairobi’s center averages around 50 Ksh and thus costs almost twice as much as the much less frequent rail service (Ruiru Matatu Drivers 2006). Additionally, NMT dominates in Ruiru for various reasons, including the affordability aspect surrounding matatu usage.

Other problems plaguing the matatu industry are issues with infrastructural conditions. For instance the bus park in the Ruiru CBD serves as the central terminal for matatu service in the area, but is too small and currently operating at capacity or beyond. The bus park is also unpaved and dusty, contributing to poor air quality which impacts the health of the matatu service operators (Ruiru Matatu Drivers 2006). A viable alternative exists for this function at the intersection of Ruiru Road, Kwa Miko Road and Hospital Road. There is an underutilized vacant lot that is significantly larger than the current park and is easily accessed from Ruiru Road and Thika Road.

The vehicles themselves are also problematic for owners and operators in that they have short life spans because of long working hours, rough handling of vehicles, poor fuel quality and poor condition of the roads. Therefore, the cost of operation is very high in that owners must change the tires three times a year (costing 20,000 Ksh each time), overhaul the engine every year (30,000 Ksh), change the oil once a week because of poor fuel quality and change break pads and filters (3000 Ksh/week). This cost must also be taken against the general short life of the vehicle, stated by the owners association to be just two and half years for urban transport vehicles (Kimutai 2006).

One of the most deep-seated issues facing the matatu industry is the poor relationship it has with its regulating institutions and the Kenyan government as a whole. The industry is seen as being disorganized and hopelessly corrupt, while owners feel hampered by increasing regulatory burdens placed upon them. For instance, the disregard of public safety through overcrowding of matatu vehicles was countered by government regulation of seatbelt use. Owners have viewed these sorts of regulation as unnecessarily punitive, such as the relegation of matatu operation to Nairobi’s periphery through banned access to the CBD. However the lack of some forms of regulation such as safety and environmental are seen as detrimental to the industry by the owners themselves. For instance, vehicle accidents are common because of the lack of speed limits and poor driver training. There is also a current regulatory shift toward higher occupancy vehicles, primarily from the predominant 14 seaters to larger 25 seat mini-buses. This is facing great opposition from the Matatu Owners Association and further deepening tensions between the matatu industry and the government (Kimutai 2006).

**Rail**

Passenger rail is currently not a viable mode of transportation since rail infrastructure is primarily used to transport goods for industrial and agricultural purposes. The duration of a one-way trip from Ruiru to Nairobi is approximately 1.5 hours. The extended travel time is attributed to the fact that the railway was completed before the construction of bridges to cross over the river. As a result, the route to Nairobi follows a curvilinear pattern, which significantly contributes to the overall travel time.

The railway line from the central business district in Nairobi to Ruiru has a single track. This limits the capacity to operate more frequent service. Within Ruiru there are two lanes of track. This could be a potential hub in which trains could stage before operating additional service. The railway company owns a good portion of the rail bed, and thus could be a potential opportunity to expand the number of rail tracks. Expansion holds financial constraints and increasing service would be premature without first assessing the overall demand.
The railway line and 183 diesel locomotives are old and in need of repair. Currently engines and coaches are imported from the United States and Canada. Therefore, the cost of new engines and new coaches is significant and perhaps should constitute a current priority for transportation investment. In the United States for example, the cost of construction for a new rail line is $250 million/mile. Thus, a commuter rail line with new track alignment would involve large capital investments. While it is anticipated that the ridership will support an improved commuter rail service, the question of feasibility for implementation is one of political will.

Private Automobiles
Private automobiles contribute to increased congestion on the roadway as the overall capacity of private automobiles is much less than matatu service. Standards for vehicle emissions are not enforced. As a result the increased use of private automobiles contributes to poor air quality, jeopardizing the environmental health of the residents. The lack of enforcement for vehicle standards and poor road conditions contribute to poor health and environmental externalities, as private vehicles traverse the Ruiru municipality. Because cars are the most flexible mode, the lack of lane delineations and the poor quality of roads facilitate poor driving behavior. Limited legal enforcement further exacerbates this problem.

Traffic has been an issue of concern in Nairobi almost immediately following the emergence of the private automobile and has only increased with an increase of automobiles on the roadway. The accident rate is high in both Nairobi and Kenya. According to the 2006 KIPPRA Report, the number of injuries per vehicle crash is 1.37 in Nairobi and 1.68 in Kenya. While the private automobile does provide tremendous individual benefits the tradeoff results in environmental and social externalities imposed on all members of society. The limited capacity of the automobile inhibits widespread benefits as access to the private automobile is a function of income. As a result, the automobile is not a viable option for all residents.

Assets
Non-Motorized Transport
Within Ruiru Municipality no mode is more important than NMT. All residents rely heavily on the ability to walk and bicycles are becoming increasingly popular due to issues of affordability associated with other transportation alternatives. Private boda-boda pedicabs were recently introduced to the area and are increasing in popularity. Increased bicycle ownership and usage has also been evidenced by a growing number of bicycle maintenance services throughout Ruiru. For instance, one repair stand on Ruiru Road services up to twenty bicycles every day. Both informal NMT services and bicycle repair present economic opportunities for residents of Ruiru.

Matatus
Despite the problems described above, the matatu industry possesses clear advantages over other modes of transportation that encourage its incorporation into a broader transportation framework. Matatus currently fill the mass transit gap in the Nairobi metropolitan area through frequent, high capacity service. The industry also services a multitude of routes, including direct routes between Ruiru and Nairobi, which allows Ruiru to act as a dormitory town to Nairobi.

The service itself provides various benefits over other modes of transport in Ruiru and Nairobi. Because of the frequency of service, there are short wait times of approximately five minutes for service. The trip length between Ruiru and Nairobi is also shorter than other mass transit modes: thirty minutes non-peak and one hour peak as compared to 1.5 hours on rail. The bus stops in Ruiru are also located in central areas, such as the CBD of Ruiru town and the Githurai roundabout facilitating mass usage.

The industry itself also provides several assets and opportunities that facilitate its incorporation into a more organized transportation strategy. The organizational structure and cooperation amongst owners, as evidenced in the Matatu Owners Association and amongst drivers through the Matatu Welfare Association, illustrate the potential for wider scale organization and cooperation. The regulatory structure in which matatus must operate on fixed routes also allows for more organized transit systems to be implemented, such as a possible Bus Rapid Transit (BRT) system using matatus.
Matatus are likely to remain a dominant mode of mass transit in the wider Nairobi transportation network. Although the National Matatu Owners Association reports static growth, the lack of transportation alternatives and the rapid Nairobi metro area urbanization are strong factors with which matatu service is likely to grow. Additionally, the National Matatu Owners Association is a young body of only two years, signaling greater cooperation amongst Matatu owners and operators. The growth of the industry and its increased amenability to change and cooperation provide the necessary context for matatu inclusion in a transportation strategy for Ruiru and Nairobi.

Rail
Currently, the rail is operating at full capacity. This illustrates a demand for increased service in the form of a safer, cleaner, low cost mode of transport that could efficiently serve the Nairobi Metropolitan region. Rail service holds the possibility to serve a greater portion of travelers with a destination to Nairobi. Increased capacity would move a larger number of passengers thereby reducing the number of trips, improving air quality and alleviating congestion on the street network. Furthermore, improvement to this service would provide another affordable transportation option, thereby enhancing equity among the population.

Private Automobiles
Private automobiles are the superior mode of travel in respect to convenience, flexibility and enhanced mobility. Private automobiles fulfill short-term and long-term transportation needs. The cost of investment to improve transportation service for automobile use is relatively low compared to other modes. As mentioned, the quality of the road supply is poor and inadequate. However, investment required to repave or provide lane delineation is relatively low compared to financing new track alignments for commuter rail, and these investments would greatly improve service for automotives.

2.4 Public Health

Public health in Kenya: Trends and Disease

Burden
Any consideration of health trends in Kenya must begin by acknowledging the devastating impact of the HIV/AIDS epidemic. The overall public health situation in Kenya can be divided in two phases, the “phase of improvement” and the “phase of degeneration.” The “phase of improvement” took place from 1960 until 1992 and was a time during which the Kenyan government aimed to provide free health care for all citizens especially infants, children and mothers (WHO CCS). During this time, life expectancy at birth improved from 44 years in 1962 to 60 years in 1993, the fertility rate declined (from 8.1 in 1975/77 to 4.7 in 1994/98), and the infant mortality rate decreased by nearly 50% from 120 per 1,000 live births in 1963 to 64 per 1,000 live births in 1993 (WHO CCS).

During the “phase of degeneration”, the positive health trends from the previous decades began to reverse. From 1993 until 2000, life expectancy declined from 60 years in 1993 to 47 years in 2000, both the infant mortality (IMR) and the under five mortality rates (U5MR) increased, the maternal mortality rate rose to 590 per 100,000 in 1998, and the population level began to increase, with the larger portion of the population being young (44% between the ages of 0-15 years) and dependent (CCS 2002). Hill (2004) argues that although economic factors such as the stagnation of per-capita income in the mid-1980’s and the uncontained education levels after decades of growth in Kenya are plausible factors for the sharp increase in child mortality, the most cited cause responsible for reversing 30 years of child mortality reduction is the emergence of HIV/AIDS epidemic in the late 1980’s and early 1990’s.

It is estimated that by the year 2000, over 2.2 million people in Kenya had been infected with HIV, and that since the start of the epidemic in 1984, 1.5 million deaths have occurred, resulting in approximately one million orphans (CCS 2002). Recent data indicates a significant decline in national sero-prevalence from 14% in 2000 to 7% in 2003, however peak prevalence rates of 13% are still found in women between 25
Although the 2003 Kenya Demographic and Health Survey found lower than expected HIV prevalence and fertility rates, it simultaneously reported continued increases in infant and under-five mortality rates when compared to 1998 (KDHS, 2003). Citing the WHO Country Cooperation Strategy for Kenya and given that the UN millennium development goals (MDGs) mandate a reduction in maternal mortality by two-thirds and under-five mortality by two-thirds between 1990 and 2015, “it is imperative that Kenya address the unacceptably high maternal and infant mortality rates which currently stand a 590–650 per 100,000 live births and 74 per 1,000 live births, respectively” (CCS, 2002). In order to address this challenge, the government of Kenya developed a Reproductive Health Policy in 1996 and adopted the International Management of Childhood Illness (IMCI) strategy of 1998 (CCS 2002). Despite these changes however, in 2000 Kenya’s health system performance was ranked number 140 out of 191 countries, clearly indicating that the current health system does not adequately address the needs of the population, and that there is a need for strengthening health systems (CCS 2002).

The disease burden in Kenya disproportionately affects (pregnant) women, infants and children, especially those under five years of age, due to their increased susceptibility to environmental factors. Maternal mortality is the leading cause of death among women of reproductive age, and results from hemorrhage, sepsis, eclampsia, obstructed labor, unsafe abortion and anemia. HIV/AIDS is also a main contributor (WHO 2004). Most maternal mortality can be prevented with adequate ante-natal care and referral services (APHRC 2002).

The major causes of child mortality in Kenya, as in most countries in sub-Saharan Africa, include malaria, acute respiratory infections (ARI), diarrhoeal disease and vaccine-preventable diseases such as measles, polio, tuberculosis and neonatal tetanus (UNICEF 1992; NCSS 2000). Although child immunization levels have dropped from 78% in 1993 to 52% in 2003, slight decreases in fever and diarrhoeal disease have been recorded (KDHS).

While respiratory illnesses are the leading cause of infant mortality, malaria, ARI, and diarrhoeal disease are projected to have comprised more than 60% of the overall disease burden (outpatient morbidity) in Kenya in 1999 (WHO CCS, WHO 2004a). In Kenya alone malaria accounts for 33% of all-cause morbidity in outpatient clinic visits and 13.4% of total mortality in Kenya (WHO 2004b). In addition, the loss in productivity due to malaria is an estimated 170 million working days lost annually (AMR 2003). Acute respiratory infections are the second leading cause of morbidity and account for up to 25% of outpatient attendance in health facilities while diarrhoeal diseases are the third leading cause of morbidity as well as mortality, especially among children (CCS 2002).

A critical underlying factor that increases children’s vulnerability to diseases like malaria, pneumonia and diarrhea is the high rate of chronic malnutrition (height for age) found in Kenya’s children, especially those under-five years of age (UNICE 2005). Diarrhoeal disease is especially influenced by malnutrition in children, and during times of drought-induced malnutrition, national diarrhoeal disease rates have ranged from 20-60% (WHO 2004b). With an alarming malnutrition rate of 33%, one in every three children is stunted due to poor nutrition (WHO 2004b). This number is expected to increase due to the drastic effects of the current drought (UNICEF 2005).

**Environmental Health**

Many of the diseases that comprise a large portion of Kenya’s health burden and pose a major threat to children’s health, are largely preventable. Therefore, in order to alleviate the burden from malaria, acute respiratory infection and diarrhoeal disease, it is critical to understand the main causes and drivers fueling this disease burden. The lack of basic services such as poor environmental sanitation, inadequate water for hygiene and consumption and lack of solid waste disposal are the main underlying causes giving rise to the increasing disease prevalence (WHO 2004b). To illustrate this, the World Health Organization states that 88% of diarrhoeal disease is attributable to unsafe water supply and inadequate sanitation and hygiene (WHO 2004c). In the words of Dr. Lee Jong-wook, Director General of WHO, “once we can secure access to clean water and to adequate sanitation facilities for all people, irrespective of the difference in their
living conditions, a huge battle against all kinds of diseases will be won” (WHO 2004c).

In addition to the lack of sanitation and water, the burden from malaria, respiratory distress and diarrhoeal disease is further exacerbated by the high rates of urbanization, population growth and uncontrolled development that have become characteristic of Kenya. (WHO 2004b). The rapid and largely unplanned growth of Nairobi has fueled a range of environmental health challenges, including deteriorating air and water quality, and inadequate sanitation and solid waste disposal. In Nairobi, an increase in vehicular traffic is adding to already high levels of outdoor air pollution which is correlated with respiratory distress, while the lack of sanitation and solid waste provision is leading to contaminated ground and surface water from indiscriminate dumping of human and solid waste, as well as air pollution from the combustion of solid wastes in the open air. Clearly, the drivers of the main three diseases are aggravated by anthropological (human) actions, behaviors and the changes humans impose on the environment and ecology of the land. Therefore the path to controlling disease transmission must include not only policy changes aimed at curbing air pollution from growing vehicular emissions, and providing basic sanitation and water services on a local level, but must also promulgate public-private collaboration and partnerships with community groups in order to improve personal behavior dictating hygiene practices. Such an integrated approach should begin to alleviate the immense health burden and associated mortality from these diseases, especially young children and women.

Public Health in Ruiru: Health Care

Provision
There is a dire need for increased public health care services in Ruiru. Although there are technically two public health clinics in Ruiru, due to the fact that one of them is located in Prison College and thus off limits to the residents of Ruiru, leaves one public health clinic to serve all of Ruiru. Thus, the second clinic, the Hindu Public Health Clinic, serves an area of 200,000 people, with the limited resources of one building and scarce staffing of only three nurses, two public health officers and no doctors. Three levels of medical providers exist in Kenya: a nurse can conduct diagnoses and preventive care, a clinical officer who has completed a 3.5-year training certification program can conduct limited surgery and provide curative care, and a medical officer (“doctor”), who has attended university for at least five years (personal communication 2006). On the morning of February 6, 2006, the day the health team visited the clinic, an informal survey counted 35 women, 17 men and 18 infants waiting on line to be helped. The public health clinic serves people in Ruiru from Githurai to Juja, and people come by on their way to work and/or in transit from Nairobi to Thika (personal communication 2006). An account from one of the warden chiefs reported that people had died trying to get to this public health clinic to treat their ailment. The clinic sits on six (6) acres of land and contains one inpatient room for maternal care and two outpatient offices. The clinic obtains water through a contract between the District Public Health Office in Thika and the Ministry of Water. A handful of housing quarters sit on the clinic’s site but most of the employees live nearby and walk to work. In addition to two septic tanks and a few pit latrines, there is an onsite incinerator for the clinic’s waste including medical waste such as needles. These bio-hazardous materials are placed in a cardboard box meant to be protective and burned as a unit.

The public health officers visit households in the area and educate the community about personal hygiene, HIV-AIDS, and any other health-related issues that may arise. The biggest challenges that face these public health officials are understaffing and lack of transportation to get around to the households assigned to them (there is one scooter). The main problems facing the nurses also include understaffing in addition to a lack of regular drug supply for the patients, which arrive every 5-8 days. If patients need surgery, they are sent to the public hospitals in Thika or Nairobi, depending on the severity of the case (i.e. the amount of time they are able to travel).

In addition to this public health clinic, there are approximately three private hospitals and at least a dozen private health clinics in Ruiru. There is, however, a significant difference in the cost of health care between the private and public health care facilities. While a patient pays a fee of 20 Kenyan shillings to be seen in the public health clinic, an adult would have to pay 500-600 Ksh to receive care in a private clinic, which is typically staffed by a medical officer. A pediatric visit to a public clinic is approximately 300 Khs.
Public Health in Ruiru: Disease Proliferation

Through interviews with healthcare professionals at the public health center in Ruiru, the health team was able to obtain aggregate case numbers of illnesses diagnosed in 2005. The chart (Figure T) illustrates the top ten causes of morbidity (i.e., diagnoses made for outpatient visits) for ten months in 2005, with the exception of the months of August and September, for which data were not available. The single most diagnosed health problem in Ruiru in 2005, representing 29% of the outpatient visits, is related to distress of the respiratory system. This number is slightly higher than Kenya’s average of 25% and is significant because respiratory illness and infection are conditions that have been associated with poor outdoor and indoor air quality. The second most commonly diagnosed illness 26% in Ruiru is malaria, followed distantly by diarrhoeal disease that is prevalent in 8% of the patients in 2005. The high incidence of malaria (a water-borne vector) followed by diarrhoeal disease, intestinal worm, and skin and eye infections (water-related diseases) underscores the need for increased hygiene measures as well as adequate water and sanitation provisions. Due to the stigma attached to diagnosing HIV/AIDS, the health team was unable to obtain a rate of prevalence in Ruiru. However, it is not uncommon in African countries to diagnose HIV/AIDS as tuberculosis (TB) and/or pneumonia, two conditions often exacerbated by immunodeficiency from HIV/AIDS. Due to the fact that these conditions have been related directly to HIV/AIDS, one would not suspect that the respiratory distress category is significantly overwhelmed by cases of HIV/AIDS. The respiratory distress category can include both upper and lower respiratory infections and may include asthma, emphysema, and bronchitis. The figure below indicates the Top Ten Outpatient Causes of Morbidity, Ruiru Public Health Center, January through July and October through December, 2005.

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>% of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distress of Respiratory System</td>
<td>29%</td>
</tr>
<tr>
<td>Malaria</td>
<td>26%</td>
</tr>
<tr>
<td>Diarrhoeal disease</td>
<td>8%</td>
</tr>
<tr>
<td>Intestinal Worms</td>
<td>7%</td>
</tr>
<tr>
<td>Skin Disease</td>
<td>5%</td>
</tr>
<tr>
<td>Eye Infection</td>
<td>4%</td>
</tr>
<tr>
<td>Pyrexia of Unknown Origin</td>
<td>3%</td>
</tr>
<tr>
<td>Rheumatism/Joint Pain</td>
<td>2%</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>2%</td>
</tr>
<tr>
<td>Urinary Tract Infection (UTI)</td>
<td>2%</td>
</tr>
</tbody>
</table>

Outdoor Air Quality in Ruiru

Although several air monitoring studies in Nairobi have been conducted over the last thirty years by UNEP and independent researchers at the University of Nairobi, there exist large gaps of data due to inconsistent measurements and units of measurement (i.e., type of pollutant measured), thereby making it extremely difficult to determine how the levels of air pollution in Nairobi and surroundings have changed with the expansion of the city. The handful of relevant air pollution-related health studies that have been conducted in Kenya and Nairobi show that air pollution is increasing, especially in industrial areas and commercial city center in Nairobi. This degradation of air quality will adversely affect an already sensitive health situation in Nairobi and environs (Mulaku 2001). In addition, interest in air quality has ebbed and flowed depending on the political climate. The current environment, however, is described by UNEP and researchers at University of Nairobi as one of ‘peak’ interest in air quality issues in the Nairobi metropolitan area. UNEP is increasingly collaborating with academic institutions in Nairobi as they recognize their researchers as the “stable” factors who can most consistently obtain air quality data necessary to influence policy actions.
There is currently little existing formal legislation or policy with which air quality issues are managed either in Kenya or in Nairobi. Although the National Environment Management Authority (NEMA) was established in 1999 to implement environmental pollution policies, to our knowledge, these policies have yet to be developed. National air quality management is necessary to assess human health impact, especially in rapidly urbanizing areas (UNEP 1996).

Nairobi Studio Air Quality Pilot Study

With the objective of conducting a small pilot air quality study in and around Nairobi and Ruiru, the health team in the studio brought air samplers and eight filters specifically to measure fine particulate matter (less than 2.5 micrograms per cubic meter) and black carbon. Both PM2.5 and black carbon are measurable pollutants emitted from combustion processes that use fossil fuels (vehicle, especially diesel, and industrial emissions) or biomass and are associated with respiratory illness as well as cardiovascular disease and mortality (Pope et al. 1999, Hendriks et al. 2004). PM2.5 has been directly correlated with acute lower respiratory infections (ALRI), a major cause of morbidity and mortality in children under the age of five, as well as chronic obstructive pulmonary disease (COPD) in adults (Pope et al., 1999). PM2.5 is of particular health concern due to the ability of the very fine size particle to lodge deeper inside the human lungs and respiratory tract.

Methodology

As part of the small pilot air quality sampling study conducted in Nairobi, the health team was equipped with two BGI air pumps, battery-packs, power supplies, backpacks, one rotameter to calibrate the pumps, eight filter cassettes and two metal cyclones to remove larger particles from the air stream prior to collection on the filters. From February 4-11, 2006, four (4) of the filter cassettes were used to monitor the air quality in Nairobi’s YMCA garden for an 8-hour continuous sample as a baseline against which the other air samples would be compared. Two filters were used for “personal air samples” which were obtained by students walking around Ruiru while carrying an air sampler in a backpack over a 2-3 hour period. The two remaining filters were used to measure the “roadway” air levels and were taken from a bus while traveling on Thika Road, the main artery between Nairobi and Ruiru, during morning and evening rush hour respectively. The eight filters were stored and in March 2006, the filters were analyzed for mass (PM2.5) and light absorbency (black carbon) by the health team at the Lamont-Doherty Earth Observatory of Columbia University.

Air Quality Pilot Study Results

Overall, the study analysis found that PM2.5 and black carbon levels on the Thika Road far exceeded the personal sample levels in Ruiru as well as the baseline measurements from the YMCA. Although one would generally expect fossil fuel related pollution to be higher on the roadway compared the baseline level, the actual levels of particulate matter and black carbon on the roadways far exceeded those anticipated by the air quality advisors and laboratory technicians.

The figures in Appendix 3 graphically display the study results for the levels of PM2.5 and black carbon respectively and compare the urban baseline samples with the personal and roadway samples. Each data point represents one air filter, with the level of pollution on the y-axis and the date of the filter collection on the x-axis. Figure 2 in Appendix 3 depicts that while the PM2.5 urban baseline samples from the YMCA ranged between 14 and 27 μg/m3, the personal air samples measured between found in Ruiru were between 55.8 and 171.8 μg/m3. Although these levels are higher than average levels in New York City, the most significant levels of PM2.5 were found on the roadway (396 and 431 μg/m3). These levels are approximately 550% higher than the World Health Organization’s (WHO) 24-hr ‘safety’ standard of 65 μg/m3 as well as almost seven times higher than those found in Mexico City (36-60 μg/m3), once proclaimed the most polluted city in the world (Alvaro et al. 2003). For further comparison, average PM2.5 levels in New York City range from 15-20 μg/m3 (Kinney et al. 2002). In the United States, any PM2.5 levels above100ug/m3 are deemed very unhealthy, thus of the eight filters collected in metropolitan Nairobi, three (including both roadway) samples far exceed that level (Loh et al. 2002).

In addition to PM2.5, the filters were also analyzed for light absorbency related as an absorbency coefficient, which is a proxy for black carbon. (See Figure 1 in Appendix 3) Black carbon, emitted largely from combustion processes, scatters and absorbs incoming solar radiation, and contributes to poor air
quality and induces respiratory and cardiovascular problems (Highwood 2006). Since black carbon stems primarily from combustion, including fossil fuel and biomass burning, sources tend to be geographically restricted to the surface in regions of highly populated areas. The absorbency coefficient in Nairobi ranged from 3.5 at the YMCA to 66 on Thika Road. Once again, even the low range is significantly higher than the levels recorded by a similar study in New York City, which found an absorbency coefficient of 1.79 in the summer and 1.94 in the winter (Kinney et al. 2002).

**Implications of Air Quality Study**

These data confirm that there are extremely high levels of air pollution, specifically levels of PM2.5 and black carbon, in most of metropolitan Nairobi, especially on and near the roadways. The findings clearly indicate that transportation is the main contributing factor to poor air quality and points to exacerbation of related health problems thereby underscoring the need for a transportation plan that mitigates air pollution by promoting increased use of non-motorized transport and use of alternative fuels (see Transportation Recommendations).

The initial study findings are of further importance not only because of the correlation between adverse respiratory health effects and the measured pollutants, but also because of the continuity and duration at which the local population is exposed to high concentrations of roadway pollution. In addition to the motorists traveling on the roadways exposed to traffic emissions, pedestrians and informal business employees are exposed more directly and at higher concentrations of PM2.5 and black carbon pollution, due to the lack of efficient public transportation modes and high density of informal business along the roadways.

Although this sample pilot air quality study was very small in scope and findings cannot be considered statistically significant, the results indicate the critical need for consistent and larger-scale air quality research, concomitant with epidemiological research in order to quantify the adverse health effect of poor air quality in metropolitan Nairobi.

**Transportation: Fuel Use, Emissions and Opportunities**

As mentioned in the transportation section of this report, there has been a significant increase over the past decade in motor vehicles in Nairobi, with the largest increase in passenger vehicles typically transporting a single person. Most of the cars in Nairobi are used and imported, thus the age and state of disrepair of many of the vehicles results in increased emissions per vehicle (UNEP 1996). It seems that although matatus are perceived as the growing source of emissions, it is truly the passenger cars that on aggregate and per unit, emit the largest amount of total suspended particles (TSP).

In terms of fuel use, although the phasing out of leaded gas and switchover to unleaded gas was decreed in early January 2006, there are still stockpiles of leaded gas that are being sold at the gas stations (UNEP 2005b). In addition, Nairobi’s refinery was built for leaded gas and does not currently have the refining capacity or budget to process unleaded gas. Based on an account from a member of the Matatu Association, in order to save costs, the gas stations mix kerosene and diesel, which as he stated not only shortens the life of the engine of the matatu, but also emits a more toxic mixture into the air. There exists opportunity to conduct further research into advising the municipality on using cleaner fuels such as biofuels, as well as fuels that use lower levels of sulphur so that catalytic converters can be mandated.

There are currently “no formal emissions limits for stationary or mobile sources” (UNEP 1996). Although vehicles can be declared unfit to drive and their drivers fined on the basis of their emissions, there are no standards and it is unclear how “excessive” emissions are defined (UNEP 1996).

**Solid Waste, Industrial Emissions and Waste**

Poor solid waste collection and disposal are significant problems in Ruiru, particularly in the more densely populated urban areas and market places. Within the Municipal Council, the Building & Works Department, Public Health & Environment Section is responsible for solid waste management. The Municipal Council operates one truck and one tractor and has a staff of approximately 30 people. It also works with private operators that collect garbage at the household level in certain wards. However, the
combined collection ratio is only about 35% (SIPA Final Report 2006). In Nairobi, only approximately 25% of the estimated 1,500 tons of solid waste generated is collected, although until the mid-1970s the Nairobi City Council removed a significant 90% of municipal solid waste (Ikiara et al. 2005). Typically, the solid waste removal is disproportionate and negatively affects the lower-income neighborhoods where less solid waste is removed when compared to higher income settlements. For example, while the Nairobi City Council and private refuse companies collect about 75% of the waste from high-income homes, formal collection services for waste produced in slums and unplanned settlements where 60% of Nairobi’s resident live, are virtually non-existent (UNEP Press 2005a). In order to account for the rapid population growth in Ruiru, without a capacity increase, service levels are expected to deteriorate (e.g. decrease to 25% by 2010) (SIPA Final Report 2006).

In addition to the inadequate removal of solid waste, existing disposal (dumping) practices are unsatisfactory and represent a public health hazard. Ruiru currently has one existing dumping site, which is in plain view on a flat, open piece of land, is located within a residential area and operating at capacity (SIPA Final Report 2006). Due to the lack of a depression in the ground at the dumpsite, water can become stagnant and mix with solid waste to seep into the soil and infiltrate rapidly in to the groundwater, resulting in negative environmental and health implications. Assuming the type of solid waste generated in Nairobi is similar to Ruiru, the largest three categories of solid waste generated are food waste (51%), paper (16%) and plastic containers and bags which constitute 12% of the waste stream (Ikiara et al. 2005). If not removed, the rotting food wastes not only attract pests but the familiar sight of littered plastic bags on the streets in metropolitan Nairobi can fill with rainwater and act as a breeding ground and reservoir for mosquitoes, increasing the transmission of malaria (UNEP Press 2005a).

Due to the lack of adequate solid waste removal and the fact that currently formal recycling practices do not exist in Ruiru, many of the residents and industries in Ruiru are forced to rely on alternative disposal methods. This includes indiscriminate dumping in illegal sites and industrial and household burning of solid wastes. Waste is often burned in close proximity to residential households, thereby exposing individuals to the harmful combination of toxic pollutants inherent in the smoke from solid waste combustion. Plastic bags especially can emit high levels of toxic fine particles. A report developed by KIPPRA, states that at least two million plastic bags are produced and used each year in Nairobi alone (UNEP Press 2005a). However, in February 2005, KIPPRA proposed a ban on plastic bags less than 30 microns thick and a levy on thicker bags aimed to reduce the use of polythene bags and provide funds for effective recycling programs, as well as alternative, more environmentally friendly bags, such as cotton or sisal (Ikiara et al. 2005). This type of proposal could become a “blue-print for similar schemes aimed at the rising tide of other wastes confronting Kenya and countries across Africa and the developing world” (UNEP Press 2005a).

Industrial emissions and pollution closely mirror household emissions and are most notably in the form of solid waste that is burned near households, as well as human waste that is typically dumped in nearby streams, rivers or on open fields. Agribusinesses such as coffee and flower industries pollute the rivers and water supply due to runoff of agricultural residue while methane and animal waste are byproducts from area cattle farms.

Although there are currently no formal emissions limits for stationary sources in Kenya, Section 17 of the Factories (Amendment) Act 1990 requires that no “dusts, fumes, gases or impurities shall be allowed to enter the atmosphere without undergoing appropriate treatment” (UNEP 1996). Although there is no systematic procedure for investigating emissions and companies are not enforced to keep records, if regulations within the Factories Act are breached, legislation allows for temporary closure of the facility until they have rectified the problem. Again, there is no clear language about when a breach is deemed to have occurred (UNEP 1996). Thus, opportunity exists to enforce these existing rules, to attempt to attract the least polluting industries to Ruiru, as well as carefully design the placement of certain industries away from households and residents.
Indoor Air Quality: Ruiru in a global context

Air pollution from biomass fuel is one of the most serious environmental health problems in rural areas of developing countries. Nearly half of the world’s total population, or 3 billion people, rely on solid fuels (biomass and coal) for their cooking and heating needs (Ezzati 2001). The emitted particulate matter, carbon monoxide, formaldehyde and other harmful pollutants from the incomplete combustion of biomass fuel, contribute significantly to respiratory morbidity and mortality, specifically ALRI in children and COPD in adults. WHO estimates that solid fuel use results in 1.6 million excess deaths annually, and attributes 24 percent of the yearly deaths in Africa to solid fuel use (World Health Organization 2002). In terms of respiratory morbidity, more than half of the 2.1 million deaths of children under age five from acute lower respiratory infections (ALRI) are induced by indoor air pollution and lack of adequate heating, while 40-45% of the disease burden in developing countries is caused by COPD (Warwick et al. 2004, WHO World Health Report 2002).

Since very few homes can afford electricity for cooking and heating, a typical open fire cook stove in Ruiru is fueled by charcoal or biomass (wood, dung, and agricultural waste). In most cases, cooking areas are poorly ventilated and lack chimneys to direct the particulate matter outside of the dwelling. Unlike a more complete combustion process inside furnaces or boilers, biomass fuels and coal are difficult to burn completely in simple household stoves, which operate at an efficiency rate of only 10-15%. The resulting emissions consist of highly concentrated health-damaging pollutants (Reddy et al. 1996, Shirnding/WHO 2002). Due to increased time spent in enclosed cooking areas (~ 3-7 hours/day), women and children in developing countries are the most exposed to high levels of pollution from biomass and are therefore at increased risk for developing disease outcomes such as acute lower respiratory infections (ALRI) and chronic obstructive pulmonary disease (COPD) respectively (Warwick 2004).

Sanitation Conditions in Ruiru

Many local authority governments throughout Kenya have been unable to undertake the construction of a central sewer system for their municipality, leaving residents to pursue their own individual solutions for sanitary services. This is the case in Ruiru, which currently does not have a central water and sewerage system. Although the construction of a central sewerage system is planned for the Ruiru Municipality, its undertaking is contingent upon significant collaboration among numerous political interests not to mention on unsecured donor support. As it is possible that Ruiru may not benefit from centrally provided sanitary services within the next few years, it is important to explore alternate options.

Demand for Sanitation Services

Kenyans largely understand the benefits of gaining access to improved sanitation, and the majority of residents demand and pay for/invest in services in some form. Nonetheless, there are large gaps in sanitation supply even where strong demand for services exists. The Water and Sanitation Program (WSP) of Kenya found that income levels in general do not affect latrine ownership, where even members of the ‘absolute poor’ own some type of facility (WSP 2004). Mere ownership of this type of facility, however, does not ensure that it is either effective in reducing public health risks of untreated waste to its owners and to other community residents, or that the facility will have an adequate lifespan to ensure its long-term use. The WSP has identified several factors that serve as fundamental constraints to increasing access to quality sanitation service where sanitary services are not centrally provided. The two main constraints to improving access to quality sanitation services that this planning document will directly address later in the section containing recommendations for this sector include: (1) a limited financial ability to raise sufficient funds for construction; and (2) a lack of knowledge on how to construct and maintain pit latrines, together resulting in poor-quality construction, basic design faults, unsafe pits and poor maintenance (WSP 2004).
2.5 Governance

History and Basic Governing

Structure
As previously mentioned, Kenya received its independence from Britain on December 12, 1963, when British East Africa officially became the Republic of Kenya. Nairobi continued to serve as the new republic’s capital and location of the central government. The Kenyan Constitution was introduced on its day of independence and was including freedom of expression and assembly, privacy of the home, the right not to be detained without cause and the right of compensation for the compulsory purchase of property (www.kenya.rc Bowen.com). The system of government in Kenya is comprised of executive, legislative (Parliamentary) and judiciary branches. The president, vice president and cabinet hold executive power. The President acts as both head of government and chief of state. He is elected by popular vote to a five-year term and must win 25% or more of the vote in five of Kenya’s seven provinces and the one area division, which is Nairobi. The legislative body is made up of 210 members, the attorney general, the speaker, and 12 members who are nominated by the major parties in parliament and appointed by the president. The judiciary branch is headed by the Chief Justice who is also appointed by the president (The World FactBook 2006).

Kenya was a de-facto one-party state between 1969 and June 1982 but became a multi-party state in November 1991. The major parties are NARC, KANU and the Forum for the Restoration of Democracy (FORD). The KANU party was the ruling party in Kenya since independence, however, in 2002 President Daniel Arap Moi was defeated by NARC candidate Mwai Kibaki. The next presidential election is slated for December 2007 (The World Fact Book 2006).

It is important to note that corruption has been an on-going problem within Kenyan government and Kenyan politics since its independence. Despite the new government’s anti corruption platform upon which Kibaki was elected and the numerous anti corruption laws and regulations currently in place, corruption still plays a role in everyday government and politics, costing Kenya roughly $1 billion USD per year (http://news.bbc.co.uk/1/hi/business/2949586.stm).

Structure of Planning in Kenya
Kenya’s government is centrally based with the responsibilities of running the country dispersed among 23 ministries. In terms of urban planning, the key ministries involved are the Ministry of Lands, Ministry of Housing, and Ministry of Local Government. The Department of Planning operates within the Ministry of Lands. Currently, the central government is moving towards a more decentralized approach to planning in an attempt to allocate more control to the smaller municipalities, which in theory should be better equipped to accurately identify and assess the needs of its residents.

There are two main legislative documents that guide urban planning in Kenya. The first is The Physical Planning Act (CAP 286) (PPA), which provides an institutional and legal framework for the preparation and implementation of physical development plans. The PPA defines development as “any material change in the use of...any land” (Mumma 2004). It considers planning on national, regional and local levels and provides the appropriate guidelines for each context. On a national level, The PPA formally creates the office of the Director of Physical Planning, which, as mentioned before, operates within the Ministry of Lands. The Office and Director of Physical Planning have many responsibilities, including the following:

- Formulating national, regional, and local development policies, guidelines and strategies as well as coordinating plans for such development;
- Advising the Commissioner of Lands and local authorities on appropriate use of land;
- Requiring local authorities to ensure the proper execution of physical development control and preservation orders.

On the regional level, the PPA also provides for the preparation of a regional physical development plan for
the purpose of "...providing for the proper physical development of such land, and securing suitable provision for transportation, public purposes, utilities and services, commercial, industrial, residential and recreational areas ..." (Mumma 2005). On a local level, the PPA provides guidelines for the proper preparation of physical development, which mainly focuses on the development of infrastructure and services within the local area. Under the PPA, the local authority is responsible for enforcing the proper implementation of any approved plans as well as granting permission to develop an area. It is also worth noting that it is against the law to commence a development plan without permission from the local authorities (Mumma 2005).

The other major planning act is the Local Government Act (CAP 265). This act begins to delegate responsibilities to the local authorities from the National Department of Planning. The Local Government Act enables local authorities to establish subdivision and land acquisition plans and gives them the power to make by-laws and to further develop the management policies of the local authority (Njihia, 2005). The Act also allocates more control to the local authorities concerning the type of land that is being developed and concerning the type of physical structure that is being built. Local authorities also have more control over the subdivision of land and of the subdivision of existing larger lots into smaller lots. Another important stipulation of the Local Government Act is that it makes the local authorities the primary service providers for services and amenities, such as water, sewerage, and trash collection. In brief, the Local Government Act is attempting to channel responsibilities from the central government and allocate them to the local authorities, allowing local authorities to better mold and guide the development plans that will best suit the immediate locality.

**Governance on a Regional Level**

Regional planning in Kenya analyzes major issues on a regional and district level, resulting in broad recommendations. The analysis is comprised of four components: population characteristics, potential of the region, employment and incomes and strategies of human settlements. The process begins by assessing the objectives focused on the potential long-term development opportunities of the selected region. After collecting and compiling data, a final report is produced with recommendations of what type of development would be beneficial to the area and what type of development should be avoided (http://www.grida.no/eis-ssa/eisnews 3-00/3-00-14.htm).

Due to the decentralization of power under the new planning acts, regional planning councils have more responsibility and have been operating on a broader level than local councils but not with the power and financial capacity of the central government. Certain constraints, notably the lack of capacity, prohibit regional councils from working as a cohesive unit. Not all regional development committees have the personnel to go through the process of collecting the appropriate data and producing a fully comprehensive report. The question of who answers to whom between the central, regional and local authorities continues to be confusing and problematic. This is a result of the decentralization process' creation of confusion over the level of autonomy concerning the central, regional and local authorities.

**Governance on a Local Level**

There are four types of local authorities that control local planning and overall governance. The types are city, county, municipal and town. Each type of authority is governed by councils comprised of publicly elected officials as well as other officials who are nominated by party officials loyal to the Minister of Local Governments. When a new district is created a new council must also be created. As of now, there are 175 councils in Kenya, the majority of which are county councils (Mwaniki 2005).

The role of the local authorities is to provide for its residents through the delivery of services, as is stipulated in the Local Government Act (CAP 265). The role can be broken down into the following three categories:

- Collection of revenues and mobilization of resources
- Management and allocation of resources
- Delivery of services such as water services and waste management (Mwaniki 2005)
The mayor holds office for two years. Therefore, long-term policy goals usually are second priority to reelection campaigns. The other elected officials sit for a five-year term while nominated officials usually serve a shorter term, depending on their relationship with their party and Minister. This system and its dynamics often create tension and instability within the local council, detracting from the overall production and efficiency of the local council.

The actual level of power and influence the local authorities have over development and other plans is a complicated issue and often depends on the elected officials, nominated officials and the council's relationship with the Minister of Local Government. The Minister does have a significant amount of control over local councils as he ultimately appoints the officials to the councils. Given Kenya's history of corruption and nepotism, it is often the case that those appointed to a council are not the best-suited candidates for the job. This also causes tension between nominated officials, elected officials and the Ministry, lending to decreased productivity within the local council (Mwaniki 2005).

Structure of Ruiru Municipal Council (RMC)
The RMC has a workforce of 130 people. The Town Clerk is the chief executive of the council and is responsible for implementing any decision made by the council. The heads of the three other departments in the RMC, listed below, assist the Town Clerk in his duties.

• Town Clerk's Dept.- headed by the Town Clerk/Chief Exec. Officer
• Town Treasure's Dept.- headed by the Town Treasurer/Chief Finance Officer
• Building and Works Dept.- headed by the Works Officer

All of the planning and development issues, including the four sectors the team has identified as main points of focus come under the jurisdiction of the Works Department. As is standard in most local councils in Kenya, there is no certified planner on staff as the council is unable to afford one. In order to address local planning and development challenges, the council must seek out technical assistance from the Ministry of Housing, which should help local authorities with these requests. Ruiru Municipality is divided into five electoral wards:

• Biashara/Viwandani
• Murera
• Gitothua
• Kahawa Sukari
• Githurai Kimbo

Each ward elects one councilor and those councilors nominate two other councilors. One nominated councilor is from the NARC party and the other is from the KANU party. The council has formed six committees, which deal with the issues facing Ruiru on a daily basis:

• Finance, Staff and General Propose Committee
• Works, Town Planning and Markets Committee
• Public Health, Education, and Social Services Committee
• Environment Committee
• Joint Staff Committee
• HIV/AIDS Committee

The RMC has a budget of $849,016.56 USD, 60% of which is used on salaries. The remaining 40% of the budget is split equally between capital investment and maintenance (Gulyani, 2004). As a point of comparison, the Bulletin of the Institute of Economic Affairs reports that most local authorities in Kenya allocate 48% of their capital expenditures on wages and labor (Mwaniki, 2005). Most of the revenue comes from business permits and licenses. The RMC also relies on financial assistance from the Local Authority Transfer Fund (LATF), a new program whose effectiveness is yet to be determined. LATF takes the taxes
collected by councils for the central government and then gives back to the council a certain amount of money that is dependent size of the population served by the council. Roughly 5% of the council's budget is currently made up of LATF money.

**Current Conditions**
Under the Local Government Act (CAP 265), the RMC is responsible for providing its residents with basic services and amenities, such as water, sewage, housing and education. However, the RMC does not have the financial base, capacity, and human resources to provide all of these services. As of now, the RMC has only been able to collect solid waste from residents and some businesses on a weekly or biweekly basis and has provided some road development and limited public housing (see Appendix 6). Due to the lack of human resources and poor transportation infrastructure, the RMC is not able to reach all the land under its jurisdiction and is thus not aware of all the subdivision of plots taking place within the municipality. As a result, the RMC is collecting roughly only 50% of taxes owed by these land owners. The council is also unable to collect all the business permits and licenses, which are the council's main source of revenue. Community participation and communication between the RMC, residents and local business and industry is extremely limited. There is a lack of trust among businesses and residents in regards to the RMC, and the RMC in turn believes that there is a lack of interest within the community as few community members attend community board meetings.

**Problems**
Implementation and enforcement of planning regulations is the principal problem facing the RMC. It is the duty of the council to inspect business licenses and plots of land, but its lack of capacity leads to the lack of enforcement of the council laws and national laws. Thus, the illegal subdividing of land and informal economic activity continue to increase. The rate of crime is also increasing as the small and poorly trained police force is not a sufficient local law enforcement body. The RMC has also noted that its offices' lack of computers and antiquated technology creates problems with record keeping and data entry.

**Assets of MCR**
The RMC's best assets are the council members themselves. During our visit, members of the RMC expressed their excitement and willingness to work with our studio team towards the goal of creating a development plan for Ruiru and its residents. The council also openly acknowledges that there are problems and obstacles on the local level as well as on the national level that need to be directly dealt with in order to fully define and ultimately implement comprehensive planning. In terms of local level governance, the RMC seems to be ready and willing to play an active role in overcoming such obstacles.
Scenarios

3.1 No Intervention: The Future of Ruiru without Planning

The Nairobi metropolitan area is currently urbanizing at a rapid pace, but with little to no guidance in the physical development of the region. Land use, transportation, housing, industry, and infrastructure development are currently occurring without an integrative, comprehensive plan to adequately forecast current and future demands. The following is an analysis of the future of Ruiru given the continued development of the region without planning and guidance. The existing conditions within the broad sectors of transportation, land use, economic development and public health consist of specific areas of growth, stagnation and decline into the future given current patterns of development.

The following analysis of the trends and future form of Ruiru are contingent upon three major assumptions. The first is the completion of the Eastern bypass, which will intersect Ruiru Road just kilometers from the CBD. Second, given the plans of the Ruiru Municipality and current agreements between Ruiru and Juja, it is likely that Ruiru will become an independent water service provider. Lastly, the new political move to decentralize authority to local governments within Kenya, as well as the introduction and further development of LATF, monetary transfers to the municipality from the central government will have increased.

Grow: Population

As in all major cities in developing countries, the population of Nairobi will continue to grow at rapid rates. The rapid urbanization and continued in-migration, coupled with a high rate of natural population growth will cause the population of Nairobi and Ruiru to rise considerably. This sharp increase in residents will further strain an already incapacitated public service system and will result in further unplanned development. Based on 1989 and 1999 Nairobi Census populations counts, growth rates and associated estimated populations for 2015 were calculated and derived. The growth rate for Nairobi was found to be 4.8%. Based on Ruiru census reports, the growth rate between 1979 and 1989 was 7.7% per year, while growth rate between 1989 and 1999 was 8.2% per year. Projecting to 2015, using the 4.8% growth rate, Nairobi’s estimated population will rise to 4.62 million. Projecting to 2015, using the 8.2% growth rate for Ruiru, the population will rise to 460,913. The high rate of growth in Ruiru can be attributed to a variety of factors including the expansion of council boundaries and migration from Nairobi.

These population changes have significant implications for the future economic, built, environmental and social condition of Ruiru and Nairobi. Assuming growth rate of 8.2, it will take only 8.4 years to double the population in Ruiru. The 1999 population was 109,507, however by mid-2007 the population will have doubled to approximately 220,000.

Grow: Matatus

Urbanization and rapid population growth from both natural population growth and migration will continue to raise demand for a variety of services, including mass transit. Current patterns of land use consumption indicate greater dispersal of uses in that residential areas are locating further from employment and the city center, thus increasing the reliance upon motorized transit. Ownership of private cars are well beyond the monetary capacity of a majority of Nairobi metro area residents, making increased mass public transit the only option to efficiently manage this growth and dispersal (KIPPRRA Report 2006).

The matatu industry will thus likely expand to meet such demand. The existing decline in bus service provided by KBS indicates the inability for the service to build capacity for this purpose. The buses lack maintenance and have not been replaced with a more functional fleet and also serve only a specific portion of Nairobi. Service does not extend far into urban fringe, including Ruiru. Therefore, KBS has been stated to not pose direct competition to matatus (Kimutai 2006). Matatus provide the only mode of mass motorized transit from Ruiru to Nairobi besides rail, which is operating at low frequency and shows no signs of being improved for passenger rail. According to the Kenyan rail service “passenger rail is not
profitable" and is thus unlikely to be developed further without incentives. Matatus also represent the growing Kenyan and African trend toward participation in the gray, informal economy. The service was borne out of a spirit of rebellion and continues to grow as a chaotic, private industry. It rose to fill the gap that the public bus service had left, as KBS and the City Hoppa primarily have served upper income areas (Kimutai 2006). It maintains the only service that is widespread to encompass a significant portion of Nairobi residents and will thus remain the dominant provider of mass transit in the absence of adequate, affordable public options.

Grow: Other Transportation Modes
In addition to the growth of matatus, all other modes of transportation will increase in number. As the population increases, more vehicles will be necessary to accommodate the increased number of trips generated. The Japan International Cooperation Agency (JICA) report estimates that in the Nairobi Metropolitan Area, the total number of public transportation trips per day will jump from 1,704,392 in 2004 to 2,326,000 in 2015.

Although all modes of transportation will increase, the percentage of personal automobiles on the road versus other forms of transportation will increase. The growth of personal car ownership and usage has been the dominant transportation trend for the region. Personal automobiles represent 50% of the vehicles on Thika Road but transport only 14% of passengers (KIPPRA Report 2006). This has clear negative implications for the future of Ruiru in terms of congestion, efficiency, productivity, and public health. This is especially problematic given the problem of affordability suffered by many Kenyans and the lack of governmental and monetary attention placed upon mass transit.

The transportation problem will be further exacerbated without planning intervention in that transportation infrastructure will decrease in quality. This is a likely scenario given the increase in numbers of all modes of transportation and the correlative increase in road usage. Yet despite the increase in vehicles using the roads, institutional capacity to maintain roads will not increase. The current infrastructure will deteriorate rapidly because of poor maintenance and increasing numbers of users.

Grow: Ribbon Development
The completion of the bypass will spur both formal and informal development because of the increased connection to Nairobi, the airport and to other satellite cities along the bypass route. The bypass forms major intersection, such as at Ruiru Road, which will become a cluster of informal and formal markets in order to take advantage of the increased traffic that will make use of the new access point. The basis for this form of development is the current ribbon development that has occurred and continues to amass along the major corridors of Thika Road and Ruiru Road. The roadsides of both of these corridors are lined with both residential and commercial developments. Much of this development is likely to be within the informal sector, as it is rapidly growing and provides an entry point for the poor into the economy.

The growth of commercial development along the bypass and at the intersection at Ruiru Road will have a variety of potential impacts. The affordability-related need of residents to live walking distance to their place of employment will result in expansion of informal housing surrounding the commercial developments. Additionally, any formal industry that locates along the bypass to take advantage of greater airport access will also be surround by pockets of high-density informal housing. This pattern of development can be seen in the current relationship between location of industrial employment and residence. For instance, there is a dirt footpath connecting Alpha Knits to a high density residential settlement in Githurai so that employees may take advantage of the only affordable mode of transit for many: walking.

Grow: Subdivisions
Approximately 70% of all land in Ruiru was subdivided before the Land Act of 1996. These plans have up to 17,000 numbered lots that each measure about 15 by 30 meters, which represent 75% of all subdivided plots. There are also larger plots that measure 100x25. These larger plots are primarily located around the area of the teacher’s cooperative Mrembo Mwalimi-Sacco, which is characterized by a dry non-agricultural soil. These plans are available to the public and are legally documented. However, as long as the land is
cheaper in Ruiru, agriculture performs poorly, and Nairobi grows rapidly in population, these subdivisions are likely to grow in order to accommodate ex-Nairobi residents in search of their own land.

The subdivisions are split into a high number of plots that are each sold for suburban consumption. Because they have not been regulated by the Council, the subdivisions have been drawn without consideration of community services or infrastructure provision. Therefore, future developments will not meet all of the needs of the residents, creating a future strain on the municipality to fill the gap, on transportation linkages to neighboring cities, such as Nairobi, and thus on transportation-related public health issues.

Suburban development is thus likely to grow because of cheaper land prices. In Ruiru, the price of one square feet of land is roughly 109 Ksh, while in Nairobi the price is twice as much for a plot with similar characteristics. In both areas land prices increase with proximity to the CBD. Kahawa Sukari, a high-income residential community in Ruiru, is the prime example of suburban development in the area. There is currently dispersed middle income residences in and around Murera, which is expected to slightly densify and expand with increasing numbers of middle class migrating from Nairobi and elsewhere.

Additionally, the current demand for cheap land and large plots for single-family dwellings, the growing population of Ruiru and the entire metropolitan area, and the economic situation of agricultural land owners who feel pressure to subdivide will lead to further subdivision of agricultural land. Without any development controls, such as a growth boundary, the prime agricultural land to the north will be lost to increased suburbanization.

Grow: Informal Businesses
According to Government of Kenya statistics, informal sector employment grew over 176% from 1998-2001, while formal sector employment fell -0.43% during the same period. (Mitullah 2003). It is thus likely that the intense informal sector growth will continue at a rapid pace. This will be enabled by increased access to Ruiru via the bypass and the increased residential population given greater subdivision of agricultural land and general population growth. The informal sector in Ruiru is also likely to grow because for many it represents the only entry point into the economy. As formal sector employment falls, there will be less employment opportunity for the growing population, especially those that cannot afford the commute to Nairobi. The informal sector is the only recourse for this subset of the population.

Grow: Ruiru Flower Industry
The flower industry in Ruiru will grow in the future because of the current success of the industry despite the infrastructural deficiencies of Ruiru and due to inherent advantages of this type of production. Most of the coffee farms and horticulture producers, such as Ruiru Coffee and Redlands Roses, receive capital and technology from outside investors. Therefore the lack of capacity of the municipal council to provide incentives that other businesses often need to survive is curbed. The industry is thus also less likely to fall victim to the fluctuations in economic health of the region and nation. The flower industry is also not nearly as weather-sensitive as coffee and thus can remain resistant to the current drought conditions throughout the Nairobi area.

As a result of these immunities, Ruiru flower producers have continued to produce profits, despite nearly twenty years of negative agricultural growth in Kenya as a whole. Ruiru is currently the second largest cut flower producer in the world, just behind Holland (KEPSA 2005). Kenya has a competitive advantage in the industry in terms of the cost of labor and land, which is directly seen in Ruiru as one of its main attractors is the availability of cheap land (World Bank / KIPPPRA 2004). Moreover, once completed, the bypass will significantly help producers access the airports and will thus improve transport efficiency.

Decline: Ruiru Coffee Industry
The coffee industry in Ruiru will most likely decline as unplanned development continues in Ruiru given the financial sensitivities of the industry and the current trend toward suburban subdivision of agricultural land. Coffee prices are extremely sensitive to world coffee gluts and drought conditions, the latter of which has been suffered by Nairobi area farmers in recent years. During times of these conditions, prices fall, which directly impacts coffee farmers, who have little access to cash reserves or financing (Krivonos 2004).
The result of the financial reality of the coffee industry has physical manifestations upon the built and social form of Ruiru in the future. During difficult financial times, individual farmers are more likely to sell their land for subdivisions or diversify their operation in order to make ends meet. The general trend of the area has been low density, single-family residential developments built upon plots of subdivided agricultural land, which thus provides a financial exit strategy for struggling coffee farmers. Moreover, intensive coffee farming can destroy the fertility of land over time, depleting the fertile condition of the soil and thus making coffee production unprofitable.

Decline: Infrastructure
Based on an analysis of the local budget for the RMC, the per capita infrastructure provision by the Ruiru municipality is 19.99 Ksh per year, based on an assumed current population of 140,000. This has been derived from the 2005-2006 expenditures of 1,500,000 Ksh for roads and drainage and 1,299,515 for water and sewage. The 2005-2006 LATF allocation of transfer funds is 37,632,922, which could theoretically be used to increase provision from the current total expenditure of 2,799,515. However, the provision of infrastructure per capita is likely to decline given the rapidly growing population, the relative lack of capacity, and the current condition of infrastructure.

Poor quality of infrastructure is evident based on analysis of field research done in Ruiru. The majority of local roads are not paved, which leads to uneven surfaces and potholes. Thika road lacks the frequent upkeep that is necessary for proper maintenance. In addition, all roads lack lane delineation and markings. “The RMC is incapacitated to provide essential infrastructure facilities and services. This influences negatively on the economic activities in the area” (KIPPRA, 2006).

Decline: Public Health
Without planning intervention, the overall public health of Ruiru will decline due to lack of adequate health care facilities, comprehensive water provision, sanitation services and sewage systems. Inadequate sanitation and water supply will increase vector-borne diseases such as malaria and water-related diseases, such as diarrhea and hookworm, which will disproportionately affect the morbidity and mortality rates in children under five. According the WHO, 1.6 million deaths per year are attributable to unsafe water, poor sanitation and lack of hygiene (Source: Millennium Project, Taskforce: Water & Sanitation 2005).

In addition to water and sanitation related disease, there are other environmental concerns that contribute to the declining public health of Ruiru. Increased traffic from the growing number of matatus and private automobiles coupled with an unlikely change in fuel use type and emission technologies will lead to increased automobile emissions. This will lead to further deterioration of air quality, which contributes to a variety of related public health concerns, such as respiratory illness, pneumonia and bronchitis. Respiratory illness and distress was the leading cause of morbidity in 2005 in Ruiru, and has been correlated to indoor and outdoor air pollution. Respiratory illness in children and adults has significant economic implications in terms of increases in direct public health costs and also increases in indirect economic and social costs, such as loss in productivity and income-generating capacity from morbidity and increased time spent collecting water by women and children.

Decline: Air Quality
Based on available, but limited 30-year air quality data from Nairobi, the air quality is deteriorating rapidly, especially in the industrial areas and commercial city center of Nairobi (UN 1994). Further field work highlighted the cause of the decline in air quality in Ruiru to three main emission contributors/ sources: 1) the increased number of vehicles in the region (as discussed previously), 2) the outdoor incineration of solid waste by households and industry, and 3) the indoor burning of biomass fuels for cooking and heating by households.

These combustion processes emit large amounts of fine particulate matter that penetrates deep into the lungs, again exacerbating respiratory distress and morbidity. Since very few homes can afford electricity for cooking and heating, a typical open fire cook stove in Ruiru is fueled by charcoal or biomass (wood, dung, and agricultural waste). In most cases, cooking areas are poorly ventilated and lack chimneys to direct the particulate matter outside of the dwelling. Unlike a more complete combustion process inside
furnaces or boilers, biomass fuels and coal are difficult to burn completely in simple household stoves, which operate at an efficiency rate of only 10-15%. The resulting emissions consist of highly concentrated health-damaging pollutants (Reddy et al. 1996, Shirnding/WHO 2002).

Decline: Municipality Capacity
As of now, the municipality’s capacity to regulate land use is in decline and it can be assumed that this will continue to worsen as Ruiru’s population grows. The Council cited that the main reasons they are unable to regulate land use is lack of manpower and inadequate financial capacity. The Local Government Act (Cap 265) stipulates that the local authorities are in control of the development and use of the land and physical environment within their jurisdiction. However, the Council’s lack of capacity inhibits any control. The Council is unable to keep track of new and existing informal economic activities occurring within Ruiru. They are aware that informal activity is occurring and of the location of activity in Githurai and along Ruiru Road. However, the Council’s limited capacity weakens any ability to enforce the designated land use laws.

The Council’s capacity to regulate land use will continue to decline. The completion of the bypass will inevitably attract more people and more informal activities, and thus add further strain to the Council’s ability to dictate control. The hinterland and rural areas in Ruiru are also under the Council’s jurisdiction, however, these areas are also mostly unregulated. Council members are unable to find representatives to send to these areas in order for law enforcement. Modes of transportation to send these representatives are limited as well. Poor regulation of land use will continue to decline as long as the Council continues to suffer from a shortage of manpower and capacity and as the population continues to grow.

As is the case with capacity and land use, the continued population increase in Ruiru is going to further strain the Council’s already fragile ability to enforce local laws. The Local Authorities Act mandates that social services and service amenities such as water, sewage, street lighting and education are to be provided by the local authorities. Actual provision of these amenities and services is extremely limited again because of the Council’s lack of capacity. Limited capacities and manpower keep the Council from collecting no more than 50% of the land taxes and permit fees, which results in low tax revenues. This directly translates into limited service provisions. As of now, the only provision that is rendered by the Council is sporadic garbage collection, which is limited solely to solid waste.

Crime is another concern highlighted by Ruiru residents that is enabled by the lack of municipal capacity. Ruiru has a small, poorly trained police force and no courthouse. With a growing population, it is likely that the crime will continue to be a problem and potentially worsen for the residents of Ruiru, as will the Council’s inability to effectively manage crime. However, it is important to note that the legislation that is governing the Council is relatively new. Both the Local Authorities Act and the Physical Planning Act were adopted in 1996 and the Council is hopeful of gaining a better understanding of the legislation in order to govern in a more efficient manner. The Council is also hopeful that the newly adopted (LATF) will increase municipality funds allowing for increases in human resources as well as their capacity to enforce local and national laws. Without substantial changes in these areas, the municipality will continue to suffer from inadequate capacity as manifested in haphazard development, poor or no infrastructure, and crime.

Stagnate: Healthcare Facilities
The amount of healthcare facilities are likely to remain the same, given the lack of economic development and more specifically, limited municipal and district capacity with regard to both human and financial resources. It is anticipated that there will be no expansion beyond the two current public health care clinics serving Ruiru. These clinics will continue to face current challenges of understaffing and irregular medicine supply. Moreover, one of the two clinics is located on Prisoner College grounds. These grounds are not accessible by the public, making the facility underutilized and unable to service the broader Ruiru public, who are served only by one Public Health Clinic located outside of the CBD.

Stagnate: Community Participation
The level of community participation within Ruiru is likely to remain at its current limited level. In addition to limited participation, there is limited community organization between residents and the RMC in four of
the five wards within Ruiru Location. The only ward that has been effective with its community participation and organization is KS, which is the wealthiest ward in Ruiru. According to the Council, the community is aware but uninterested in attending the community board meetings. The Council posts the town meeting schedule on a notice board in Githurai and at the Town Council, however, meetings are rarely attended by the public. Members of the community have lost faith in the Council to actually achieve the goals and responsibilities they set forth and many do not want to engage with the Council. As a result, the relationship between the residents in Ruiru and the RMC is tense and accusatory. Considering the lack of community participation and organization now and the already tense relationship between the community and the RMC, no intervention in this arena will promote this trend.

Stagnate: Industry
Ruiru’s current stock of industry is limited to six major firms, which were either established in Ruiru more than ten years ago or have recently moved into facilities formerly occupied by another industrial tenant. Most industry players interviewed were pessimistic about prospects for improvement in infrastructure and seemed to accept that inadequacies in this area would continue to inhibit the competitiveness of their operations. However, other local operational advantages, including cheap land and the future location of the bypass help to offset losses incurred from inadequate infrastructure. Therefore, it is likely that the current situation will continue as is. (Field interviews, conducted week of Feb 5-9, 2006).

The stagnation of industry in Ruiru also affects the stagnation of formal sector wage employment. As stated previously, formal wage employment has decreased in real terms since 1998. This stagnation has occurred as recent economic activity has posted only moderate gains and the public sector has shed jobs in privatizations and in other efforts to streamline operations. As a proportion of total jobs available, formal wage sector employment is rapidly losing ground against strong growth in informal sector employment. The stagnation of formal industrial presence coupled with an increasing population and few affordable mass transportation options into Nairobi will lead many to seek employment in the informal sector. Formal sector employment will thus stagnate (Mitullah 2003).

These areas of land use, economic development, transportation, public health, and governance that will either grow, decline, or stagnate coalesce to form a condition of development within Ruiru that is not efficient or healthy for its residents. The lack of control due to the limited capacity of the Council will lead to increased adjacent incompatible uses of industrial, commercial and residential space. As Ruiru’s population continues to rise with growth rates likely above both national and metropolitan rates, residential growth will continue in an irrational fashion. Additionally, an increasingly large percentage of residents will be without water, sewer, solid waste disposal or reliable transport options. Without planning intervention, the residents of Ruiru will be left without necessary services, adequate governance, good public health, green space, among many other deficiencies.

3.2 Mononucleated
The mononucleated scenario envisions Nairobi as a single nucleus of economic activity within the metropolitan region. The focus of the mononucleated plan is residential housing development and the development of transport systems and services to serve a primarily commuter population. This scenario is meant to strengthen ties between Nairobi and surrounding municipalities, such as Ruiru, by creating well-planned dormitory communities for Nairobi’s workforce.

In the mononucleated scenario, Ruiru’s function in the metropolitan area would be little different from what it is now: a place for commuters to live of little independent economic importance. Nairobi would remain the center of economic activity in the metropolitan area, and would provide regional services, local services and employment. However, the mononucleated scenario mitigates the effects of unregulated residential development through planning regulations to create better outcomes than would be expected with no planning interventions. This scenario builds upon two of Ruiru’s greatest physical strengths: its proximity to Nairobi and its relative abundance of cheap, available land. Thus the mononucleated scenario is the most practical vision of Ruiru, given the limited financial and operational capacity of the Municipal Council.
The agricultural land in Ruiru is precious and cannot be replaced once it is developed. Therefore, in the mononucleated scenario, it is recommended that strict limits be placed on residential development so as to protect the valuable agricultural assets to the northwest and southeast, via zoning of agricultural lands, other land use regulations or strict limits on the sale of such agricultural lands. The land use recommendations of this report are applicable to both the mononucleated and polynucleated scenarios. Likewise, current industry may be encouraged to remain in Ruiru; however the Municipal Council would not actively seek additional industrial development.

It is recommended that the majority of the new housing in the mononucleated plan be developed in areas where it is already developing—along Thika Road in the center of the Municipality. However, it is also recommended that these developments be planned for higher densities. This would minimize distance between housing and transportation, ideally making new local and regional transport systems more accessible to all people. Additionally, it is recommended that all new developments have infrastructure requirements so as to prevent residential growth without the provision of necessary services such as water, electricity and sewerage. Mixed residential densities can provide a variety of housing options for both the wealthy and the very poor. It is recommended that the highest density housing occur around Githurai and the current CBD, and along Thika Road between these two points. Medium density residential development should occur between Thika Road and the preserved agricultural areas, and the lowest density residential developments should be reserved for an area east-southeast of Githurai, where KS is currently located.

An important aspect of the mononucleated plan is the recommended location of "transit-service hubs" at Githurai and the CBD. These hubs can serve as connecting points between local and regional transport systems, and provide commercial areas with markets, shops and services for commuters and their families. Both Githurai and the CBD currently serve as informal hubs; the mononucleated plan explicitly organizes land use and urban design in these areas to meet the Municipality's heavy transport needs.

It is recommended that transport within Ruiru Municipality be improved by the construction of new roads radiating from the transport hubs and by the development of existing roads, such as Ruiru Road, which runs lengthwise through the Municipality via the CBD. Many of Ruiru's priority roads are identified in the transportation background and recommendation sections of this report, as are methods of financing road infrastructure and strategies for community involvement. It is recommended that either the Municipal Council or the larger Nairobi transport authority develop a local transport system to move people from their homes to the transport hubs. This local transport system could then connect to a regional transport system, either a bus-rapid-transit system, commuter rail or a modified matatu system, to transport people from these local hubs to downtown Nairobi. The transportation recommendations section of this report offers applicable examples of the elements of a matatu rapid transit system, which can be adapted to the mononucleated scenario. Thus a significant focus of the mononucleated scenario is efficient movement of commuters between their homes and their place of work on a daily basis.

The health and well being of the residential population is a concern. In order to support significant population growth, it is recommended that healthcare facilities in Ruiru increase in number. Currently, only one health facility serves nearly 200,000 people. As Ruiru's population grows, additional facilities will be necessary, and it is recommended that these facilities be located so as to maximize access and minimize distance between residents and healthcare facilities. Additionally, public health concerns will likely grow with increasing residential density, so improved public health education will be essential. It is recommended that any additional revenue claimed by the Municipal Council as a result of population increase be used, in part, to fund improved access to public healthcare and education programs. Likewise, it is recommended that any regional or local transport system aim to reduce vehicle emissions so as to protect the health of the commuter population. Use of hybrid vehicles and clean fuels offer solutions to the air quality problems produced by traffic, and it is recommended that these alternatives be incentivized or subsidized by both the Municipal Council and the city of Nairobi. Examples of alternative fuel propagation and use can be found in the transportation recommendations section of this report.

Municipal capacity will likely increase in the mononucleated scenario. Ideally, financial transfers from the central government will increase as population grows, and the Municipal Council will be able to broaden its
tax base with regulated residential and commercial development. While wise spending will be necessary, it is recommended that these additional funds be used to improve municipal residential services, such as solid waste collection, water and sanitation service provision, transport services, public health facilities and other public services, such as schools. Additionally, it is recommended that the Municipal Council actively encourage community participation in the planning process and develop strategies that both consider and represent the opinions and needs of all residents, regardless of income level.

3.3 Poly Nucleated
The goal of the poly-nucleated Scenario is to promote efficiency, economic activity and equity within the Nairobi Metropolitan region. The poly-nucleated scenario would position Ruiru as a place to live, work and invest. In this scenario Ruiru would be a strong nucleus in a poly-nucleated metropolitan region. However, to ensure its development as a strong nuclei, it is recommended that policies be targeted towards economic development to strengthen the local economic base. A strong economic base decreases Ruiru's dependence on Nairobi for employment and services and would ensure that Ruiru is both an asset and a contributor to the metropolitan region.

As a strong nuclei, Ruiru would provide a mix of both uses and services for local residents. Furthermore localizing uses decreases the number of regional transportation trips, because residents would be able to live, work, and shop in Ruiru. As a result, this would alleviate pressure on the existing transportation infrastructure, particularly Thika Road. In addition, a reduction in regional trips would reduce traffic congestion, which in effect would reduce vehicle emissions and air pollution. Workers would also be more productive as they would spend less time commuting. It is recommended that Ruiru increase local economic opportunity. Strategies to develop local economic opportunity are discussed in the following sections. This would strengthen the economic base, while also ensuring a more equitable Ruiru. Currently, the poor pay a larger portion of their income on transportation. Therefore, the increase of local economic opportunity would reduce transportation dependence and prevent spatial isolation of the poor.

It is recommended that an improved regional transportation system operate between the Nairobi CBD to Ruiru. While the exact system will be determined in a later section (see Transportation Recommendations), the system would operate in two components; a regional connection between Nairobi and Ruiru (and perhaps beyond) and feeder routes which would service within Ruiru municipality. It is anticipated that the
feeder hubs would be located in the areas with congested cluster of uses and users. Currently, these locations are the Githurai roundabout and the Ruiru CBD. Feeder routes would service the eastern and western areas of Ruiru from these two hubs to more efficiently provide service to industrial and residential uses.

It is anticipated that feeder routes would be flanked with high-density residential development, and the area outside the high-density residential would be flanked with medium-density residential development. Densifying residential uses maximizes residential access to transportation and employment. Furthermore, the clustering of uses and the integration of transportation and land use would decrease dependency on regional transportation trips. This would encourage pedestrianization which would improve environmental health and enhance the quality of life of Ruiru residents.

The Eastern bypass is currently under construction. It is recommended that when the bypass is complete it should primarily serve freight traffic, whereas, Thika Road should serve commuters and mass transit. The rationale behind this recommendation is such that, in order for freight traffic to move efficiently, the number of entry points onto the bypass should be restricted. By restricting access points this would ensure an efficient flow of traffic along the bypass. Furthermore, this efficiency could be achieved by preserving the ranchland around the bypass to prevent ribbon development. While a mix of uses is a sustainable form of planning, mixed uses should rather be encouraged in other areas, whereas the Bypass would function as a thoroughfare for goods.

It is recommended that the development of commercial and residential services expand in the CBD. With respect to residential uses, it is recommended that high-density residential be integrated with commercial uses. This would maximize the use of a central location and would provide a large number of residents with access to services and transportation. The CBD could expand both in types of uses and in physical area.

Currently the CBD is home to dozens of small businesses. In addition, there is tremendous pressure on the informal sector to formalize, as this sector does not significantly contribute to the tax base. However, there is a lack of access to capital for advancement. While the informal sector should be allowed to continue to grow, planning should become more responsive to its needs in order to best accommodate its development. Recommendations to this end are included in the Economy Recommendations section.

It is recommended that an industrial park locate in the southeast portion of the municipality to more efficiently utilize the dry soil. The bypass would service the Industrial Park, which would be advantageous for industry. Furthermore, this area could be serviced by feeder routes, which would ensure direct transportation access for employees and industrial purposes.

It is recommended that a second industrial park locate at the intersection of the bypass and Ruiru Road. This location would provide direct access onto the bypass for regional transport and onto Ruiru Road for local needs. This area is currently underdeveloped and the municipality could benefit greatly from viable industrial uses to strengthen economic activity. The co-location of industry would enable these industries to share resources. This would decrease construction and maintenance costs and create a more sustainable and viable industrial base.

It is recommended that the area in the northwest portion of Ruiru be preserved for agriculture use to conserve and capitalize on the rich soil. Land use reforms are outlined in the recommendation section that follows. 50% of Ruiru’s land is currently used for agricultural purposes. Rich soil is one of Ruiru’s assets and a comparative advantage over other municipalities. It is recommended that the agricultural area be protected and preserved.

It is recommended that Ruiru develop community facilities and preserve open space. These public spaces would foster a sense of community. Public spaces would increase safety within the community, because the organic mixing of people creates awareness and familiarity among residents. Furthermore the provision of public spaces would ensure a more democratic society, as every resident regardless of income level would have equal access and use of public space.
Recommendations

4.1 Land Use and Housing

The main restriction to land development and housing in Nairobi and Ruiru include land tenure problems, lack of financing, lack of infrastructure and non-performing institutions. However, when the government and the market are unable to provide land and shelter for their citizens, people find ways to overcome it usually resulting in informal solutions. In this sense, informality in Nairobi has taken the form of slums and illegal markets. The lack of housing and available land in Nairobi has shifted uncontrolled growth towards cheaper land. Ruiru’s land in comparison to Nairobi’s can be up to 50% cheaper. Ruiru, like other small agricultural towns close to Nairobi, is facing rapid conversions of agricultural land. This agricultural land, traditionally the economic base of the country, is being transformed to legal and illegal disorganized settlements that lack infrastructure, water, sewer and electricity and are having severe consequences on the environment.

Create a Zoning and Land Use Map

The first step to implementing successful land use regulation in Ruiru could be the creation of general and flexible land use plan that integrates the environment, balances agriculture, industrial and businesses uses, institutional needs and housing. Although the University of Nairobi is currently developing this plan, the zones detected with the most acute developing needs are:

- The area around the CBD with increased pressure along Thika road
- A big possible growth as well as skyrocketing land prices around the bypass
- The preservation of fertile agricultural land

The first two bullets should be the priority for the RMC. A physical plan is not a real solution unless all the stakeholders, public, private, informal or informal are integrated and brought to the table. The plan must address and balance the needs of all stakeholders.

We recommend to start by approaching the major landowners that have plots of land in the strategic zones described above: the area around the CBD and along Thika road, the area around the bypass and the fertile agricultural zones.

Housing Possibilities for all: Site and Services Approach

In Kenya the lack of choices and development has driven people to engage in what is known as Individual Housing Development (IHD) (Kariuki Kamau 2002). This process can be defined as the “buying of land by individuals with the ultimate aim of developing their own houses as they lack other alternatives to own a house”. IHD is not exclusive to medium income, “it is popular among all urban residents, whether rich or poor” (Kariuki Kamau 2002), slums are indicative of this universal application. Ruiru is home to one development of medium-high-income residents, KS, previously mentioned and serves as an example of how a community, by organizing and working together, can achieve housing and efficient land use.

What is significant about KS is that 1) the development concentrates in one area, and 2) it was a community driven development, where the community organized itself to get land and infrastructure. KS is a medium to high income gated community, but the process in which it was developed can provide lessons for development in other neighborhoods in Ruiru. In the rest of Ruiru, single-family houses are appearing in the middle of agricultural lands, with no infrastructure and no order. Places like Githurai are exploding with low-income and slum-type development. If these trends continue, Ruiru will have a sprawling distribution of houses that lack infrastructure. This will result in greater expenses for the Municipal Council than would otherwise result if it were to accommodate housing into a planned approach to development.

To solve this problem the team strongly recommends a “sites and services” approach. This approach consists of providing low income residents with serviced plots and credit for build-aid as well as land
tenure. In this approach the community must be a full participant and the landowners must be willing to sell at least one portion of their land and to stop selling plots in the agricultural area. This approach demands the participation of welfare associations and NGOs as negotiators. The development process would follow the process of community organization and concentrated development in one location used in KS.

The sites and services approach would be based on a spatial grid, which is recommended when there is “need to accommodate growth, inability to control squatting, limited institutional capacity, need for large-scale efforts and speed” (World Bank). The advantages of the sites and services approach are that “it provides immediate action, without lengthy studies or detailed preplanning, it is proactive, it does not overburden municipalities, it allows more predictability of major infrastructure investment, it provides flexibility, it is responsive to market demands, it provides a holding action for municipalities.” (World Bank).

As mentioned earlier, the grid should be organized in areas where rapid development is occurring or will occur. The grid must be flexible and consider the topography, geology and future or existing roads, as well as possible links to employment and easy access to streets for transportation. A plan must be created in advance that considers possible locations for necessary public institutions, schools, clinics and open space. The provision of infrastructure would follow the siting of these facilities. Residents will be charged for the sites and a simple tenure system be created.

The sites and services finance model, which is the reverse of the traditional services-first-than-housing, is based on the following principles:

1) Settlers move into area and claim lots
2) Houses are built by settlers
3) Infrastructure is installed
4) Charges are levied

The RMC could adopt two strategies:

• Short-term services including the development of the complete site plan, the reservation of public spaces, roads, and public facilities.
• Long-term services including administrating legal titles, controlling sequence of development, supplying self-help groups with infrastructure materials and plans, and home-building loans.

Successful examples of sites and services schemes can be found all over Latin America, where this system consists in preventing the proliferation of slums and upgrading existing sites. This sites and services planning makes the development process of low-income areas much cheaper and helps to control growth.

Integrating all Stakeholders

The success of land use regulations is contingent on stakeholder support and collaboration. The following stakeholders and their respective roles in land use regulation are identified below.

Government: The government must function as a facilitator. The RMC must provide easy land regulation, should closely follow the process, and negotiate with major landowners. In Ruiru’s case, because the Council does not own the majority of local land, it must negotiate and provide incentives for the landowners so the Council may be able to buy some of this land. The state should also incentivize and provide support for keeping the agricultural land free of residential development.

Land Owners: Should be active participants in the process, and could potentially function as developers.

Private Sector: In Ruiru’s case the private sector includes the land-selling companies that have rapidly increased in number and in level of activity. An effective strategy would maintain them as integral to the process, and integrating them as possible lenders and/or developers.
The Community: The project's success ultimately will depend on the community's participation as they are the ones who must manage their homes.

NGOs and Welfare Associations: A project advocate (agency or person) takes the lead, and involves all interested stakeholders. NGOs must function as regulatory agents throughout the entire process, and must balance interest and needs of all stakeholders. NGOs can also serve as loan providers or community organizers. It has been found that in Kenya a large percentage of self-builders belong to welfare associations, therefore this relationship between the community and welfare associations already exists and needs only to be further developed.

**Mixed Use**
The team strongly recommends using a mixed use—commercial and residential—type of zoning, which could increase the economic base of Ruiru, making it a better place to live, work and invest for residents and businesses alike. Local businesses are one of the main sources of revenue for the Council. Landowners and commercial business owners could form a joint venture. Zoning the land as mixed use provides benefits, such as:

- Reduced infrastructure cost, as dense places are need less length of water and sewer networks
- The use of non motorized transport, reduces pollution, and infrastructure costs
- Residents can live in close proximity places of employment

**Thinking Regionally**
The RMC could integrate with the development of future metropolitan planning. The Council should actively participate with the national planning process. Ruiru is one of many towns in the Nairobi metropolitan region that is experiencing the externalities of Nairobi's expansion. In addition, the municipality lacks the financial capacity to provide basic services to its residents, which in turn hinders economic growth. Nairobi's metropolitan land use planning must address the whole metropolitan area. It is in the best interest of Ruiru to participate and share its concerns with the national government.

**4.2 Economic Development**
While in the field, two key concerns arose in discussion with businesses in Ruiru. First, nearly all businesses (agricultural, industrial, small and informal) identified a nonexistent or negative relationship with the Municipal Council. Most businesses were frustrated by high licensing fees and taxes, and felt that they received nothing in return for their money in the way of services or support. Most businesses in Ruiru are left to their own devices in terms of procuring water, sanitation and solid waste management services and most receive their electricity from Nairobi. Essentially, businesses are frustrated because they do not see their tax dollars at work and their needs and concerns are perceived as generally being ignored by the Council. Additionally, most businesses identified a lack of infrastructure as a significant challenge to business operations within Ruiru. These priorities included a lack of paved roads for transportation of raw materials and finished goods, a lack of affordable electricity options and lack of water and sanitation services. These infrastructure concerns are of course a natural outgrowth of the Municipality's overall lack of capacity, both financial and human, to undertake major infrastructure projects, and are a major point of contention in the relationship between business owners and the Council. Therefore, this economic development section seeks to provide recommendations to solve these problems and examples of successful programs from around the world in order to create a better business environment in Ruiru.

**General Recommendations**
The RMC has identified water service provision as the major barrier to promoting economic development within the municipality. However, during the team’s series of meetings and conversations with local business owners, they identified other challenges, including lack of general infrastructure provision and strained relationships between local business and the Council, as equally problematic. Working within these parameters, the team has identified three main opportunities to better promote business development within the Ruiru Municipality.
Priority Infrastructure Development
While the Municipal Council has identified the lack of water service provision as the local infrastructure development priority, several business owners quickly identified the high cost of electricity as a top concern, followed by poor road conditions and finally a lack of water and sewerage service. The team's initial recommendations to the Council regarding infrastructure development are to focus more broadly on general infrastructure provision and guide local investment policies to promote development beyond the water sector. The Council should strive to encourage alternative and innovative infrastructure solutions, such as incentivizing solar energy generation, public-private partnerships and community-led initiatives in local infrastructure improvements.

Building Relationships Between MCR and the Business Community
A supportive relationship between local government and the business community is a prerequisite for a healthy local economic environment. Through a series of meetings and interviews with key local business stakeholders, it is clear that the poor relationships between RMC and business owners are hindering local economic development. Business owners are frustrated because they pay taxes and license fees to the Council and feel they receive little or no services or support in return. The Council feels overextended in service demands given its lack of revenue base. A first crucial step in relationship building is to open a clear line of communication between these parties. This new understanding will allow the Council and business community to jointly address challenges to local economic development.

The business community may find it valuable to organize into a local business association to facilitate collective negotiation with the Council on issues of common concern. Such associations may also increase networking opportunities and promote inter-industry collaboration and development. Business associations have many precedents in the United States, and successful examples include Rotary International and local Chambers of Commerce. Local business associations provide a platform for business owners to participate in local governance on a larger scale.

Building an incentives-based relationship between business and the RMC is an effective strategy to facilitate increased cooperation and collaboration in local development. Throughout the United States, such incentives-based relationships have proven highly effective in spurring economic activity and revitalizing local economies. Several businesses currently provide services to the local community, including boreholes and nursery school education for local children, and the Council should consider providing tax breaks and other incentives to encourage and reward businesses for providing such services. This is an initial step towards establishing meaningful public-private partnerships that will expand services throughout the municipality and create a more business-friendly atmosphere.

Marketing Ruiru
In an increasingly competitive global economy, it is important for cities and municipalities to take a proactive role in promoting themselves as a prime business location. Ruiru is fortunate to be able to offer several advantages to the business community, such as increased accessibility upon the completion of bypass, and a strategic location along Thika Road. Additionally, Ruiru has the potential to offer a positive business environment, fostered by increased infrastructure provision and improved relationships between business and the Municipal Council. Therefore, once these improvements have begun to develop, Ruiru could take measures to proactively promote itself to the metropolitan business community and beyond, in order to attract new investment to locate within its boundaries.

A first step to actively promote local economic development is to create a ‘marketing kit’, which the Council may use to attract specific industries that would most positively benefit the local economy in terms of job creation and minimal environmental impact. The marketing kit may include an informative brochure highlighting the positive aspects of locating a business in Ruiru, contact information for both the Council and members of the existing business community, and an invitation to receive personalized information and attention from the Council in regards to a given business’ interest. Ruiru offers a unique opportunity for growth in a currently underdeveloped tourism industry. The bypass will make the locality directly accessible from Nairobi’s international airport, making it an attractive location for tourists who wish to avoid the confusion and congestion found within Nairobi. The local coffee industry may provide an
attractive context for eco-tourism development. Coffee farmers may be intrigued by the opportunity to diversify their income base by providing guesthouses and cultural and educational activities for tourists.

Specific Recommendations

Business Associations

Throughout the world, business associations have proven effective in enhancing the global success of their members. The businesses in Ruiru can build on Kenya’s long tradition of self-help and form a civil-society based business organization in Ruiru whose members include industry, agriculture, small commercial businesses and the informal sector. Jointly, members of the association could advocate business interests to the Municipal Council. In most international case studies, business associations are most successful when the members are within one sector or make up a vertically integrated chain. However, given the diversity of Ruiru’s business interests, a business association in Ruiru would diverge from this single sector model and incorporate representatives from all business sectors: agriculture, industry, small businesses and even the informal sector. In order for this association to be successful and make genuine progress within Ruiru, all groups within the economic sector should be given equitable access to representation. Through the creation of a business association, the Council can continue its mission to make Ruiru an attractive place to both work and invest.

There are several benefits to the creation of a business association, to both local businesses and the Council. First, business associations become increasingly sophisticated as they mature. Initially, the function of a business association is generally a political one. Business associations provide a platform upon which businesses can jointly lobby local government to address their needs. In the case of Ruiru, a business association could help identify priority infrastructure projects or lobby for the creation of more appropriate taxation structures. Associations can progress and become more sophisticated, facilitating knowledge-sharing activities amongst members. Those businesses who have devised innovative ways of handling infrastructure deficiencies, for example, can share these solutions with other members of the association. In the Ruiru business association, knowledge sharing can work in two ways. First, it can operate within sectors, so that agricultural producers might share ideas for mitigating transport deficiencies. Additionally, it might operate across sectors, where a business might share its cost effective method for reuse of wastewater. More sophisticated business associations can provide technical assistance to their members, thus making them more competitive both locally and globally.

Aside from the obvious benefits of an improved relationship between businesses and the Municipal Council, the formation of a business association is recommended to increase municipal capacity. An open dialogue between businesses and the Council will assist the Council in determining local development priorities and will provide the Council with important information about conditions within the Municipality. In consultation with a representative business association, the Council can target funds to directly address business concerns and improve the economic base of the Municipality. This dialogue also allows for the Municipality to explain its logic with regards to licensing and taxation, and to show businesses how their money is being used. Open dialogue and increased transparency will provide a more favorable atmosphere, particularly if the Municipality needs to raise tax or license rates, or otherwise impose restrictions on local business. A final benefit of a business association is that it takes very little financial investment, particularly in its initial phases. Both the Council and local businesses stand to benefit significantly from such an association, and it is very easy to implement. The most major constraints to such a recommendation are time requirements on the part of both business leaders and Council members.

Business Advisor to Municipal Council

Another way to improve the relationship between businesses and the Municipal Council is to include a dedicated business representative as a non-voting Council advisor. This representative would attend Council meeting and provide input with regards to the business community’s stance on particular issues. Essentially, the role of the business advisor would be as an advocate for business interests within Ruiru. While it would be most effective to draw a representative from a functioning business association, it is
feasible to implement this recommendation by simply drawing leaders from the varying local sectors. Regardless of how the business representative is determined, equitable representation is a key issue in this recommendation. The representative could be a rotating seat open to leaders from agriculture, industry, small business and the informal sector. Regulations could be in place upon the formation of the representative position to ensure that sectoral representation is equitable. For example, the position might require that a representative from each of the four sectors serve once every four terms, and that sectors cannot hold the position for two terms in a row. Such a policy ensures that the interests of all sectors receive equal consideration. However, it is the role of the representative to act as an advocate for all business interests and reach out to those leaders in other sectors in order to better understand and represent their interests. The representative must not only advocate for their own interests, but for the interests of the business community as a whole.

Much like the business association, the addition of a business advisor to the Municipal Council provides tangible benefits to local government and is relatively inexpensive to implement. This recommendation increases transparency with regards to the Council’s decision-making process, thus making the business community more likely to support the Council’s initiatives. Additionally, it provides the Council with information about the needs and priorities of the community, so that Council members can better target limited Municipal funds to ensure maximum development impacts. Finally, the business representative would be an unpaid, non-voting, rotating position occupied by local business leaders, thus limiting opportunities for corruption or misuse of any perceived power the position might have. In the context of a business association, the representative would be directly responsible to the association members and lack of compensation for the position ensures that the representative is not interested in the position for personal financial gains. The non-voting aspect of the position ensures that business interests are not unfairly weighted over other Municipal interests, such as services for local residents.

Incentives for Priority Infrastructure Development
As mentioned earlier, infrastructure deficiencies are one of the largest constraints to businesses in Ruiru. However, many of the businesses in Ruiru have found innovative ways around such infrastructure deficiencies. Redlands Roses, for example, uses a modified wetland system to clean its wastewater, while at the same time providing a community borehole for area residents. Redlands also uses ultraviolet radiation to purify its water, rather than a chemical treatment process. All industries and businesses with whom the team spoke identified private contractors as key to their solid waste and sanitation solutions. As business owners are so frustrated with the lack of services provided by the municipality, and as the Municipal Council has little financial capacity to undertake large infrastructure projects, it is recommended that the Council provide tax incentives for those businesses that solve their own infrastructure problems or provide a community service. In particular, this draws upon the precedent of the Lower Manhattan Development Corporation, who negotiated for a series of tax incentives for businesses to either stay in or relocate to lower Manhattan following September 11, 2001. Examples of some of the incentives include a reduction in sales tax on all office furniture and greater allowances for building height in the case of new construction. While these exact incentives might not be the best strategy for Ruiru, they do illustrate the point that in order for growth to happen in a way that the municipality wants, any incentives must be tailored to fit both the particular location and goals of an area.

In the case of Ruiru, some recommendations for specific incentives may include tax breaks for those businesses paving a road or funding water and sanitation infrastructure, a reduction in tax or licensing fees for those businesses who recycle or reuse wastewater or practice some other environmentally friendly technique, and tax reduction incentives for those businesses that provide a community service, such as a borehole. Based on the goals and capacity of the Council to grant such incentives, the program might also include tax and licensing reductions for those businesses that provide training programs to their employees. Before such a program is undertaken, it is important that the municipality determine how such programs might fit within their budget. Initially the municipality can identify a certain amount of money to be dedicated to an incentives program to replace lost tax and licensing revenue. Applications for the program can be accepted on a first-come, first served basis.

Another way to handle the program is through a process of community prioritization of infrastructure needs. This builds upon several case studies from Brazil, including participatory budgeting in Porto Allegre.
and participatory water allocation in Ceará. In these cases, community members gather annually to jointly decide the best use of the year’s water resources or budgetary funds. In the case of Ruiru, the community could jointly identify those projects or services which they need the most, and the Municipal Council might then set tax incentives accordingly by providing greater tax breaks for the completion of high-priority projects. This process can be combined with the community road prioritization identified in the transportation section. In each case, the tax or licensing reduction should cost the Municipality less than the infrastructure project would have cost, but still be enough to provide a genuine incentive for businesses to take action. This would be an excellent time to consult with a local business organization and/or the business advisor on the Council, in order to determine what level of tax relief would provide real incentives and produce real results.

Informality
All of the recommendations designed to address informality previously mentioned in the background economy section (Section 2.2) can be directly applied to informality in Ruiru. First, it is necessary to acknowledge the value of the informal sector for the many jobs it provides and families its existence supports. Secondly, the Council could realize that many of the inefficiencies generated from the presence of current informal activity are not necessarily a product of the nature of the sector and these effects can be mitigated with proper action in local planning. Specific recommendations regarding a variety of proper actions in planning to better accommodate the informal sector in Ruiru are provided below:

• Expect informal business development in both the business and housing sectors, and plan to accommodate, rather than restrict this development.

• Anticipate informal business development along the new bypass and especially at its intersection with Ruiru Road. To best plan for this development, land should be set aside for these businesses, so that they will not have to compete for space with vehicles and pedestrians.

• To guide the location of informal business or housing development, the Council may consider providing ‘sites and services’ arrangements, in which land that is equipped with basic urban services such as water and sanitary facilities is designated specifically for informal development. In this manner, the Council would be able to guide the location of informal development by providing meaningful incentives for its location at these sites. Additionally, the Council would minimize the negative environmental effects that informal development may otherwise have if it were not provided with specific locations and basic services such as water and sanitation. Lastly, by providing these sites and services now, the Council will save a significant amount of money by finding land while Ruiru is still underdeveloped and by not waiting to provide basic services after informal development has already taken place (when it becomes many times as expensive and as complicated politically to provide).

• When possible, accept the location of existing informal activity, and work with these business owners to improve the conditions of these areas. The Council could create incentives for business owners to pay vendor fees, while, for its own part, should strive to increase efforts to collect these fees. One possible solution may be to develop an account to which all fees would be paid whose funds would then be used to improve local conditions by increasing available land area, establishing water connections, sanitary facilities, concrete flooring, roofing or other.

• The Council could encourage efforts to improve access to credit through government- or non-governmental-sponsored microfinance schemes. By granting increasing local access to credit, more businesses will be able to expand their operations, improve their profitability and potentially move into better-established locations such as storefronts.
4.3 Transportation

Evaluation of Alternative Modes

In order to develop a solution to the transportation issues in the Nairobi metropolitan area, the team conducted an Evaluation of Alternative Modes. This is a standardized procedure done for transportation projects worldwide.

The Evaluation of Alternative Modes is an analysis of transportation modes and is comprised of various factors. A chart can be used as a tool by decision makers to evaluate an appropriate mode given specified factors. The chart illustrates the tradeoff among various factors and the strengths and weakness of each mode. An appropriate mode can be determined once the objective of the transportation service has been clearly defined. The objective for the transportation service in the Nairobi metropolitan area is to provide an equitable, affordable and efficient system. The transportation system has three essential components: improve regional access between Nairobi and Ruiri, improve local access within Ruiri and facilitate movement of local and regional freight traffic.

Factors

The factors that have been included in this evaluation include: Passenger Fare, Travel Time (peak/off peak), Operating Speed, Maximum Speed, Comfort, Safety, Operating costs, Construction Cost of Channel, Capital Cost of Rolling Stock, Size of Vehicle, Headway, Capacity, Lowest Minimum Density, Political Feasibility Time Scale for Implementation, Own Resources for Implementation, Pollution Emissions, Community Disruption, Community Building, Flexibility, Civic Pride, and Feeder Service. Each of the factors has been evaluated either qualitatively or quantitatively with respect to each mode. A definition of each factor is outlined below.

Passenger Fare – The monetary amount one passenger pays for one trip. This far does not include any social, environmental, or health costs the passenger may endure as a result of travel. Furthermore, the fares for many of the modes assume a subsidy either from the government or outside investment. The success of this transportation system is dependent on the ability to increase mass transit and decrease private automobile use. This transition cannot happen without proper subsidies. The fare in and of itself will not cover the operational and capital costs of providing a transportation service.

Travel Time – The total time per vehicle to travel from Ruiri CBD to Nairobi CBD. Peak hours are defined as the hours from 7 AM-10 AM and 4 PM-7 PM. Off-peak refers to the remaining hours in the day.

Operating Speed – The speed at which a vehicle travels when operating. This speed includes the time between stops.

Maximum Speed – The maximum speed in which the vehicle operates.

Comfort – The level of comfort the mode provides for its passengers. This evaluation is ultimately a function of preference. However there is a range of comfort among modes which influences modal choice.

Safety – The presence of accidents and injury associated with each mode.

Operating Costs – The lowest cost per 1000 passengers per hour in dollars. The numbers were derived from a study competed by the World Resources Institute.

Construction Cost of Channel – The cost of construction for the infrastructure to provide the transportation service. This could include road investment, rail tracks, and stations. The numbers are expressed by dollar amounts per mile.

Public Capital Cost of Rolling Stock – The cost to the public for purchasing new rolling stock and the price
of maintaining existing rolling stock. Rolling stock includes rail cars, light rail cars, matatus, private automobiles and bicycles.

Size of Vehicle – The capacity per vehicle expressed in people.

Headway – The amount of time in minutes between trips in which the service operates.

Capacity – This is expressed per lane per hour and is derived by multiplying the size of the vehicle and the headway.

Lowest Minimum Density – Expressed in dwelling unit per acre.

Political Feasibility – The political feasibility of implementing the mode within the transportation system. This factor is important to consider given the structure of government in Ruiru and Kenya. Ruiru is a small municipality in the greater Nairobi metropolitan context and the country. Because there is a strong central government, local development projects are reliant on political support to streamline the development process.

Time Scale for Implementation – The timeframe in which the mode could be implemented as part of the transportation system. This evaluation of alternative modes purely descriptive without including a factor to evaluate implementation.

National Resources for Implementation – The level of resources the Kenyan government has for implementation. A resource implies both physical resources for infrastructure as well as human capital of the population. The ability to use local resources decreases dependence on other countries or other areas and gives the Ruiru Municipality and the Kenyan government more control over the time frame for implementation, as resources are locally derived.

Pollution Emissions – The level of emissions the mode releases into the air. There is a connection between mode and pollution emissions. Travel behavior further impacts air quality. The evaluation chart illustrates the level of environmental and health effects associated with each mode.

Community Disruption – The level of community disruption that would result in the construction of the transportation system. The level of community disruption is associated with the time frame for implementation and the type of construction that is needed for

Community Building – The level of community building that results in the development of the transportation system. Local development has the ability to provide jobs and economic activity to the local and regional community. This collaborative effort allows the community to work together on a unified project, as opposed to community disruption in which the duration of the project or construction process impedes on the quality of life for the community.

Flexibility – Flexibility is defined by the ability of a mode to change routes, lanes and placement with ease. The infrastructure required for operation impacts the flexibility. Modes, which are fixed to a specific lane and route, are less flexible than modes, which can easily maneuver and weave through traffic.

Civic Pride – The level of civic pride the system would create among the municipality. Transportation projects and systems promote a sense of civic pride within the country and city that can draw national attention or serve as a model for other localities.

Feeder Service – A feeder service is a complimentary transportation route and system, which provides a more comprehensive transportation system serving more people and a larger geographic area. Feeder service improves the overall transportation system by linking other modes, routes and areas into one system. The necessity to include a feeder system is related to the flexibility of the mode.
Modes
The modes that have been included in this evaluation include commuter rail with new track alignment, commuter rail with improved service, commuter rail, light rail, matatu bus rapid transit, public bus, matatu, private car, boda-boda, bicycle, pedestrian. A brief description of each mode is below.

Regional Transportation Service
The function of the modes listed below is to provide regional transportation service between Ruiru and Nairobi. Regional service will utilize modes which provide a mass transit service thereby enhancing connectivity between the two municipalities. While there are strengths of each mode, the table in Appendix 2 illustrates the trade off cost, investment and feasibility. A regional transportation service does not exclude the local modes discussed below.

Commuter Rail with new Track Alignment – This mode includes new track alignment constructed to improve efficiency and expedite the overall travel time. The current infrastructure is old and in desperate need of repair. The rail currently operates on a curvilinear, one-line track which contributes to increased travel time. Multiple rail tracks would increase the frequency of service and a redesign of the rail route or the construction of bridges would create a more direct route.

Commuter rail with upgraded service – This mode includes investment in new rail cars. It is expected that service can increase with a larger rolling stock of rail cars. New rail cars will increase the capacity of the system, which could increase the overall ridership and entice new riders to commuter rail service. This scenario includes small investments in the physical channel.

Commuter Rail- In this scenario the commuter rail will remain in the current state of operation and quality of infrastructure. This would include limited investment in the rolling stock of vehicles.

Light Rail – In this scenario light rail would operate along a fixed right of way in the median of Thika road to provide regional transportation service from Nairobi to Ruiru and possibly beyond. This would require investment in new infrastructure, new rolling stock of vehicles, and the redesign of Thika Road to integrate and coordinate light rail service.

BRT (Matatu) – The road design in this scenario would be similar to Light Rail, however, instead of light rail cars, matatus would provide the transportation service. This scenario requires less capital investment than commuter rail or light rail, however the efficiency and capacity is comparable.

Local Transportation Service
The function of the modes listed below is to improve and provide local access within Ruiru. The undefined street pattern, lack of paved roads, and poor infrastructure within the municipality are constraints for any mode. The local service does not exclude a regional component discussed above.

Public Bus – Currently there is an absence of public bus service in Ruiru. A public bus has the capacity of 60-75 passengers and would provide local access for Ruiru residents.

Matatu – Matas are 14 seat mini buses which provide mass transit in Ruiru and the metropolitan area. The Matatus are privately run and operated.

Private Car – Automobile privately owned and operated. The use of the private automobile is at the discretion of the owner. Private cars provide an individual transportation service.

Boda-Boda- This is a mode which combines taxi service and bicycles. This mode provides local transportation access and local employment. While the distance is a function of endurance and topography, the transportation service provides convenience and efficiency for the passenger.

Bike – There is a viable bicycle presence both within the municipality and along Thika road. Bikes provide an affordable means of mobility. However, the quality of the roads and the absence of lane delineation
increase probability of vehicular conflict. The safety of bicyclists is of major concern.
Pedestrian – In monetary terms walking is the most affordable mode. The monetary cost to walk is free, however, the social and health effects of walking must also be considered in the evaluation. In a country with high levels of poverty and limited access to reliable water sources, walking long distances can place many strains on human health and livability. Furthermore, this mode is not accessible to the entire population such as the elderly and handicapped nor is it conducive for transporting goods.

Evaluation
The objective of the transportation is to ensure an equitable, affordable and efficient system. While there is a tradeoff among these factors, the ideal system would meet the stated objective. To improve regional transportation, it is recommended that a redesign of the roadway to include a fixed right of way either in the median of Thika road.

Equity
Transportation access in Ruiru is stratified by income. Wealthier residents have more access to private vehicles and thus enhanced mobility, whereas the poor cannot afford private vehicles and often the price of public transit makes ridership among the poor unfeasible. Affordable and accessible transportation modes ensure an equitable system. The affordability issue is outlined in the section below. Furthermore an equitable transportation system will increase access and as a result further economic activity as workers have a means of transport. Providing an equitable transportation system would be in the best interest of the regional economy.

Affordability
Ridership is largely influenced by passenger fare. Furthermore, the ability to provide mass transportation to the greatest quantity of people will reduce congestion and traffic on the roadway. However this assumes that residents have a choice among modes and this is not the case for all residents in the Nairobi metropolitan area. The difference in price of fare between private automobiles and walking is vast. Therefore, while higher income residents may have a choice among modes, lower income residents are presented with less choice.

While there are other factors, which contribute to fare such as health and social welfare, the table illustrates the difference in monetary fare for one passenger trip. This price of passenger fare assumes a substantial subsidy. In this respect Light Rail is the most expensive mode, while commuter rail (despite the level of investment) and MRT have the same fare of 30 Ksh.

The passenger fare for the private automobile is a function of the price of gas. This price is relative depending on household income. Overall the price an individual driver pays to use a private automobile does not proportionally affect the cost that the metropolitan region incurs as a result of increased automobile traffic, congestion, accidents and vehicle emissions.

Efficiency
A specified right of way would increase efficiency for all regional modes. Vehicles, which operate in a fixed right of way, are more efficient as there is less need to maneuver through traffic, thereby a fixed right of way ensures a smooth and steady traffic flow. The regional transportation modes assume a fixed right of way along Thika road. The congestion on the roadway contributes to delay, increases occurrence of vehicular traffic thereby jeopardizing passenger safety. An efficient transport system is one which minimizes delay and maximum the level of service. This is largely a function of the flexibility, speed and capacity.

Flexibility
The efficiency of a vehicle is a function of its flexibility. The infrastructure needed to support a mode determines the flexibility of the mode. For example, Light Rail and Commuter Rail require heavy infrastructure. Furthermore, these modes will only operate on this infrastructure. A light Rail or Commuter Rail cannot change lanes or routes to increase speed or avoid obstructions. MRT is more flexibility. A bus is not tied to infrastructure other then the road in which it operated. Thus if necessary the Matatu can speed up or slow down, change lanes to avoid an accident or road obstructions. This flexibility enhances
efficiency. In respect to flexibility MRT is the superior mode for regional transport.

In respect to local transport cars, boda-boda's, bikes and pedestrians are highly flexible modes. Matatu is the least flexible of the local modes, as current structure of matatu operations is a function of maximizing passenger ridership to maximize operator profit. Thus, matatu routes are tied to areas with high demand for ridership. Often these areas are highly congestion, and as a result, the efficient of service is minimized.

Speed
With respect to operating speed, light rail is the superior mode operated at 43mph, followed by MRT at 40 mph. In respect to maximum speed, MRT is the superior mode with a maximum speed of 60mph followed by Commuter Rail and Light rail with a maximum speed of 50 mph. With respect to operating speed and maximum speed for local modes, the private car is the superior mode with a speed of 40pmh and 65mph respectively. The speed for NMT (boda-bodas, bikes, and pedestrians) is a function of human strength and endurance. These speeds are significantly lower than motorized modes. However, the speed of non-motorized modes is not greatly affected by roadway traffic.

Capacity
The ability to transport a maximum number of passengers ensures an efficient service. This is a function of the capacity of the mode, which is defined by the number of passengers per lane per hour. Commuter rail with new track alignment has the largest capacity with 4800 people/lane/hour. Light rail and MRT follow this with a capacity of 4200 and 2800 passengers respectively. The capacity for local transportation modes cannot be determined. Capacity is defined as the amount of people per land per hour, however these local modes operate without headway. In respect to the size of the vehicle the public bus is the superior mode, followed by matatu and private car.

Recommendations for Regional Modes
It is recommended that in this case a MRT system be implemented along the median of Thika Road to provide regional transportation service and enhance connectivity between Ruiru and the metropolitan region. Of the regional modes outlined in the evaluation, a MRT provides a low-cost, efficient, mass transportation system that can be implemented in a shorter time period. This would involve a redesign of Thika road to include a fixed right of way and operational measures to integrate the MRT into current transportation system. MRT is an affordable transportation mode. Furthermore, an affordable transportation system serves more people, which ensure a more equitable and productive metropolitan region. A MRT would require less capital investment, lower operating costs, and lower construction costs for implementation. The financial feasibility decreases the time frame for implementation. MRT provides comparable capacity to other regional modes, but is more flexible, more comfortable and safer.

General Physical Structure of Regional Connection
The MRT system could run along Thika Road, the primary transport corridor between Nairobi and Ruiru. This will require a complete redesign of the roadway, though the existing road reserves are ample and provide the necessary amount of space for this redesign. The team recommends that the MRT connection along Thika Road should take the form of a single MRT lane in each direction in the center median of the current roadway, with two lanes of conventional traffic in each direction. The team experimented with a variety of lane configurations. To enhance safety and include built-in enforcement of exclusivity, our team recommends that MRT lanes be barrier separated. Since the side of Thika Road is where pedestrian activity is centered, locating the MRT lane on the outside of the roadway was tempting. However, we ultimately decided that placing the MRT lane in the center would best serve the system. By placing the lane, in the center we allow for possible expansion of the system. Expansion could include the addition of a second lane of MRT in each direction or a transition to a light rail system in the future when Kenya is a prosperous nation with a large, dense population. We also considered the number of necessary MRT lanes in each direction. By creating a second lane, faster vehicles could pass slower vehicles thus improving efficiency. The second lane would also safeguard against blockage due to broken-down vehicles (vehicles are generally in poor condition in Kenya). However, current demand does not justify the implementation of a second MRT lane in each direction. The team recommends that at stations a second lane be provided for pullouts. This will increase efficiency and allow for skip-stop service. The conventional traffic lanes should
be reconstructed with their existing two lanes in each direction and widths of (12.5')'. These lanes could be clearly delineated with solid lines, as the current configuration does not have lane markers. Additionally, the redesign should include grade separated pedestrian sidewalks and bicycle lanes on both sides of Thika Road.

**Stations**

Decisions for placement of MRT stations could rely on origin/destination and population density data and should be done in coordination with a comprehensive land use plan. Unfortunately the team has limited access to this data and in some cases the data simply does not exist. Additionally, there are institutional framework deficiencies that undercut efforts to enforce land use plans. However, there are some logical sites for transit stops. There are five roundabouts between Ruiru and Nairobi. These roundabouts are a remnant of the British colonial period. Each of these roundabouts is an activity center, especially the Githurai Roundabout which features a large informal market. These roundabouts also feature abundant space in their centers that can accommodate transit stops. Placing transit stations in the center of the roundabouts also addresses the safety problem that the roundabouts present. These roundabouts are chaotic and the locus of many accidents. Lane delineations disappear and there is no clear standard for right of way. Motorists charge into the roundabouts full steam then slam on brakes to avoid merging traffic. In an effort to alleviate this traffic hazard, the team recommends that the MRT system should continue straight through the existing roundabouts. The undeveloped centers of these roundabouts could be transformed into MRT stations. Conventional traffic running parallel to the MRT line along Thika Road should be directed around the roundabout. The intersecting traffic headed in the east/west directions should be carried over the roundabout on overpasses. The roundabout will feature entrances and exits that will merge with the intersecting traffic lanes. Since the MRT lane will prevent northbound traffic exiting the roundabout to the east and southbound traffic from exiting to the west and vice versa, the eastbound and westbound lanes must provide U-turn lanes on both sides of the roundabout after the intersecting merged traffic.

**Termini**

In Ruiru Town, the Bus Park could be moved. The site of the current bus park is overcrowded and cannot expand any further. At any given time, the park currently circulates about 100 Matatus an hour during peak hours. The new MRT Park should be able to accommodate roughly three times that volume. The undeveloped site at the intersection of Kwa Maiko Road and Hospital Road is an ideal location. It is easily accessible from Thika Road via Ruiru Road and has significantly more space than the current, overcrowded bus park. The entrance should occur on the Hospital Road side of the sight and the exit on Kwa Maiko Road. Within the park, the matatus should queue for access to passenger pre-pay booths. This will facilitate more efficient passenger loading and departing. The Ministry of Roads and Transport is currently developing a plan to restrict matatu access from the Nairobi CBD. In this plan, each of the major roads that connect to the CBD would have a terminal with matatu loading and unloading. On the opposite side of the terminal passengers can transfer to city busses that will provide exclusive public transport service to the CBD. This plan could integrate with our proposal.

**Operational Measures**

It is recommended that the new transportation system integrate with the existing modes. This is function of roadway design, transportation fleet, governance, enforcement, and operation. It is recommended that two operational issues Ticketing Mechanisms and Passenger Boarding Features could be addressed to improve efficiency and provide a higher level of service.

**Ticketing Mechanisms**

The boarding process can contribute to increased delays and inefficiency within a transit system. One way this can be overcome is with proper ticketing mechanisms. Currently each matatu operates with two people-the driver and the fare collector. The presence of two people expedites the boarding process as one person drives and one person collects the fare. However, this feature contributes to high operating costs, as the matatu owner must pay for two employees. It is recommended that passengers purchase advance tickets to expedite the boarding process. The exact place of purchase could vary. Systems in other countries have allowed riders to purchase tickets in places such as grocery stores or newsstands or providing ticketing machines at the bus stop. Because riders purchase tickets at other locations, the bus driver does not have money on board. Thus, advance purchase tickets limits incidence for robbery, which serves as a safety
measure for both the passengers and the matatu operator.

The provision of ticketing machines and money exchange would require enforcement and monitoring. While the incidence of robbery and corruption is frequent in Kenya, this could be addressed with proper design and operational features. In Curbitiba, Brazil tinted plexi-glass tubes serve as mini-stations in which passengers pay a fare to an attendant before the bus arrives. Furthermore, in Curbitiba passengers can purchase prepaid tokens at shops, newsstands and transfer stations, which separates money exchange and transportation service.

It is recommended that the ticketing mechanism be transferable among other modes and transportation services. This transferability would facilitate smooth transitions between various modes and encourage ridership. This would require both new technologies and engineering. This may be a longer-term objective of the transportation system, as the transferability among modes is difficult because modes are both privately and publicly owned and operated. However, this barrier should be addressed to ensure seamless connections and provide a universal multi-modal system.

**Passenger Boarding Features**

Design features can expedite the passenger boarding process, which in turn can improve the overall efficiency of the transportation system. A grade boarding system is one mechanism to expedite the boarding process. In addition to speed, at grade boarding would ensure a system, access for people of all ages and physical conditions would be improved. Therefore, the height at which passengers would board is a critical design feature. At grade boarding can be achieved with two different design strategies, low-floor bus fleet or raised boarding platform. A low-floor bus fleet would involve essentially the design of low floor matatu. Successful measures have been accomplished in Bogotá, Colombia in which the floor of the TransMilenio bus is at an equal level to the station. This design would ensure a safe, fast and efficient boarding process that is assessable to all users, in particular the handicapped.

**Boarding Design**

A raised boarding platform would be constructed in the roundabout of every designated station. It is recommended that the platform be raised approximately 3 feet off the ground. This would ensure that the matatu and platform are of equal heights. Furthermore, it is recommended that the boarding platform be approximately 50 feet long and 8 feet wide. This would ensure ample room for a passenger boarding area. Ticketing booths and/or concession stands could also be located on the platform to foster as both a gathering and a waiting space.

The section below illustrates a potential boarding platform and matatu stop. The section includes the boarding platform, a bikeway and two lanes for matatu travel. One lane would be designated as a pullout and the other lane would be designated for continued right-of-way. The pullout would allow matatus to skip a stop if passengers on board do not need to stop or if no one is waiting to board. This design feature would improve efficiency on the roadway, as matatus would only make stops if necessary. Vehicular traffic would continue around the perimeter of the roundabout, whereas matatus would proceed through the roundabout to the designated stop.

**Issues to Implementation Enforcement**

Thika road is controlled, maintained and regulated by the central government. A new system would require a period of time for drivers and passengers to adjust. To ensure efficiency, the matatu right-of-way must be exclusive and remain closed to automobiles and other modes of transport. Enforcement measures must be in place to ensure that a fixed right of way is exclusive for matatu service. In Mexico City, Route Associations were developed to enforce paratransit regulations. The responsibilities for these route associations include: allocating and controlling the number of vehicles on each route, assisting owners with financing mechanisms, settling claims resulting from accidents, and representing owners in legal situations. In the case of Mexico City, an outside body was influential in balancing the demands and roles of all parties. In the case of Ruiru, while it may be easier for the local municipality to monitor and regulate Thika road because the road is centrally governed and the system will service the metropolitan region, implementation and operation will involve coordination between Ruiru and Nairobi.
Training
A uniform training process would have to be given to all matatu drivers and operators. Changes in the road design would take some adjustments for the drivers. In addition, the roundabouts currently have no right of way. Unlike the United States, where most roundabouts have traffic lights or a yield sign to enter, in Nairobi there is an absence of such order. In addition, there is no-right-of-way for vehicles even once inside the roundabout. The right of way must first be established and traffic lights and lane delineation must be put in place to support this framework. This may be a particular challenge as a lack of right-of-way is common throughout the country. However, the Matatu Association is heavily organized and with time and proper communication, a formal training process can be established. It is in the best interest of the Matatu Association to work with the regulatory players to establish clear guidelines for training. This in turn will formalize the system, which will ensure efficiency.

MRT/MPTA Authority
The implementation of such a scheme will depend on the creation of a new regulatory body. The unconventional blend of private and public interests should be represented on this new Metropolitan Public Transportation Authority. Though the pressures and demands on such a body are unconventional, the conditions are not wholly unique. In Bogotá, Colombia, a similar paratransit industry existed before the opening of a BRT system. The owners and operators of paratransit vehicles were brought into the program. The public/private partnership required the creation of a new public company, TransMilenio S.A. The company’s structure “is very small, given that it performs its charter through third parties, and its operations are funded with 3% of the ticket sales and ancillary activities. Under the supervision of TransMilenio S.A., the main lines are operated by four companies and feeder buses are operated by three companies. Investment comes from five public entities including the Bogotá Mayor’s office” (Lee, 2003). The design, planning, and investment in the infrastructure is carried out by public institutions such as the Bogotá Mayor’s office, the fund for education and road safety of the Secretary of Transit and Transportation, Institute of Urban Development, and The District Institute of Culture and Tourism. Its operations are overseen by private entities such as trunk line operators, feeder bus operators, fare collection concessionary, and control center providers” (Lee, 2003). This division of private and public responsibilities has been highly successful. The team recommends that Nairobi Metropolitan Public Transportation have a similar structure. There are currently matatu route associations. These associations as well as the Matatu Owners Association and Matatu Welfare Association will play critical roles in the implementation of this system.

Partial Evaluation of Road Stock

<table>
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<tr>
<th>Road</th>
<th>Width of Road Bed in Feet</th>
<th>Paved</th>
<th>General Condition (good/fair/poor)</th>
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<td>Poor</td>
</tr>
<tr>
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<tr>
<td>Unnamed Road</td>
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<td>Poor</td>
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</tbody>
</table>

Recommendations for Local Modes
If it is recommended that a multimodal system be implemented to enhance local access within the municipality. A multimodal system would incorporate both motorized and non-motorized modes. In respect to motorized modes, it is recommended that matatu use increase over the use of private automobiles. Matatus provide a form of public transportation that is accessible and affordable to a larger portion of the population. Private automobiles, however, provide a service to a smaller proportion of the regional population. It is recommended that infrastructure be provided to enhance and encourage the safe use of
NMT transit. A multimodal system is dependent on a defined local street pattern, improved road quality, clear separation of modes, and the creation of exclusive pedestrian and bicycle pathways.

Road Supply Assessment
Despite the decentralized framework for providing local services, Ruiru municipality has no framework for provision of transportation services. Where implementation of road construction and maintenance and financing will necessarily rely on some cooperation from the central government, the first step of this proposal can be conducted by the Municipality. In order to provide a framework, the team recommends that the Municipality create a Local Transport Plan. The plan should include the results of a comprehensive inventory and condition survey (see Table 1) of roads and footpaths and an “as-is map” from which stakeholders can cooperatively make decisions (Lebo 1998).

Community Prioritization of Roads
The local population constitutes the primary stakeholders and therefore must be included in the assessment and implementation phases of the transport planning process. There are three common techniques used to select priority roads: multi-criteria analysis (MCA), cost-effectiveness analysis (CEA), and cost-benefit analysis (CBA). With MCA, criteria such as population served, traffic volume, proximity to health, educational, and commercial services are given weights or point values. Each road link is then assigned a point value based on its fulfillment of the given criteria. Those roads with the highest scores are selected as priority roads. This method is frequently utilized by consultants, often in isolation resulting in nontransparent results. However, it would be possible to open the process to the citizens of Ruiru. In public meetings the criteria and point system could be decided democratically. For example, our team performed this exercise with the roads in the Central Business District. Using the criteria established in Table 2, the three top priority roads in the CBD are Ruiru, Hospital, and the Unnamed Road with 18, 17, and 12 points respectively. This analysis would then provide a clear direction for progress on the road improvement project.

Table 1

<table>
<thead>
<tr>
<th>Multi-Criteria Analysis</th>
<th>Point Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Criterion</strong></td>
<td></td>
</tr>
<tr>
<td>Motorized Traffic Volume (low, high)</td>
<td>0.2</td>
</tr>
<tr>
<td>NMT Traffic Volume (low, high)</td>
<td>0.3</td>
</tr>
<tr>
<td>Population Served (Poor, Middle Class, Wealthy)</td>
<td>3, 1, 0</td>
</tr>
<tr>
<td>Community Facility</td>
<td>1</td>
</tr>
<tr>
<td>Education Facility</td>
<td>1</td>
</tr>
<tr>
<td>Commercial Center</td>
<td>1</td>
</tr>
<tr>
<td>Factory</td>
<td>2</td>
</tr>
<tr>
<td>Regional Transport Connection</td>
<td>1</td>
</tr>
<tr>
<td>Informal Economy Center</td>
<td>1</td>
</tr>
</tbody>
</table>

The team was unable to perform CEA and CBA due to a lack of available economic data. These processes are generally technocratic and do not easily incorporate public participation. However, CBA in other developing countries has provided interesting results. In Bangladesh, economists included rickshaw operating costs in the estimation of operating cost savings in their cost-benefit analysis and found that the
human pulled vehicles (similar to the handcarts used in Ruiru) depended on even surfaces more than motorized traffic and that, “investments in black-topping could be justified when heavy NMT traffic exists, even though the number of motor vehicles in use is less than 50 per day” (Ledo 30).

Road Design
The Municipality should implement a road classification system similar to the National Classification System. Thika Road and the planned bypass are the only roads within the municipality that are classified under the National system. This classification system can provide a framework for construction standards. For example, each Class 1 road should feature two (12') lanes in each direction, one (6') bicycle lane in each direction, and one (10') pedestrian sidewalk in each direction.

The team created a possible transportation schemes consisting of five classes:

Class 1
Regional Connections
Examples:
Ruiru Road
Kwa Maiko Road
Murutha Road

Class 2
Intra-Muni Connections
Examples:
Mugra Road
Hospital Road

Class 3
Secondary Muni Roads
Examples:
Baptist Road

Class 4
Tertiary Muni Roads
Example:
Mathigu Road

Class 5
Ped and NMT Paths
Example:
Unnamed road

Once the appropriate priority roads have been chosen with input from the public, the RMC, and engineers, construction could begin immediately. In terms of construction materials, local engineers could be consulted. Local lateritic quarries will likely be useful for proving road base rock. Blacktopped roads in Kenya have been very prone to plastic deformation. This is likely due to inadequate enforcement of construction standards coupled with failure to adjust asphalt concrete (AC) mixes for overloaded Kenyan vehicles and increased used of radial ply tires (Wambura 1999). The Municipality could perform testing during road construction to verify appropriate compaction on road sub-grade, aggregate base, and AC. Many rural transport plans compromise design standards for scope. The emphasis is placed on providing basic access to the greatest number of people rather than full access to few. In the case of Ruiru, the expected population increase would render basic access inadequate. The team recommends a plan that utilizes full access standards including blacktopping and lane delineation. The strategy should involve a phased approach. In the first phase, the Municipality could perform reactive improvements that meet current demands within the space provided by current road reserves. At this time, the municipality should also target strategic reserves where necessary to provide space for expansion of roads. Expansion of many of the municipal roads will be required to meet the demands of the projected population. Some of the
outlying areas, including Murera and KS, are home to wealthier communities that may be relied upon to provide their own transportation infrastructure.

Though the high traffic roads in the CBD (Ruiru Road and Kwa Maiko Road) have been paved, they lack lane delineation and separation for modes. We recommend road designs that protect pedestrian, operators of handcarts, and cyclists. Due to space constraints, some roads within the CBD should be reduced to One-Way Roads during Phase I improvements. The commercial core should be closed to auto traffic. This will involve relocating the Bus Park to the undeveloped site at the intersection of Hospital Road and Kwa Maiko Road.

Biofuel - MRT

Overview of Plan
Given the high costs of operation associated with poor fuel use expressed by the matatu owners, this MRT plan incorporates a strategy to help alleviate these stresses as well as provide local economic and environmental sustainability through the production and use of biodiesel. There is strong potential in the agricultural land of Ruiru to produce oil crops and provide at least a local supply of biodiesel for use by the MRT fleet. This plan serves as a recommendation to the RMC to take introductory measures to meet the goals inherent in a plan for a long-term, self-sufficient Ruiru. These objectives include minimizing negative environmental externalities, providing equitable transportation alternatives, and improving local economic opportunity. The production and use of biofuel using Jatropha Curcas can effectively meet these objectives and is within the scope of Ruiru’s means and abilities.

The crop of choice for this transition to cleaner fuels is Jatropha Curcas, commonly known as castor oil. It may have the highest energy payback of any biofuel, including copra, palm, groundnut, cottonseed, rapeseed, soya and sunflower. Jatropha Curcas crude oil has also produced the lowest exhaust gas emissions of these crops in several studies (Parsons 2006). Additionally, there is potential for high yields and thus high returns for farmers who are currently plagued by drought conditions and are increasingly enticed by the immediate profit from the sale of their open land for low-density housing subdivisions.

There are specific characteristics of Jatropha that make it both desirable and feasible for use in sub-Saharan Africa. A major criticism of biofuel oil crop production is the opportunity cost associated with using fertile land for non-food production. Jatropha circumvents this issue through its ability to grow on non-arable land or wastelands. The crop itself cannot be used for edible purposes and thus also does not run into competitive use problems. It also has a long life span of roughly 50 years and is drought resistant, which is a necessary condition for cultivation in Kenya, which currently suffers from drought conditions. In Egypt, the crop has been successfully irrigated with treated sewage water, thus providing a potential link between sewerage solutions and agricultural water issues.

Other favorable characteristics of Jatropha include its ability to serve as a living fence in that it can not only protect farmlands and gardens from hungry livestock, but can also reduce damage and erosion from wind and water (Akom 2005). Also, although it is native to the Americas, it is not an invasive species and can even serve as a pacesetter for the re-vegetation of barren soils because it permits growth of other plants in the vicinity (Akom 2005). Nairobi also falls within the appropriate precipitation range of 300-1000 mm and temperature Range of 20-28°. In fact, over half of Africa’s land is suitable for Jatropha cultivation in that if only 2% of that land was used to produce Jatropha, it would yield as much oil per year as the best estimate by US oil companies for extraction from Alaska’s north slope over the next twenty years. However, after the twenty years, the Jatropha fields would still be in production (Parsons 2006). Jatropha reaches its maximum productivity after five years and lives up to fifty years (Azam 2005: 300).

A blend of 5% biodiesel with petrodiesel (B5) could be used as an introductory step for the municipality to decrease its dependence upon foreign oil and to transition into cleaner fuel technology. The B5 blend would be used to avoid initial problems and once this system was in place the municipality would be able to expand the system to B20 blends and upward without major commitments of resources (Environmental Alliance 2002). With the B5 blend infrastructural changes in both vehicles and distribution systems are
unnecessary. Moreover, "EMA members expect that blends up to a maximum of B5 should not cause engine or fuel system problems, provided the B100 used in the blend meets the requirements..." (EMA 2003). Low biodiesel blends also decrease the risks of using biodiesel, such as lower fuel economy and deterioration of specific engine parts (CNET Review, 2006).

Additionally, as developed countries continue to improve their vehicles, the second-hand usage of these vehicles will spur trickle-down benefits of these advancements. This will likely translate into greater compatibility between higher biodiesel blends in the future and matatu vehicles, which can be readily introduced when the overall climate is appropriate. The initial use of a small B5 blend will thus set the stage for more radical and beneficial changes once Ruiru and Nairobi have the necessary institutional buy-in. This introductory blend provides a feasible method of incorporating cleaner, renewable fuel use into the currently problematic system.

Meeting the Goals
The production and use of biodiesel for MRT system serves as an integrative approach to meet the goals of the polynucleated form of development for Ruiru. In this form Ruiru is self-sustaining nucleus within a large regional network of polynuclei. It has a strong local economic base and thus creates local housing, transportation and economic opportunities and alternatives within its boundaries. It is currently a dormitory town and is largely dependent on Nairobi. By incorporating a series of strategic plans, such as alternative fuel production, Ruiru can foster a healthier environment that will have long-term benefits as well as move away from simply an ancillary role to Nairobi. The switch to alternative fuel would meet several of the goals devised to enable this transition. It provides sustainable local economic opportunity, minimizes negative environmental externalities, and promotes transport efficiency.

Economic Development
The production of biodiesel by local Ruiru farmers has the potential to bring the area substantial economic and social gains. The use of jatropha for biodiesel production stands to offer farmers greater returns than coffee is currently producing and if coupled with other high-yielding crops could reduce the incentive to subdivide. During times of high yield and stable world coffee market conditions, each harvest on the Ruiru coffee farms yield roughly 1.52 tons per hectare of coffee producing land, which translates to 27.58 fifty kilogram bags of grade one coffee per hectare. At 35,000 Ksh per bag, the high-end estimate for gross earnings is 965,300 Ksh per hectare. However, during times of drought and/or world market glut, such as now, only 0.665 tons of coffee per hectare is produced, or only 12,070 Ksh per hectare.

When compared to the stable returns from Jatropha cultivation, the production of biofuel is clearly advantageous. At 320 USD per ton for crude oil, Jatropha can yield 768 USD per hectare per year. This assumes a yield of 2-3 tons per hectare, however several studies have shown up to 8 tons per hectare. Jatropha processing also creates 7% glycerin as a byproduct, which can be used for soap production with a sale value of up to 2000 USD per ton, or 1120 USD per hectare per year. Total sales are thus 1888 USD per hectare per year, or 135,030 KES (Parsons 2006). Processing the crude oil into biodiesel would add an average of 15% to the sales value.

This must also be compared to other uses of agricultural land in Ruiru, such as horticulture and the potential returns from the sale of agricultural land for subdivision. When examining the typical returns of horticulture, this use of the land is more competitive than the conservative estimates for Jatropha. The gross margin per year for Kenyan farmers engaged in horticulture production is roughly 568,821 Ksh per hectare (Minot 2004: 33). This use of land has also proven to be extraordinarily successful in Ruiru and thus should not be substituted with Jatropha production. For instance, Redland Roses has estimated their annual returns per hectare to be roughly 60 million Ksh.

The sale of land for housing subdivisions is not surprisingly the most immediately profitable use of the land. Currently the sale of land is advertised by private land banks to be around 333,333 Ksh per hectare. However, it should be noted that this is a one-time return. If this return were allowed to collect interest over twenty years in a high-interest yield savings account, it would amount to 730,373 Ksh. However, the return over the entire productive life of one jatropha tree (of about 50 years) is roughly nine times higher than this figure. Therefore, if farmers are informed of the economic viability and the stability of growth and
economic returns regardless of drought conditions, the natural incentive to cultivate Jatropha is clear.

The individual potential for local farmers to reap economic rewards from Jatropha cultivation can lead to the creation of greater economic opportunity through export. As competition in developed countries rises between oil crops and food crops and demand for biofuel continues to grow, the focus will likely shift to other locations for production and export of oil crops. The climatic and environmental conditions that make sub-Saharan Africa perfect for jatropha production could also place these producers in a position of economic opportunity to supply the developed world. The National Biodiesel Board has stated that the market for biodiesel could climb to more than half a billion gallons per year if diesel refiners add just two percent biodiesel to their products. The twenty-one existing biodiesel production plants in the US could expand their collective capacity to roughly 80 million gallons per year (Gartner 2004). “Based on existing policies, demand growth can be expected in particular in the European Union, the United States and China. Since these regions hardly coincide with potentially producing regions, with increasing demand also an international market with worldwide trade-flows can be expected to develop” (Slingerland 2005). Kenya could take advantage of this opportunity and explore financing mechanisms such as the use of taxes on the sale of export biodiesel to subsidize domestically used biodiesel.

Other economic benefits include the insulation of the area from the price spikes in international oil markets. While there are price fluctuations in biodiesel, it is largely a result of higher feedstock prices during winter, which can be accounted for in advance. “Diversification of energy sources is one option for risk abatement” (Slingerland 2005). While the Nairobi metropolitan area becomes increasingly dependent on private automobile use, their relationship with international oil markets will grow significantly. When coupled with extreme issues of affordability, an alternative to petroleum will be necessary as the price of oil rises.

**Transport Efficiency**

The use of biodiesel also contributes to the overall efficiency in the MRT system because of the performance quality it offers. “The application of Canola based lubricity additives in both unadditized and commercial low sulfur diesel fuels has been shown effective in reducing engine wear by as much as one-half, thereby potentially doubling diesel engine life. Fuel economy gains of up to 13% have also been recorded” (Hertz 1999). This is especially important in the matatu case where vehicles have been reported to last a mere 3-4 years, requiring engine overhauls annually.

The B5 blend will be used in order for the biodiesel to act as a lubricity additive. “Even a 1% blend of biodiesel improves lubricity by 65%” (Environmental Alliance 2002). Otherwise, biodiesel performs with all of the same benefits as petrodiesel. It has the same payload capacity and range, and similar horsepower, torque and fuel economy as petrodiesel. However, it has a higher cetane number, which increases the engine’s performance. It should be noted that B100 has a 10% lower fuel economy than petrodiesel, but this remains a small differential relative to the 40% penalty of compressed natural gases (Environmental Alliance 2002). There have been problems with neat biodiesel and higher blends such as filter plugging, injector coking, piston ring sticking and breaking, elastomer seal problems and severe engine lubricant degradation (EMA 2003). For these reasons it is recommended that older diesel vehicles use blends of B5 or less (Clean Air Initiative 2006). Therefore, the use of B5 blend for this plan, which incorporates second-hand matatu vehicles, can effectively circumvent these potential disadvantages.
Environmental Consequences/Benefits
Air quality is a primary factor in determining the overall need for a transition to cleaner fuels in Nairobi. The air quality in Nairobi is a major concern given the rise in automobile use and the rapid rates of urbanization. The use of biodiesel could be a major contributor to the amelioration of public health consequences of poor air quality. The roadways were shown to have astonishingly high levels of particulate matter (PM2.5) at 433 ug/m³ (see Appendix 3). When compared to New York City levels of 15-20 ug/m³ or even Mexico City levels of 60 ug/m³, the severity of Nairobi's air quality problem is evident. It should be noted that anything above 100 ug/m³ is considered unhealthy.

The environmental benefits offered by the use of biodiesel, even at small levels, directly mitigate the negative effects of Nairobi's current air quality condition. For instance, with the use of a B20 blend the EPA found reductions in emissions of CO₂ by 10%, particulate matter by 15%, total hydrocarbon by 10%, and sulfate by 20%. There is however generally an increase in nitrogen oxide emissions, shown by the B20 blend to be 2% (EPA Fact Sheet 2002). Additionally, emissions from vehicles using B100 contain 94% less carcinogenic particulate matter than petrodiesel emissions. A B20 blend has also been shown to reduce visible emissions by 35%, contributing to area aesthetics as well (Environmental Alliance 2002). There is also a minute amount of sulfur in biodiesel, producing sulfur dioxide emissions that are favorable to that of petrodiesel.

Biodiesel production can have negative environmental consequences through indirect impacts from fertilizer production, unsustainable agricultural production, and fuel production. Agricultural production of oil crops can be relatively land intensive and involve higher transportation efforts than fossil fuels. It can also reduce biodiversity if cultivated in monocultures (Franke 1998). However, the properties of Jatropha can serve to minimize these effects. For instance, the crop itself works as an insecticide by reducing the amount of nematodes in soil (GTZ Project Zambia). It also allows for the cultivation of other crops in its immediate vicinity, thus reducing the need for monoculture. However it should be noted that production of the fuel has been shown to increase pollution in the immediate vicinity of production. There is currently no conclusion yet on whether this pollution concentration outweighs the dispersed pollution from fossil fuel.
combustion. It is probable that on a small scale such as what is proposed for Ruiru, the effects of production will be minimized.

**Production**

This plan advocates the use of Jatropha, commonly known as castor oil, to be produced on Ruiru agricultural land by local farmers who would otherwise subdivide their under-producing coffee farms. Jatropha would be cultivated and production, processing, and distribution of the resultant biofuel would all be done on site at these small-scale agricultural operations.

Biofuels are produced by transesterification, where triglycerides are reacted with methanol and sodium or potassium hydroxide as a catalyst to convert the oils into methyl esters. The by-products of this process are glycerols and water, which must be removed from the fuel (EMA 2003). Generally the production process flows from the production of the crop, to processing the seeds by extracting the oil and creating seed meal, esterification, and then production of glycerine and biodiesel fuel via the process described earlier. Oil extraction is done by heating the seeds to allow for easier oil outflow. This can be done using either manual or mechanical press equipment, both of which can be manufactured locally (Akom 2005). The oil must then be purified through either sedimentation or boiling with water (GTZ Project Zambia). Once biodiesel is produced, it is safe to handle by producers not only because it is nontoxic, but also because it has a higher flashpoint and lower volatility and thus does not ignite as easily as petrodiesel (EPA Fact Sheet 2002).

In order to produce biofuel in this manner the properties of the crop, including its yield potential must be understood. Jatropha's fruit production occurs after 4-5 months with full productivity by the third year. It is generally planted with a density of 1111-2500 plants per hectare and has been conservatively stated to have a yield of 2-3 tons of seed per hectare in dry areas. However, it has been reported to yield up to eight tons per hectare in climates similar to Nairobi.

Given these properties of Jatropha, the production requirement for the MRT system, given a fleet of 300 vehicles can be calculated. This fleet size assumes future expansion of the system and thus does not reflect the current proposed fleet size of roughly 200. The individual vehicles currently used are 14-seater Nissans, which have 65-liter fuel tanks. Using a B5 blend, 3.25 liters of biodiesel will be needed per fuel tank. Assuming the use of two tanks of fuel per day across the 300-vehicle fleet, 711,750 liters of biodiesel will be needed per year. Therefore, if one hectare can conservatively produce two tons of seed per year, roughly 381 liters of oil are produced per hectare per year. This means that 1868 hectares, or 18.68 square kilometers of agricultural land would need to be dedicated to Jatropha cultivation. It should be noted however, that current producers in Sub Saharan Africa have reported 1600 liters of oil per hectare. This land requirement represents 13% of Ruiru’s total agricultural land, however it should be noted that Jatropha can be grown on non-arable land and thus can be grown on the dry soils in the southeast of Ruiru. It will thus not require use of the fertile agricultural in the northwest.

A logistics system maybe helpful for local farmers because of the timing requirements associated with distribution and storage of biodiesel. However, direct consultation with farmers would be necessary to design such a system because it would have to be done according the appropriate technology constraints. For instance, the exact transportation equipment available to farmers would have to be known. Specifically, storage of biodiesel for more than six months should be avoided, meaning that more frequent distribution must be planned for to maintain consistent supply (Clean Air Initiative 2006). This is due to temperature sensitivities with biodiesel being more critical than petrodiesel because it is made with vegetable-based products. Sitting in a warm storage tank can leave the fuel susceptible to mold growth, however sitting in a cold tank can cause the fuel to become thick and difficult to dispense (CNET Review 2006). The climate of Kenya diminishes the severity of these potential problems, however these issues can be further reduced by buying only enough biodiesel as the market currently demands. An efficient, well-functioning logistics system to connect the rural producers to the Thika Road consumers will be helpful.

This system could be relatively simple in that much of the farmland has direct access to the main roads of Thika Road and Ruiru Road. This would simply require weekly coordination for delivery to stations along Thika Road. In this way transaction costs would also be kept to a minimum. The transporting equipment
could also potentially remain the same for farmers transitioning from coffee production to Jatropha production.

For those farms without direct access to Ruiru’s main transport arteries, inter-modal logistics will be necessary and ideal. “Solutions are inter-modal logistic transport systems, with low-cost means taking care of the ‘first mile’s’ journey from the field to the collection point, where trucks pick up their loads” (Abmann 2005). The distribution chain is relatively tight and it is thus unlikely that a thorough logistics modeling exercise is necessary. If future activity requires this, far more data regarding local farm production in Ruiru will be required.

Cost

Biodiesel is generally regarded as cost-prohibitive in that it generally costs 30-40 cents more per gallon than conventional diesel. However “fleet managers can make the switch to alternative fuels without purchasing new vehicles, acquiring new spare parts inventories, rebuilding refueling stations, or hiring new mechanics” (EPA Fact Sheet 2002). This is also dependent on the oil market, which could conceivably rise to prices that are either comparable to biodiesel or even more expensive. In most countries the use of biodiesel is partially subsidized in order for it to remain competitive against petrodiesel. It is likely that the Kenyan national government will have to support a national effort on some scale because Ruiru municipality does not have the capacity or the jurisdiction to support such efforts.

Additionally, present first generation biofuels are more expensive than their fossil fuel counterparts, but second generation fuels are expected to become substantially cheaper than even present petrol and diesel. It should also be noted that the implementation of biodiesel use and the positive effects upon vehicle and human health will be amplified with time. Kenya currently imports much of its vehicles from Japan. As the developed world continues to make efficiency and environmental improvements upon their vehicles, the positive effects will eventually trickle down to the developing world. “Therefore in poor countries the emissions levels can be compared with those of used cars in the developed world and any efficiency improvements implemented in the North will also have long run effects in the South” (Abmann 2005: 722).

Infrastructural Requirements

The initial costs of small-scale conversion to blending with biodiesel are minimal because of the minimal infrastructural changes that are necessary. Because biodiesel will just be used as an additive to petrodiesel, it will not necessitate the construction of different distribution and storage systems, as is the case for CNG or hydrogen. Engine modifications are also not necessary, however hoses and gaskets in older vehicles should be replaced with biodiesel compatible elastomers. There are problems with maintaining a workable temperature in that it freezes at temperatures 3-5 degrees Fahrenheit higher than petrodiesel, however as previously stated, this is not a major issue given the temperate climate of Kenya (EPA Fact Sheet 2002). There may be distribution issues requiring enhanced equipment for producers to transfer their product to filling stations along Thika Road. Jatropha oil is hydroscopic, meaning that it absorbs water. This characteristic translates into a requirement for nitrogen blanketing on steel tanks in order to keep water from contaminating the fuel (Parsons 2006).

Maintenance requirements may also be increased with biodiesel use, however these are far less problematic with small biodiesel blends. For instance, many vehicles need to replace oil filters more frequently immediately after conversion to biodiesel. However this is countered by the fact that the cleaner burning properties and higher lubricity of biodiesel has been proven to prolong engine life and decrease overall maintenance costs. In all other regards, the maintenance requirements for B20 vehicles and petrodiesel vehicles are the same (EPA Fact Sheet 2002).

There are seven petrol stations along Thika Road from Nairobi to Ruiru. The infrastructural requirements for these filling stations include small modifications that are potentially unnecessary in Kenya. The higher cloud point of biodiesel requires storage at 29 degrees Fahrenheit or above (Environmental Alliance 2002). This is clearly not much of an issue in Kenya. Biodiesel must also be blended at or near the end user, meaning at the filling stations, because blended fuels are not compatible with pipeline movements. Supply will have to come from truck delivery along Thika Road, already discussed. The greatest problem posed to filling stations is the requirement for appropriate technical facilities permitting homogenous mixing of
petrodiesel with biodiesel. These two fuels have different densities and can thus cause problematic stratification in tanks.

Implementation Challenges/Political Feasibility
There are several challenges to implementation that impede the momentum of this plan. Stakeholder participation and commitment is central to the success of an alternative fuel strategy. First, buy-in from Matatu owners is essential. This plan was initially borne out of the genuine interest of the National Matatu Owners Association President, Simon Kimutai, to consider fuel choices that would increase the life of matatu vehicles, even if they posed greater initial investments. However, on a general scale, matatus are informal and are operated without any consideration for future fleet renewal. This disconnection between future planning and current operations is a clear impediment.

Stakeholder buy-in will also be necessary from local farmers and landowners. The natural financial incentives must be conveyed to farmers to discourage subdivision. Also the availability of assistance in acquiring trees and equipment must be widespread and expressed to potential Jatropha farmers. For instance, there is possible assistance that could be available through international programs, such as the Clean Development Mechanism, which offers incentives to developed nations to offer technical assistance for clean development purposes to developing nations. This would be most feasible by leveraging cooperation with the EU, which currently leads the way in utilization of the CDM and has among the greatest biofuel needs. Lastly, financial incentives, potentially through price breaks on utility services, if available in Ruiru’s future, should be explored for biofuel producers.

Additionally the cost of biodiesel is a strong impediment. The disparity in fuel cost must be subsidized governmentally to prevent the cost from being borne by the drivers rather than matatu owners. Currently drivers pay the fuel costs out of their own pockets; therefore, the regressive economic effects of this price hike must be mitigated. The national government must make alternative fuel production a priority, as has been done in India, in order to allow production and use to be financially feasible.

Case Studies
The feasibility of biofuel production is most evident when examining its success in other contexts across the world. It has been applied successfully in both the developed and developing nation contexts, and is most notable in African countries with similar conditions as Kenya. However, developed nations, such as the U.S. are worth looking at as they offer a prototype for future development and expansion of an alternative fuel program.

In the United States there are currently over 200 fleets and over 40 million road miles that utilize biodiesel use. Biodiesel is also the primary alternative fuel for military and federal fleets, such as the postal service vehicle fleet (Environmental Alliance 2002). Many of these fleets use blends of biodiesel because of the environmental improvements without having to compromise fuel economy, as well as cost considerations. However, many of these programs have been expanded to larger proportions of biodiesel or to 100% biodiesel, such as for all municipal vehicles in Berkeley, CA. Additionally, two billion liters of biodiesel were produced in 2003, primarily within the European Union. The primary vehicle to stimulate development of biofuels was the offering of tax exemptions to producers (Slingerland 2005: 3). This is likely to be a necessary component for large-scale production until the price of biodiesel falls.

The developing country context is the most salient for the application of alternative fuel programs in Kenya. South Africa, Brazil, Malaysia, Egypt and India all offer examples from which Kenya can learn. For instance, in South Africa, a 45,000-hectare nursery for four million Jatropha Curcas trees was recently planted for biofuel production. This project will immediately create 800 new jobs and in the future will create an additional 2,000 jobs. As is the proposed case in Ruiru, the fuel produced will be used by motorists currently using diesel vehicles and for industrial purposes. The first batch of biodiesel is expected to be harvested a year and half after planting (Sapa 2005). The Brazilian government has also incorporated biodiesel into its alternative fuel program. In 2004, they started to blend 2% soybean biodiesel with their petrodiesel. By 2013, it will be increased to a B5 blend (Slingerland 2005).

Egypt provides an important illustration of the hardness of the Jatropha plant, which is of great concern in
drought-ridden sub-Saharan Africa. In Egypt, Jatropha is currently being cultivated on 500,000 hectares of desert land and is being irrigated by treated sewerage water. Similar to the Ruiru plan, it provides an integrative strategy in which four main aspects of development are addressed: provision of renewable energy, erosion control, economic empowerment through job creation, and poverty reduction (Ackom 2005).

However, there have been cases highlighting the negative effects that improper management of biofuel production can have across a developing nation. Malaysia is currently the world’s largest palm oil producer, where palm oil represents 70% of the agricultural economy, which is 11% of GDP. However, in focusing upon palm oil production, Malaysia depleted its own primary rainforest, and thus both plant and animal biodiversity has been significantly reduced. There were also negative social consequences, in that the average salary per month of the farm workers is still 80% below the poverty level. Therefore, the application of oil crop production for economic development and environmental protection must be checked and controlled to ensure specific objectives are being met (Abmann 2005). In Ruiru it is essential that biofuel production serve to meet local economic development goals, by encouraging small-scale production and ownership for Ruiru local farmers.

In India, only plants producing inedible oil that can be grown in large quantities on marginal land and wastelands can be considered viable options for biodiesel production. Jatropha falls within the plants of this category. “Biodiesel manufactured from nontraditional oils not only makes the country totally free from costly imports, it will generate employment on a large scale. Moreover, due to low cost labor, production of biodiesel would be cheaper (Azam 2005). It is in this regard that biodiesel can further the goals of Ruiru to become viable in the long-term on both an economic and environmental scale.

4.4 Health & Environment

General Recommendations
As described in the “Health and Environment” background section of this report, there are a multitude of critical public health and environmental issues emerging in Ruiru. These challenges and consequences include the following:

1) Generally modest or no existing policy to manage air quality issues and specifically, a lack of enforcement of transportation emissions standards and fuel use, leading to increased levels of harmful air pollution and the related health burden of respiratory disease;

2) Lack of sanitation/sewerage system such that currently, human waste runs directly into streams and rivers, thereby contaminating the environment and the groundwater;

3) Lack of water provision and inadequate solid waste removal resulting in an increase in water related disease and contamination of surface and groundwater; and

4) Inadequate public health care, with only one facility that is understaffed and serving over 200,000 people in Ruiru.

Although all of these issues bear significant public health and environmental consequences, and therefore necessitate remediation, this report will set forth recommendations specifically focused on the first two challenges as outlined above, transportation and sanitation. A complementary report currently under development by SIPA will cover in detail the problems facing Ruiru that pertain specifically to sanitation, water provision and solid waste removal. For this reason and the fact that this report is written from an urban planning perspective, the recommendations related to health and environment will provide a details strategy on community-involved sanitation initiatives and set forth a plan to promote a more efficient use of current transportation modes and increase the use of non-motorized transport, as well as outline strategies for increased cultivation and utilization of alternative, cleaner fuels.
In addition to the specific sanitation and transportation recommendations that will follow this section, we uncovered a variety of opportunities/needs, which we recommend for further research by groups working on this mandate in the future. Areas for future research include:

- Establishing baseline air quality measurements in/around Ruiru and conduct epidemiological studies to quantify the relationship between fine particulate matter and respiratory illness, the number one reported illness in Ruiru
- Developing incentives that attract low-emission industries and conducting research regarding the citing of high-emissions industry (away from households, school, etc.)
- Recommending landfill citing and ecological construction techniques (such as basic lining) to make the environment less habitable for disease vectors
- Developing formal recycling practices and uncover potential for private-public collaboration to establish effective composting and recycling program in which the community could play a vital role
- Recommending use of low cost, improved cook stoves in collaboration with local foundation to alleviate the high exposures to indoor air pollution in Ruiru

Sanitation

Variations and Innovations in the Supply of Sanitary Services

Many individuals may regard the options for sanitation service delivery as limited to the previously mentioned publicly managed traditional systems of infrastructure, privately maintained septic tank systems and the basic pit latrines. Each of these forms of service-provision is problematic in the case of Ruiru. However, none of them presents a realistic opportunity for the majority of residents to gain access to effective, affordable and sustainable sanitation services. While a certain amount of financing and technical knowledge is indeed necessary to establish improved sanitation services, neither of these requirements need be so daunting as to prevent improvement of services in Ruiru.

There has been much innovation in the field of sanitary infrastructure in the past years that has not only broadened the options for affordable sanitary service delivery, but also in terms of the methods by which these services may be established. Improvements in methodology and technology, for example, have produced new designs of pit latrines, requiring very low-cost construction and minimum maintenance that have significantly improved their ability to treat waste while reducing their environmental impact. Additionally, impressive efforts in community organizing and knowledge sharing between experts and community members have enabled residents in underserved communities across the world to construct, manage and maintain their own systems of community sanitation infrastructure where public or private authorities have been unwilling or uncommitted to do so. One of the most successful examples of such a system of community-managed infrastructure is located in Karachi, Pakistan, where over a million people currently benefit from an affordable community sewage system (see section discussing the ‘Orangi Pilot Project’ later in document).

This document will review several of these innovations in technology and methodology in the field of sanitary service delivery, specifically selected with regards to their potential applicability in the local context of Ruiru. The team will make recommendations for the adaptation of these various technologies and practices in order to enable residents of Ruiru to overcome the constraints of insufficient financing and lack of technical knowledge and thus gain access to sanitation services.

Private Latrines

Many wealthier residents and small businesses in Ruiru depend on septic tanks and their periodic exhaustion to meet their needs for sanitation services. Septic tanks and especially their maintenance are however expensive and inaccessible to many residents of Ruiru. It is therefore important to promote the construction of low-cost, effective and environmentally sustainable pit latrines as a viable option to
increasing access to sanitation for the greater local population. Below, the advantages and disadvantages of private latrine usage are reviewed in terms of their technical utility:

Advantages:
• Private latrines have a high level of convenience and are therefore the most likely of the latrine options to be used (as opposed to public community latrines, which introduce potential conflicts over responsibility for maintenance and which offer less privacy and convenience to users)
• Vent pipes reduce smell and, if screened, discourage flies
• Lined pits reduce risk of collapse, improve emptying and have the possibility of upgrading
• Septic tanks reduce groundwater contamination are permanent and have possibility of upgrading
• Composting systems (EcoSan variations) reduce risk of groundwater contamination, are suitable for poor ground conditions and may provide some economic benefit

Disadvantages:
• Pit latrines in urban areas will have a long-term effect on groundwater.
• Septic tanks and sewerage require reliable water supply.
• Septic tanks require an emptying and disposal system (South African Department of Water Affairs and Forestry 2002).

Ventilated Improved Pit Latrines: An effective but expensive latrine construction method Ventilated Improved Pit latrines (VIPs), while presenting many advantages in design in terms of reducing environmental impact and an enhanced user experience, have not been widely adopted throughout Kenya due to their high cost. The Kenya Water and Sanitation Program notes that VIPs are barely seen except in areas where external project assistance provided materials for construction, and that many VIPs have been abandoned after filling as they were made of concrete elements that could not be moved or re-used (2004). Variations in VIP construction are however possible, and their general effectiveness and pleasant design nonetheless may make them an attractive option to some residents. Please refer to the illustrations of varying models of VIPs provided in the Appendix, which outline their construction methods and cost effectiveness.

Viable Alternative Methods of Latrine Construction Ecological Sanitation (EcoSan) is a methodology of latrine construction based on three main principles:
• It offers a safe sanitation solution that prevents disease and promotes health by successfully and hygienically removing pathogen-rich excreta from the immediate environment.
• It is environmentally sound as it doesn’t contaminate groundwater or use scarce water resources.
• It creates a valuable resource from what is usually regarded as a waste product.

While the Kenya Water for Health Organization argues that EcoSan has made little progress in Africa despite decades of promotion by donors, the Kenya Water and Sanitation Program has found that two of the more basic EcoSan designs that utilize local materials have been enthusiastically adopted and replicated in pilot communities throughout Kenya (WSP 2004). The Kenya Water for Health Organization and the WSP agree upon the following attributes of EcoSan

Toilets:
• On-plot, convenient location
• Minimal use of water
• Dehydration/aerobic composting (with or without urine separation)
• May require drying/bulking material (ash, dry soil, lime, crushed sea shells etc.)
• May be above ground to facilitate contents removal
• Nutrients and sanitized excreta as end-products
• Especially applicable in communities where environmental conditions of rocky soils and a high water table exist.

The team thus recommends the promotion of two basic and affordable forms of EcoSan latrines as viable options to increase access to sanitation for residents unable to afford other privately provided options and in
the persisting absence of centrally provided services. An outline description of these two latrine options is provided below, while diagrams that outline their construction and cost-effectiveness may be found in the Appendix.

- Arborloo latrine: has a portable superstructure and no urine diversion, enabling a tree to be planted in the pit after filled. The Arborloo is affordable and easy to construct, utilizing locally available resources; and does not need a deep pit.
- Fossa Alterna latrine: has dual pits and portable superstructure, and digested contents of the pit not in use can be emptied after a year. This type also does not divert urine and does not require any emptying of its contents. Its maintenance is simple, one need only to spread wood ash and dry soil on top of the excreta every time one uses the latrine. Its costs are less than the cost of ordinary pit latrines (WSP 2004).

Community-Led Initiatives
The provision of sanitary services normally benefits from economies of scale in that a significant initial investment is necessary to establish initial infrastructure, the costs of which may be reduced as they are shared among more users. While, as previously explained, individual solutions for sanitary services can be provided in a cost-effective and sustainable manner, a centrally-provided system provides many additional benefits to users in terms of its convenience, increased sustainability and possibly in lower costs to the individual. Centralized systems provide even greater benefit to residents of very dense urban communities, where it may not be possible to construct numerous individual latrines.

Although Ruiru currently lacks a central sewerage system, one must be constructed in the near future. When construction for such a system begins, it is likely that it will not reach many areas of the municipality due to limited local resources. However the absence of a publicly provided central system does not prohibit un-served communities from benefiting from centralized sewerage services. In fact, rural, peri-urban and urban communities across the world have succeeded in constructing neighborhood systems of water and sewerage that connect to limited trunk lines. A regulatory environment that permits such arrangements, in addition to basic local government approvals are required. However, support beyond this basic level, while advantageous, is not necessary for these ventures to be successful.

In most of these cases, communities were able to construct their own water and sewerage systems utilizing the assistance of a non-governmental organization that provides technical and sometimes financial assistance. The most successful cases boasting extensive outreach, effective management and maintenance of the system are usually driven from community involvement from the earliest stages of concept development and depend primarily upon community ownership and operation once constructed. Community involvement throughout the entire process usually begins with local residents identifying and agreeing upon sewerage infrastructure as a priority community undertaking, financial and materials contributions on behalf of each family to benefit from the new system, and local labor in the construction and ongoing management and maintenance of the system.

The following section includes case studies, guidance and recommendations to enable community-led initiatives to improve access to sanitary services in Ruiru. The case study of the community- led Orangi Pilot Project, what many consider the most successful example of such initiatives ever, is provided to inform residents, government officials and others of the extent of success that community-led initiatives have achieved elsewhere. A short description of Condominial sewer design follows, as such is an innovation to the design of sewer systems that dramatically reduces their cost and is a technique that may be employed at the community and municipal level of service provision. Finally, resources for technical assistance and financing are explored to facilitate the development of sewerage infrastructure at varying scales within the municipality of Ruiru.

The Orangi Pilot Project (OPP): an example of the vast potential of community initiatives
In the city of Karachi, Pakistan, over half of its population of 9 million residents live in informal settlements in which basic urban services such as water and sewerage are not provided. Indeed, the official sewage system of Karachi serves only 40% of the city’s residents (Hasan et al., 1999). The Orangi Pilot Project (OPP) began in 1980 in Orangi, the largest squatter settlement of Karachi, with a population of 1.2 million. The project began with the broadly defined objective to implement sustainable solutions to local
development problems, and was centered upon the concept that local residents must be responsible for identifying and devising solutions to these problems. A team of local development professionals and university faculty played an advisory role throughout the project and first helped residents living alongside each other to initially organize and develop strategies to collectively address local development problems.

The very first groups of these organized residents identified the local lack of sewerage infrastructure as the primary local development problem they wished to address. The objective of the project thus defined, the plan of action was designed so that residents took primary ownership of the project, providing for all its costs and labor needs, whereas the non-resident professionals limited their involvement to an advisory role in the provision of assistance in organizing and technical assistance for the construction of a locally-appropriate sewerage system. As other area residents witnessed the success these first resident groups achieved in developing their own solutions to the absence of local sewerage infrastructure, thousands of additional resident groups likewise organized themselves, identified sewerage as their main development priority, and sought to connect their residences to the growing network of a community-built sewerage infrastructure system.

The methodology of the OPP has been adapted and applied in communities across the developing world acting alone or most often along with the assistance of other technical advisory groups. WaterAid, an international NGO that seeks to enable communities to gain access to potable water and sanitation, employs methodology similar to that of the OPP in many of its projects in countries throughout Africa and Asia. The description that follows of the original methodology of the OPP is largely taken from a report produced for WaterAid (Zaidi 2001).

In the OPP model, the advisory group first identifies existing local community organizations and works to help them further organize and include additional members of the general community. Once sufficiently organized, the advisory group asks these groups to identify their priority local development problems. The community must do so, and subsequently submit a written request to the advisory facility to begin working together. Upon the submission of a written request from the community, the advisory group will undertake a survey of lane conditions and local resources. From this survey, the advisors prepare a map and cost estimates of the sewer line.

As the advisory group does not participate in either the construction or administration of the system, residents designate local lane leaders and activists as the key on-the-ground workers. Local lane leaders collect money from each household for initial system construction based on a prescribed contribution plan. Two additional local positions, an organizer and a treasurer, are also either nominated or elected by residents of the lane to manage its construction and operation. The organizer represents the needs of the community to the advisory group while the treasurer collects and keeps the money and accounts (Zaidi 2001).

The advisory group establishes physical levels in the lane and demarcates the position of the sewer line. The lane manager purchases materials and assists with hiring local labor. As work begins, the advisory group provides ongoing technical assistance in community organizing and training of local individuals to develop necessary skills for construction and maintenance of the system (Zaidi 2001).

National & Multi-national NGOs Working to Improve Water & Sanitation in Kenya: Water for People: Water for People is a multinational NGO that coordinated a program for the provision of water and sanitation services in five East African countries beginning approximately in 2001 with funds from the U.S. Environmental Protection Agency. The group subcontracted the majority of field activities to two other NGOs, Community Management and Training Services (CMTS) and the Intermediate Technology Development Group (ITDG) (now referred to as 'Practical Action'). Project activities focused on community building, improving hygiene and sanitation education, the building of small affordable demonstration latrines and improving solid waste collection. It is not clear whether these project activities continue at present.
Community Management and Training Services – East Africa (CMTS-EA): CMTS-EA was established in 1991 in Kenya but with a regional orientation. The main focus of activities is to promote community participation in decision-making in development activities that affect their lives. Based on experiences the core activities have been targeted towards training to improve knowledge and skills. CMTS provided the bulk of educational services in their role as subcontractors in the Water for People project.

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Community Management and Training Services
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Cmts2001ke@hotmail.com

Intermediate Technology Development Group (ITDG)/Practical Action: Recently changing its name to “Practical Action”, this multinational NGO works with poor communities to help them choose and use technology to improve their lives for today and generations to come. Practical Action has participated in several projects in Nairobi’s informal settlements, and was responsible for the organization of secondary water service providers as well as for the building of demonstration latrines in their role as subcontractors for the Water for People (WFP) project. It is unclear, however, based on information provided in project progress reports on the WFP project, whether these activities were realized.

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Kenya Water for Health Organisation (KWAHO): KWAHO is a national non-governmental organization based in Kenya. Its efforts are geared towards providing sustainable water and sanitation for the disadvantaged communities in Kenya. Its website indicates that it is currently working in Kibera, as well as in other locations throughout the country.

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Condominial Sewer Design

Condominial network technology for the provision of water and sewerage service is a modification of the traditional design of central water and sewer lines that significantly reduces the costs of providing such infrastructure. First implemented successfully in Parauapebas, Brazil in 1996, and utilized in the city of La Paz, Bolivia since 1999, it has generated much interest among municipalities across the developing world seeking to establish water and sewerage infrastructure. The Condominial model consists of two basic components (WSP 2005):

1) The model consists of extending the water and sewerage lines along sidewalks and inside lots, as opposed to in the streets. Rather than providing each individual house with a connection to the public network, a group of houses, as if they were a condominium or apartment building, share a connection point, hence the name Condominial system. This type of network design facilitates subdivision of the system into sectors comprising a specific number of blocks. Network maintenance is possible by installing a collecting chamber. In this way, only a small number of users will be affected by system maintenance.

2) The community participates in the construction and maintenance of networks, further reducing costs.

The cost of building Condominial water and sewer lines is significantly lower than that of conventional systems. A comparison of project costs of the Condominial system in Parauapebas, Brazil revealed that its costs were less than 40% of what construction of a conventional system would have required (WSP 2005).

Financing the Development of Sewerage Infrastructure

Municipal infrastructure development demands significant investment beyond the financial capacity of most municipalities in the developing world. The team is aware of the limited financial capacity of the RMC and that is unable to undertake much infrastructure development of any kind within its borders. However, the construction of sewerage infrastructure is fundamental to the future development of Ruiru, both in terms of promoting the health of residents and as basic urban infrastructure required to enable further economic development.

Investment in Trunk Sewerage Infrastructure Should be Top Priority of Council

As the Council prepares to extend water service to its residents, it must acknowledge that investment in water infrastructure should only be undertaken in conjunction with a corresponding investment in sewerage infrastructure. Without the corresponding sewerage infrastructure necessary to drain and dispose of the increased wastewater generated from new water infrastructure in addition to the human waste of a growing local population, there may be disastrous consequences in local public health and economic efficiency. In order to avoid such consequences while also ensuring the value of investment undertaken in water infrastructure, the Council should pursue, at the very least, construction of basic trunk sewerage infrastructure.

Trunk infrastructure should be laid in centers of greatest population density, where the benefits and returns from undertaking such investment would be greatest. Once basic trunk infrastructure is in place, it can later be extended in a similar fashion, while other subsystems utilizing alternative, more cost-effective designs in otherwise un-served areas may also integrate these systems with the primary infrastructure. In the latter scenario, the Municipality will effectively leverage its investment in trunk infrastructure by enabling unserved neighborhoods and businesses to bring these services to themselves, as described in the prior sections discussing community-led initiatives and Condominial design systems.

Investment in Sewerage Infrastructure can be Relatively Affordable

While the expense of the development of sewerage infrastructure will be great, it is absolutely necessary. Because such infrastructure is indispensable in terms of local health and economic development, the Council may be able to obtain funding from multilateral bodies such as The World Bank in order to pursue its development. By first developing only the basic trunk sewerage lines, the Council will dramatically reduce the total investment required as opposed to extending lines across the municipality. Ecological latrines and community-built sewerage systems both provide particularly attractive solutions in terms of financing to individuals and to the Municipal Council. Both options use local materials and labor to the fullest extent possible, resulting in the lowest possible costs in construction. Additionally, both options
largely depend on local residents to manage and maintain the facilities, reducing these costs, while also creating local employment. The NGOs listed previously may also be able to finance a portion of the costs of the development of community sewerage systems, further reducing the burden of its costs on residents and the Council.

There are additionally new programs in development that would provide grants and low-interest loans to communities to undertake the development of community infrastructure development. One such initiative that residents and the Council should follow the development of is called the Community-Led Infrastructure Finance Facility (CLIFF). CLIFF is a financial mechanism that facilitates access to capital by organizations of the urban poor. Operating for 3 yrs in India, the program recently initiated the second pilot scheme in Nairobi, where the project is to be undertaken in Kibera by Kenyan partners Pamoja Trust and Muungano wa Wanajiji. Regardless of the outcome of this venture, Ruiru may be able to learn from many of the program’s lessons and use contacts made in Kibera, as well as to capitalize on the general interest and momentum for financing community-led infrastructure development it creates. (http://www.citiesalliance.org/activities-output/topics/finance/ cliff.html)

4.5 Governance

Decentralization in Kenya

Although historically a highly centralized government, with all governing and decision making powers belonging to the central government and Ministries, in recent years, Kenya has become increasingly interested in the possibilities and benefits of decentralization. Decentralization is viewed as a way to “improve the planning and implementation of development” (Gow and Morss 1988) by shifting responsibilities and powers from the central government to local authorities who are more aware and in touch with issues facing their residents, but which usually are lacking in service provision. Under this concept, local authorities are more likely to be responsive to the major issues of the community, as they are closer to the community and they can work with the community, thus implementing faster solutions and more effective delivery. The success of decentralization is dependent on an increase in community participation and communication between the residents, business and agriculture producers and the local authority. If the local population, especially those most marginalized, are going to have any chance of benefiting from any type of development both decentralization and participation must be present as this is the way in which all members of the community will receive improvements in service provision and public services (Gow and Morss 1988). Increased power to govern coupled with a better field knowledge of their jurisdiction as opposed to the central government makes decentralization an attractive option for Kenya.

Problems and Issues at the Municipal Level

As previously mentioned, the Local Governance Act mandates an overall increase in responsibility and governing powers, mainly for service provision, to local authorities. The RMC is meant to assume this increase in responsibility, such as water provision, housing, education, sewage and garbage collection but is currently unable to successfully or consistently render these services. As a result of decentralization, there are three main issues at the municipal level; inadequate funding, lack of capacity and an ambiguous role of autonomy, which together create difficulties for the RMC to provide the services mentioned above. It is important to note that decentralization occurs not only on the political but also on the financial level. The argument is that fiscal decentralization should create economic growth which should have a direct impact on the quality of life of a town or municipality (i.e. economic growth creates more revenue for local authorities which then is used to provide services). However, there is no consistent empirical data supporting this argument and as of now (Martinez-Vazquez and McNab 2003) the RMC due to their limitations in capacity, are only able to collect 50% of all revenues coming from business permits and licensing and they are only receiving 5% from LATF (Gulyani 2004). A portion of the revenue collected is paid back to the central government leaving the RMC with depleted coffers but increased service responsibility which they cannot fulfill.

Decentralization affects the capacity, defined for this report as human resources and capital, of local
governments simply due to the large increase in service responsibilities. Many of these responsibilities were once national but as they became local responsibilities, local authorities such as the RMC, found themselves short staffed and unequipped with the skill sets needed to fulfill the new responsibilities. The RMC does not have a planner on staff which is a problem for a municipality like Ruiru that is growing so rapidly and faced with a deteriorating infrastructure.

Decentralization also challenges the RMC in that it contradicts a weakening institutional framework. There is confusion among local authorities concerning their autonomy, as the legal and institutional documents do not match the current governing trends. Although the role of the local authorities has expanded, their realm of autonomy has not grown with it. This confusion is illustrated in the Local Governance Act where it stated that local authorities must become service providers. Thus it seems the local authorities have more control and have more autonomy. But, the Act states that this autonomy is limited and subject to overall control of each local authority (Mwaniki 2005). Local authorities do not know their governing parameters leading to violation of laws, neglect of responsibilities and mistrust between governments and communities.

The problems of institutional framework, while it can be linked to a number of issues, seems to be based on national leadership’s reluctance to admit its new less commanding role in governance and the lack of communication and knowledge of what happening at the local level (Fiszbein, 1997). The institutional framework hampers what is occurring at the local level. The institutional framework can’t be ignored as it results in projects such as roads and infrastructure improvements being built but not maintained due to confusion over who is responsible for maintaining such projects. Changes in the institutional framework are just as critical as changes in the way in which the council governs over the municipality.

The RMC can address this question of autonomy in a few ways. First, The Ministry of Local Governance could clarify the autonomous role of subnational government. Second, the RMC itself could go to the Ministry of Local Governance and ask for clarification of their autonomous role in a decentralized state. Third, the RMC could consult with other municipal councils to see how they dealt issues concerning the ambiguous autonomous issues and discuss ways in which they can work around the problems. Fourth, the RMC could ignore these issues and operate in a way that they believe would best serve the residents of Ruiru.

A major effect of inadequate funding, lack of capacity and confusion over the role of the RMC’s autonomy, all spurred on by decentralization, is limited participation. Participation in Ruiru has been minimal to nonexistent. As stated before, decentralization is seen to be most effective when in conjunction with the participation of the community. The underlying intention of using decentralization as a tool for development is that by bringing government closer to the people, more people will participate in local politics, increasing awareness spurring on initiatives and projects that reflect community needs. The point of participation is that the community has the opportunity to create a community that best serves them and they can create the capacity to achieve objectives as they work together to achieve a common goal. “Community ownership of programs and ideas is one of the few, and most important conditions for continuity of the process of local capacity development” (Fiszbein 1997).

Currently in Ruiru, community participation is limited to the town meetings which are attended by few citizens and to only one known community group based in Kahawa Sukari, comprised of the municipality’s wealthiest residents. Based on the assessment of the current situation facing the RMC as well as the current governing trend of decentralization and participation, the following is a series of recommendations for the RMC and residents of Ruiru that look to enhance the amount of participation between both groups, and strive towards the common goal of improving the quality of life in Ruiru.

Central vs. Subnational Governments
The process of decentralization is in full swing in Kenya, but it is too early to evaluate its various effects. While there is no formula for a smooth transition from a centralized to a decentralized government, when considering the three main issues facing local authorities, such as the MCR, the best governance scenario for Kenya lies somewhere in between a centralized and a decentralized state. To this end, increasing
communication between national and subnational levels is essential.

There needs to be a balance between supervision and autonomy as evidence has shown that in order for decentralization to be completely effective, there needs to be strong central core. A study in agricultural administration in Kenya pointed out that in a strong decentralized administrative center, the central administration should be just as strong (Gow and Morss 1988). It is important to promote controlled decentralization, rather than just divesting local authorities loose from central control. There also needs to be an understanding on the behalf of the central government that if they are going to decentralize responsibilities, they also need to decentralize finances in order to meet these responsibilities (Dillinger and Fay 1999). Therefore, it can be argued that if subnational governments are to become the major service providers, higher-level jurisdictions, like the national government, must share part of their revenues with the subnational governments to help bridge the gap otherwise created due to lack of subnational fiscal capacity (De Mello Jr. 2000).

Literature suggests that finding a balance between a centralized and decentralized state can be accomplished by creating a system that is based on a concise and stable set of rules that explain in detail the nature of the relationship and responsibilities between the central and subnational government (Dillinger and Fay 1999). These rules create clear and strong intergovernmental linkages and stipulate responsibilities, focused on three main areas; regional and national interests, accountability and subnational function and resources.

First, both governments should be aware of each other’s interests and do what they can to keep each other in the forefront in order to alleviate fears that many regional interests will contradict national interests, creating political and macroeconomic instability.

Second, accountability is essential to local governance. In order to achieve accountability that results in effective democratic governance at the local level, there needs to be democratic elections. As of now, in Ruiru, only the ward representatives are popularly elected and two councilmen are appointed by the Ministry of Local Governance. The five ward representatives and the two ministry representatives make up the political unit of the RMC. The members of the council elect a mayor, in accordance with the rules set forth by the Electoral Commission of Kenya (ECK) (Mwaniki 2005).

Third, an understanding between intergovernmental relationships concerning functions and resources must be made clear. It must be clear as to what the central government should provide and what the local government should provide. The central government also needs to take into consideration the lack of capacity of the local governments to provide services when allocating responsibilities and step in when necessary. This can be done by creating a “division of functions” in the form of a principal-agent relationship (Dillinger and Fay, 1999). This works by the subnational government working as an agent of a higher-level governing official and as a principle agent in delivering local service. This works by each level providing whatever best reflects their interest. For example, education is seen as a tool of poverty alleviation having positive effects on both the local and the national level. Therefore in this principal-agent relationship, the agent (national government) can provide financial support to education in all jurisdictions, while the local authority handles the management responsibilities. Currently, RMC is unable to support any type of school, especially secondary schooling. This type of partnership may be a way to provide more schooling.

What is important to keep in mind, however, is that whatever the function the partnership is trying to provide, the rules of responsibility need to be made clear so nothing slips through the cracks and money is spent where it is supposed to be. In terms of resource provision, notably in Africa, often the response of governments in financial crisis is to allocate service responsibilities to subnational governments (Dillenger and Fay 1999). Such is the case with Ruiru. However, as mentioned before, the central government has not provided the necessary revenue to provide these services which results in limited or no service provision at all. This is the problem in Ruiru. In conjunction with this transfer of funds, such as the LATF, only have a minimum effect. It is the hope of the RMC that more will come from the LAFT as the central government must make this transfer of funds consistent and easy so the RMC can use it for accurate budgeting purposes.
The bottom line is that decentralization is going to continue. The process will also continue to foster problems within the current institutional framework. While the GoK is apprehensive to relinquish control, they need to recognize and embrace the trend and work with the local authorities to ensure the best possible outcome for all involved.

It is clear that the implementation of the aforementioned suggestions and recommendations are not in control of the RMC, but rather in the control of the GoK. Still, in trying to create and understand the entire picture of how RMC can better manage its rapid urbanization and spill over effects from Nairobi, as well its ability to embrace and manage the effects of decentralization, it is important to be aware of how the relationship between the local authorities (RMC) and the central government of Kenya fit together as both parties put forth the effort to improve the quality of life for Kenyans. The following suggestions and recommendations do fall under the control of both the RMC and the residents of Ruiru, and could be implemented, independent of the central government.

Institutional Issues in Project Selection: Lessons from Literature

The institutional framework which the RMC must deal with on a daily basis has to be addressed. While the RMC cannot make sweeping changes, there are certain measures that can be taken to deal with project implementation on the local level. Many times projects are implemented at the expense of focusing on strengthening the institution and as a result, most of the time the reason that projects fail is due to institutional failures (Gow and Morss 1988). Roads are built but not maintained, new technology is introduced but not supported and people are trained in new technologies but are not able to effectively use them. The projects that are implemented should be focused on strengthening weak institutions by implementing provisions within the project that help strengthen the framework. Important institutional factors to consider are as follows:

• Administrative capacity
• Selection of agencies that are responsible for the project oversight
• Agency access to resources
• Structures that support effective information flow horizontal; between technical agencies and vertical between beneficiaries, local government and higher jurisdictions (Gow and Morss 1988).

For many projects, the budget, talent and attention are skewed towards the infrastructure rather than the institutional context in which the projects can be sustained. Attention needs to be directed towards institutional development so that the projects can be monitored and thrive. It is more important to focus on ways to sustain projects through creating a solid institutional framework, rather than temporary solutions. “Capacity to mobilize resources and achieve set objectives must be embedded in the institutions for developments to be self sustaining” (Gow and Morss 1988). Therefore the projects and initiatives that the RMC decides to focus on must work towards developing both the structural side as well as the institutional development objectives. This can be done in a few ways.

• Focus on performance improvements rather than production increases
• Side effects on local institutions capacity must be examined
• Designs must reflect a deeper understanding of the existing institutional framework

Built into every plan must be provisions explaining how the projects will be able to survive once resources have evaporated. Projects should be more simplistic and training should be an important component in order to continue receiving benefits from the projects.

MCR and Residents of Ruiru: Enhancing Participation

As stated earlier, participation is extremely limited in Ruiru, comprised mostly of poorly advertised and attended town meetings and one community organization made up of the municipality’s wealthier residents, located in Kahawa Sukari. The following recommendations focus on how the RMC can strengthen its relationship with its residents by increasing participation as well as increasing communications between the RMC, other satellite cities and the Nairobi City Council. The
recommendations are broken into four categories: civic, information dissemination, knowledge sharing and feedback. Through these recommendations, all focused on enhancing participation, the issues of accountability, transparency and lack of capacity can be addressed. It should also be noted that while these recommendations are geared towards what the RMC can do and what the residents can do as individual actors, the overall success of the recommendations lie within both parties willingness to work and act together towards the common goal of improving overall quality of life in Ruiru.

Civics

In an effort to increase transparency, RMC and the residents of Ruiru could create an Accord that details the rights and responsibilities of the residents and the RMC. The Accord will make it clear what the RMC can provide at the moment (even if limited) and that it is also the responsibility of the residents and the community to pay taxes in order to receive these services.

Information Dissemination

Participation and communication are essential in creating more stable and democratic governance in Ruiru, as local participation increases government accountability (Fiszbein 1997). Therefore, it is recommended that the mayor or town clerk have a daily or weekly radio show which explains the type of projects and initiatives occurring within the community. In this show, laws, regulations and procedures both pertaining to the national and local levels should be explained in order to keep the public as well informed and educated as possible. The mayor of Valledupar, Colombia initiated such plan and it helped encourage and eventually increase public participation within his town (Fiszbein 1997). The radio show could also tell the community when and where the next town meeting will be, ensuring that as many people as possible know. This information coupled with the explanations of local initiatives and local/national policies will provide a solid foundation and overall understanding of what is going on in their community, how the RMC is involved and how the central government fits it, allowing for debates and public participation to flourish.

To continue to capitalize on community participation, if possible, town meetings could rotate occasionally from ward to ward, offering the opportunity for ward members to visit other wards as well as include members of the community who cannot make it to the council’s office due to various constraints. This would demonstrate a genuine effort towards unifying all of Ruiru by making attempts to familiarize and encompass all areas and residents into the governance process. Enhanced participation and cooperation between the RMC and the residents of Ruiru could also manifest itself through participatory budgeting. Participatory budgeting ensures that the community plays an active role in the decision making and policy creating processes that directly affect the allocation of resources. Involving the community in the decision making process results in greater transparency and accountability. There also is a more equitable allocation of resources as the community is able to identify and express their interests to the RMC. In order for participatory budgeting to be successful, attendance of community meetings by all actors in essential.

Participatory budgeting has proven to be extremely effective throughout Brazil, where currently almost 180 municipalities and many other Latin American countries had incorporated the practice of participatory budgeting into their governing framework. In these cases, participatory budgeting has empowered the municipalities as well as fostered more equitable allocation of resources (www.iabd.org).

To further perpetuate participation, communities within Ruiru should take advantage of their democratic right to attend public meetings and review minutes of proceedings and documents that may have important effects on the community. These rights are stipulated in the Local Governance Act (CAP 265). This is going to increase awareness and accountability within the RMC which will benefit each community.

Knowledge Sharing/Networking

The RMC should continue working with independent and volunteer groups, such as the Association of Local Government Authorities in Kenya (ALGAK). This particular group aims specifically to help local authorities increase capacity building in order to increase service provision as well as increase responsiveness of the concerns of the citizens from whom they collect taxed and levies (Mwaniki 2005). The RMC could share with the community that they are taking the appropriate steps and measures to increase services and effectiveness by working with ALGAK. This may help begin to ease the fragile and tense relationship between community members and businessmen who believe the RMC is taking their money and not channeling it towards service provision. There are many ways in which the community and
residents can band together to achieve certain goals, without the help of the RMC or national government. Initiatives and projects, led by the community, will mostly reflect the issues most important to the community and some of these can be achieved solely through cost effective community participation. An example of this is the community led initiative sanitation effort in Karachi, Pakistan where the community, with help from university faculty and development professionals, was able to create an affordable and effective sewage system. Residents could seek the aid of residential associations and organizations which can teach communities how to best articulate their concerns and needs to the RMC. There are approximately 200 residential associations in Nairobi that are committed to improving the quality of life on the local level (Mwaniki 2005). It is more effective if residents act collectively as some of these organizations do not offer such advantages to individuals. Resident associations such as, We Can Do It and Kenya Alliance of Resident Associations can assist in finding ways to improve and provide technical assistance for service provision (Mwaniki 2005). These organizations can help and inform residents on how to best utilize and assemble their members- whether it should be by ward or popularly elected officials from each ward working with the MCR. It should be noted that some of these organizations attempt to achieve these goals through legal action. It may be best to try to find alternative ways to improve service provision as legal action could potentially be a waste of precious time and resources. Considering the proximity of Ruiru and Nairobi, becoming involved with these associations should be relatively easy.

The RMC proximity to Nairobi is a clear advantage and the RMC could use it as leverage. The urbanization and spillover effects of Nairobi negatively impact Ruiru and as such the RMC could consult with the Nairobi City Council and demand more technical assistance. As of now, only Nakuru and Nairobi have staffed planners. With the amount of uncontrolled growth and the severity of the capacity and funding problems, coupled with these impacts being directly related to Nairobi, a planner is required to assist Ruiru. This assistance could be in the form of a full time, certified planner or by supplying the MCR a small technical and planning unit that can deal with the concerns of all the residents and deal with how these concerns are connected to the development of Ruiru. Issues are initially synthesized by these smaller units and thus the RMC can effectively respond to more problems in a more effective manner. This same approach was taken by the Mayor of Valledupar, Colombia and it proved to by effective. It was also a positive approach to dealing with a larger municipality, specially one exceeding 40,000 residents (Fiszbien 1997). On the same philosophy, the RMC should band together with other satellite cities experiencing similar effects from Nairobi and work with the Nairobi City Council on how these impacts can be mitigated.

The RMC must continue to evaluate their staff and budget and keep in mind that reforming both might be unavoidable. It may be necessary to streamline employment and review the skills on staff verse the skills needed on staff (Mwaniki 2005). This is important also because a problem with many local authorities is that a majority of their revenues goes to paying wages. RMC spends roughly 60% of its budget on wages. Exacerbating this problem is the fact that with such inconsistent revenue collection, often times staff does not get paid. To this end, the RMC needs to carefully examine its budget and decide if it’s expenditures go to the most needed resources or if there are alternative ways to spend what they have to better serve the residents of Ruiru.

Feedback
The RMC could distribute report cards to the residents, allowing residents to evaluate the performance of the RMC. The RMC could use these surveys to better understand the concerns of the residents and how the RMC can better address these issues as well as facilitate communication between the RMC and the residents of Ruiru. In Bangalore, India, reports cards have also been used to address corruption, promote transparency and community participation. The report cards could also be distributed internally within the RMC to help improve staff performance. A complaints and grievances procedure is another way the residents of Ruiru could share their problems with the RMC and they can do this anonymously. There could be a suggestion box at the council’s office or at other strategic locations where the residents could submit grievances and suggest ways in which improvements can be made.
Conclusion

5.1 Theory

The team took a strategic approach to planning in Ruiru. Although the plan sought to address issues of the environment, equity and efficiency, it has in many ways been physically deterministic and limited in scope. In order for a plan to be effective, it must address both physical and social goals concurrently. Any subsequent work should explore other planning methods, their goals and outcomes, and examine some of the critical questions they raise for the future of Ruiru. This plan may have looked very different had the team chosen a different planning approach, and strategic planning, by its very nature, leaves large gaps that need to be filled. While the team has addressed what is believed to be several top-priority sectors, some critical questions remain. What should be the role of the Kenyan planner in the planning process? At what scale, local or metropolitan, are the issues of Ruiru best addressed? And finally, what is the African version of the just city?

The role of the Kenyan planner

Kenyan planners are overextended, with single planners responsible for vast land areas and many people. It is essential that the role of the Kenyan planner be defined and understood at both a local and national level. To do so, one must consider the literature produced by planning theorists in regards to the planner’s responsibility to their client and to the public. To define the planner’s role, Kenyan towns, local governments, district planners and national ministries must also decide on a planning process, so that the planner’s responsibilities within a well-defined process are clear.

Advocacy planning, equity planning, strategic planning and environmental planning are four of the processes and roles considered here. Advocacy planning defines the planning process as one of conflicted interests, where interest groups present their arguments through formal discussion, much like legal proceedings in the United States. Here, the planner’s role is as an advocate for the needs of the particular group he or she represents. The planner is also defined as a technocratic expert, with special skills and education that makes him most qualified to enter into higher-level planning discussions and debates. In the Kenyan context, advocacy planning might take two forms. First, in the ideal situation, Kenyan advocacy planning would involve significantly more planners. Each municipality, district, metropolitan area and special interest organization (welfare organizations, slum dwellers associations, business associations) would have their own planner, who would meet in a formal forum and advocate on their behalf. The purpose of this forum would be metropolitan, regional or national cooperation and allocation of limited resources. In order for this forum to be successful, it should include representatives from all interests groups, including the informal sector, and not just representatives from the rich and powerful. A different version of Kenyan advocacy planning would require single planners, such as those responsible for entire districts, to act as advocates for different groups at different times within their own jurisdiction. When planning decisions needed to be made, the planner would be responsible for identifying all stakeholders and determining the effects of the proposed project on such groups. The planner would then intervene on the behalf of marginalized groups or those who would be negatively affected by the project, in order to reach a compromise where negative externalities are minimized. Individual planners would perform this type of decision-making at the local, regional and national level.

Equity planning holds a great deal of promise for Kenya, where socioeconomic disparities are widening, not shrinking. Equity planning calls on planners to address the needs of the most needy, the marginalized, and in the Kenyan context, the informal. Here, planners are again advocates, but this time for a very specific group and with a very specific goal: equity. An equitable planning process ensures equal representation from all stakeholder groups regardless of wealth or political power and is focused on ensuring equitable access to resources and services. A major point of our polynucleated scenario is the inclusion of locally-based economic activity. This element of the plan most directly addresses equity of access to economic activities, a major issue in the Kenyan economy. Coupled with economic access, our transport system attempts to provide as many Kenyans as possible with access to inexpensive transportation. Therefore, a significant part of equity planning is concerned with creating access for the poor and the marginalized, addressing issues of safety, health, economic development, transport and
governance, to name a few. A Kenyan planner concerned with equity should ensure equal representation of all stakeholders in the planning process and use goals of equity and access in all sectors to inform their decision-making.

While strategic planning provides an efficient guide for decision-making given its limited resources, it is important to also identify its shortcomings. In the strategic planning process, the planner may consult with a community and/or team of experts in order to create a ranked list of planning priorities. As resources become available, these priorities can be addressed. Essentially, strategic planning operates fully within the real world and considers only what might be done given the current situation and limited resources. Additionally, strategic planning works well when time and information are both limited- a significant reason why this project adopted this method. However, a strategic planning process does not always explicitly contain equitable goals, and therefore is subject to the distortion of rationality, power and wealth. As noted above, strategic planning cannot comprehensively address all the needs of any particular area or group, and thus leaves large sectoral gaps to be filled at an indefinite date. A strategic planning process may be very useful in the Kenyan context if all stakeholders are involved in the identification and prioritization of planning issues and the ultimate goal of equity acts as a backdrop to planning decision-making.

In developing countries, it is important to identify environmental concerns from the outset of the planning process, as equitable access to a country’s resources is always a concern for planners. Thus environmental planning is concerned with sustainability and the balancing of social, economic and natural interests. One of the most challenging aspects of environmental planning is the permanency of decision-making. Once agricultural land is developed as residential housing, the productivity of that land is lost forever- or at least as long as it remains developed. Therefore, a significant goal of environmental planning is the preservation of agricultural and undeveloped land, particularly the 20% of Kenyan land that is fertile and arable. To accomplish this, planners must balance the interests of society and economic development, and weigh them against the negative externalities of loss of open land, or pollution of natural resources.

It is important to note that the above planning approaches are not mutually exclusive. Any planning process can incorporate goals of equity and environmental protection, and community consultation and prioritization can make the process and outcomes of the Kenyan planning process more efficient and more likely to succeed by including all stakeholders in the decision-making process. Ultimately, it is important to realize that equity and efficiency are not a tradeoff, and that equity is really long term efficiency, with lowered social costs. When inequity becomes out of control, it is very difficult to “fix”. However, by clearly defining the planning process, identifying goals and stakeholders, and defining the role of the Kenyan planner, equity in Kenya can be increased and the democratic process will be deepened.

Scale for planning interventions
A significant amount of the teams discussion has been devoted to the scale at which planning will be most effective in Kenya. Should it occur at a local, metropolitan, regional or national level? The answer, of course, is all of these. The point, however, is that planning in Kenya should be vertically integrated, so that the national planning process both reinforces the goals, decisions and power of the metro and local planning authorities, while at the same time addressing larger issues which require the cooperation of many local planning boards. This efficient, vertically integrated system is accomplished first by clearly defining the planning process and the roles of local, metro and national planning authorities within such a process. Special attention should be given to ensuring that power and jurisdiction match responsibilities and resources. If the local government is to be responsible for the enforcement of land use regulations, they must have the backing of the police department and local courts to enforce land use laws. Additionally, they must have the financial and human capacity to identify land use violations in a timely manner. At the same time, metropolitan planners should take a wider view of the expanded metropolitan area and have the responsibility and authority to make decisions for the entire metro area, such as limited peripheral growth or increased density within the central city. However, each level of planning should work with the level below, to insure that interests are equally represented in planning decisions, and so that more local bodies are involved in and understand the decision-making process of regional planning commissions.
The Kenyan “Just City”

The “good society” is a struggle for both common shared interests and people’s own personal interests. Such is the case in Kenya, where individual actions, such as private car ownership, often come at a significant cost to Kenyan society in terms of the negative externalities they produce, which seem to fall unevenly upon the poor. And while we might never achieve a utopian society of complete income equality, we may be able to function better in a society where income is not equal but access to opportunity is. Susan Fainstein, an urban theorist, has identified the following characteristics in her vision of the “Just City”: it is egalitarian, democratic, diverse, environmentally concerned and is supported by a strong welfare state with ties to civil society. In order to imagine what the just city might look like in the Kenyan context, it is first useful to see where Kenya currently falls on the matrix above.

Fainstein believes that the city of Amsterdam provides the best example of the Just City, and that in order to achieve such a society a community must come to agreement on “right” and “good” actions, identify the interests of social actors and groups and enter into truthful discourse. This is, of course, the making of urban utopian thought; however the tenets of the Just City model do have direct applications in the Kenyan context. First, one might envision a system where the poorest of society—those in the informal housing and economic sectors—are given more equal footing in terms of access to services, economic activities and representation. Elements of this planning document address this point, particularly in terms of sectoral associations and increased participation in governance, but these recommendations could also be strengthened at the metro and national levels by the facilitation of regular meetings between national and metro authorities and local governments. In regards to increased democracy, corruption remains a significant issue in Kenya. Governance strategies should be aimed at creating positions where those in power are more directly accountable to the people, and equitable access to voting mechanisms should be guaranteed to all people.

<table>
<thead>
<tr>
<th>The Just City</th>
<th>Kenya</th>
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<tr>
<td>Egalitarian</td>
<td>Social and monetary inequality</td>
</tr>
<tr>
<td>Democratic</td>
<td>Democratic but corrupt</td>
</tr>
<tr>
<td>Eco Friendly</td>
<td>Minimal enforcement of environmental regulation and preservation</td>
</tr>
<tr>
<td>Welfare state with connections in civil society</td>
<td>Tradition of self help due to lack of government capacity</td>
</tr>
</tbody>
</table>

Many of Kenya’s neighbors have fallen victim to ethnic violence thus experiencing severe consequences. Kenyans should be proud that despite their diversity, they have maintained a tradition of peaceful coexistence. Therefore, it is important that Kenyans continue to address ethnic and tribal conflicts in a peaceful and timely manner. As Kenyans have learned in the past, this method of conflict resolution is vital to the peace and security of the country. In the interest of equity, all ethnic and tribal groups must have access to representation and conflict resolution resources, and all groups must have a voice within society.
Other aspects of the Kenyan Just City might include making environmental preservation an explicit goal, and engaging in environmental education as a way of guaranteeing future understanding and concern. Local, metro, regional and national bodies should legislate for environmental protection and provide the financial and human resources to enforce such legislation. In terms of civil society and the welfare state, Kenya should build on its tradition of self-help groups and make use of international donors, NGOs and community organizations for decentralized and targeted social welfare distribution. Overall, the creation of the Kenyan Just City requires increased discourse and representation at both the local and national levels.
5.2 Timeline/Prioritization

Implementability Scheme Ruiru Planning Recommendations 2006
This document is designed to classify the recommendations of this report in terms of the implementability of each. The team has defined implementability relative to the immediacy, relative ease/difficulty of undertaking, and predicted duration of each recommendation. Additionally, the team has specified whether each recommendation directly, indirectly or does not address local concerns for the promotion of equity, economic development and efficiency. The scale for each criteria is explained as follows:

Priority
(1-5)
1 = Most urgent
5 = Least urgent
(takes into consideration cost, convenience and importance of recommendation)

Timeframe
(Short, Medium, Long)
Short = 0-2 years
Medium = 2-5 years
Long = Over 5 years

Financing
($$$ - $)
$$$$ = Greater than US$10 million
$$$ = US$5-10 million
$$ = US$1-5 million
$ = Under US$1 million.
<table>
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<th>Priority</th>
<th>Timeframe</th>
<th>Financing</th>
<th>Eqty</th>
<th>Econ Dev</th>
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<td></td>
</tr>
<tr>
<td>Community networking with NGOs</td>
<td>2</td>
<td>Short</td>
<td>$5</td>
<td>Explicit</td>
<td>Implicit</td>
<td>Implicit</td>
</tr>
<tr>
<td>Increase information and dissemination of meeting</td>
<td>1</td>
<td>Short</td>
<td>$5</td>
<td>Explicit</td>
<td>Implicit</td>
<td>Implicit</td>
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Appendix

Appendix 1

Safety

1. Current Conditions
Safety is a major concern in all cities and particularly imperative in Nairobi, whose nickname “Nairobbery” reveals the notorious extent of crime in the area. A functioning city relies on the ability of its citizens to feel comfortable walking in public to fulfill daily activities. Without this, a city fails to provide a basic comfort in life, loses its sense of community, and prevents new economic opportunities from investing in the region.

According to a 2002 UN-HABITAT crime survey that interviewed over 10,000 residents in Nairobi, 37% of residents have been a victim of robbery, 18% have been a victim of physical assault, and 72% avoid working or traveling after dark (Stavou, 2002). These trends in crime extend into Ruiru where both residents and companies have expressed concerns over safety. David, an administrator of an NGO located in the central business district of Ruiru, said he moved out of Ruiru because his home was broken into and burglarized several times. Redlands Roses, a cut flower farm located on Ruiru Road northwest of the central business district, voiced their concern about local safety due to recent criminal attacks on their employees. As Ruiru’s population continues to grow at an enormous rate, these problems will only escalate. If current trends continue, Ruiru will be adversely affected in three major areas: 1) fracturing of social capital, 2) weakened trust in governance and 3) hindering of economic opportunities.

Fracturing of Social Capital
Community interaction enables people to build social networks and create a sense of belonging, trust, and tolerance. Crime in Nairobi is eroding its social capital, and over half of the City’s residents think both people inside and outside the community is responsible for local crimes (Stavou, 2002). Social capital can be destroyed not only by emotional barriers but by physical ones too. A common reaction to crime in Nairobi has been the establishment of private security. Most residential neighborhoods, as well as many malls and public spaces, are enclosed by walls, barbed wire, and electrical fences. This leaves most pedestrians isolated on narrow paths, left to walk alongside tall and intimidating barriers. Part of this strong physical separation is rooted in the historic colonial divisions between races when Nairobi developed under British rule. What were once racial divides have now become economic divides. These separations continue in Ruiru, where newly built single-family homes in high-income neighborhoods like Kahawa Sukari are each enclosed by private walls. While barriers may provide an immediate sense of safety for those within its boundaries, they establish an immediate sense of distrust for those outside of them. In the end, walls erode public interaction, community networks, and only intensify the social and economic divides that lead to criminal behavior.

Weakened Trust in Governance
Crime in Nairobi is not just seen as a high amount of crime, but a low amount of enforcement. 98% of residents believe that there are elements of corruption in the police force and 29% admitted to giving a bribe in order to either do away with a problem or maintain their operational activities (Stavou, 2002). John, a cab driver in Nairobi who lives in Kibera, said he doesn’t complain to police officers because nothing will come of it. Accounts of unreported crimes, including rape, are common due to public impressions that filed reports rarely lead to proper investigation or prosecution (Petrus, 2002). These incidents and attitudes weaken trust in local enforcement and the ability for the Municipality to foster open communications with its citizens and successfully implement any programs.

Hindering of Economic Opportunities
Africa is the only country to experience rapid urbanization without the corresponding increase in jobs (Nairobi Metropolitan Growth Strategy, 2005). Because of this, attracting economic opportunities is particularly essential to provide residents with income and alleviate the high rate of poverty. Crime in the Nairobi metropolitan area hinders new businesses from developing, and as much as infrastructure is
necessary to appeal to new economic opportunities in Ruiru, a safe environment is equally vital. As a satellite town to an international city, Ruiru also has the potential to develop a stronger tourism industry. Under current conditions, however, tourists are strongly discouraged due to Nairobi’s criminal reputation. Tourists are discouraged from bringing any valuables to the city, walking around the city after dusk, and are inundated with a number of other precautions to take to prevent common theft and petty crime. These parameters prevent Nairobi and Ruiru from developing a tourism industry to its full potential and increasing economic prospects in hotels, retail, restaurants, entertainment industries, and educational institutions.

2. Challenges
There are a number of factors that lead to crime and violence. High rates of crime arise from social, economic, and physical inequalities. This includes disparity in income, which is the case in Ruiru where 50% of residents live below the poverty rate and 50% of job seekers cannot find employment. Crime also grows out of poor enforcement and lack of social capital. As the Nairobi metropolitan area continues to grow at an alarming rate, the current enforcement system will soon become inadequate and unable to respond to the needs of all residents. While the government continues to take steps towards decentralizing power, a corresponding increase in community involvement has yet to be fully realized. In order to create a safer city, crime prevention needs to be tackled not only by governmental forces but by all citizens.

3. Opportunities
The officials and residents of Nairobi have become increasingly active in addressing the city’s crime problem. With Nairobi City Council’s establishment of the Urban Safety Liaison Unit in 2002 and the Safer Cities Nairobi Action Group, more organizations are being developed to encourage a broader coalition of stakeholders in crime prevention strategies. Several conferences, including “Nairobi We Want,” have opened the doors to reform and the upcoming Africities Summit in the September 2006 is devoted to building local coalitions for the implementation of the Millennium Development Goals in African local governments. Nairobi and Ruiru can continue to improve the city’s safety by considering the following four areas: 1) investment in enforcement, 2) consideration of environmental design, 3) increase in public awareness, and 4) increase in community involvement.

Investment in Enforcement
Successful crime prevention involves an adequate number of police officers to patrol areas and a consistent crack down on small crimes. While Nairobi differs from New York City in many ways, its current situation is reminiscent of New York City’s former crime epidemic. For almost 100 years, New York City was the crime capital of the world. During the 1990s the City reduced overall crime by 57 percent and today, New York City is rated the safest large city in the country (NYC.gov) (Werde, 2006). Many factors can be attributed to New York City’s turnaround, including an increase in the number of law enforcement officers, a crack down on smaller crimes, such as prostitution, that were once overlooked, and an increase in community involvement through neighborhood watches. While the RMC does not have the capacity to increase enforcement officers, there are other ways besides institutional manpower that help improve and sustain a community. The establishment of networks and programs that involve both governmental and non-governmental actors has proven to be one of the most effective ways to build stronger and safer communities, as well as improve transparency between local officials and the community.

Consideration of Environmental Design
The built environment can directly influence crime prevention by facilitating surveillance by both police and residents. 90 percent of the respondents in the 2002 UN-HABITAT Crime Survey suggest that all personal crimes occur in the open when residents are in transit to and from work or school. If current trends continue, Ruiru will become a city of walls, where barriers create community distrust and prevent people from being seen. Public spaces can be improved through Crime Prevention Through Environmental Design (CPTED), which involves two main components. First, defensible space should allow people to see and be seen continuously.

This reduces fear because residents know that a potential offender can easily be observed, identified, and apprehended. Second, people must be willing to intervene or report a crime when it occurs. By increasing
the sense of security in settings where people live and work, it encourages people to take control of their areas and assume a role of ownership. When people feel safe in their neighborhood they are more likely to interact with one another and intervene when crime occurs. The Department of Community and Social Development in Montreal created a program called “Women and the City” that ensures adequate lighting and visibility in public places and parking lots (Federation of Canadian Municipalities, 2004). Open spaces, sidewalks, street signs, and well-lit areas are some of the ways to facilitate comfortable community interaction and a safer environment.

Increase in Public Awareness
Public education is an important part of emphasizing every citizen’s responsibility in preventing crime. Nairobi currently has a commendable public awareness campaign against rape that can be seen on the sides of public trashcans in the City’s central business district. These campaigns can extend into radio ads, church meetings, and other residents for accessing information about their community. Since 1981, the United States has celebrated National Crime Victims’ Rights Week (NCVRW), which involves events and informational resources that put criminal issues in the forefront. Ruiru could similarly establish stronger public awareness campaigns to call attention to crime prevention.

Increase in Community Involvement
In the 2002 UN-HABITAT Crime Survey, the majority of residents in Nairobi felt they had no ability to do anything about crime (Stavou, 2002). For a traditionally top-down society, this reaction may be natural. However, as successful examples from the past have shown and as the government continues steps towards decentralization, it is essential to promote more community-based strategies to help solve this problem. Not only do integrated efforts between local government and citizens optimize the limited resources of the Municipal Council, but they also help create better-addressed programs, self-reliant communities, and social capital. Opposed to the imbalance of power in vertical networks, horizontal networks facilitate communication, trustworthiness, and an understanding of mutual benefit. The more horizontally structured an organization, the more it should foster institutional success in the broader community (Putnam, 1993). A campaign in Delft, the Netherlands, brought local officials and residents together to improve recreational programs, social services, and public spaces. As a result, the number of offences per 100 housing units was reduced by 50% in only three years (UN, 1999). In Cali, Columbia, the local government created a program called DESEPAZ (Development, Security and Peace) where the mayor and community leaders held a two-hour problem-solving meeting every week that was open to the public and moved to different districts. As a result, several successful programs for street vendors and youth groups developed. Neighborhood watch groups in New York City and other places have proved to be effective ways for the community to protect itself and improve social networks. These are a few examples of how Ruiru can increase community involvement in crime prevention.

Conclusion
A safe city is the responsibility of all citizens and can only be sustained through the combined efforts of local governance and community action. Improving communication lines between police officers and residents, evaluating the consequences of environmental design on community behavior, investing in public awareness campaigns, and promoting stronger community participation in crime prevention strategies are a few ways that Ruiru can actively become a safer city in the future.
### Evaluation of Alternative Modes - Regional Transportation Connection between Nairobi and Ruiru

<table>
<thead>
<tr>
<th>Factors</th>
<th>Commuter Rail (with new track alignment)</th>
<th>Commuter Rail (with upgraded service)</th>
<th>Commuter Rail (at present)</th>
<th>LRT</th>
<th>Metro (Bus Rapid Transit)</th>
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<tr>
<td>Passenger Fare 3</td>
<td>0 Ksh</td>
<td>20 Ksh</td>
<td>30 Ksh</td>
<td>50 Ksh</td>
<td>35 Ksh</td>
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<tr>
<td>Travel Time (peak/off peak)</td>
<td>30 min</td>
<td>90 min/90 min</td>
<td>90 min/90 min</td>
<td>45 min</td>
<td>30 min</td>
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<td>Operating Speed</td>
<td>35 mph</td>
<td>18 mph</td>
<td>25 mph</td>
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<td>Maximum Speed</td>
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<td>20 mph</td>
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<td>60 mph</td>
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<td>Safety (low/medium/high)</td>
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<td>high</td>
<td>high</td>
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<tr>
<td>Operating costs ($US/1000 passenger per 1 hour)</td>
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<td>$60-70</td>
<td>$60-70</td>
<td>$45-55</td>
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<td>Construction Cost of Channel</td>
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<td>$3.5 million</td>
<td>$0</td>
<td>$68 million/mile</td>
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<td>Public Capital Cost of Rolling Stock</td>
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<td>$3.5 million</td>
<td>$0</td>
<td>$4 million/mile</td>
<td>$700,000</td>
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<td>Size of Vehicle</td>
<td>120 seats/car and 10 cars/train</td>
<td>120 seats/car and 10 cars/train</td>
<td>120 seats/car and 10 cars/train</td>
<td>140 passengers/car</td>
<td>24/bus</td>
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<td>Headway</td>
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<td>20 min</td>
<td>30 min</td>
<td>2 min</td>
<td>50 min</td>
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<td>Capacity per lane/per hour</td>
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<td>2400</td>
<td>2400</td>
<td>2400</td>
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<td>Political Feasibility (low/medium/high)</td>
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<td>Time Scale for Implementation (low/medium/high)</td>
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<td>high</td>
<td>medium</td>
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<td>Feeder Service Needed (yes/no)</td>
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108
FIGURE 1
AIR QUALITY STUDY: BLACK CARBON
66 COMPARED TO NYC LEVEL (1.79-1.94)

FIGURE 2
AIR QUALITY STUDY: PM 2.5
433 UG/M3 COMPARED TO NYC 15-20 UG/M3
Appendix 4
Local Road Recommendations

MAP OF RUIRU: REGIONAL ROADS

COMMUNITY PRIORITIZATION OF ROADS
Appendix 5

NAIROBI & RUIRU POPULATION GROWTH RATE PROJECTIONS

Reference for exponential population growth equation:

“Calculating Growth Rates (r): “To calculate a population’s growth rate you need make an assumption and know two things. If you assume that the growth is exponential (which it is), and if you know the population size at some initial time, N(0) and at some later time N(t), you calculate the growth rate (r) using the logarithmic growth equation”

FOR NAIROBI STUDIO REPORT:

Population Growth Rate and projections: Nairobi

Based on existing literature, we calculated the population growth rate for Nairobi using the logarithmic growth equation, which assumes the growth rate to be exponential.

\[ N(t) = N(O) e^{rt} \]

Which converts to...

\[ \ln (N(t)) = \ln(N(O)) + rt \]

and

\[ r = \frac{\ln(N(t)) - \ln(N(0))}{t} \]

where

- \( t \) = number of years over which growth is to be measured (in our case 10, i.e. difference between 1989 and 1999)
- \( r \) = rate of change (i.e growth rate)
- \( N(0) \) = present value (population in 1989) at \( t = 0 \); and
- \( N(t) \) = future value (population in 1999).

Using the Nairobi 1989 and 1999 census population counts (see Table X), we calculated an annual growth rate of 4.8% for Nairobi between the years 1989 and 1999. Using this annual growth rate in the logarithmic equation, Nairobi’s projected population will be an estimated 4.62 million in the year 2015 (the year in which the Millennium Development Goals are expected to reach their targets).

Table X POPULATION COUNT, Nairobi

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
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<tr>
<td>1969</td>
<td>509,286</td>
</tr>
<tr>
<td>1979</td>
<td>827,775</td>
</tr>
<tr>
<td>1989</td>
<td>1,324,570</td>
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<tr>
<td>1999</td>
<td>2,143,254</td>
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</table>


Population Growth Rate and Projections: Ruiru

Based on Ruiru’s census reports, the growth rate between 1979 and 1989 was 7.7% per year, while growth rate between 1989 and 1999 was 8.2% per year. Assuming a growth rate of 8.2, the time it will take to double the population in Ruiru would be 8.4 years. Accordingly, the 1999 population of 109,507 would double to 220,000 people living in Ruiru by mid-2007. Projecting to 2015 and using the 8.2% growth rate, Ruiru’s population would be estimated at 406,913. Conservatively, if we use the Nairobi annual growth rate of 4.8% to project Ruiru’s population in 2015, the count would be approximately 236,181.
Appendix 6
Services offered and rendered by the MCR

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<th>Service Provision of MCR</th>
<th>Service Offered</th>
<th>Service Rendered</th>
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<tr>
<td>Refuse Collection</td>
<td>Yes</td>
<td>Limited</td>
</tr>
<tr>
<td>Road Maintenance</td>
<td>Yes</td>
<td>Limited</td>
</tr>
<tr>
<td>Establishment of Marketing Outlets</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Job Creation</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Community development and participation</td>
<td>Yes</td>
<td>Limited</td>
</tr>
<tr>
<td>Planning and Development Control</td>
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<td>No</td>
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<tr>
<td>Housing</td>
<td>Yes</td>
<td>Limited</td>
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<tr>
<td>Education</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Water</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Public Health Facilities</td>
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