“Inadequate revenue bases mean that large investments tend to be shaped by the availability of funds from other sources, including development finance and loans from international development banks. At the same time, the absence of effective and inclusive governance structures creates a vacuum in which other actors initiate projects. Taken together, this means that investments in African cities are frequently governed by ‘projects’ rather than by ‘planning’. The disjointed and fragmented approach to infrastructure investment is likely to exacerbate exposure to risk, not least because power relations dictate that the interests of high-income households and businesses will typically be protected and prioritised over those with lower levels of adaptive capacity. For example, it is not sufficient to engineer or maintain one stretch of an urban river if this only moves flood water into a less well maintained area where risk accumulates. The complexity of governance is exacerbated by rapid population growth, which compounds historical deficits in urban infrastructure and institutions, and the scale of informality, which means that new developments may not comply with official plans and regulations” (Dodman et al, 2017).
ABBREVIATIONS

AFDB - African Development Bank
AWSB - Athi Water Services Board
EIA - Environment Impact Assessment
EMP - Environmental Management Plan
ESIA - Environment and Social Impact Assessment
FGD - Focus Group Discussion
GOK - Government of Kenya
G44 - Githurai 44
G45 - Githurai 45
HHS - Household Survey
KENHA - Kenya National Highways Authority
KII - Key Informant Interview
NCC - Nairobi City County
NCWSC - Nairobi City Water and Sewerage Company
NEMA - National Environment Management Authority
NIUPLAN - Nairobi Integrated Urban Plan
RUJWASCO - Ruiru-Juja Water and Sewerage Company Limited
THIP - Thika Highway Improvement Project (the Thika road project)
TRD - Two Rivers Development (the Two Rivers Project)
UK-DfID - UK’s Department for International Development

ACKNOWLEDGEMENTS

This study carried out by Arup would not have been possible without the research support provided by the Department of Environmental Studies & Community Development, Kenyatta University alongside the willingness of the Nairobi city stakeholders to engage in the study including:

Athena Properties Ltd and Two Rivers Development Limited | Kenya National Highways Authority (KenyHA) | Nairobi City County Planning Department | Residents of Githurai and Ruaka and all other interviewees listed in this report.

Arup International Development study team: Kieran Birtill, James Bristow, Sara Candiracci, Andrew Charles, Jo da Silva, Caroline Ray, Sarah Saeed, Roman Svidran, James Waters.

Foreword

Jo da Silva
Arup Fellow | Director, International Development | Global Sustainable Development Leader

For those living in larger African cities, or for regular visitors like myself, the pace of urban growth is self-evident in the number of new roads and developments appearing each year that are re-defining the urban landscape. At the same time, the ever-increasing number of people living in informal settlements bears witness to the inability of city planning departments to keep up with the needs of a rapidly increasing urban population for land, housing and basic services - notably water, energy, sanitation and drainage.

The infrastructure that has been built in recent years represents a fraction of the infrastructure needed to provide essential services to a growing population, and create the mobility and connectivity needed for economic growth – let alone realise the aspirations of a burgeoning middle class. Much has been written about the financing needed to address the shortfalls in planning regulations and limited capacity within planning departments, the onus falls on investors, developers and designers to take on this responsibility. Much depends on their motivations, mandate, and understanding of risk. Our hope is that this report raises awareness of contribution large infrastructure play in urban risk accumulation, and encourages everyone involved in large infrastructure projects to think about risk ‘beyond the red-line’.

Unless required by the planning process, there is little incentive to look ‘beyond the red line’ and consider how the project might create, compound or even mitigate risks that communities close by, or in other parts of the city, face.

The Urban-ARK research programme has provided a unique opportunity to explore this dynamic through examination of two significant projects in Nairobi. It has highlighted the need to look ‘beyond the red line’ to prevent risk accumulating, and the opportunity doing so provides to reduce vulnerability. The challenge at present is that in the absence of effective planning regulations and limited capacity within planning departments, the onus falls on investors, developers and designers to take on this responsibility. Much depends on their motivations, mandate, and understanding of risk. Our hope is that this report raises awareness of contribution large infrastructure play in urban risk accumulation, and encourages everyone involved in large infrastructure projects to think about risk ‘beyond the red-line’.

The design and construction of large infrastructure projects poses many challenges. Risks that might lead to additional costs, an extended programme, or a structure that is unsafe need to be pro-actively managed. Not surprisingly, an infrastructure project team’s main concern is risk to the project within the bounds of the ‘red line’ that typically represents the site boundary on the construction drawings.
The Thika Highway Improvement Project and the Two Rivers Mall Development were selected as case studies as they represent typical large scale ‘road’ and key ‘nodal’ developments that are shaping urban growth in Africa. The research explored the relationship between projects and risk accumulation at three different scales as illustrated in the below diagram:

- **City** - whether urban risk from large scale projects is addressed within existing national and city planning, policy and regulations;
- **Project** - Through the analysis of two case studies the research investigated whether large scale projects are planned (or at least regulated) with awareness of risk accumulation ‘beyond the red line’ of their project plan boundary.
- **Neighbourhood** - the positive and negative impacts of case study projects on risk accumulation in adjacent communities.

Pressure for development in Nairobi

- A number of lead agencies noted that they are under considerable pressure not to hold up development in Nairobi. This drive to develop is resulting in rushed planning that does not adequately consider risk.

Gaps in the current planning process

- Fragmentation of the planning system was the principal risk cited by the majority of city stakeholders. Currently the Nairobi city masterplan is not supported by detailed local area plans, zoning or development guidance. In this context, each new development is negotiated between the developer and the County and risk is managed on a case-by-case basis.
- Planning departments lack capacity to enforce regulation and rapidly changing land use is not adequately addressed in the current guidance.

Executive Summary

African cities will be at the centre stage in the region’s pathway to prosperity, with a majority of the population expected to be living in urban areas in twelve years’ time. Currently, the infrastructure gap to accommodate this demographic shift and the economic opportunity it affords is creating a plethora of large scale projects, mainly in transport infrastructure and real estate development. In the absence of appropriate governance and regulation, the urban environment is being shaped by these projects individually, rather than by planning processes that recognise the city as a system. (Dodman et al, 2016). The potential risks posed by piecemeal development and uncoordinated growth to both local communities, and the city overall are being overlooked. Understandably, investors, developers, and designers are primarily concerned with risk to their project, rather than risk from their project on the locality or wider city.

Between 2016 and 2017, Arup carried out case study research to explore how large two infrastructure projects are creating, compounding or mitigating risk in Nairobi.

This report identifies key challenges which influence urban risk accumulation from large infrastructure projects. In response to these challenges the report proposes 5 key principles and 4 imrods for change:

**Key Challenges**

Both case studies were intended to support economic development in Nairobi and have certainly benefited the city, providing increased opportunities within communities. However while these developments have mitigated certain risks for local residents, they have also created or compounded other risks. This is because projects have not managed to sufficiently consider and address risk beyond the red line boundary of their development. The following underlying challenges are influencing urban risk accumulation from these projects.

**Pressure for development in Nairobi**

- Given the complexity of risk management on large projects, contractual arrangements play a significant role in effective mitigation. The appropriate allocation of risk to the relevant project stakeholders is key and the management of the financial resources to address the risks is equally important.
- In the case of Thika Highway, financier AfDB have a bank policy that a recipient country carries risk by being responsible for procurement, or early works and due-diligence at start of project. This creates risk as the Government struggles to finance enabling works that are then pushed to the Contractor. Contractors prioritise important issues over lower priority works.
- In comparison, privately financed infrastructure projects go to significant effort to agree contracts and risk apportionment. Risk is quantified as far as possible through precise technical assessments. These processes reduce risk to investors and developers and by extension to the neighbourhoods around the projects.

**Insufficient detail in project design and implementation**

- The Detailed Design stage is a key step in project design where risks are addressed before the very costly construction stage begins. This stage is often skipped to save costs and speed up development and exposes projects to risks that are much more difficult and expensive to resolve during construction or even operation.
- The quality and quantity of data used to understand key risks on case study projects was limited. On Thika Highway the ability to plan around existing utilities was generally not possible as no records existed. Disruptive, intrusive and costly investigations were required to identify existing utility constraints. Projects did not obtain or generate sufficient rainfall, run-off and aquifer geology data for flood and groundwater risk modelling and analysis.

**Ineffective contracts and project finance**

- Public consultation is often carried out to achieve compliance. Case study projects complied with legal requirements for consultation, however, for the scale of projects, the level of consultation was minimal.
- The Environmental Impact Assessment process is ineffective. Developers themselves are responsible for appointing a Consultant who is responsible for the EIA. Enforcement capacity is insufficient. The EIA and planning approval processes are not linked and small to medium developments often slip between the cracks.

**Gaps in the current planning process**

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Principles for Risk-Sensitive Development

The key challenges outlined will require continued institutional reform and capacity building. Meanwhile we suggest that the negative impacts of large infrastructure projects can be avoided or at least reduced if planners and developers place greater emphasis on the following principles:

1. Normalize inclusive development:

   Infrastructure can be inclusive or exclusive. It is important to consider who the infrastructure is serving. Good urban governance aims to broker this dynamic and to ensure where possible that development is equitable and inclusive for all. Full consideration needs to be given to the direct and indirect impacts of a large scale project and the effect they have on the most vulnerable. For example, those whose employment situation will improve and those who will suffer, home owners versus renters, and those living near hazard hot spots versus those living further away.

2. Plan for the magnetic effect of large scale projects:

   Both Thika Highway and Two Rivers have added desirability to surrounding locations. This has affected house prices, population growth and related infrastructure demand. Residents with adequate financial capacity are able to absorb the impact. However, for more vulnerable parts of the community, the day-to-day, extensive risks that they experience are compounded by rapid development.

3. Do not forget the small to medium scale projects:

   Despite their issues, large scale projects are being delivered locally to a higher standard and have captured the attention of the public. Numerous small and medium scale developments are popping up surrounding these large scale projects which are often
designed and constructed rapidly without seeking planning permission. They often fly under the radar and pose a risk to occupants and/or those residing nearby these buildings. Urban authorities should be aware of the risks and anticipate the need for greater building control demands once a large scale project is planned for an area.

4. Understand the complex risk network:

   The research highlights complex project-risk relationships where certain risks have been mitigated but others created, compounded or transferred with cascading impacts. A robust risk analysis should be undertaken before a large scale project is approved. Risk analysis should consider both internal risk to a project and the project’s relationship with the wider environment outside the project boundary. This means not only considering local risks which might be created or compounded by the project but also opportunities to mitigate existing risks faced by local communities. This risk-sensitive approach can be achieved by rigorous, methodical consideration of the potential direct and indirect benefits of the project during the design process.

Inroads for Change

The majority of the underlying issues behind the development-related risks described in this paper can largely be categorised as:

- Those inhibited by a lack of awareness;
- Those requiring regulatory reform;
- Those requiring increased capacity; and
- Those which do not align with financial objectives.

Knowledge and awareness – thinking beyond the ‘red line’

Case studies highlighted the need for project stakeholders (both developers and regulators), to employ greater systems-thinking in consideration of risk beyond the project boundary. The use of accessible tools, such as those used in this research, could potentially be used to engage developers and regulators in this approach.

Regulatory reform, systems and processes

Much progress has been made in Nairobi and Kenya in creating legislation, plans, policies and regulation since the 2010 Constitution and devolution process. This research highlights examples of recent road projects such as Western Bypass which appear to have displayed greater integrated thinking. However, there is still progress needed and the research highlights the importance of up-to-date and detailed plans, policies and regulation for effective development control.

It is crucial to be able to identify actors and mechanisms which can be engaged to influence risk management on projects. While the research highlights how strengthening the planning process including EIAs would help to regulate risk beyond the red line of projects, this may also require the identification of new actors who hold significant influence over development.

In Kenya the Special Economic Zones Authority a special national body formed in 2015 to establish and regulate these zones are in a powerful position to ensure developers employ ‘red-line’ thinking. The capacity of agencies involved in development control is a key issue blocking the robust regulation of risk. Quantifying the problem will aid awareness such as asking questions like: How many applications planning departments currently process versus the number of full-time staff? Develop tools and processes to help planners consider and regulate the full spectrum of project risks. This paper outlines certain tools which might help in this respect. Planning tools are out-of-date and need to be refreshed urgently to help planners make the right decisions regarding development applications.

Community-level, civil society actors have an important role to play in the mitigation of development risk especially if national, city and project level actors cannot be engaged or do not have capacity. In Nairobi, some neighbourhoods already have up to date local plans and zoning. These neighbourhoods have influential residents with the knowledge and power to prevent unsuitable development taking place.

Civil society actors and NGOs should explore what support can be provided to neighbourhood organisations, harnessing community potential.

Reputational and financial incentives

The long-term value of an expanded project brief that considers risk ‘beyond the red-line’ needs to be clearly articulated especially in the case of privately-financed projects where investor returns dictate decisions. Investment beyond the red line can lead to gains in local workers’ productivity, reduction in ‘lost time’, and improved well-being resulting from safer environments. Globally, incentives exist for meeting sustainability criteria. Is it possible to incorporate ‘red-line thinking’ criteria or adopt as a parallel standard?

As land within Nairobi becomes more and more desirable there is the opportunity to demand that private developments are part of an inclusive, sustainable community project.

The corporate social responsibility and public image of large corporations setting up business in East Africa is something which can be capitalised on by a growing civil society engaged in planning decisions.
Introduction

African cities will be at the centre stage in the region’s pathway to prosperity, with a majority of the population expected to be living in urban areas in twelve years’ time. Currently, the infrastructure gap to accommodate this demographic shift and the economic opportunity it affords is creating a plethora of large scale projects, mainly in transport infrastructure and real estate development. In the absence of appropriate governance and regulation, the urban environment is being shaped by these projects individually, rather than being by planning processes that recognise the city as a system (Dodman et al, 2016). Potential risks to local communities, and the city overall arising from piecemeal development and uncoordinated growth are being overlooked. Understandably, investors, developers, and designers are primarily concerned with risk to their project, rather than risk from their project on the locality or wider city.

This report summarises research carried out by Arup as part of ‘Urban Africa: Risk Knowledge (UrbanARK), a 3 year research programme supported by the UK’s Department for International Development (DfID) and the Economic and Social Research Council (ESRC) to address evidence gaps around urbanisation and risk accumulation in an African context. The report title ‘Beyond the Red Line’ refers to the boundary between a project and the city shown on construction drawings. Our research explores this boundary considering how two large scale infrastructure projects in Nairobi – the Thika Highway Improvement Project and the Two Rivers Development – create, compound or mitigate risk.

URBAN ARK

UrbanARK aims to reduce disaster risk by breaking cycles of risk accumulation by:

* building a community of practice of African risk researchers and practitioners;
* developing a detailed understanding of underlying factors driving risk accumulation;
* understanding risk to vulnerable groups; and
* understanding how risks change in the context of urban growth, poverty and climate change.

Urban ARK is focused in depth on four cities: Ibadan, Nigeria; Karonga, Malawi; Nairobi, Kenya; and Niamey, Niger. It is structured around four linked work programmes (WP):

WP 1 – Vulnerability Assessment
WP 2 – Hazard Assessment
WP 3 – Risk Root Cause Analysis and Historical Urban Trajectories
WP 4 – Governance and Planning

KEY TERMS AND DEFINITIONS

Risk is comprised of three core elements which interact to generate impacts: hazard, exposure and vulnerability (IPCC SREX, 2012). Therefore, risk is an accumulation of vulnerability and hazard exposure.

Dimensions of Risk (adapted by Arup from Crichton, 1999)

Hazard is “the potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources” (IPCC SREX, 2012: 5).

Vulnerability is “the propensity or predisposition to be adversely affected” (IPCC SREX, 2012: 5).

For Urban ARK the propensity to be affected refers to the concept of susceptibility as well as the capacity of actors and systems to prepare for, cope with and recover from disaster events (Pelling and Leck, 2016).

Exposure is “The presence of people; livelihoods; environmental services and resources; infrastructure; or economic, social, or cultural assets in places that could be adversely affected” (IPCC SREX, 2012: 5).

Intensive risk is the risk from major disasters with the potential for 25 or more deaths and/or 600 or more houses destroyed or seriously damaged (United Nations, 2015).

Extensive risk is the risk of premature death, injury/illness and impoverishment from all events whose impact is too small to be classified as major disasters. UNISDR refers to these as high-frequency, low-severity losses” that “manifests as large numbers of recurrent, small-scale, low severity disasters (United Nations, 2015: 90).

Disaster risk is the ‘likelihood over a specified time period of severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery’ (IPCC, 2012 & 2014).

Risk accumulation is the “gradual build-up of vulnerability and hazard exposure in specific locations, often due to a combination of processes, some persistent and/or gradual, others more erratic, often in a combination of inequality, marginalisation, and risk over time” (modified from Cardona et al, 2012:95).
CHAPTER 2

Background

Africa is the world’s fastest urbanising region, due to population growth (figure 1) and rural-urban migration (figure 2). Over one third of Africa’s 1 billion inhabitants currently live in urban areas, and by 2030 that proportion will have risen to 50%. This is equivalent to adding ten cities the size of Cairo (currently Africa’s largest metropolitan area) to the continent’s urban population (McKinsey Global Institute, 2016).

Cities have powered the world economy for centuries, and urbanisation throughout Africa has potential to create significant economic and social opportunities. Cities generate about 75% of global GDP today, expected to increase to 86% of worldwide GDP growth by 2030. Although to date large cities have dominated, there is a shift from mega cities to mid-level cities (150,000 to 10,000,000 population) which will contribute 50% of the global GDP by 2025 (McKinsey Global Institute, 2016).
Urban growth trends in Africa

There has been significant economic growth in East African cities, especially in Kenya, which has half of the ten fastest growing African cities forecast for 2010. It’s estimated that Nairobi will grow by 22 people per hour over the next 12 years (figure 3). Kenya’s economic growth has consistently remained highest in East Africa, due to political stability, progress on ease of doing business, large scale Foreign Direct Investment, and service, construction and e-commerce sector booms (Economic Outlook, 2016, Euromonitor, 2017). This, combined with recent rapid uptake of broadband internet have driven higher incomes and greater demand for goods, services and real estate (Euromonitor, 2017).

Although urbanisation has the potential to make cities more prosperous and countries more developed, it has so far failed to bring inclusive growth in many African countries. Rising inequality, food and water shortages, poor infrastructure and a lack of housing are among the problems facing African governments because of rapid urbanisation. Some estimates now suggest slum dwellers currently account for 70% of urban inhabitants, illustrating the scale of the challenges yet to be addressed (The Economist, 2010).

In the last decade, the estimated investment required to fill the infrastructure gap in sub-Saharan Africa is $93 billion per year (Foster & Briceno-Garmendia, 2009). The private sector has seen this gap as a huge opportunity. Private equity investment in sub-Saharan Africa has grown from $2 billion to $6 billion between 2009 and 2014 (The Economist, 2015) with strong inflows of investment into real estate, hospitality and construction in 2014 (EY, 2015). Chinese lending for infrastructure projects in sub-Saharan Africa has almost doubled in the last four years from $3.6bn in 2014 to almost $9bn in 2017 (Matthewson, 2018). Much of this investment is being channelled into large projects - both major public infrastructure and private real estate developments - which are playing a significant role in shaping the physical growth of African cities (Handoy et al, 2013). Our own research into urban growth trends in East Africa has demonstrated that East African cities are being shaped by large scale foreign investment channelled through large scale public transport projects and significant private real estate developments. This is illustrated by similar patterns of urban growth in Arusha, Kampala and Nairobi. In all three cities, growth was historically constrained by natural features – water bodies, forests, mountains. Today, roads are resulting in “finger-like” development corridors while large out-of-town retail centres are becoming new ‘nodes’ of growth. The result is urban sprawl along roads and nodes that is affecting the risk landscape at both the neighbourhood and city scale.

Rural to urban migration
- Natural population growth

Figure 2: Urban growth rates for selected African countries, 1960-2010 (OECD, 2016)

Figure 3: Africa’s fastest growing cities (UN, 2014)
Preliminary growth per hour, 2010-2030

Nairobi
- Population: 6.5 million
- Population Growth Rate: 5.26%
- Population Density: 4,850/km²
- Percentage of population in informal settlements: 60%

Kampala
- Population: 1.7 million
- Population Growth Rate: 6.75%
- Population Density: 8,262/km²
- Percentage of population in informal settlements: 63.4%

Arusha
- Population: 3.3 million
- Population Growth Rate: 3.96%
- Population Density: 1,559/km²
- Percentage of population in informal settlements: 65.0%

Land Area
- Arusha: 270 km²
- Kampala: 189 km²
- Nairobi: 695 km²

Population Growth Rate
- Arusha: 77%
- Kampala: 61%
- Nairobi: 23%
- Ouagadougou: 21%
- Khartoum: 21%
- Abidjan: 21%
- Johannesburg: 22%
- Bamako: 19%

Figure 4: Arusha, Kampala, Nairobi, Arup
**ARUSHA, TANZANIA - PATTERNS OF URBAN GROWTH**

Arusha is a secondary city in northern Tanzania located at the base of Mt. Meru, known as the “Geneva of Africa”. Since the 1900s, the city has expanded from German colonial fort (boma) to being a sprawling city with a 2017 estimated population of 477,615 (Government of Tanzania, 2018). Urban growth is primarily along key road corridors in a finger-like pattern restricted only by natural barriers such at Mt. Meru to the north, and Lake Duluti to the east. Considerable growth is occurring to the east towards Usa River and beyond to Kilimanjaro International Airport.

To the west urban growth is following the Dodoma Road toward Kisongo and encroaching on the coffee plantations. Due to land values informal settlement are following roads expanding south from Arusha centre toward Muriet and Njiro. A new southern bypass is planned to connect up the expanding fingers and will likely create a radial pattern of growth in the future. Meanwhile, new nodes of development on the periphery, including two universities shopping centres and new satellite towns are attracting further urban sprawl both planned and unplanned.

**KAMPALA, UGANDA - PATTERNS OF URBAN GROWTH**

Kampala is the primary city of Uganda and the de facto capital city located along the northern shore of Lake Victoria. Known as the “city of seven hills” there are in fact many more hills and the city’s undulating topography has defined its historical urban growth with each hill occupied by a different political or religious order. Wetlands commonly found between these hilly areas are prone to significant seasonal flooding and have been occupied as a last resort.

Urban growth in Kampala had been concentric until the 1970’s. At present this growth has adjusted to reflect the sprawling growth between Kampala and Entebbe to the southwest and Muko along the Jinja road to the east. Aside from the undulating terrain the other significant constraint to the growth of Kampala is Lake Victoria to the south. Road infrastructure is a key driver enabling the finger-like sprawl of the city area.
Nairobi, Kenya - Patterns of Urban Growth

Nairobi has experienced significant growth over the past 25 years almost doubling in its urban area with sprawl taking place in a radial pattern (New York University, 2014). Spatial distribution of large scale projects in Nairobi illustrates that current investment patterns are taking place along major road corridors particularly to the southeast, north and west of Nairobi.

Further nodes of development typically relate to upgraded road infrastructure, such as Thika Highway and the Southern Bypass, with growth occurring along transport corridors in defined ‘finger-like’ patterns, emanating outwards along major connecting roads towards other cities.

New developments such as satellite towns or large housing projects are often found further along major roads. Out of town developments such as shopping centres and even satellite towns appear to ‘pull’ urban growth, as other smaller developments often occur around these larger ones. This obviously affects local development, but also the creation of risk, for example significant new urban development puts pressure on existing city services or water resources, which rapidly accumulates as other development occur in the same locality – clustering to benefit from the provision of infrastructure services.
Thinking beyond the ‘Red Line’

Despite growing investment and the increasing number of large scale infrastructure projects being delivered in Africa, there has been little research carried out into understanding their impact on urban development and risk accumulation.

(See Box 1 for our definition of risk accumulation).

Several studies have looked at Chinese investment in special economic zones in sub-Saharan Africa identifying both positive and negative impact of large scale projects. These include significant contributions to economic growth, but also unequal service provision, local tensions regarding land tenure and loss of agricultural land. They also suggest that economic objectives have been driving development, more so than environmental objectives (Myllyla & Kavaja, 2005; Buckingham & Jepson, 2014; Douglas 1986; Rapoport, 2014).

Outside Africa, there has been significant research into the regional impact of large scale projects and their impacts on local society. These studies show that large developments, such as roads or new housing developments, can have a significant impact on the urban risk landscape as they re-shape hill-slopes, extract ground water and fill in valleys or swamps as well as adversely impact the most vulnerable in society (Douglas 1983), (Yntiso 2008).

Local communities affected by large scale projects often have different perceptions of risk to the ‘top-down’ perception of risk addressed in planning and policy (Fitton, et al. 2015). Leung and Yu (2011) highlight the importance of an equal, fair and balanced platform for local engagement to ensure differing perceptions are understood. Nevertheless, mega-projects tend to take a top down approach which typically offers limited possibilities for democratic negotiations (Altshuler and Luberoff, 2003), and there is often a reluctance to adopt bottom up consultation due to frequent public resistance (Zekovic et al 2017; Flyvbjerg, et al. 2002; Davis and Dewey 2013; Kennedy, et al. 2011). Large urban development projects have ‘less democratic and more elite-driven priorities’ (Snyrgedoué (1996) and Petalla (2013) suggests that in Brazil mega projects are being executed at a rapid rate with disregard for the basic principles of the democratic rule of law.

While the majority of social research on large-scale investments tends to focus on negative impacts, Orueta and Fainstein (2008) describe ‘new mega projects’ that are taking place in Europe and North America which display a sense of ‘greater environmental and social sensitivity’ than their predecessors, with minimised displacement. However, the paper also acknowledges the different political and economic context of significant projects in developing and rapidly urbanising countries. To consider the appropriateness of this ‘new mega-project’ concept in such contexts would require collaboration between the public and the private sectors and consideration of the role of foreign investment as well as the forms of local action and instruments (for engagement) available to local communities.

Large projects involve a wide range of actors whose relations and actions influence the production of urban risks, and the potential reduction of risks (Rapoport, 2015; Fitton et al., 2015). At the project level, financiers, developers, insurers traditionally consider the risks to these projects rather than ‘how the project might reconfigure risk territorially’ (da Silva, 2014). In this context the power dynamics of actors and stakeholders involved in urban development becomes increasingly important. Leung and Yu (2011) undertook a detailed examination of stakeholder dynamics in public engagement of mega projects, defining five different types of power associated with the consultation process: coercive, reward, legitimate, expert, and referent (see Table 1). They suggest that stakeholders with high reward power (e.g. governmental departments or project developers) should directly engage in the consultation process to understand public views and deliver appropriate development. Non-governmental organisations and academics in relevant fields should use their strong referent power to influence and enhance final project outcomes. This understanding of power and stakeholder dynamics has influenced our approach to investigating risk at three scales examining the presence of these stakeholder types in research case studies.

### Stakeholder dynamics

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<th>POWER</th>
<th>STAKEHOLDERS</th>
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<tr>
<td><strong>Coercive power:</strong></td>
<td>Power to pressure project through criticism</td>
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<td></td>
<td>- Could make projects unpleasant</td>
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<td></td>
<td>- Could make project engagement distasteful</td>
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<td></td>
<td>- Could make others fail to achieve their wants</td>
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<td></td>
<td>Local communities, residents, NGOs, Environmentalists, Legislation authorities, Political parties, local politicians</td>
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<tr>
<td><strong>Reward Power:</strong></td>
<td>Power to provide rewards from projects</td>
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<td></td>
<td>- Make project desirable</td>
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<td></td>
<td>- Increase financial resources</td>
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<td></td>
<td>- Important approval for project engagement</td>
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<td></td>
<td>Project team, Government departments (that provide funding)</td>
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<tr>
<td><strong>Legitimate power:</strong></td>
<td>Concentrates on the regulation and policy</td>
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<tr>
<td></td>
<td>- Make demands of others</td>
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<td>- Expect others to carry wishes</td>
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<tr>
<td></td>
<td>Represent the authority</td>
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<tr>
<td></td>
<td>Government departments, Legislative council, District council members</td>
</tr>
<tr>
<td><strong>Expert power:</strong></td>
<td>Connect to personal competencies, experiences and influence</td>
</tr>
<tr>
<td></td>
<td>- Provide technical knowledge</td>
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<td></td>
<td>- Provide useful suggestions</td>
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<td></td>
<td>- Share experiences</td>
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<td>- Be respected</td>
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<td>- Be admired</td>
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<td>- Be acceptable</td>
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<tr>
<td></td>
<td>Project team, Professionals (such as architect, engineers, lawyers, etc.)</td>
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<tr>
<td><strong>Referent power:</strong></td>
<td></td>
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<tr>
<td></td>
<td>Social workers, District council members, NGOs, Community representatives</td>
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</tbody>
</table>

Table 1: Types of Stakeholder Power (Leung and Yu, 2011)

(1) Petalla and many other authors use the term ‘mega-project’ to describe significant capital investment projects. What defines a mega project is disputed throughout the literature with some authors suggesting an investment of more than a $10Bn is required whereas others believe it is relative to the development of the country in question. For the sake of argument this research uses the broader term Large scale projects.
Approach

UrbanARK is a partnership between UK and African universities, research centres and international non-government organisations and the United Nations. Led by Professor Mark Pelling of King’s College London, it brings together academics, practitioners and policy actors in the generation of knowledge and action – an approach called ‘co-production’. This approach ensures that knowledge is legitimate and accessible through conception, generation, dissemination, leading to innovation and wider application (Pelling et al, 2017).

Arup’s contribution to UrbanARK is exploring how large-scale infrastructure projects are shaping the risk landscape in Nairobi. Our research is intended to help practitioners in local government, national administrators, developers, built environment professionals, and international organisations better understand how urban risk is being generated through large scale projects and how to help manage this build-up. Our overall research question is **How do large scale projects create, compound or mitigate risk in African cities?**

Our research was carried out with support from Kenyatta University. It focusses on two case study projects: the Thika Highway Improvement Project (THIP) and the Two Rivers Development (TRD) in Nairobi. Nairobi was selected because it is experiencing rapid urban growth and there has been significant foreign and domestic investment with many large scale projects completed over the last decade.

Our two case studies are representative of other large scale ‘road’ and ‘node’ developments in East Africa, and were selected due to the willingness of the project developers to share information and participate in the research process. Githurai and Ruaka were selected for the neighbourhood study due to their proximity to the project.

The literature review highlighted different perspectives of risk. Therefore, the research was designed to investigate the relationship between projects and risk accumulation at three different scales – city, project, and neighbourhood. This is illustrated in Box 6.

A combination of data collection and analysis methods were used, with a strong emphasis on consultation. Over the course of the research we engaged with city and county authorities (e.g. planning authorities, environmental agency, construction authorities); members of the project teams (e.g. developer, project manager, engineers, architect); and with local community residents (e.g. neighbours and end-users). See Appendices 2-5 for more detail on research methods.

**Scope**

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### Table 2: Research methods

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<thead>
<tr>
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<tr>
<td>Desk reviews</td>
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<td>Focus group discussions</td>
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<td>Key informant interviews</td>
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<td>Workshop (100RC Nairobi)</td>
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<td>Household surveys</td>
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<td>Site observations</td>
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RISK GENERATION AND ACCUMULATION BETWEEN SCALES

Risk is created, compounded and mitigated between scales.

**City**

*How do planning policies, regulatory frameworks, and associated power dynamics, influence risk?*

The research investigates whether urban risk from large scale projects is addressed within existing national and city planning, policy and regulations; and whether these enable urban development authorities to manage risk or if they are contributing to the accumulation of risk within the Nairobi.

**How do large projects consider risk outside the project boundary?**

Through the analysis of two case studies (THIP & TRD), the research investigates whether large scale projects are planned (or at least regulated) with awareness of risk accumulation 'beyond the red line'. It focuses on understanding how policies, plans and regulations and associated regulatory capacity are influencing risk accumulation through the various projects stages (from inception, through to construction and operation).

**Neighbourhoods**

*How do large projects influence risk in local neighbourhoods?*

To understand how projects are impacting neighbourhoods, the research examines specific local neighbourhoods that border the two case study locations (Githurai for THIP and Ruaka for TRD). The research looks at local exposure to each hazard and underlying vulnerability of local communities, before discussing whether change in risk can be at all linked to the development.

**How are the underlying hazards influencing contextual risk in Nairobi?**

Our research investigates whether urban risk from large scale projects is addressed within existing national and city planning, policy and regulations; and to what extent this enables urban development authorities to manage risk.

**How Risk is Accumulating**

- e.g. Traff congestion
- e.g. Flooding
- e.g. Water shortage
- e.g. Crime
- e.g. Displacement of people

**How Risk is Managed**

- Organisation/Project Risk
- Informal Systems
- Community Risk
- Contextual Risk

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*Images by Johnny Miller © 2014*
Rapid urban growth is increasing land value within the city and placing enormous pressure on existing infrastructure, leading to urban sprawl and the growth of informal settlements in marginal areas (e.g. along river valleys). It is estimated that half of Nairobi’s population now live in informal settlements, and face inadequate access to drinking water, poor public health infrastructure and an inefficient transportation system. At the same time there is significant on-going investment into roads infrastructure and property development. Nairobi is currently experiencing the largest expansion of retail developments on the continent in response to increased prosperity. These developments typically occur on the edges of the city. Land within Nairobi is left under-utilised opening up opportunities for planned densification.

“Over the last decade, economic growth in Kenya has created a rising middle class in tandem with increasing rates of urbanization. With its property boom and shiny new skyscrapers and malls, Nairobi has especially been at the heart of this transformation, attracting both global tech companies and wealthy investors looking for second homes.”

(Dahir, 2018)

“City context

Nairobi is the capital of Kenya and an economic powerhouse within the East Africa region. Founded in 1899 as a staging post for the development of the East African Railway network, Nairobi is now the second largest city in East Africa and Kenya’s most populated city. The city’s population exploded after independence increasing from 800,000 citizens in 1980 to 3.1 million in 2009, with significant migration from rural areas (NIUPLAN, 2014). The city area of 696 sq.km suggests an average population density of 4,500 per sq. km but this implies a deceptively low density across the city, and parts of the city such as Kibera, one of the world’s largest slums, has been previously estimated by some to accommodate up to 290,000 per sq. km (Affordable Housing Institute, 2005).
Hazards in Nairobi

The city faces a number of significant hazards that create risk for residents and business. This research has focused on the 15 hazards in 6 categories shown adjacent in Table 3. These are derived from a review of global city resilience initiatives, such as the City Resilience Index (2014) and World Bank’s CityStrength (2015). Nairobi shocks and stresses identified at a 100 Resilient Cities multi-stakeholder workshop and national/local disaster management plans and city masterplans (see Appendix 1). The lens prioritises those that large-scale infrastructure can realistically influence.

100RC Workshop participants also identified areas in the city where the top ten individual shocks and stresses tended to concentrate (see Map 1), namely, in informal settlements and along river valleys and main roads where there are high levels of vulnerability and/or exposure. The key shocks and stresses were: traffic congestion, inadequate public transportation, terrorism, fire, flooding, uncontrolled urban development, crime and violence, environmental degradation, informal housing, and lack of affordable housing.

The hazard list was used as a lens through which to analyse the hazard awareness of development plans, policies and regulation, case study project plans and processes and as an initial framework to discuss the positive or negative impact of case study projects with local neighbourhood focus groups. In the case of the latter participants were always given the chance to discuss additional hazards they deemed relevant which the framework does not include.
Urban planning is both a technical and political process concerned with the welfare of people, control of the use of land, design of the urban environment including transportation and communication networks, and protection and enhancement of the natural environment. Overall the mandate of a planning system is largely to guide the way cities develop. The purpose of the National Land Use Policy is to provide direction to achieve better planning decisions, and to identify areas which need National and County Governments need to jointly address.

Each County is required to develop a County Integrated Development Plan (CIDP) and subsequently city area plans which proposals for new developments must align with. As an example, Kiambu County is developing its CIDP, and has developed city area plans for Thika – Thika Integrated Spatial Urban Development Plan 2015-2035. DFID programme Sustainable Urban Economic Development is supporting rapidly growing towns and secondary cities to put in place sustainable urban economic plans and climate resilient investments (DfID, 2017).

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A historical perspective

The Kenyan system, like the UK system, is devised to be plan-led whereby planning decisions are taken in the context of a strategic masterplan. However, in a Kenyan context political instability, inadequate legal structures and limited capacity combined with devolution has resulted in planning system that is fragmented and under-resourced with critical gaps.

The 1948 Colonial Master plan compounded the racially segregated zoning that characterised much of Nairobi’s early settlement (Olima, 2001; Mutisya and Yarime, 2011). This neglected informal settlements and the Kenyans who had come to the city in search of work during this period (Mutisya and Yarime, 2011).

The first post-independence Nairobi masterplan was created in 1973 but was never implemented and was overtaken by rapid urban growth (NCC, 2015). It officially expired in 2000. Throughout the period 1963 - 2003 lack of planning policy and implementation has been attributed to a turbulent political situation, poor legal structures, reduced city powers, lack of interest and/or capacity (NUIPLAN, 2014, I, p251). A weak institutional environment including ineffective land information management and inadequate regulation allowed corruption to occur at both national and local levels. The 1980s saw land grabbing and insufficient infrastructure investment at a time of significant population growth (Aschwanden et al 2007).

The new Constitution of Kenya was adopted in 2010 following a period of significant political change between 2003-2010 culminating in conflict during the 2007 elections. This devolves responsibility for planning from national level to newly formed Counties. A consequence of devolution is that the legal instruments that underpin the planning system have to be reviewed and updated with some regulations more advanced than others. The capacity to address this quickly is limited by lack of capacity, political cycles, unwillingness, and/or the political interference. As a result of devolution, a range of new legislation has been enacted over the past 5 years.

The Physical Planning Act (2015) is intended to replace the 1996 Physical Planning Act which has been the legislation that has guided urban development in Kenya for the past 20 years. It has not yet been enacted leading to confusion regarding who is responsible for what but theoretically both Acts include a legislative ‘hook’ requiring an Environmental Impact Assessment as part of the overall planning approvals process.

The Urban Areas and Cities Act (2011) and the County Government Act (2012) devolve responsibility for urban planning and development to a city (or municipality) and to County Governments. But their ability to take on this responsibility is compromised by: shortage of land for development, continued corruption, unresolved land disputes and a lack of secure tenure for low income groups (NCC, 2014). These two Acts recognise the right for residents to participate in the preparation, implementation and review of the integrated development plan and strategic decisions relating to the delivery of service.

A National Land Use Policy (draft May 2016) is being developed by the Ministry of Lands and Physical Planning which all County plans should align with.
The Nairobi City County has developed its CIDP with help from the Japanese government. The Nairobi Integrated Urban Development Masterplan 2014-30 (NIUPLAN) goes beyond what is required in a typical CIDP providing a spatial perspective to the economic policies. NIUPLAN sets the overall direction for spatial development in Nairobi and lays the foundation for the preparation of more detailed local area plans and policies.

The Plan is aligned with other strategic documents influencing development in Nairobi: Kenya’s Vision 2030, Nairobi Metro 2030 (2009), and The Spatial Planning Concept for Nairobi Metropolitan Region (2013) (see Appendix 6). According to NIUPLAN, a lack of institutional capacity, no detailed local zoning, and a planning approval process that is not linked to a land use plan has resulted in urban sprawl and uncontrolled urban development in Nairobi. NIUPLAN recognises the need for controlled development, and identifies most of the 15 hazards (see chapter 4) as key to development-driven risk, although some are only dealt with superficially including: population displacement, community cohesion, public space and traffic hazards (Appendix 7). To date the intent of NIUPLAN has not been translated into detailed local area plans, zoning and development guidance.

Until these are complete the NIUPLAN will not meaningfully impact local planning decisions and implementation. At present, permitted development is currently negotiated between the developer and the County. Risk is being managed on a case-by-case basis and relies on capable, resourced, and fully staffed planning departments. It also relies heavily on developers to voluntarily consider risk beyond their immediate boundaries, i.e. to go beyond compliance.

NIUPLAN fosters a ‘roads-and-nodes’ approach along the urban transport system, with sub-centre development at Runda-Ruaka, Ruuru, Kasarani, Githurai, and several other areas. It intends to strengthen sub-centres to promote balanced development by narrowing the gap between east and west, easing pressure on the CBD (NCC | JICA, 2015). Planning approval

The planning approvals process is a mechanism within a plan-led planning system to ensure proposed development complies with legislation and reflects the vision and objectives as laid out in the Plan – in this case NIUPLAN. Typically a planning approvals process considers the welfare of people and the environment taking account of how a proposed development reflects the wider context (social, environmental, economic) and the implications for infrastructure services. The approval process is typically concerned with understanding development impacts arising from: the location, land use, design, siting, layout, aesthetics and structural integrity.

Nairobi City County is responsible for land development control (permits for land use etc.) which is managed by Programme Implementation Section of the City Planning Department. The Kenyan planning process follows a permit-based approach but there is not a consistent approach to implementation, due to inadequate guidance and limited resources.

Alongside NIUPLAN, the principal tool to guide development is the Guide of Nairobi City Development Ordinances and Zones (2004). This does not provide updated zoning plans, instead illustrates what the city has been doing to date to control development but has limited value as it does not provide justification as to why different types of development have been permitted in different areas. The Physical Planning Handbook (2007) developed by the Ministry of Lands provides guidance on minimum physical planning standards, but does not consider hazards in any detail. It is not a legal document and was prepared more than ten years ago, as was the latest land use zoning documentation (NIUPLAN 2014). Because these documents are out of date and do not reflect land use patterns and values they are no longer considered relevant (PCs 2 and 6, Nairobi private planner and NCC). The planning process itself is complex involving several steps (Appendix 8), and is not transparent. Several approvals and permits are required that together collectively comprise planning consent from local government and other stakeholders. However, there are several loop-holes. For example, a development that requires but has not yet acquired an Environmental Impact Assessment (EIA) licence may nevertheless be granted planning consent as different steps in the approvals process are not linked. NIUPLAN implies that developers have been able to deviate from regulations without significant repercussions due to the lack of capacity and the slow and inefficient permit process.

Financial capacity was cited by several interviewees as a key issue for agents responsible for permitting development, although Counties now have a specific budget transfer from the national government allocated to urban planning which should help. Developers also pay a charge to the County to support local infrastructure improvements, however this charge goes into a single fund and rarely goes directly into improving local service delivery at the project location.

The lack of detailed local plans directly affects planning approvals as discussed previously, requiring planners to negotiate with developers which is time-consuming. There is not the human resource capacity to properly review applications and undertake the necessary follow-up actions to ensure recommendations have been followed. There have been recent steps to improve the processing of planning applications:

The development of local area plans aligned with CIDPs is a critical step that will help planners to make more informed and consistent planning decisions and consider risk at a local level.

Counties are now starting to ask developers to submit detailed architectural and structural plans at the same time to ensure structural plans are actually submitted (as often developers start construction following architectural approval). This change is thought to be helping tighten up the process (Personal Communication (PC) 1: private planning consultancy).

In a recent development, most planning applications are now done online through a new portal that has been establish with support from The World Bank (2016). The online process aims to streamline development applications, improve monitoring (and reduce the opportunity for corruption) and allow planning officials to spend some time on forward planning rather than just reactionary development control processes as has been the case until now (PC 1&2 priv. planning consultancy & private planner).
Building control

Building control ensures that any new building work complies with existing building regulations. Building control is carried out by reviewing architectural and engineering plans and details, and carrying out regular site inspections during construction. In the UK, building regulations set minimum standards for the design, construction, and alterations of buildings to ensure compliance with health and safety, energy conservation and accessibility requirements.

Nairobi City County is responsible for building control and this is managed by the Development Control Section of the City Planning Department. NIUPLAN suggests that there is a lack of coordination between the planning approval process and building control, and a lack of consistency in which codes and standards are enforced.

The 1968 Building Code is a replica of the 1965 British Building Regulations which do not account for local building technologies, materials and terminology, and refers to technical engineering standards which are now out of date (NIUPLAN 2014, p265). Local engineers have highlighted that a new building code was created in 2009, but was never enacted and the 1968 code is still the ‘official’ standard.

The new building code is more comprehensive than the 1968 code and contains key updates such as disabled access and energy efficiency. It also considers hazards expected of a building code in a comprehensive format. The NIUPLAN states that another building code is in place but overall the building codes consider most of the relevant Nairobi hazards, however these are not comprehensive and there are some significant gaps. See Appendix 9. The Kenya version of the BS does not require seismic design for many structures 4–6 storeys or less depending on the zone and usage classification. This may mean that the majority of buildings across the city are not built to appropriate seismic standards and only those that have gone beyond compliance can be considered safe (Lubkowski et al., 2014).

In the UK the EIA process was formally introduced in 1988 and is currently governed within the Town and Country Planning Act (2017). In Kenya, the EIA process sits outside the standard planning approvals and development control process.

The use of EIAs in Kenya originates in the 1970s, however despite a number of ministerial commitments, the necessary legal framework to ensure the effectiveness of EIA was not in place until the Environmental Management and Coordination Act (EMCA) in January 20001.

The EIA process is administered by the National Environmental Management Authority (NEMA). This is the Kenyan agency with overall responsibility for environmental policy and environmental management. EMCA states that an EIA may be carried out for all development projects that are likely to cause significant environmental impacts. This assessment can consider not only environmental but also social, cultural, economic and legal factors (Muigu, 2012).

The developer pays for the EIA and commissions a private, independent environmental planning consultancy to carry this out. The extent of the assessment varies by project and an initial screening process between the developer and NEMA determines the level of assessment required.

The Environmental Impact Assessment and Audit Regulations Guidelines (2003) outline what should be considered in an EIA. This document addresses the majority of key hazards but waste, wastewater capacity and traffic safety are notable omissions. There is no specific guidance for assessing what hazards exist currently, or may be created by a development or how this translates into risk for local communities or the city overall. This results in EIAs of varying quality and robustness. (Appendix 10).

NEMA only require a full EIA if a project is deemed to be of significant impact. Therefore, only major projects, transport projects, or those posing clear environmental impact are subject to EIA legislation (EMCA, 1999, 2015). Muigu (2012) suggests that many recent high profile developments in Kenya have not complied with sound environmental management practices, citing mangrove forests that were destroyed and human settlement disrupted, in the Lamu Port and Lamu Southern Sudan-Ethiopia Transport Corridor projects. Projects of strategic national importance are at times fast-tracked through the planning, design and implementation process (PC 9 Kiambu County interview).

Muigu also suggests that environmental management has suffered due to the lack of a harmonized environmental regulatory framework between key agencies dealing with specific components of environmental management, such as forestry, water and roads.

NEMA’s ability to implement and enforce the EMCA is often stymied by a number of factors.

Environmental Impact Assessment

An Environmental Impact Assessment (EIA) is a key tool that exists to independently assess the impacts that infrastructure projects will have on the environment and often includes social impacts as part of its remit. An effective EIA should ensure that environmental impacts have been fully considered and managed in a project specific Environmental Management Plan (EMP) before planning approval is granted. They should then monitor the steps outlined in the EMP to ensure that they have been undertaken.

EIA regulations typically set out a procedure for identifying projects that should be subject to an assessment and the wider procedure thereafter.

Environmental Impact Assessment regulations across the country (PC7: Engineer Arup).

1. The direct financial relationship between a project promoter and the lead independent environmental expert responsible for submitting the EIA. This relationship can place pressure on the independent expert to overlook some of the environmental impacts of the proposed project.

2. NEMA’s budgetary constraints mean that it is unable to sufficiently investigate, review and monitor EIAs and related EMPs. Inadequate staffing also impacts NEMA’s ability to monitor projects effectively and conduct the large-scale scientific tests which may be needed (Irandu and Malii, 2013; PC13).

3. There is limited integration with the planning approvals process. NEMA approvals can be granted without the planning approvals and vice versa. NEMA are often placed in a difficult position when a county planning department approves development prior to EIA approval. NEMA often provide approvals with the hope and expectation that planning approval will be given on the basis that the necessary planning and infrastructure provisions are satisfied (PC 13).

4. Many agencies including NEMA are pressured to be enablers of development and not agents that are hindering progress. Within the constitutional change, there are efforts to improve EIA including a NEMA code of conduct in the revised EMCA (2015). This intends to increase quality and consistency in EIA.

(a) https://www.eia.nl/en/countries/af/kenya/
Planning for road infrastructure in Nairobi

Planning of new road infrastructure is typically aligned with strategic national interest therefore often falls outside the jurisdiction of the typical urban planning approvals process. Nevertheless, roads do fall under the purview of most environmental impact regulation. In England, the strategic road network is governed by Highways England whose mandate is derived from the Infrastructure Act 2015 and who is also a legal consultee in the UK Planning system. Highways England, ‘Our Delivery Plan 2015-2020’ sets out the strategic investment plan to operate, maintain, and modernise the strategic road network. Highways England work proactively with planners developing local area plans to integrate plans for growth to ensure strategic infrastructure priorities are identified and funding opportunities maximised (Highways England, 2015).

In Kenya planning for service sectors such as roads and water has typically happened outside of an integrated framework, making accountability and effective monitoring of development plans a problem (ACC 2015). There are, however, several key plans, policy and legislation that govern the planning, design, operations and maintenance of roads:

- The most common document in Kenya for road design is the 1979 Road Design Manual – Part 1: Geometric Design of Rural Roads. This was updated in 2009, however the changes are minor, do not adequately respond to the needs of modern vehicles, and remain rural-roads focused (high-speed mobility focused highways; not low-speed, pedestrian and NMT friendly accessible streets).
- Hazard analysis of the Road Design Manual suggests it addresses most Nairobi development hazards under the guidance on route selection. Guidance is weak on areas of social cohesion and loss of public space/heritage and stakeholder consultation which it is assumed are covered by EIA process as outlined in the Integrated National Transport Policy (2009) (Appendix 12).

Existing technical guidance is recognised as dated and in some areas inadequate (most suitably for urban roads), so the use of alternative design standards and practices is commonplace and accepted by the regulatory authorities. However, this allowance has progressively been abused not fit for purpose leading to violations in the fundamental principles of road design. The Thika Superhighway, in large parts designed by an Indian consultant and generally based on Indian design practices, was delivered by an inexperienced Chinese-Kenyan n Indian construction consortium company is based on Indian design standards but results with major violations in fundamental Kenyan and international highway design standards (e.g. distances between accesses, random lane loss/ lane gain, sight clearances and visibility, kerb horizontal clearance, kerb geometry, drainage systems, and design and operating speeds) (PC 3 Road Engineer, Nairobi).

Interviews with private transport consultants in Nairobi suggested that lack of cohesive and appropriate guidance has contributed to poor design of urban roads, (e.g. high speed, open drains, inappropriate junctions, no pavements).

For nationally significant urban roads it depends who designed the road and implemented the design. For example, if a road has primarily been supported by Japanese investment it will use Japanese standards. While many other similar profile roads will still have acceptable designs, there will be case-by-case variation in quality and design suitability (PC4: Engineer, Nairobi). The use of a range of the best international design standards creates a disjointed operating environment that isn’t easy for drivers to understand and follow. Inappropriate design examples include:

- The use of white road divider markings instead of yellow (to divide opposing traffic flows) – fortunately this is mostly of-public roads (but there are some examples on busy public road sections).
- The use of yellow general roadside and parking bay demarcation markings instead of white (the use of yellow in these circumstances has a mandatory prohibitionary status by Kenyan law, similar to the UK). Yellow markings are used in this way in South Africa, Tanzania, and USA/Canada (PC 3).


- Signage for right-side driving (but permanent “No Overtaking” signage on Nairobi’s Limuru Road)

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Case studies

Section 5 examined the planning and policy environment for mitigating and/or enabling the accumulation of risk from large infrastructure projects. This chapter presents research findings examining projects from both the ‘project’ and ‘neighbourhood’ scale. Specifically, the aim of the case study research is to examine:

- How do large scale projects consider risk outside their project boundaries; and
- How do the projects influence risk in local neighbourhoods.

Thika Highway and Two Rivers Development represent two large scale projects that are shaping urban growth in Nairobi in different ways. Our research examines how these projects consider risks to Nairobi and to the local neighbourhoods that border the developments, Githurai for Thika Highway and Ruaka for Two Rivers.

The research examines if projects consider risk to the city and surrounding neighbourhoods during planning, design, implementation and operations. It examines the specific role of the planning process in risk management. An understanding of local power and stakeholder dynamics is considered alongside understanding local risk trends, for example understanding whether new risk are being created or existing risks compounded / mitigated. The Hazard Lens is applied to understand risk accumulation during and after implementation of the project.

Case Study

Thika Highway

The Thika Highway Improvement Project (‘THIP’, ‘Thika Highway’ or ‘the Highway’) represents a major investment into upgrading Nairobi’s strategic road network. The investment is the first of a series of large scale highway development projects in Nairobi. The Government of Kenya is actively investing in road infrastructure under the Road Network Expansion Vision 2030 target: ‘To develop and maintain existing road networks in order to improve access as well as spur movement of people and goods’ (2030 Kenya Vision, 2016).

Thika Highway opened in 2012 and has now been operational for 5 years. The Highway occupies approximately 3.6km² of land area stretched over 45 km linking Nairobi to Thika and forms a strategically important national and international link along the Great North Trans-African Highway (Cape Town to Cairo).

The Highway aims to improve capacity, decrease accident rates, and provide separate service roads for local and non-motorized traffic. Reducing journey times will improve economic growth in and around Nairobi. Specific upgrades involved additional lanes and raised interchanges (AfDB, 2007).

"The time taken to traverse Thika town and Nairobi has dropped from 3 hours to 30 minutes, greatly improving transport connections throughout the area. This is an important development since the Nairobi Metropolitan Area accounts for more than 30% of national GDP”. – PwC, 2013

The Highway has influenced transport connections throughout Nairobi as well as directly impacting the neighbourhoods that it traverses, such as Githurai. This study focuses on Githurai to understand local impacts of Thika Highway.
Githurai is a large bustling and vibrant lower-income neighbourhood located on the Nairobi-Kiambu county border. Thika Highway divides Githurai into two equal parts – Githurai 44 and 45. Githurai 44 is located east of Thika Highway and has an estimated population of 47,000 and falls in Nairobi County. Githurai 45 is west of the Highway and has an estimated population of 44,000 and lies in Kiambu County. For the purposes of our study we consider Githurai 44 and 45 as one neighbourhood - Githurai.

(7) http://elimuonline.com. G45 can be considered to be 56,694 if Mwihoko ward is included.
DESIGN, DEVELOPMENT AND IMPLEMENTATION OF THIKA HIGHWAY

The African Development Bank (AfDB) provided the principal finance (70%) for the Thika Highway Improvement Project (THIP). Due to an underestimation of the original budget, the Chinese Export-Import (EXIM) Bank agreed to provide an additional 30% of the project costs to complete the highway and connect to Thika. The design contract was awarded to the consortium of Consulting Engineering Services & APEC and the construction of the road was awarded in three lots (CES, 2013).

The project followed a design and implementation process (project need, feasibility and consultation, design, construction) however it is acknowledged that THIP followed an accelerated programme to fit a political cycle. This is not uncommon for large scale infrastructure of strategic importance. The need for THIP is identified in the Nairobi Urban Transport Study (JICA, 2006) which aims “to remove the capacity constraints and improve road safety by reducing travel time, vehicle operating cost and accidents by segregating through and local traffic” (CES, 2013). Given this objective the project does not consider local transport issues, such as non-motorised transport (e.g. pedestrians) or interface with feeder roads. The formal Traffic Assessment (CES, 2007) focuses on the level of service for through traffic only.

The environmental assessment process goes hand in hand with planning. In Kenya the process for incorporating EIA is clear through EMCA. However, the document review indicated that the EIA process that was followed was very high level. E.g. surface water drainage was addressed generically in one paragraph and inferred that no design consideration had been given to it at the time of the EIA. When questioned on the role of NEMA in ensuring Environmental Management Plan (EMP) compliance during construction, NEMA noted that most of the projects EMP matters are “beyond NEMA” as they are more related to signage and drainage etc. However, it was also generally noted that the situation is improving, “most road contractors are doing things well” (PC 13, NEMA staff).

Consultation with relevant local municipalities is fundamental to the development of a road scheme. Stakeholder engagement is a critical part of defining the need and route of the road, and the secondary works needed to mitigate risk accumulation due to unplanned growth. There is evidence that planning and consultation activities may have been actively limited to avoid complicating and delaying the project process. The AfDB (2007) appraisal report does not indicate that any more specific planning – other than the EIA – was followed prior to the project being approved for funding. Although the EIA process provides for consultation with lead agencies, very limited consultation on utilities occurred (PCs 10 AWSB eng., 11 NCWSC 12 RUJWASCo eng.). All utilities noted the slowed and fragmented approach to planning without clarity on how their responses informed the overall planning process (PC 10, 11). This was compounded by gaps in utility data and records.

Detailed design is a critical stage where risks are significantly reduced and there is no evidence this was completed. It is the last chance to significantly influence the risk profile of a project. The Final Feasibility and Preliminary Engineering Report (CES, 2007) covers the activities of Phase 1 and 2 i.e. Feasibility and Detailed Design. However, the report also states that hydrological investigation will be carried out to establish the hydraulic adequacy of existing culverts in detailed design stage. There is no evidence that this was done.

No formal Road Safety Audit (RSA) process was carried out on Thika Highway. This is a fundamental process to follow due to the high risk associated with road design. KoNHA noted that RSAs are now carried out on projects internally within KoNHA and AfDB have made RSAs a requirement on funded projects (PC 14, KenHA Eng.).

Although procurement doesn’t fall under any planning regulations, it is the means of setting up the implementation of the project which accounts for and complies with outcomes from the planning process. AfDB have a bank policy that recipient country burdens risk by being responsible for procurement, due-diligence at start of project, early works procurement. This is to encourage capacity building by the recipient country. This also offers a means for the bank to limit its risk exposure. PC 21: Makajuma AfDB (interviewee’s individual view). In reality this creates risk as GoK struggles to finance early works, therefore then end up with the Contractor and lower priorities may suffer. On THIP the procurement process and contractual set up is not clear. It appears weak and there is no evidence of any party (proponent, funder, designer, contractor) doing anything “beyond compliance” to address this. There is no evidence of risk communication or risks being formally managed through contracts. No evidence was identified of enabling works being done to mitigate risks such as interface with existing utilities, ground conditions, and land ownership. Comparing the design report with the post completion report, it is clear that there were a number of shortcomings such as:

- Delays due to resettlement and utilities;
- No evidence of design of surface water structures; and
- Numerous design decisions being made on the job during construction (e.g. drainage in the median).

As well as the direct impact from these issues – utility disruption, community cohesion/business disruption, the lack of contract / finance management can mean that indirect risk accumulation occurs also such as temporary works, footbridges, enviro-compliance etc. (PC 14).

Residents of Githurai confirmed that they were not meaningfully engaged during the planning, design and implementation process. Most local residents were informed about the project through media coverage or through word-of-mouth (Appendix 13).

Some stakeholders (e.g. the local boda-boda / motorcycle taxi representative) feel that they were engaged only to fulfil statutory consultation requirements and were not given genuine opportunity to share concerns or ideas. Boda-boda drivers asked for a bus terminus to reduce congestion and discussed where speed bumps should be, but these points were not considered (PC 23). The SACCO leaders also suggested bus stops on the Highway that were ignored (PC 24). This may highlight the conflict between the formal and informal transport economy in Nairobi but does reflect limited public consultation which is evident more widely in the official Thika ESEA (AfDB, 2007).

A marketplace representative suggested that there are added complications because Githurai is divided between two jurisdictions Kiambu County / Nairobi City County suggesting that politicians did not agree on issues escalating tensions in the area. It is the provincial administration (chiefs and sub chiefs) who typically deal with issues such as displacement, working closely with the various community groups such as boda-boda associations, SACCOs and hawkers (PC 25, Githurai market association member). While the local chiefs play an important role in reducing tensions and helping to deliver a project (that is widely agreed is a good for the area), local views need to be acknowledged. This largely comes down to the robustness of the EIA process.

Interviews did provide evidence of the growing role of local advocates in representing local interests and influencing the future shape of the neighbourhood. This includes local environmental Community based organisation (CBO) Small Axe, who armed with knowledge of environmental legislation, work to protect the riparian habitat which provides a precious socio-environmental asset to Githurai (PC22; CEO Africa, 2017). National civil society actors like the Kenya Alliance of Residents Association (KARA) have also had a growing influence over the past decade. KARA carried out an independent study of the Thika Highway expansion process, because ‘they felt that the voices of ordinary people were not being taken into consideration’ (PC 26). They therefore engaged KenHA and locals to discuss issues along the highway. KARA felt they influenced changes to the number of pedestrian bridge crossings available along the route. This reflects a wider pattern throughout the city of increasing civic engagement in planning issues.

Neighbourhood Development Acts are now in place in Nairobi and Kiambu counties, formally recognising residents associations and other community interest groups and promoting collaboration including scheduled forums between residential associations and local government at least twice a year (Nairobi County Government 2016 and Kiambu County Government 2016).

The growing role of global NGOs such Amnesti International and Slum Dwellers International in supporting community organisations have also been widely publicised, with the latter currently engaging with both government and community stakeholders in the development of an integrated plan for Mukuru an informal settlement of more than 100,000 families in South-East Nairobi (Dodman, 2017).
RISK ACCUMULATION IN GITHURAI NEIGHBOURHOOD

The results of household surveys, Focus Group Discussions, Key Informant Interviews (Appendix 17) and wider desktop research revealed a complex and dynamic patchwork of risk locally, where some risks have been created or compounded in places, but mitigated or reduced in other parts of the neighbourhood (Figure 10). Specifically:

While crime and violence has historically been an issue locally and remains so, THIP has played an important role in reducing this risk in particular around Githurai roundabout. THIP brought roadway lighting and CCTV, cleared poor quality vegetation removing hiding places for criminals, reduced previous risks around stagnant traffic and enabled increased night-time livelihood activity. A more secure environment and increased livelihood presence has had a virtuous effect on local security within the immediate vicinity.

Inadequate hard and soft measures were stated as factors that compounded an existing local risk of traffic fatalities. Thika Highway was the first road of its size in Nairobi and the greater speeds it enables needed to be managed through appropriate degree of corresponding road-safety education for both motorists and pedestrians. Accidents in Githurai were also attributed to unnecessary speed bumps, lack of appropriate pedestrian crossing points and a population increase with greater car ownership.

Focus groups felt that congestion was becoming a greater problem locally. The highway itself was perceived to be less congested, allowing for a greater volume of cars but service roads entering and exiting both sides of Githurai and through roads into the communities have not been sufficiently developed and as a result had become more congested.

Improving highway access to (and from) the neighbourhood had mitigated the risk of various hazards through improved emergency response reducing multi-hazard vulnerability. Residents noted that this improved all forms of emergency response, such as fire, medical and police response.

THIP appears to have improved livelihood conditions for some but detrimentally for others. Some traders have benefitted from increased accessibility and night-time lighting, while others experienced livelihood disruption during construction. Manji (2015) suggests that THIP ‘took a meat axe’ to Githurai market, scattering market traders but appendix 18 FGAs suggest that some of those negatively impacted were already small, informal traders and this would have added to pre-existing financial vulnerability. Klopp (2011) states that some female traders who continued to try and sell along the route became transport fatalities.

During the construction phase of THIP it was suggested to have compounded water shortages in the neighbourhood by damaging and blocking water pipes. Several focus groups linked THIP to increased population growth along the route, generating longer-term problems:

- Population growth has outpaced local capacity to deliver essential services such as water and waste water management. Neighbourhood residents now spend more money on water, with those that can afford to do so relying on alternate water sources such as boreholes and private water tankers.
- THIP has increased local real estate prices, helping owners but hindering renters. Increased Business competition has impacted existing businesses.
- The draw of THIP is resulting in increased, often unplanned development pressure on marginal land. Small Axe CBIO stated that THIP has been very positive for the local community but they also have to work hard to protect local riparian public space from unpermitted, opportunists developers (PC 22). While not mentioned as a key issue in Githurai, unplanned development, without proper building standards has resulted in collapses of small-medium size new buildings elsewhere along the highway (Appendix 19).
- Residents discussed the health risks associated with increased air, land and water pollution as well as decreased water availability.

Githurai provides a snapshot of perceived positive and negative impacts of THIP on a local community, some of which may have also been experienced by other communities along the highway. Teipelke’s (2013) study along the length of Thika Highway highlighted road safety, livelihood disruption, affordability and pollution as common impacts along the route. Project level investigation further highlights consequences of THIP have been felt at the wider city level. Notably, as a result of the project, risk is accumulating in Nairobi in two key areas: increasing traffic hazard and congestion and impacting on water supply and wastewater overcapacity (flooding).

Traffic hazard and congestion

The principal driver for Thika Highway is the improvement of traffic flow in and out of Nairobi through the ‘aggregation of throughput traffic’ from local traffic (AIDB, 2007). Public consultations along the corridor clearly indicate there was concern over the high rates of road accidents which would undoubtedly increase with the higher speeds possible on the improved road (African Development Fund, 2007). The same report notes that land was mitigated through ‘elaborate engineering design measures’. No significant design of the interfaces between the highway and the surrounding neighbourhoods is found in the Final Feasibility and Preliminary Engineering Design Report (CES, 2007) indicating that attention was not given to ‘addressing these concerns along the 45km stretch of Highway between Nairobi and Thika.

The traffic assessment carried out for the project addressed through traffic flow on the highway and did not consider the requirements of other road users. Dangers related to limited pedestrian crossings were raised during consultation carried out by KARA in 2011. KeNHA and Ministry of Roads noted that further provision for footbridges would be made at the end of the project as ‘it is easier to get the road built first’ (KARA & CSUD, 2012).

Data provided in the post-construction report indicate that fatal accidents increased 59% and serious injury accidents increased 77% during construction relative to the original road baseline. The lack of traffic management during temporary works was cited as a concern for residents and businesses alike (KARA & CSUD, 2012).

It was apparent from site observations in many places along Thika Highway that pedestrian provision is still very limited and exposure to traffic hazards is widespread. Only 9 pedestrian crossings were proposed along the Highway at the time of construction – one every 5 km (CES, 2013). In 2012 the AIDB sent a mission to investigate reports that accident rates on the highway had increased due to inadequate provision of crossing points (Capital Business, 2012). Before the end of construction, a further 9 footbridges were built to account for the unplanned increase in urban growth along the highway corridor (CES, 2013).

However, road design and construction has improved in the 10 years since Thika Highway was designed. Road Safety Audits are now carried out internally within KeNHA, and the National Transport and Safety Authority has a mandate to minimise loss of lives through road accidents (PC 14 KenHA Engineer, PC 15 APEC Engineer). In addition, there is now greater consideration of pedestrian risk and service roads development as illustrated in the recent Nairobi Western Bypass project (EarthCare Services Limited, 2017). In April 2017 Kenya Urban Roads Authority (KURA) announced a collaboration with Architectural Association of Kenya (AAK) for the design of urban footbridges that “take into consideration universal access, security, adaptability to the environment, aesthetically appealing to both pedestrians and motorists” (Kenya Engineer, 2017).

Water supply and wastewater overcapacity (flooding)

One of Nairobi’s main sources of water is located near Thika and supplied via a pipeline that runs along the Highway. Thika Highway runs against the natural surface water drainage catchment (the southern slopes of the Aberdares). To accommodate its location, the road is crossed by numerous wastewater and drainage pipelines. However, the strategic nature of Thika Highway to act as an integrated utility corridor for the whole of NE Nairobi was not considered during planning and design. Although the need to relocate existing utilities was identified, no assessment of the process to do this was considered in the design and the risk of disruption was only superficially considered within the EIA.

The Nairobi City Water and Sewerage Company (NCWSC) noted that consultation with utilities occurred very late in the project design process (PC 14 KenHA Engineer). The relocation of utilities was undertaken late in the programme at the time of the main highway works. Due to the constrained nature of the road corridor, the utility relocation works delayed the main highway works resulting in additional project costs (CES, 2013).

Limited planning of utilities along Thika Highway contributed to direct risk accumulation through interruption in water supply. The road is crossed by a large soakaway along the corridor. Nearly 10 years after construction started, some wastewater connections are yet to be repaired (PC 11, NCWSC). The increased rate of urban growth in north-eastern Nairobi along the Highway was not accounted for during the planning and design of the project or in the infrastructure improvements needed to support this growth (PC 16, AQUACONsultant) and (Wairimu, 2012). There is growing concern that left unplanned – the lands adjacent to the Highway corridor are turning into ‘one large soakaway’ (PC 15, APEC Engineer). To support urban growth to the east of Nairobi, NCWSC now needs to construct a major water pipeline across Thika Highway. No provision was made for this strategic crossing at the time of the Highway development. NCWSC are now considering boring the pipeline beneath the road or crossing the road with an open trench. Both methods are intended to avoid disruptive to Nairobi (PCs 10, 11 NCWSC).
Traffic fatalities
- Over speeding
- Construction dust

Traffic hazards - congestion
- Connections damaged and longer term capacity issues

Land and water pollution
- Waste and wastewater
  - Stagnant water
  - Wastewater into river
  - Odours

Air pollution
- Traffic hazards - congestion
- Land and water pollution

Flooded road causes delays

Loss of space
- Traffic hazards - congestion
- Land and water pollution

Waste flows into river but cleaner at road

Surface flooding - road floods
- Threat to Riparian zone from increased population

Health
- Traffic hazards - congestion
- Land and water pollution

Riparian zone Small Axe protects helps prevent fluvial flooding

Electrical Water-borne disease

Wastewater into river

Water shortage
- Traffic hazards - congestion
- Land and water pollution

Riparian zone
- Fire
- Deforestation/vegetation destruction

Unreliable water

Poverty
- Rising rents
- Local Business
- Community cohesion, crime and violence

Spend extra money buying water

Displacement or competition

Spending extra money buying water

An alternative version of the Risk Network diagram is presented in Appendix 20.
Two Rivers Development (Two Rivers) is the largest mall in sub-Saharan Africa outside of South Africa. Two Rivers, named after the Gicchi and Ruaka Rivers that flow either side of it is an integrated mixed-use development set on 100 acres, 14 km northwest from Nairobi CBD along Limuru Road. It is being developed by Athena Properties Limited (Athena), a subsidiary of Centum Investment Company Limited. The project includes the development of a master planned urban community that will integrate retail, entertainment and lifestyle facilities, modern office parks, residential apartments, hotels and public amenities (Two Rivers Lifestyle Centre Limited, 2013). The development is being constructed in phases and when complete will have an estimated built up area of 851,000 SQM. It is estimated that Two Rivers will provide employment opportunities for approximately 10,000 Kenyans.

The development has been classified as a Vision 2030 Flagship Project meaning it will receive technical support from Vision 2030 in terms of compliance and requests for interventions as covered by the public private partnership framework. Two Rivers will collaborate with Vision 2030 in capacity building, benchmarking, technology and knowledge transfer.

“This project proves that we have the capacity to tackle our own challenges such as unemployment and rapid urbanisation. We all have an opportunity to be part of something great” Two Rivers Board Chairman Chris Kirubi (Business Daily, 2016)

“Through Vision 2030 we are spearheading the transformation of Kenya into a newly industrialising, middle-income country providing a high quality life to all its citizens and a clean and secure environment… ”projects like Two Rivers are crucial steps in attaining our goals and we are pleased to collaborate in this venture.” Acting Director General Vision 2030 Delivery Secretariat, Prof Gituro Wainaina. (Business Daily, 2016).

The Two Rivers Development is surrounded by residential areas and a greenfield site. The high-income neighbourhoods of Runda to the east and Roslyn to the south and the low-to-middle income neighbourhood of Ruaka to the west. To the north of the site, separated by the recently opened Northern Bypass is a large greenfield site with a small dam (Closeburn Dam). Beyond the greenfield site are expanding residential areas of Gumbo and Muongoiyai in Kiambu County. Ruaka straddles to the border between Nairobi City County and Kiambu County. This study focuses on Ruaka to understand local impacts of the Two Rivers Development.

Ruaka is a small town that for many years was separated from the urban growth of Nairobi. The neighbourhood is located primarily in Kiambu County in the north west corner of Nairobi although part of the neighbourhood is located in Nairobi City County. The neighbourhood is within the urban growth boundary of Nairobi and is due west of Two Rivers. Over the past 15 years Ruaka has grown from a small low-income community into a much larger middle-income neighbourhood with an estimated population of 50,000. Much of this development is driven by the expansion of Limuru Road and the Northern Bypass which passes either side of Two Rivers and through Ruaka.
Two Rivers is located at an identified ‘node’ within the Nairobi Integrated Urban Plan (NIUPLAN). The developer’s vision is to create a landmark project incorporating global best practice from environmental standards, amenities and spatial requirements. Athena is an affiliated member of the Green Building Council of Kenya and Two Rivers is currently in the process of obtaining a four-star Green Star rating, (Athena, 2017).

Generally, an appropriate and compliant process was followed throughout the design, development and implementation process. The process followed is in line with overall planning context and the right due-diligence and feasibility work was carried out. Planning permission was attained in December 2011 and an EIA was carried out in accordance with the EMCA regulations.

Athena viewed the EIA as a necessary planning process but that, due to weakness in the system, they did not rely on it to guide the principals of their development and rather they sought to go ‘beyond compliance’ (PC 17, Athena). Another key driver was to demonstrate to potential investors that the project was de-risked and therefore secure investment necessary to realise the development.

A Traffic Assessment is a requirement for both the planning and EIA process. Athena recognised a business need to proactively engage with KNHUA and KURA to go beyond compliance in order to address accessibility issues.

During project planning Athena established a Compliance Team to manage all issues of compliance with planning and environmental conditions and securing of necessary approvals. This team pro-actively engaged and consulted with stakeholders and authorities. However, the EIA was carried out early in the project development and the resulting EMP makes very generic requirements. The EIA received approval despite fundamental aspects being unclear or flawed.

The ‘danger of flooding in case the dam collapses’ is identified but is not addressed in the Environmental Management Plan (EMP) and it is unclear how this was considered further in the development process.

The EIA states that the project will fit in with the ‘existing neighbourhood with no violation of the physical planning zone specifications’. While this assessment can be debated, no planning documents related to the project appear to make reference to Ruaka. Another key risk identified in the EIA relates to informal development around the site (PC 13, NEMA staff).

Athena originally expressed a desire for formal boundaries, but weak planning controls around the site would leave them exposed to unregulated development. Therefore, Athena had to develop a hard boundary to protect Two Rivers from unplanned development (PC 17, Athena).

It is understood that no significant detailed design occurred prior to construction commencing and that tender was carried out and construction commenced based on schematic design information. There is little evidence of the risk management process considering risks to (or from) the project. Planning and the EIA played little role in the lack of detailed design. These is no evidence of organisation in the design team and limited coordination between professionals was cited as a frustration by the developer (PC 17, Athena). The level of detail design carried out appears to be very limited and there are some shortcomings such as in the water system, e.g. flood flow, hydraulic and hydrology. The hydrogeological interpretation of aquifer characteristics appears questionable.

Utility coordination also appears to have been driven by a business need rather than a planning or environmental requirement.

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Utility coordination also appears to have been driven by a business need rather than a planning or environmental requirement.
The results of household surveys, Focus Group Discussions and Key Informant Interviews in Ruaka (Appendix 22-23) revealed the following local perceptions in relation to local neighbourhood risk accumulation and the role of Two Rivers Development (TRD) and other developments within this:

TRD is considered by local residents of Ruaka to be a successful investment. People use it, and by and large, like it. It has become a point of reference, and a sign of progress, development and change in the neighbourhood. The standard of construction and management is considered to be high and appropriate systems are in place (including water, drainage, sewage) and support services (fire safety) are all considered by residents to be appropriate to demands for the development itself.

However, consultations with Ruaka residents illustrate a common pattern of risk accumulation. Many risks are identified as low risk in the past, medium risk in the present, and high risk in the future (with exception to some risks including Fire Hazards). The question then is why are the existing resources as well as changing and influenced by large developments.

Technical analysis of TRD identified three further key risks that could potentially be impacting not only Ruaka but also surrounding areas. These are all concerned with water: flood risk, water shortage and water quality. They reflect wider gaps in development regulation which are felt at the city level.

Flood risk

The TRD site is bordered on one side by the Ruaka River and crossed by the Giichi River, a tributary of the Ruaka River which joins the Ruaka River downstream of the site. The flood risk due to increased storm water run-off from the site is identified in the EIA, however the risk is considered to be ‘minimal’ since a ‘good drainage system’ will be constructed and ‘proper landscaping and planting of kikuyu grass will be done’. The EIA notes that ‘a storm water management plan that minimises impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structures will be designed.’ These requirements are also recorded in the EMP (AWEMAC, 2012). However, it is not apparent that any such measures were incorporated in the first phase of the development as they do not appear to have been incorporated within the civil engineering design.

The additional risk of flooding from Closenberg Dam is also identified in the EIA although there is no discussion of this or of potential mitigation measures. Although there is awareness of the potential risk of increased surface water run-off from the development and interaction with the rivers, the design and approval process did not result in any significant mitigation measures of these risks in downstream areas in the city.

Water shortage

Water shortage is a key risk to any development. The developer carried out a hydrogeological investigation to assess water resource potential and needs for Two Rivers. The study recommended solutions that included impounding rivers and drilling boreholes for groundwater abstraction. The study did not explicitly consider possible impacts of water abstraction (surface and groundwater) from Two Rivers on the local area or the wider city (Earth Water Ltd, 2011).

Although the hydrogeology report attempts to quantify the aquifer characteristics and therefore sustainable yield, the technical detail is not complete. The report does not consider the impact of borehole abstraction on the wider aquifer. This is a common occurrence across Nairobi and the resulting risk accumulation within the city may be significant and is currently unknown.

Water quality issues

Currently, there are underlying water quality issues in Nairobi as the groundwater contains high fluoride levels that exceed the World Health Organisation standards. To address this issue, Two Rivers has installed a reverse osmosis treatment plant to provide potable water to the site. To provide potable water to the site, Athena have developed a reverse osmosis treatment plant due to fluoride levels exceeding WHO standards in one borehole sample. However, despite Athena’s design scope requiring that the water treatment plant be designed in accordance with ‘best practice’, the discharge of the brine concentrate was not fully considered in the plant design and this risk was not fully understood by the designers, developers or authorities prior to construction being carried out.

Two Rivers have developed an on-site wastewater treatment plant due to a lack of surrounding wastewater infrastructure. The treated effluent from this plant is used to supply irrigation water and fire water supply on the site, thereby reducing potable water demand. Runda Water – a Water Service Provider downstream of Two Rivers has noted that the unplanned growth of Ruaka without associated infrastructure development has resulted in increased biochemical-oxygen-demand (BOD) content in the river. A high BOD level is an indicator that a lot of oxygen is being used up by bacteria to break down organic material and is typically the result of a high level of organic matter dissolved in the water. Ruaka Water attribute the high BOD levels to a lack of oxygen being used up by bacteria due to the flow of sewage and wastewater. An alternative strategy might have been for TRD to contribute to a waste water facility that could have also served the growing needs of the surrounding area.

RISK ACCUMULATION IN RUAKA NEIGHBOURHOOD

The following specific points can be made regarding Two Rivers Development and short-term and long-term drivers of risk accumulation in the neighbourhood:

It appears that some locals will benefit from the livelihood opportunities that Two Rivers offers but focus groups suggest that others are having their livelihoods put under increased pressure, with this impact playing out in both the short and the longer term. The development has raised the profile of the surrounding area and local real estate firms have drawn direct correlation between Two Rivers and local house prices (Cytom, 2015; BuildAfrique, 2016). While this is good news for local land owners it is concerning for those with less secure tenure.

While Two Rivers does not appear to have significantly impacted local community cohesion it appears to have missed an opportunity to be more inclusive and to cater to the needs of the whole community rather than just higher income residents. Focus Group participants suggested they just go to TRD ‘for a selfie’ but cannot afford to shop there. They stated that more affordable perimeter shops would have been appreciated. Social cohesion in Ruaka was not considered in the EIA and neither was it identified within the Planning conditions. However, the EIA notes the potential benefits of job creation (during construction and for servicing of the mall) and the provision of ‘affordable recreational facilities’, ‘affordable learning institutions’ and ‘affordable mixed rental houses’.

Athena also noted that a ‘softer boundary’ with the adjacent communities would have been preferred, but that due to lack of regulation in the planning process, a more formal controlled boundary was necessary to maintain the value of TRD.

In the long-term, TRD appears to have contributed to population growth which does not appear to have been adequately planned for. This has a significant effect on extensive risks in the surrounding area including strain on existing local infrastructure and services. Despite the fact that Two Rivers’ own infrastructure is capable of managing this growth, infrastructure within neighbouring towns such as Ruaka is struggling to cope with the magnetic effect of TRD. The research suggests that the impact of large developments beyond its boundary needs to be considered in an inclusive and holistic fashion. Large developments are coming up in Ruaka at an increasing rate including a new mixed-use development, ‘Alma’. There is the need for an integrated plan, with detailed consideration of all direct and (more importantly) indirect social benefits and consequences before planning approval for any development is granted.

What has emerged strongly is the cumulative and collective impact of overall development in Ruaka on local risk accumulation of which TRD can be considered as a key contributor despite the developer’s efforts to manage the impact of the site.

New development is identified as built infrastructure including new shopping centres, supermarkets, residential, malls and bypasses. Development has brought new facilities and amenities to the local community, but it has also increased the cost of living and decreased the quality of life for some residents, including loss of space and strain on already stretched local amenities and services.

Local population growth has been rapid and influenced by large developments. It is this that is placing added strain on existing resources as well as changing the social and economic fabric of the community. It is referenced in nearly every hazard discussed.
Figure 10: Risk network - influence of Two Rivers development on local risk accumulation in Ruaka

An alternative version of the Risk Network diagram is presented in Appendix 24.
Conclusion

This study sought to examine urban risk from large scale infrastructure projects in Kenya at city, project and neighbourhood levels of investigation.

At the city level the research sought to understand whether urban risk from large scale infrastructure projects is adequately addressed by national and city level planning policy, processes and regulation.

At the project and neighbourhood levels the research set out to examine how case study large scale projects have considered risk outside their project boundaries; and how these projects influence risk accumulation in local neighbourhoods.

Challenges for Nairobi

Nairobi has a fragmented planning process with critical gaps in the level of detail particularly at the local level. While the Nairobi Masterplan (NIUPLAN) clearly sets out city intentions, until local plans are finalised with capacity to implement and control projects, city ideas will not be able to fully translate down to local level. This is compounded by a lack of a robust basis to evaluate individual projects and limited resources across regulatory agencies including city planning departments and NEMA. These gaps are leading to a misalignment between projects that are being developed and the planning process.

The current public consultations process is perceived by some residents largely as a tick-box exercise and limited benefit is attached to this process by local residents. In the context of rapid urban growth there is intense pressure on authorities not to hold up progress and to greenlight development in Nairobi. This all contributes to an environment where projected related urban risk is not sufficiently addressed.

However, NIUPLAN as a strategic Masterplan offers a framework up to 2030 and in places local plans are completed or in progress. Furthermore increasing environment of civic society as outlined in chapter 6 suggests progress with respect to inclusive development planning.

The previous sections demonstrate that both the Two Rivers Development and the Thika Highway expansion have in many ways had a positive impact on the city and nearby local communities.

Nevertheless both projects also illustrate how large projects can create or compound risks both in adjacent neighbourhoods and also at a city scale - notably impacting the urban water system and increasing the inequality between those who can afford to live in rapidly developing environments and those who cannot.

Without a sufficiently robust regulatory environment it is inevitable that developers are self-interested to ensure that their projects are delivered on time and on budget. Risk is therefore accumulating due to limited planning information, lack of detail in design, disengaged communities and an absence of robust risk management processes.

The various stages of the project cycle - inception, feasibility, scheme, detail, construction, handover - offer significant opportunity to identify and pro-actively manage risk (RIBA, 2013) but it isn’t happening. It is unavoidable that large scale projects have some level of impact where they are placed. It is in taking the time to recognise what these impacts are that can mean the difference. The 2012 London Olympics represents an example of current best practice where a large project has been used to re-generate and re-vitalise part of a city previously ignored. That project majored on the need to understand and plan for the Legacy of the Games, addressing a history of poor environmental planning and improving the opportunities and resilience of local communities.
Key challenges

The research highlights seven underlying challenges which are influencing urban risk accumulation from large infrastructure projects. These points are applicable to future planned development in Nairobi and for other cities in a similar situation.

1. Pressure for development in Nairobi

A number of lead agencies, as well as NEMA itself, noted that they are under pressure not to hold up development in Nairobi. NEMA noted that where planning approval has been granted, it is difficult for NEMA to delay the development and not approve the EIA (PC 20: NEMA staff) NCWSC and WRMA both also noted that although water resource use is not sustainable, they are under pressure to not limit the rate of development in Nairobi (PCs 11 and 18). This drive to develop is resulting in rushed planning that does not adequately consider risk.

2. Fragmented, out of date, and conflicting planning process

Fragmentation of the planning system is the principal risk cited by almost all key stakeholders. Currently the Nairobi masterplan (NIUPLAN) is not supported by detailed local area plans, zoning or development guidance. In this context, each new development is negotiated between the developer and the City and risk is managed on a case-by-case basis. This development model relies on planning departments that are capable, resourced, and have the appropriate planning tools at their disposal. However, the current tools that planners have at their disposal are out of date and overly generic and planning departments lack the necessary level of capacity to enforce regulation. The rapidly changing land use factors are not adequately addressed in the current guidance - impacting decision making today, and potentially compounding existing risks for the future. Finally, it relies on developers to go beyond compliance to consider risks beyond their site boundaries.

3. Inadequate detail in design

There are examples where more substantial EIA processes have been followed in projects that are currently underway in Nairobi and it is notable that the ADB has recently revised its safeguards standards to include, for example, recognition of land rights for informal settlements.

4. Limited perceived benefit from consultation with public and authorities

Both large scale projects complied with EMCA requirements for consultation. However, for the scale of projects, the amount of consultation was very light-touch. This is a missed opportunity to maximise potential benefit from the project for the public as well as to hold developers accountable to their risk management responsibilities.

5. Insufficient detail in design

The Detail Design stage on projects is a key step in the design process where risks are addressed before the very costly construction stage commences. Detail Design is often skipped to save costs and speed up the development process. Failure to invest in the Detail Design stage exposes projects to risks that are much more difficult and expensive to resolve during construction or even operation. The lack of a robust and comprehensive design process may contribute to the direct and/or indirect accumulation of risk in the neighbourhood around the project and the city at large.

6. Limited data and information

The quality and quantity of data used to consider certain key risks on the projects was limited. On Thika Highway the ability to plan around existing utilities was generally not possible as no data existed. Thus disruptive, intrusive and costly investigations were required to identify existing utility constraints.

Management of flood and groundwater risk is dependent on modelling and analysis which in turn is dependent on good quality data regarding rainfall and run-off data and aquifer geology and recharge rates etc. In many cases on these projects it does not appear significant effort was made to obtain or generate data (e.g. stormwater infrastructure was often designed by inspection) and where data was generated (e.g. geohydrology Two Rivers) the method of generation and interpretation appears to be limited.

The lack of utility plans was cited as a key risk by a number of utility providers, such as AWSB, KeNHA, NCWSC, RUJWASCo. RUJWASCo also noted that due to risk of infrastructure damage by works, they put their pipes at back of the road corridor. If damage occurs, they just have to get on and repair and bear the cost as it is too costly/time consuming to try to get others to pay for repairs (PCs 12, RUJWASCo). All utility disruption creates a risk for the local community and if this consumes funds that would otherwise be used for further utility development, the risk is compounded.

7. Ineffective contracts and project finance

Given the complexity of risk management on large projects, the contractual arrangements on such projects play a large role in effective of risk management. The appropriate allocation of risk management to the relevant project stakeholder is key and management of the financial resources to address the risks is equally important.

Although the design and construction contracts of Thika Highway and Two Rivers Development were not reviewed within this research, key informant interviews with the developers and financiers raised some key points. The contrasting opinions of ADB and KeNHA illustrate well the challenges that are faced in major highway works in Kenya: ADB have a bank policy that recipient country carries risk by being responsible for procurement, due-diligence at start of project, and the procurement of early (or enabling) works. This is a Bank policy in order to encourage capacity building in the recipient government institutions. This is also a means for the Bank to limit its risk exposure (PC 21: George Makajuma AFDIB (interviewee’s individual view). However, KeNHA noted that in reality this creates risk as the Government struggles to finance enabling works that are then pushed to the Contractor. Contractors prioritise important issues over lower priority works.

Makajuma also noted that the Bank carries out fixed lending and it is the responsibility of the country to make up any shortfall in the case of unexpected costs. However, to take this position and at the same time distance the Bank from the key risk mitigating processes in the early stages of the project seems contradictory and likely to promote risk accumulation.

In comparison, privately financed infrastructure projects (e.g. roads or energy) go to significant effort to agree contracts and risk apportionment. Risk is quantified as far as possible through precise technical assessments. These processes reduce risk to the project investors and developers and by extension to the neighbourhoods around the projects.
Nairobi is continuing to develop at a rapid rate. To ensure that future development benefits the city as a whole requires continued application of the principles outlined in this section.

Addressing the challenge of risk accumulation from large scale projects will not be achieved through a single standalone solution but through a series of actions that result in more robust systems, and change behaviour. These ideas are potentially applicable not just to Nairobi, but to other cities across Kenya, East Africa and sub-Saharan Africa.

## Principles for risk-sensitive development

Key challenges outlined will require continued institutional reform and capacity building. Meanwhile we suggest that the negative impacts of large infrastructure projects can be avoided or at least reduced if planners and developers place greater emphasis on the following principles:

### Normalize inclusive development

Infrastructure can be inclusive or exclusive. It is important to consider who the infrastructure is serving. Good urban governance aims to broker this dynamic and to ensure where possible that development is equitable and inclusive for all. Full consideration needs to be given to the direct and indirect impacts of a large scale project and the effect they have on the most vulnerable. For example, those whose employment situation will improve and those who will suffer, home owners versus renters, and those living near hazard hot spots versus those living further away.

### Plan for the Magnetic Effect of large scale projects

It is important to plan for the magnetic effect of large scale projects. Both Thika Highway and Two Rivers have added desirability to both locations. This has affected house prices, population growth and related infrastructure demand. Residents with adequate financial capacity are able to absorb the impact (e.g. private infrastructure provision) and house prices increases actually serve the interests of parts of the community at each location. However, for more vulnerable parts of the community, the day-to-day, extensive risks that they experience are compounded by rapid development.

### Do not forget the small to medium scale projects

Large scale projects, such as the case studies examined here, are being delivered locally to a higher standard and have captured the attention of the public. Numerous small and medium scale developments (such as 4-5 storey apartments) are popping up surrounding these large scale projects. These developments are sometimes led by opportunistic developers and are often designed and constructed rapidly. They often fly under the radar and pose a risk to occupants or those residing nearby these buildings. Further research is needed to understand the impact of small to medium scale development in Nairobi.

### Understand the complex network of risk

The research highlights complex project-risk relationships where certain risks have been mitigated but others created, compounded or transferred. Both case studies have outlined a sophisticated network of risks with cascading impacts from certain hazards to others. A robust risk analysis should be undertaken before a large scale project is approved. The risk analysis should consider both internal risk to a project but also the project’s relationship with the wider risk environment outside the project boundary. Finally, urban authorities should be aware of the risks and anticipate the need for greater building control demands once a large scale project is planned for an area.

### Consider both direct and indirect project benefits

Linked to the previous point is the need to not only understand potential negative impacts of large infrastructure projects on local communities but also opportunities to improve existing conditions. There are various direct benefits from the case study projects most notably employment opportunities in the case of Two Rivers and increased mobility due to Thika Highway. There are also clear indirect positive impacts from both developments. For example, the transformation that lighting and CCTV have made to safety and productivity around the Githurai roundabout and increased police presence in both Githurai and Ruaka. This provides a small indication of the wider indirect social benefits that could have been realised had the true resilience value of the project been fully considered and incorporated into the project design.

### Recognise the need for quality engagement

Several of the areas for improvement discussed throughout this paper can be addressed through better engagement with communities and between agencies. The lack of timely and comprehensive consultation was mentioned in both case studies. KARA suggests there are positive signs that future public consultations in Kenya will be improved. A follow-up study is needed to examine how engagement is managed on the next major road project and/or mixed-use development in Nairobi.
The majority of the underlying issues behind the development-related risks described in this paper can largely be categorised as:

- Those inhibited by a lack of awareness;
- Those requiring regulatory reform;
- Those requiring increased capacity; and
- Those which do not correlate with financial objectives.

Addressing the challenge of development-related risk therefore requires actions across each of these 4 areas...

Figure 11: Framework for Building a Conducive Environment for Reducing Development-related Urban Risk

Knowledge and awareness – thinking beyond the ‘red line’

Ensuring that developers, regulators, local communities and all other key stakeholders fully appreciate how risk can accumulate ‘beyond the red line’ of a project boundary requires language and styles of communication which fully highlight this risk. The study of two projects in two different communities highlighted the need for those involved in development and in the regulation and control of development, to employ greater systems-thinking in consideration of risk beyond the project boundary. The use of accessible tools, such as the hazard lens and hazard interdependency map used in this research, can be facilitate this and be used as communication device when engaging with developers and regulators.

Additional research is needed to explore the role of different actors in reducing risk at different stages of the project cycle. Further studies might also look as specific issues identified in this study to quantify of the problem. E.g.,

- How many significant projects are currently under construction in Nairobi?
- What is their level of stakeholder engagement e.g. turnout at EIA consultations?
- What developer levies are in place and what are they spent on?
- How many smaller developments go under the radar?

Reputational and Financial Incentives

Top down – plug existing gaps: The capacity of agencies involved in development control is a key issue blocking the robust regulation of risk. Quantification of the problem may aid awareness asking questions such as:

- How many applications planning departments currently process versus the number of full-time staff?
- How many environment agency staff versus the volume of EIA applications?

Equip the players: Develop tools and processes which help planners to consider and regulate the full spectrum of project risks. There are tools which exist that can start to address these gaps, for example the UK DfID funded “Construction Capacity Framework.” This Framework offers a structured approach to understanding the strengths and weaknesses of a country’s construction industry. This aims to help identify key areas that should be strengthened to enable more effective infrastructure delivery and development outcomes. The Framework has also been designed to support line ministries or government departments, donor bodies supporting government capacity-building programmes, or industry development agencies to understand the construction industry landscape, identify strengths and weaknesses and inform investment decisions. Planning tools are out-of-date and need to be refreshed urgently to help planners make the right decisions regarding development applications.

Bottom up - strengthen community voices: Community-level actors have an important role to play in the mitigation of development risk especially if national, city and project level actors cannot be engaged or do not have capacity. In Nairobi, some neighbourhoods already have up to date local plans and zoning. These neighbourhoods have influential residents with the knowledge and power to prevent unsuitable development taking place. Civil society actors and NGOs should explore what support can be provided to neighbourhood organisations, harnessing community potential. In Kenya there is growing evidence of community based planning, including a growing network of neighbourhood actors supported by evolving legislation. This should be built on.

Finally, the corporate social responsibility and public image of large corporations setting up business in East Africa is something which can be capitalised on by a growing civil society engaged in planning decisions. For a media campaigns to be successful again comes back to effective communication and public awareness of risks which exist ‘beyond the red-line’ of development.
RISK BEYOND THE RED LINE

2018

Appendices
### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>AFDB</td>
<td>African Development Bank</td>
</tr>
<tr>
<td>AWSB</td>
<td>Athi Water Services Board</td>
</tr>
<tr>
<td>EIA</td>
<td>Environment Impact Assessment</td>
</tr>
<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
</tr>
<tr>
<td>ESIA</td>
<td>Environment and Social Impact Assessment</td>
</tr>
<tr>
<td>FGD</td>
<td>Focus Group Discussion</td>
</tr>
<tr>
<td>GOK</td>
<td>Government of Kenya</td>
</tr>
<tr>
<td>G44</td>
<td>Githurai 44</td>
</tr>
<tr>
<td>G45</td>
<td>Githurai 45</td>
</tr>
<tr>
<td>HHS</td>
<td>Household Survey</td>
</tr>
<tr>
<td>HI</td>
<td>Higher income (focus group: M-male, F-female)</td>
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<td>KENHA</td>
<td>Kenya National Highways Authority</td>
</tr>
<tr>
<td>KII</td>
<td>Key Informant Interview</td>
</tr>
<tr>
<td>LI</td>
<td>Lower income (focus group: M-male, F-female)</td>
</tr>
<tr>
<td>NCC</td>
<td>Nairobi City County</td>
</tr>
<tr>
<td>NCWSC</td>
<td>Nairobi City Water and Sewerage Company</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Environment Management Authority</td>
</tr>
<tr>
<td>NIPLAN</td>
<td>Nairobi Integrated Urban Plan</td>
</tr>
<tr>
<td>RUJWASCO</td>
<td>Ruiru-Juja Water and Sewerage Company Limited</td>
</tr>
<tr>
<td>THIP</td>
<td>Thika Highway Improvement Project (the Thika road project)</td>
</tr>
<tr>
<td>TRD</td>
<td>Two Rivers Development (the Two Rivers Project)</td>
</tr>
<tr>
<td>UK-DfID</td>
<td>UK’s Department for International Development</td>
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<td>Appendix 22</td>
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### Cover Image

Cover Image shows Southern Bypass above Kibera, Nairobi © Johnny Miller

[https://www.unequalscenes.com/](https://www.unequalscenes.com/)
## APPENDIX 1: NAIROBI HAZARD LENS SELECTION

A long list of shocks and stresses from City Strength (World Bank, 2015) was cross-referenced with Nairobi hazard data from expert interviews and 100 Resilient Cities Nairobi primary workshop data. This was supplemented by desktop data collection from local and national disaster plans, Google searches and specific hazard-relevant websites including emdat.be and reliefweb. This list was then further narrowed based on expert judgement regarding whether a large infrastructure project would be likely to have a significant impact on the risk of each hazard locally.

<table>
<thead>
<tr>
<th>City Strength Shocks and Stresses</th>
<th>Justification (Nairobi or Project Relevance)</th>
<th>Project Hazard Lens 15 Hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extreme Temps</td>
<td>Large infrastructure projects relevance. Vegetation loss (which may contribute to these hazards) included elsewhere.</td>
<td>-</td>
</tr>
<tr>
<td>o Heatwave; o Coldwave</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Strong Winds</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Earthquake</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Landslides</td>
<td>Included to an extent by looking at collapse / damage (zoning of the development will naturally be considered)</td>
<td>-</td>
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<tr>
<td>Subsidence</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Building Collapse</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Volcanic Eruption</td>
<td>Not that relevant to Nairobi</td>
<td>-</td>
</tr>
<tr>
<td>Surface flooding</td>
<td>Merged and included</td>
<td>-</td>
</tr>
<tr>
<td>River Flooding</td>
<td>Merged</td>
<td>-</td>
</tr>
<tr>
<td>Wildfire</td>
<td>Merged</td>
<td>-</td>
</tr>
<tr>
<td>Marooned Fire</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Transport accidents</td>
<td>included</td>
<td>-</td>
</tr>
<tr>
<td>Terrorism and cross-border conflict</td>
<td>included</td>
<td>-</td>
</tr>
<tr>
<td>Drought</td>
<td>Large infrastructure projects relevance (water scarcity included)</td>
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</tr>
<tr>
<td>Water Scarcity</td>
<td>Project damages local supply and/or stimulates local pop growth which outpaces local supply</td>
<td>-</td>
</tr>
<tr>
<td>Water Contamination</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Food Crisis</td>
<td>Unless food related infrastructure or removal wide removal of agriculture for development</td>
<td>-</td>
</tr>
<tr>
<td>Communicable Disease</td>
<td>Viewed as a consequence of other hazards (e.g. pollution, water quality etc.) which will be included</td>
<td>-</td>
</tr>
<tr>
<td>Non-Communicable Disease</td>
<td>Either direct or through stimulated land prices</td>
<td>-</td>
</tr>
<tr>
<td>Shortage of appropriate Housing</td>
<td>Displacement of People</td>
<td>-</td>
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<tr>
<td>Energy shortage</td>
<td>Doesn’t seem to have come up as key issue</td>
<td>-</td>
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<tr>
<td>Insufficient Wastewater Management System</td>
<td>Project could disrupt directly &amp;/or stimulates local growth which creates local capacity issues</td>
<td>-</td>
</tr>
<tr>
<td>Ineffective Waste Management System</td>
<td></td>
<td>-</td>
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<tr>
<td>Poor Communications Network</td>
<td>Did not come up as key and not as relevant as other hazards</td>
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<table>
<thead>
<tr>
<th>City Strength Shocks and Stresses</th>
<th>Justification (Nairobi or Project Relevance)</th>
<th>Project Hazard Lens 15 Hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyber attack</td>
<td>Large infrastructure projects relevance traffic lights?</td>
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</tr>
<tr>
<td>Loss of community identity or cohesion</td>
<td>Project could increase crime and/or decrease cohesion during construction (influx of new people) or changes face of community over longer term</td>
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</tr>
<tr>
<td>Crime</td>
<td></td>
<td>-</td>
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<tr>
<td>Social Unrest and Local Political Conflict</td>
<td>Project could directly impact this</td>
<td>-</td>
</tr>
<tr>
<td>Loss of cultural heritage (place)</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Lack of protection of public space</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Insufficient or ineffective education provision</td>
<td>Not as relevant for large infrastructure projects</td>
<td>-</td>
</tr>
<tr>
<td>A lack of disaster awareness</td>
<td>Not as relevant for large infrastructure projects</td>
<td>-</td>
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<tr>
<td>Poverty &amp; Inequality</td>
<td>Business loss included and poverty examined as cross-cutting theme</td>
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</tr>
<tr>
<td>Unemployment</td>
<td></td>
<td>-</td>
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<tr>
<td>Child/Youth Vulnerability</td>
<td>Vulnerability will be explored across the hazards as a cross-cutting theme</td>
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<tr>
<td>Minority vulnerability</td>
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<tr>
<td>Gender inequality</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Economic Instability</td>
<td>Project impact on jobs covered</td>
<td>-</td>
</tr>
<tr>
<td>Corruption</td>
<td>Ultimate underlying cause of hazard but not something the project itself would cause</td>
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<tr>
<td>Emergency Service Failure</td>
<td>Large infrastructure projects relevance</td>
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<tr>
<td>Industrial Accidents</td>
<td>Pollution, collapse etc. included</td>
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<tr>
<td>Demographic pressures</td>
<td>Too vague</td>
<td>-</td>
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<tr>
<td>Ecosystem Degradation</td>
<td>Project could directly impact vegetation loss</td>
<td>-</td>
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<tr>
<td>Invasive Species</td>
<td></td>
<td>-</td>
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<tr>
<td>Land Contamination</td>
<td>Included</td>
<td>-</td>
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<tr>
<td>Poor Transport</td>
<td>Congestion, service access/immobility incl.</td>
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</tr>
<tr>
<td>Congestion</td>
<td>Included</td>
<td>-</td>
</tr>
<tr>
<td>Air Pollution</td>
<td>Included</td>
<td>-</td>
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APPENDIX 2: METHODOLOGY SUMMARY

CITY WORK-STREAM

The analysis of the planning and regulatory frameworks in Nairobi was based on both primary and secondary data, including documentation review and key informant interviews.

Documentation review

The purpose of the documentation review was to understand the current legislative, planning and regulatory context of urban development in Nairobi, and to generate a hypothesis for comparison with the findings from the key informant interviews. A broad range of plans, policies, and regulations were targeted for the city of Nairobi, including codes, plans and legal instruments pertaining to building and development control.

The document review undertook a risk-based approach to reviewing urban planning legislation, plans and policies; and considered the role of external checks and balances including donor requirements and international regulations and the relationship between these, national and local regulatory mechanisms.

The research then summarised this desktop review and specifically what the regulatory environment might mean for consideration of risk in large investment projects.

Key informant interviews

While the document review examined the presence and quality of legislation and underlying plans, policies and regulation; issues of their local appropriateness, capacity to implement and enforce; and of institutional coordination were addressed through key informant interviews with stakeholders involved in development control and regulation within Nairobi.

Key informant interviews were conducted in Nairobi City County and Kiambu County in December 2016 and June 2017, with a range of participants including representatives of county government, national authorities, private sector representatives, academics and external built environment experts. The research used semi-structured approach to questioning (Appendix 3) asking all stakeholders about any challenges experienced in the enforcement of regulations. Emergent themes were abstracted from the stakeholder interview data through a process of summarising and distillation data into key themes.

NEIGHBOURHOOD WORK-STREAM

This research looked from the neighbourhood perspective how risk from the 15 local hazards has evolved locally before, during and after the case study projects, taking note of any additional hazards mentioned by communities which have not been considered by the list (fieldwork activities included on the right).

Focus Group Discussions (FGD’s)

The FGD exercises and corresponding data collection templates were designed to easily facilitate spatial and temporal analysis of hazard distribution. A purposive sampling strategy was used for the selection of the participants, with specific selection criteria and percentage requirements based on residential distance from the project case study, gender, number of year’s residence and economic circumstance.

Hazards were analysed in specific groups: those concerning infrastructure services, livelihoods, community assets, environmental impact, traffic-specific issues and structural integrity. The research looked for patterns across the four FGD stakeholder groups for each hazard grouping. Comparative patterns were explored in relation to lower/higher income groups and gender. Four FGDs were undertaken in Githurai and in Ruaka, and spatial and temporal risk data were collected through a carefully designed series of exercises, which considered the 15 hazards outlined in the Nairobi hazards lens. A detailed description of each exercise is in Appendix 4.

Key Informant Interviews (KII)

KIIIs used semi-structured questions (Appendix 5) split into sections on three sections: Local hazards, Impact of SCIP, and SCIP consultation. The questions first discussed broadly the impact of SCIP developments, before narrowing down to specific case-study impacts. It was in these groups that data was sorted and analysed. KII questions did not specifically mention the pre-determined hazards lens, but KII responses were examined for their presence, validating or challenging FGD data. The analysis also looked for mentions of any other local risks not covered in the hazard lens. Key informants were undertaken with select members of the community as well as external stakeholders thought to represent the interests of local communities. A list of interviewees is available in the references.

Household Surveys (HHS)

Given the limited number of participants in the focus group discussions, and considering that the neighbourhoods chosen have significant populations, 50-60 HHS were undertaken to gain consensus or views from the population at large. The household surveys used simple qualitative and quantitative analytical techniques to establish the range of hazards affecting each neighbourhood, influence of the project and level of engagement. Surveys were distributed through Ruaka and Githurai using systematic random sampling and using Kenyatta University students to undertake this distribution. The HHS consisted of a standardised questionnaire of 10 questions and supported the triangulation of findings. The survey asked simple, closed questions concerning local neighbourhood risks, role of the megaproject (positive or negative) and engagement in the megaproject.

Observation walks

Site observation visits were used to inform and verify an independent assessment of the risk variables of the selected area. Hazard maps and tables created by focus group participants were used for observation walks to identify points of potential interest. Photographs and written notes were used in field.
APPENDIX 3: GOVERNMENT STAKEHOLDER SEMI-STRUCTURED INTERVIEW QUESTIONS

Introduction & opening questions
What is your role in the city?
How long have you worked in this role/for your organisation?

City risks and how they are managed (perception of city risk & institutional capacity)
What are the main (top 5) challenges (hazards) that the city faces?
Do these challenges interfere with the performing of the city?
If so, how?
How are these monitored and information shared on them?
Whose responsibility is it to deal with these challenges? Are those organisations able to manage the risks?
How have significant hazards changed in the last 10 years?

Planning methods
Can you tell me about the process of large developments obtaining planning permission? What are the key stages?
Is there often a link to the masterplan?
Can you tell me about the criteria for approving or disapproving large developments in the city?
How are challenges that you spoke about managed in planning and policy?
  - Robustness of regulations,
  - Ability to enforce
  - Any other obstacles?

Influence of Capital Projects on risks in the city (motivations, perception of project impact locally)
What do you think the impacts (positive and negative) have been from large developments on the city? And on their adjacent communities?
What do you think are the priorities of these developments for the city and the local communities?

Stakeholder relations & power dynamics
Do you interact with other government departments in planning decisions?
What about these types of large developments – how much engagement do you have with them during their design and delivery?

Mechanisms to broker interest
Are there ways in which local communities can influence the planning process?
To what extent do you feel all individuals and organisations involved were able to share their interests in making the project a success? If so, how? If not, why not?
Is there anyone else that you interact with in the regulation of large developments that we have not yet discussed?

Closing Qs
What do you feel needs to change for large developments having a greater positive impact on the city?

APPENDIX 4: NEIGHBOURHOOD FOCUS GROUP DISCUSSION EXERCISES

Exercise 1: Understanding the Neighbourhood

Aim
Discuss the ‘make-up’ of the neighbourhood in order to establish a general understanding.

Explain purpose of the activity: Explain to the participants why we need to understand aspects of the neighbourhood: so that we have a basic understanding of your neighbourhood and how it functions.

Discuss various topics including Health, Livelihoods, Education & Community.
(Note: This exercise is intended to ‘get the conversation going’ and learn a little about the community instead of jumping straight into risk identification and analysis. It is meant to give a general overview and not a detailed analysis. It is an opportunity to gather some qualitative information about the target audience. It is also an effective task in starting to identify some challenges that community members may face.)
Exercise 2: Understanding Local Risk

**Aim**
- Identify risks in the neighbourhood over a period of time
- Understand what created the risks & why they improved or worsened

**2.A. Risk timeline 1 hr 15 min (including B. Hazard Map)**
- Undertake the Risk timeline with ‘B. Hazard Map’.
- The facilitator should fill in the timeline including the explanation, whilst someone from the group can annotate the map.
- Groups remain in male/female split groups. Each group has their own Timeline and Hazard map
- Spend 5 minutes per challenge

**Explain the activity:** We are interested in the challenges that people are facing in this area – both occasional big events and day-to-day challenges. We would like to draw up a timeline of the challenges you have faced and discuss a little bit about them as well as find out where the are occurring.

**Q1. Populate the timeline:** Identify risks that the participants face in the past, present and those they think they will face in the future. Use the ‘risk cards’ (cards that are pre-notated with risks). Ask participants ‘how much of a problem is this for your neighbourhood’ (high, moderate or low and place accordingly). Start by populating the present, followed by the past and then future.

- **Populate the timeline horizontally i.e. once they have selected the location in ‘present’ ask them to place the corresponding risk card in ‘past’ and ‘future’.

  - **Ask some key questions and annotate in the right hand column:**
    - **Past:** What created the risk (e.g. a major natural event/urban development/risk/combination of risks). Try to establish a year when it happened and annotate in next to the issue in the ‘past’ column.
    - **Present:** After each risk is allocated a position on the timeline in past and present, ask why it got better or worse. Annotate this in the column provided. “E.g. Traffic congestion got worse because more people own cars (due to cheaper car rentals) and more people have moved to the neighbourhood due to better job opportunities.”
    - Start to populate the hazard map by locating the areas where the challenge is significant.
    - **Future:** Ask the participants to map the risks into the future and explain why they think it will get better/worse/stay the same in the future.

**Q2. Mark on the timeline any major events or developments e.g. introduction of new urban developments (roads, malls, apartment buildings etc.), natural disasters (e.g. earthquake, cyclone, flooding), conflict, social/political shifts etc.)**

**Exercise 3: Understanding Project Impact**

**Post Break Introduction**

One facilitator will make a post-break introduction to the whole group. Introduce the urban project (Thika or Two Rivers) by referring back to projects that the participants may have identified in the timeline exercise.

**3.A What do you think of the Project? (15 mins)**

There will be a brief group discussion about the project altogether. Either the same facilitator or the other facilitator will ask participants the following questions:

- **Q1:** For those who live close to the project, Do you like it? Use it? Has it affected you in any way?
- **Q2:** For those who live further from the project what are your thoughts? Do you like it? use it? Has it affected you?
- **Q3:** For those who have lived here before the project was put in place Do you like it? Use it? Has it affected you?
- **Q4:** For newer residents Do you like it? Use it? Has it affected you?

Record findings

<table>
<thead>
<tr>
<th>Issue: how bad is this in your community</th>
<th>Past</th>
<th>Present</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water shortage</td>
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<tr>
<td>Damage to local business</td>
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<tr>
<td>Loss of cohesion, crime &amp; violence</td>
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<td>Loss of public space</td>
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<tr>
<td>Deforestation/vegetation</td>
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<tr>
<td>Waste &amp; wastewater overcapacity</td>
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<tr>
<td>Displacement of people</td>
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<td></td>
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<tr>
<td>Damage to local business</td>
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<td></td>
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</tbody>
</table>

Record findings

<table>
<thead>
<tr>
<th>Perception of risk</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
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</thead>
<tbody>
<tr>
<td>Results from last exercise</td>
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<td>Positive impacts</td>
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<td>Negative impacts</td>
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<td>Affect on ability to cope</td>
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</table>
Exercise 4: Community engagement

Aim
- Understand how the community was engaged in the development of the urban area.

4.4. Community Engagement and the Project (20 min)

Q1 Did you hear about the project before it started? How?

Q2: Introduce participants to the types of community engagement by explaining the terms in the graph.

There are various ways that residents can be engaged and included throughout the process of developments. Sometimes residents are simply told about a development happening (informed) or other times they are asked to voice their concerns about problems the project may impact (consult). Sometimes they are involved in a particular decision (involve) and other times they are asked to work with others (collaborate) to make decisions. Finally residents can also be given the authority or power to undertake certain parts of the development themselves (empower).

Ask participants to identify which stakeholders engaged the residents in the different types of engagement activities - if any. This could include Government, Private developer, residents in the different types of engagement activities - if any. Sometimes residents are simply told about a development happening (informed) or other times they are asked to voice their concerns about problems the project may impact (consult). Sometimes they are involved in a particular decision (involve) and other times they are asked to work with others (collaborate) to make decisions. Finally residents can also be given the authority or power to undertake certain parts of the development themselves (empower). Map this on the graph.

Q3 Next to each mapped stakeholder note the details of:

a) Which members of the neighbourhood was consulted (was it a specific group of people within the neighbourhood?).

b) What stage of the project this was undertaken (pre-construction, construction, post-construction etc.).

c) What was it about? (What were you asked to do? Did you voice your concerns about problems the project may impact?)

d) How was the group engaged (focus group, flyer, meeting, workshop, information session)

e) What resulted from the engagement? Was it successful? (for e.g., were opinions taken into account etc.)

Q4 What involvement would you have liked to happen?

Who would you have liked to engage with including how/at what stage/why/and concerning what. Annotate this on the side of the graph so that it is clear this is not what actually happened.

The purpose of using an illustrative graph is to introduce the community to types of engagement strategies, so that they are more aware of the role they can play in the future, and so they are able to understand what potential impact or involvement they could have.

APPENDIX 5: NEIGHBOURHOOD KEY INFORMANT INTERVIEW QUESTIONS

Key informant interviews were semi-structured conversations, using the below questions as a guide.

Background Information
Name of Interviewee: Position/Role/Job:

Introductory questions:
- Do you live in the community?
- If yes, how long have you lived in the community?
- What is your opinion of the project? (positive/negative)?
- What is your role in the community? Or What is your relationship with the community?

1. Local risks and change over time

We are interested in the challenges that people are facing in this area - both occasional big events and day to day challenges.

- What are the main challenges/risks faced in this community?
- Whose responsibility is it to deal with each of these challenges?
- What support is provided...from who?

E.g. What organisations or leaders does the community interact with?... (Are there any other NGO/charity/Government projects/initiatives involved in this neighbourhood?)

2. Impact of Capital Projects on local risks

- Introduce project and why the research is focusing on it
- What is your interaction with the project (do you use it for e.g., were opinions taken into account etc.)
- How far do you live from the project (depending on interviewee...has this process been changing in recent developments?)

- What impact has Thika SH / Two Rivers had on the local area in relation to the above challenges / other challenges? - positive and/or negative (reiterate the risks they identified) Why?
- (if negative) What could have mitigated this?
- (if positive) What contributed to this?

3. Community engagement.

General:

With regard to Two Rivers Development / Thika Superhighway

- What is your opinion of the project? (positive/negative)
- Do you feel the community were talked to about the project? (or when there are big developments in the area, do people speak to you about it?)
- Were you/ or the community able to share your interests or concerns about the project? If yes When? (at what stage-concept stage, construction, post construction?)
- What stakeholders were involved in this engagement? (look for lit review power types) and for what purpose (types of engagement - inform/consult/involve/collaborate/empower)
- What was the outcome of this engagement? Were local concerns acted upon...why...why not?
- Were you/community satisfied with the engagement?
- What needs to change in future developments? (depending on interviewee...has this process been changing in recent developments?)
APPENDIX 6: OTHER KEY POLICY DRIVERS AND STRATEGIC DOCUMENTATION

Vision 2030 is a key strategic document affecting national development. This is the country’s development blueprint to transform Kenya into a newly industrialising, “middle-income country providing a high quality life to all its citizens by 2030” (Kenya Vision 2030 (2008)).

The vision is based around Economic, Social and Political pillars and ten sector areas:
1. Infrastructure 2. Science, Technology & Innovation; 3. Public Sector Reforms; 4. Tourism; 5. Agriculture; 6. Trade; 7. Manufacturing; 8. Business Process Outsourcing & ICT; 9. Financial Services; 10. Education It is expected that the Vision’s strategies and action plans are to be systematically reviewed and adjusted every 5 years to respond to changing conditions. However, the monitoring and evaluation is not immediately clear and initial targets such as quadrupling tourist GDP by 2012 appear to have been missed (WTTC, 2015). At the city level, Vision 2030 has been localised in the form of Nairobi 2030. Both documents act as a policy director and as a useful marketing tool when it comes to obtaining public support for new projects (PC4).

NIUPLAN (2014) describes Nairobi 2030 and the Spatial Planning Concept for Nairobi Metro Region (2013) as umbrella documents for NIUPLAN. These and Kenya Vision (2030) are referenced throughout NIUPLAN with sector development plans such as transport and ICT said to be in conformity with these visions. Furthermore, decentralisation is one of the eight governing principles of the Kenya vision stating that the strategy uses devolved funds to strengthen decentralization of development projects at community level (Kenya Vision 2030).

Lastly, the Nairobi City County Strategic Plan 2015-2025 was undertaken for Nairobi City County by Price Waterhouse Cooper. This plan states that it will harmonise and offer leadership for the implementation of various existing plans and initiatives in the City County. This document has a monitoring aspect not as present in the other plans, with key performance areas, initiatives and indicators with implementation timescales. This plan links to the County Integrated Development Plan (CIDP) (2014) - a five year plan supporting medium-term objectives. It also links to NIUPLAN throughout the documents, highlighting where action points are flagship programmes under the masterplan and highlighting implementation schedule, responsibility and indicative budget for masterplan (and other) activities (see adjacent table).

This is a positive step in establishing a monitoring and evaluation system for masterplan activities. However, there needs to be a clear system in place in terms of who (in each office) is monitoring progress and ensuring activities are fulfilled. More importantly, as previously mentioned, local sub-centre plans are needed to ensure that at the detailed level development happens in a sustainable fashion throughout specific parts of the city.

### Governors Office

<table>
<thead>
<tr>
<th>No</th>
<th>Initiatives (continued)</th>
<th>Implementation Year</th>
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</thead>
<tbody>
<tr>
<td>67</td>
<td>Implement and disaster information gathering and dissemination</td>
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### Department of Lands, Housing and Urban Planning

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<thead>
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<th>No</th>
<th>Projects</th>
<th>Source of funding</th>
<th>Indicative budget (Kshs. in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Execute the Eastlands Urban Renewal Project (flagship Urban Master Plan)</td>
<td>430</td>
<td>30</td>
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<tr>
<td>3</td>
<td>Prepare and execute the Dandora Sub-Centre Development Plan (flagship Urban Master Plan)</td>
<td>70</td>
<td>20</td>
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<tr>
<td>4</td>
<td>Develop and execute the East of Tom Mboya St. Development, CBF revitalization plan (priority Urban Master Plan)</td>
<td>105</td>
<td>25</td>
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</table>
## APPENDIX 7: ASSESSMENT OF HAZARDS IN NIUPLAN

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Status</th>
<th>Notes and Details</th>
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</thead>
<tbody>
<tr>
<td>Water Shortage</td>
<td>YES</td>
<td>&quot;The master plan of water supply with target for completion 2035 has been prepared by the local water board supported by World Bank and AFD. The development of water supply carried out in accordance with master plan.&quot;</td>
</tr>
</tbody>
</table>
| Displacement (forced or economic) | PARTLY | "Housing for all" is a principal policy of NIUPLAN.  
'Re-development from low/med to high density residence necessary.'  
'Appropriate housing scheme for low income is necessary.'  
'Ensure informal settlement land developed in ordered, sustainable manner.' (Details in not clear.) |
| Damage to local business        | PARTLY | Suggests plan will have a net positive on jobs – (Part II, p274)  
"New large shopping malls should optimise overall urban functions and attractions…. Informal markets should be guided to places better for the public and themselves." (Part II, p279) |
| Deforestation / Vegetation destruction | YES | Principal policy of land use plan – “Existing forests & woods should be protected. River & river banks restored.”  
"Ecological Network.” p55  
SEA suggests development path will harm environment without regional env. & social mgmt plans & for each sub-centre (p274) |
| Pollution (air)                 | YES     | "Technical cooperation program aims to provide relevant technical support for setting up NCC’s own urban air quality monitoring system to monitor and develop relevant environmental mitigation measures." |
| Land and Water pollution        | YES     | "Environment improvement program: to improve urban environment for water, solid waste, and air quality is a priority program of NIUPLAN” (Part II, p281)  
SEA suggests development path will harm environment without regional plans and for each sub-centre - assume highlighting what NIUPLAN needs to pay attention to (Part II, p274) |
| Waste and wastewater overcapacity | YES | Ministry of Local Government is planning a master plan for storm drainage in Nairobi.  
NIUPLAN proposes maintaining the hydraulic capacity and sub-drainage systems of local rivers and restoring the functionality of City Engineering department to manage the stormwater drainage systems" (Part I, page 258 and II, p150). |
| Flooding (all types)            | YES     | Comprehensive road management plan to improve road network and reduce congestion.  
Urban transport development program is a priority program (Part II, p281) |
| Traffic - congestion,           | YES     | No mention                                                                                                                                 |
| Traffic fatalities              | NO      | No mention                                                                                                                                 |
| Fire                            | PARTLY | Part II of the JICA plan (p210) talks about increasing institutional capacity but these are building control issues. |
| Collapse/ seismic / movement    | PARTLY | Community spaces mentioned within the plan and retention of historical buildings but this does not appear to be a core priority of NIUPLAN.
## APPENDIX 8: DEVELOPMENT APPROVALS PROCESS (2017)

<table>
<thead>
<tr>
<th>Step</th>
<th>OWNER</th>
<th>ARCHITECT</th>
<th>STRUCTURAL ENGINEER</th>
<th>DEVELOPER</th>
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</thead>
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<td>Contact details</td>
<td>Identify form</td>
<td>NCA project registration form</td>
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<td></td>
<td>Authorisation for payment Search payment receipt</td>
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<td>Certificate structural design</td>
<td>Authenticated architectural plans (steps 7-12)</td>
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<td>Authorisation for payment for survey plan</td>
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<td>Structural drawings</td>
<td>Authenticated structural plans (steps 13-16) Nema approval</td>
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<td>Pay for Survey Plan Survey Plan</td>
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<td>Structural design calculations</td>
<td>Bill of quantities</td>
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<td>Engineer’s practising certificate</td>
<td>Contractor’s registration cert.</td>
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<td></td>
<td>Engineer’s registration certificate</td>
<td>Practicing certificate of architect, engineer Quality surveyor</td>
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<td>Disclaimer from (applies where there is excess coverage)</td>
<td>10. Notification of approval is desired result but may not be accepted if requirement not met 11. Notification of approval of architectural plans 12. Architectural drawing</td>
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<td>Architectural drawing Survey plan</td>
<td>Structural drawings (original)</td>
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<td>Land rates clearance receipt</td>
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<td>Proof of land ownership Change of user (original)</td>
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<td>In case of parcel of land needs a change of use</td>
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<td>Construction permit invoice</td>
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<td>Register with Nairobi City Country self service portal</td>
<td>Register with Nairobi City Country self service portal</td>
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<td>15-16</td>
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<td>Structural plans approval</td>
<td>National construction Authority (NCA approval)</td>
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**Details / Needed**

- Architect: Nairobi City Council
- Structural Engineer: City Council - City Hall Annex - Country Planning Department
- Developer: City Council - City Hall Annex - Country Planning Department

**Law**

- Build Code - Sections 3, 4, 5, 7, 8, 10, 11
- Physical planning Act - Sections 30, 31, 32, 4th schedule + sections 32, 33, 34, 37, 38, 39, 40, 41, 42, 43, 44
- Architects and Quality Surveyors Act - Sections 7, 8, 9 Survey Act - Sections 30, 32, 33

**Unit**

- Development control sections
- Structural Engineers Section
- Development control section
- Communication and corporate affairs department
- Project regulation dept.
### APPENDIX 9: COMPARISON BETWEEN 1968 AND 2009 BUILDING CODES AND HOW THEY REFLECT THE KEY HAZARDS IN NAIROBI.

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td><strong>Water Shortage</strong></td>
<td>Considered on site but nothing about the added capacity required off-site this brings. The physical planning act and local plans would cover in theory.</td>
</tr>
<tr>
<td><strong>Traffic fatalities</strong></td>
<td>Permitted site coverage and plot ratio shall be generated from the Development Index and Infrastructure Debt Level (IDL). IDL will be derived from consideration given to the following although not limited to, availability of water... (p171)</td>
</tr>
<tr>
<td><strong>Displacement (forced/economic)</strong></td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Damage to local business</strong></td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Deforestation / Veg. destruction</strong></td>
<td>Not considered</td>
</tr>
<tr>
<td><strong>Pollution (air)</strong></td>
<td>AA35.1 approval in a way of a permit must be obtained by the owner or contractor prior to the felling of any trees over 3m and any conditions must be met. The application should be made to the Ministry for Forestry.</td>
</tr>
<tr>
<td><strong>Collapse/ seismic / mass movement</strong></td>
<td>More up to date sewage consideration, industrial effluent requirements considered too (p401).</td>
</tr>
<tr>
<td><strong>Waste and wastewater overcapacity</strong></td>
<td>Seems to cover the requirement on site but nothing about the added capacity required. The physical planning act and local plans would cover in theory.</td>
</tr>
<tr>
<td><strong>Loss cohesion, crime &amp; violence</strong></td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Flooding (all types)</strong></td>
<td>168. ‘Unless, the council agrees, plans must show satisfactory provision for drainage’ Other guidance includes subsoil drainage and permission for sewer connection.</td>
</tr>
<tr>
<td><strong>Traffic congestion</strong></td>
<td>Firms in requirements and reflects modern drainage considerations such as electrical sanitary fixtures, (page 398).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traffic congestion</strong></td>
<td>Refers to role of long term plans, development plans and applications for development permission. States authority shall refuse the development if vehicular and pedestrian circulation spaces or other services to the plot or premises are inadequate (p158)</td>
</tr>
<tr>
<td><strong>Fire</strong></td>
<td>69. Building shall have a fire resistance of a specified period capable of resisting the action of fire thereon for that period under the conditions of the test appropriate to that part under BS 476. Comprehensive regulations regarding General fire resistance of different buildings and walls. Means of escape and water provision vague.</td>
</tr>
<tr>
<td><strong>Collapse/ seismic / mass movement</strong></td>
<td>While the document does provide instructions on foundations, load bearing requirements, walls etc. It is a 1968 document and therefore refers to outdated standards e.g. British Standard Code of Practice-CP 114 for concrete which has twice been succeeded by BS8110 and then more recently the Eurocodes.</td>
</tr>
<tr>
<td><strong>Terrorism</strong></td>
<td>Not covered and just high level information on emergency escape in fire.</td>
</tr>
<tr>
<td><strong>Loss of Public Space / heritage</strong></td>
<td>Just that the council may require the owner to pave their plot? (Point 247)</td>
</tr>
<tr>
<td><strong>Pollution (air)</strong></td>
<td>Not applicable Mainly indoor but BS116 states ‘building cannot reduce quantity of air to any other building’</td>
</tr>
<tr>
<td><strong>Land and Water pollution</strong></td>
<td>Outlines requirements for sewerage arrangements but appears outdated and industrial contamination not considered.</td>
</tr>
<tr>
<td><strong>Waste and wastewater overcapacity</strong></td>
<td>Seems to cover the requirement on site but nothing about the added capacity required. The physical planning act and local plans would cover in theory.</td>
</tr>
<tr>
<td><strong>Loss cohesion, crime &amp; violence</strong></td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Flooding (all types)</strong></td>
<td>‘Unless, the council agrees, plans must show satisfactory provision for drainage’ Other guidance includes subsoil drainage and permission for sewer connection.</td>
</tr>
<tr>
<td><strong>Traffic congestion</strong></td>
<td>Firms in requirements and reflects modern drainage considerations such as electrical sanitary fixtures, (page 398).</td>
</tr>
</tbody>
</table>

---

As with 1968 plan. Also ‘Every construction site shall be organized in such a way that, so far as is reasonably practicable, pedestrians and vehicles can move safely and without risks to health.’ Comprehensive guidance that appears to be up to date and addresses means of escape in more detail than the 1968 plan. (p469).

Comprehensive guidance generally up to date and refers to more recent engineering standards than the 1968 document but needs updating to refer to recently adopted Eurocodes.

Just that development should comply with Planning and Building Act and the Planning and Building Regulations (p155).
### APPENDIX 10: ASSESSMENT OF HAZARDS IN EIA PROCESS


<table>
<thead>
<tr>
<th>Hazard</th>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Shortage</td>
<td>PARTLY</td>
<td>water sources (quantity and quality p31)</td>
</tr>
<tr>
<td>Displacement (forced or economic)</td>
<td>PARTLY</td>
<td>‘Economic and social analysis’ p31</td>
</tr>
<tr>
<td>Damage to local business</td>
<td>PARTLY</td>
<td>‘Economic and social analysis’ p31</td>
</tr>
<tr>
<td>Deforestation / Vegetation destruction</td>
<td>PARTLY</td>
<td>effect of proposal on number, diversity, breeding habits, etc. of wild animals and veg. p30</td>
</tr>
<tr>
<td>Pollution (air)</td>
<td>PARTLY</td>
<td>Env. Audit p23</td>
</tr>
<tr>
<td>Land and Water pollution</td>
<td>PARTLY</td>
<td>Env. Audit p23</td>
</tr>
<tr>
<td>Waste and wastewater overcapacity</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Loss cohesion, crime &amp; violence</td>
<td>PARTLY</td>
<td>social cohesion or disruption P31</td>
</tr>
<tr>
<td>Flooding (all types)</td>
<td>PARTLY</td>
<td>drainage patterns / drainage systems; p32</td>
</tr>
<tr>
<td>Traffic Hazards - congestion,</td>
<td>PARTLY</td>
<td>P31 - roads opened up, closed, rerouted</td>
</tr>
<tr>
<td>Traffic fatalities</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Fire Hazards</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Infrastructure collapse / damage (incl. seismic/mass movements)</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Terrorism</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Loss of Public Space / heritage</td>
<td>PARTLY</td>
<td>amenity opened up or closed, e.g recreation possibilities, culture/objects of cult value P31</td>
</tr>
</tbody>
</table>
APPENDIX 11: ADDITIONAL HAZARD RELEVANT LEGISLATION

There are several other important pieces of specific legislation that are aimed at mitigate the impact of developments on local hazards.

<table>
<thead>
<tr>
<th>Water Shortage</th>
<th>Land and Water pollution</th>
</tr>
</thead>
<tbody>
<tr>
<td>State scheme” means - (a) a scheme, whether formulated in detail or not, for the use for any public purpose of whole or part of a water resource; (b) a reservation by the Minister, after consultation with the Authority, of the whole or part of a water resource for use for any public purpose; or (c) a scheme for draining any land, which has been declared by Minister after consultation with the Authority, by notice published in the Gazette, to be state scheme for the purposes of this Act.</td>
<td>Environment Management and Co-ordination (Water Quality) Regulations, No. 120 of 2006 - standards for discharge of effluent into the sewerage and the aquatic environment. While it is the responsibility of the sewerage service providers to regulate discharges into sewerage lines based on the given specifications, NEMA regulates discharge of all effluent into aquatic environment.</td>
</tr>
<tr>
<td>20. (1) A state scheme shall take precedence over all other schemes for the use of water or the drainage of land. (2) A community project shall take precedence over all other schemes for the use of water or the drainage of land, except a state scheme.</td>
<td>Any development activities to be planned at the riverbanks of tributaries running through Nairobi City need an environmental permit by conducting EIA from NEMA for the water quality protection. Basically, 6 m to 30 m from the highest water level (flood event) are defined as the protected river bank. Exact configuration of this protected area depends on development natures, surrounding land use, environmental importance….</td>
</tr>
<tr>
<td>21. (1) The Minister may, by notice published in the Gazette, designate the land required for the development of any state scheme. (2) Land required for a state scheme may be acquired in any manner provided by law for the acquisition of land for public purposes. (3) Land which is not immediately required for the full development of a state scheme may, with the approval of the Minister and in accordance with any law for the time being in force relating to the leasing of such land, be leased by the Commissioner of Lands to the previous owner, if not required by him, to any other</td>
<td>Environmental Management &amp; Co-ordination (Wetlands, River Banks, Lake Shores &amp; Sea Shore Management) Regs, 19, 2009</td>
</tr>
<tr>
<td>The Republic of Kenya Forest Act of 2005 protects state, local and provisional forests from development but this is for formally designated forest areas. Environment and Management Coordination Act 1999: NEMA in consultation with the relevant lead agencies, shall develop issue and implement regulations, procedures, guidelines and measures for the sustainable use of hill sides, hill tops, mountain areas and forests and such regulations, guidelines, procedures and measures shall control the harvesting of forests and any natural resources located in or on a hill side, hill top or mountain areas so as to protect water catchment areas, prevent soil erosion and regulate human settlement. Every District Environment Committee shall identify the hilly and mountainous areas under their jurisdiction which are at risk from environmental degradation.</td>
<td>If development works are planned inside such a wetland, a special permit shall be obtained from the Water Resources Management Authority (WRMA) by conducting appropriate study such as EIA,</td>
</tr>
<tr>
<td>Deforestation / Vegetation destruction</td>
<td>Waste and wastewater overcapacity</td>
</tr>
<tr>
<td>Environment and Management Coordination Act 1999 suggests that NEMA has significant enforcement power in this area: 80.(1) An owner or operator of a trade, industrial undertaking or an establishment which after the commencement of this Act, is emitting a substance or energy which is causing or is likely to cause air pollution shall apply to the Authority for an emission licence. Before issuing a licence in respect of emissions, the Authority shall:- (a) consider possible effects of the emissions on the quality of ambient air; (b) consider existing licences affecting the same air resource; (c) give due regard to the requirements for the residents, human settlements and other industrial and commercial activities; (d) solicit comments of relevant Local Authorities &amp; concerned organisations; Any person who emits any substances which cause air pollution in contravention of emission standards established under this Part shall be guilty of an offence and liable to imprisonment for a term of not more than two years or to a fine of not more than five hundred thousand shillings or to both such fine and imprisonment.</td>
<td>No person shall discharge or dispose of any wastes, whether generated within or outside Kenya, in such manner as to cause pollution to the environment or ill health to any person….Any person who contravenes any provisions of this section shall be guilty of an offence and liable to imprisonment for a term of not more than two years or to a fine of not more than one million shillings or to both.</td>
</tr>
<tr>
<td>Pollution (air)</td>
<td>Flooding (all types)</td>
</tr>
<tr>
<td>Environment and Management Coordination Act 1999 suggests that NEMA has significant enforcement power in this area: 80.(1) An owner or operator of a trade, industrial undertaking or an establishment which after the commencement of this Act, is emitting a substance or energy which is causing or is likely to cause air pollution shall apply to the Authority for an emission licence. Before issuing a licence in respect of emissions, the Authority shall:- (a) consider possible effects of the emissions on the quality of ambient air; (b) consider existing licences affecting the same air resource; (c) give due regard to the requirements for the residents, human settlements and other industrial and commercial activities; (d) solicit comments of relevant Local Authorities &amp; concerned organisations; Any person who emits any substances which cause air pollution in contravention of emission standards established under this Part shall be guilty of an offence and liable to imprisonment for a term of not more than two years or to a fine of not more than five hundred thousand shillings or to both such fine and imprisonment.</td>
<td>The Ministry of Local Government (MOLG) has a plan to carry out the preparation of a master plan for stormwater drainage in Nairobi City under the Kenya Municipal Program (KMP). (NIUPLAN, 2014) (+ see above Environmental Management regulations regarding development near riverbanks or wetlands.)</td>
</tr>
<tr>
<td>Loss of Public Space / heritage</td>
<td>No person shall discharge or dispose of any wastes, whether generated within or outside Kenya, in such manner as to cause pollution to the environment or ill health to any person….Any person who contravenes any provisions of this section shall be guilty of an offence and liable to imprisonment for a term of not more than two years or to a fine of not more than one million shillings or to both.</td>
</tr>
</tbody>
</table>

(+: see above Environmental Management regulations regarding development near riverbanks or wetlands.)
### APPENDIX 12: NAIROBI HAZARDS IN INTEGRATED NATIONAL TRANSPORT POLICY AND KENYAN ROAD DESIGN MANUALS

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water Shortage</strong></td>
<td>Not Considered</td>
<td>In the route selection for roads - assess the positive or negative influence of the number, type and characteristics of water courses. Preservation of particular areas and land used for specific purpose, including: forests, wetlands and other important natural resources.</td>
</tr>
<tr>
<td><strong>Displacement</strong></td>
<td>The construction of transport systems affect the environment through... displacement of human settlements. GoK will ensure that development of transport infrastructure causes minimum damage by incorporating environmental impact assessments as a key requirement in transport projects and implementing mitigation measures.</td>
<td>In the route selection for roads - assess the positive or negative influence of human settlements affected by the road.</td>
</tr>
<tr>
<td><strong>Damage to local business</strong></td>
<td>A management information system should be established to ensure economic efficiency and enhance socio-economic impacts of road infrastructure development and maintenance on various aspects of the economy.</td>
<td>Route selection to consider preservation of land of great economic value, and consider - potential influx of settlers into an undesirable area.</td>
</tr>
<tr>
<td><strong>Deforestation / Vegetation destruction</strong></td>
<td>Enforcement of the Environmental Management and Coordination Act of 1999 and the Physical Planning Act, Cap 598 shall be observed to ensure that environmental issues are explicitly part of multiple criteria decision-making systems. Current guidelines on environmental issues shall be expanded to include road transport infrastructure development indicators in environmental management.</td>
<td>Indirect factors considered during route planning include: increased deforestation of an area, stemming from easier (more profitable) transportation of logs to market.</td>
</tr>
<tr>
<td><strong>Pollution (air)</strong></td>
<td>Other considerations of route planning include the detrimental affects of air pollution.</td>
<td>Indirect environmental factors to consider include:- degradation of surface water quality by the erosion of land cleared as a result of a new road.</td>
</tr>
<tr>
<td><strong>Land and Water pollution</strong></td>
<td>Not addressed.</td>
<td>Not addressed.</td>
</tr>
<tr>
<td><strong>Waste and wastewater overcapacity</strong></td>
<td>Not addressed.</td>
<td>Not addressed.</td>
</tr>
<tr>
<td><strong>Loss cohesion, crime &amp; violence</strong></td>
<td>Not addressed.</td>
<td>Route selection to consider historic, archaeological and cultural sites, cemeteries and other man-made features of outstanding value. An environmentalist/sociologist is to be part of the route planning team.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flooding (all types)</strong></td>
<td>Not addressed.</td>
<td>Route selection to consider he prevention of health hazards by ponding of water leading to the formation of swamps.</td>
</tr>
<tr>
<td><strong>Traffic Hazards - congestion,</strong></td>
<td>INTP aims to: a. Improve road traffic safety. b. Enhance road traffic discipline. c. Protect the expensive capital investment in the road system. d. Enhance administrative and economic order in the field of road traffic and transport. Specific objectives will be set for each of these aims. Performance indicators should be established, and the relevant co-ordinating bodies should monitor the achievement of these objectives.</td>
<td>The following direct factors, related to the road as a physical feature in the environment, have to be considered in the location and design of a road project: The prevention of undesirable roadside development.</td>
</tr>
<tr>
<td><strong>Traffic fatalities</strong></td>
<td>Not addressed.</td>
<td>Design safety features into roads to: (i) To provide design features aimed at preventing accidents, and; (ii) To provide design features aimed at reducing their seriousness when they occur. A road safety audit should be considered during construction.</td>
</tr>
<tr>
<td><strong>Fire Hazards</strong></td>
<td>Not addressed.</td>
<td>Route traffic management – Incident management: set-up back up emergency evacuation units including fire engines. Pipeline infrastructure – fire hazard potential.</td>
</tr>
<tr>
<td><strong>Infrastructure collapse / damage (incl. seismic/mass movements)</strong></td>
<td>Not addressed.</td>
<td>Alignment corridors should be studied to understand: Topographic, geologic, and physical characteristics; and potential risk of slides, slope instability or floods;</td>
</tr>
<tr>
<td><strong>Terrorism</strong></td>
<td>Not addressed.</td>
<td>Enhancing Maritime Safety and Security considers the threat of terrorism within Kenya’s territorial waters and EEZ.</td>
</tr>
<tr>
<td><strong>Loss of Public Space / heritage</strong></td>
<td>Not addressed.</td>
<td>Route selection to consider historic, archaeological and cultural sites, cemeteries and other man-made features of outstanding value.</td>
</tr>
</tbody>
</table>

Notes:
- "INTP" refers to the Integrated National Transport Policy of Kenya.
- "Kenyan Design Manuals" refer to the Kenyan design manuals for road construction.
APPENDIX 13: CONSULTATION AND ENGAGEMENT CHART GITHURAI

The graph took FGD participants through varying levels of consultation from low impact, basic informing of project occurrence, through to local empowerment, asking participants for any evidence under each heading.

Record findings

**High impact**

- **INVOLVE** kuhushirikiana
  - (Others had) employment opportunities/casual labour

- **COLLABORATE** kuishiikiana
  - No one was consulted - residents just woke up to find ‘x’ signs on their premises by KenHA

- **EMPOWER** kuwezeshwa
  - Some residents were empowered through creation of employment during construction (casual labour but not those there). The project has empowered the residents (especially the youths) to establish/expand business

**Low impact**

- **CONSULT** kujulishwa
  - 1. Media - TV, radio and newspapers
  - 2. Rumours from friends and neighbours
  - 3. The people who were to be displaced

APPENDIX 14: GITHURAI-THIKA HIGHWAY
HOUSEHOLD SURVEYS

a) General issues identified in Githurai (not necessarily linked to THIP)

Enumerators asked residents to list the most significant challenges (up to 5) that they faced locally (figure a) and then challenges that THIP had influenced positively (b) and negatively (c).

The question was open and participants were not shown the list of 15 hazards from section 1.2. Hazards have subsequently been grouped.

Regarding THIP impacts (graphs b and c) participants generally only provided one answer. Service challenges, crime and congestion were by far the most common issues with a significant number of participants suggesting some influence by the highway (positive, negative or both).
### APPENDIX 15: THIKA FOCUS GROUP

**HAZARD FEEDBACK**

<table>
<thead>
<tr>
<th>Group</th>
<th>Past</th>
<th>Present</th>
<th>Future</th>
<th>Initial Explanation</th>
<th>Did the Development affect the Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>44 HI</td>
<td></td>
<td></td>
<td></td>
<td>More police, lights, gangs neutralised</td>
<td>+ve More CCTV and highway patrols</td>
</tr>
<tr>
<td>44 LI</td>
<td></td>
<td></td>
<td></td>
<td>Unemployment and drug addiction</td>
<td>Both Due to road expansion crime hotspots now more accessible by police… But better escape routes</td>
</tr>
<tr>
<td>45 HI</td>
<td></td>
<td></td>
<td></td>
<td>Current situation better as motorbikes provide jobs for youths, +&gt; education</td>
<td>-ve Provided other different routes to run from law enforcers</td>
</tr>
<tr>
<td>45 LI</td>
<td></td>
<td></td>
<td></td>
<td>More police, jobs, lights, presence of people</td>
<td>+ve Less jams = less opportunities for theft + enhanced lights along TSH, patrols and presence of people</td>
</tr>
</tbody>
</table>

This process was undertaken for all 15 hazards for each case study project.

### APPENDIX 16: GITHURAI CRIME AND PUBLIC SPACE

**MAP FROM FGD**

![Map of Githurai Crime and Public Space](image-url)
APPENDIX 17: GITHURAI HAZARD ANALYSIS
NEIGHBOURHOOD PERCEPTION - FULL REPORTING

Community Safety and Cohesion
The influence of Thika Highway on social cohesion and security was stated as positive overall. Household Surveys (Appendix 12) confirmed that crime and violence is a significant concern for local residents (46/53 participants). Focus Group Discussions felt that the situation was either the same or slightly worse before the development. Increased police presence, lighting, CCTV and reduction in congestion (reducing carjacking opportunities) were all cited as key reasons for a reduction in crime and exposure to vulnerability of people around this area. Risk mapping exercises suggested that crime hotspots still exist as you move into Githurai 44 and 45 (Appendix 14).

It was made clear that not much public space is available, and where it is, local actors need to work very hard to protect it. A local environmental community-based organisation highlighted the importance of legislation such as the Environmental Management Act in empowering them to prevent construction near local Riparian environments (PC 22 – local CBO). Whilst not stated as a public space, the presence of Thika Highway into the night and consequentially contributing to increased vulnerability to disease. Another stated that they now need to buy water more frequently. Three out of the four focus groups stated that as well as new houses and services coming to the neighbourhood.

Residents did not perceive infrastructure and building collapse to be a significant local risk. Unlike other neighbourhoods along the highway, Githurai has not experienced any collapses in recent history. This might suggest less risk, or less awareness of the risk. Appendix 16 maps several recent medium (5-10) storey collapses that have occurred along the highway. While it would be irresponsible to link these to Thika Highway, the area did become more attractive to investors, placing additional pressure on local development control.

The capacity of local essential services appears to be an issue that affects residents across almost all of Githurai, in some cases compounding existing economic vulnerability and raising health concerns. The consensus across all Focus Group Discussions was that the situation has worsened over time and periods of water shortage were now experienced more frequently. Three of the four focus groups stated that they now need to buy more water often. One group indicated that this source was not reliable and increased their vulnerability to disease. Another focused on the economic impact stating that they now had to spend too much on water, with other residents buying individual storage tanks where they were able to afford to do so.

The highway was linked both directly and indirectly to local infrastructure service challenges. Direct impacts mentioned included water pipe damage during construction, while certain focus groups and household surveys linked Thika Highway to local population growth and therefore reduced infrastructure capacity with respect to several local services, including wastewater and drainage.

Discussion of environmental hazards echoes some of the issues raised with respect to physical services, suggesting winners and losers and unequal spatial distribution risk. Higher income residents in Githurai 44 highlighted the benefits of living in the far reaches of the neighbourhood with favourable circumstances with respect to pollution and flood risk. These participants perceived a positive trend of reduced flooding which would continue into the future. All other participants observed little improvement over time but varied completely in how much of an issue they considered flooding to be. Two focus groups suggested that surface run-off on the expanded highway produces isolated flooding near the development. Another suggested that the roadside drainage pathway now transports water into the river, reducing flooding locally. Highway drainage channels may reduce flood risk at points in Githurai, but shorter water lag-times raise the question of increased fluvial flood risk downstream.

Thika Highway created the first road of its size in Nairobi but lacked road-safety education and harder measures for both motorists and pedestrians. Poor project design in terms of both hard and soft measures were stated as factors that contributed to congestion and more significantly to transport fatalities. Some of this was attributed to unnecessary speed humps, poorly designed zebra crossings, plus population increase and greater car ownership. A lack of road awareness and understanding of signage were also discussed as contributory factors.

The general feeling was that the highway itself was less congested, allowing for a greater volume of cars. However, service roads entering and exiting Githurai and through roads into communities had not been sufficiently developed.
APPENDIX 18: GITHURAI ROUNDABOUT PRE, DURING & POST CONSTRUCTION

The 3rd image shows significant activity on the roundabout pre-construction (Jan 2010). This appears to be matatu (buses) and cars parked and small stalls. This was verified by a local academic from the University of Nairobi (PC 27).

However, this does not appear to be an everyday occurrence and the first 2 images – March/June 2009 show activity only taking place to the side of the roundabout, particularly to the left.

The 4th image shows side service-road activity disrupted in G44 but that does not appear to be on a large scale. Activity actually increases in G44 on the 5th image. The covered markets (away from the road, not shown) appear unaffected.

Images 6 to 8 appear to show some of the open market at Githurai 45 moved back a bit on both sides but not removed entirely. This correlates with newspaper reports of disruption (The Nation, 2014). In image 9 activity has stated again on the left feeder road coming into in Githurai 45. (Images taken from Google Earth)

APPENDIX 19: BUILDING COLLAPSES ALONG THIKA HIGHWAY

March 09, 2016: A four-storey building in Zimmerman, Nairobi, whose construction was questioned two years before collapsed. No one was injured since it has been evacuated

May 2016: Kenyan authorities demolish a building in the Mathare before it collapses

January 2015 7 storey collapse in Haruna. Built 2 years after THIP

2015: Building under construction behind Thika Rd Mall collapses “Since the building and opening of TRM, more than 20 flats have come up at a very fast rate. Possible cause of collapse of building.” A resident said.


**APPENDIX 20: THIKA RISK NETWORK ALTERNATIVE VIEW**

- **Water Shortage**
  - Unreliable water
  - Spending extra money buying water

- **Rising rents**
  - Construction damage & increased population vs capacity
  - No shelters for criminals to hide in

- **Poverty**
  - Construction removed bushes

- **Traffic fatalities**
  - Better road but lack of road awareness & pedestrian crossings

- **Traffic hazards - Congestion**
  - Better mobility & accessibility - Journey time to hospital

- **Air pollution**
  - From stationary traffic

- **Waste & wastewater**
  - Waste flows into river but cleaner at road

- **Land and water pollution**
  - Odours
  - Waterborne disease

- **Fire**
  - Lights, CCTV and mobility enable 24hr economy ...
    - but increased population, competition and construction displacement

- **Deforestation/Vegetation destruction**
  - Construction damage & increased population

- **Community cohesion, crime and violence**
  - No shelters for criminals to hide in

- **Loss of space**
  - Riparian zone Small Axe protects helps prevent fluvial flooding

- **Flooding**
  - Riparian zone Small Axe protects helps prevent fluvial flooding

- **Traffic hazards - Congestion**
  - From stationary traffic

- **Health**
  - Respiratory conditions

- **Unreliable water**
  - Spending extra money buying water

- **Flooded road causes delays**

**APPENDIX 21: CONSULTATION AND ENGAGEMENT CHART RUAKA FGD**

The graph took FGD participants through varying levels of consultation from low impact, basic informing of project occurrence, through to local empowerment, asking participants for any evidence under each heading.

**Record findings**

- **HIGH IMPACT**
  - **INFORM**
    - Some consultation did occur, however little details are known as none of the participants were personally consulted (FGD HI)
  - **COLLABORATE**
    - Some labourers came from Ruaka (Key informant interviews)
  - **EMPOWER**
    - Would have liked to have had a sense of ownership by being able to buy shares in the development (FGD HI)

- **LOW IMPACT**
  - **CONSULT**
    - Would have liked to supply materials (FGD HI)
  - **INFORM**
    - Would have liked more involvement from local radio station (Kameme FM), church and local leaders to consult and inform? (FGD HI)

- **SIMPLE TOPIC**
  - **INFORM**
    - Would have liked more involvement from local radio station (Kameme FM), church and local leaders to consult and inform? (FGD HI)

- **COMPLEX**
  - **CONSULT**
    - Would have liked to have had a sense of ownership by being able to buy shares in the development (FGD HI)
  - **EMPOWER**
    - Would have liked kids to have employment opportunities at the development (very few knew anyone working at Two Rivers) (FGD HI)
**APPENDIX 22: RUAKA-TWO RIVERS HOUSEHOLD SURVEYS**

(a) Most raised issues in Ruaka (generally, not necessarily linked to TRD)

![Graph showing most raised issues in Ruaka](image)

Enumerators asked residents to list the most significant challenges (up to 5) that they faced locally (figure a) and then challenges that TRD had influenced positively (b) and negatively (c).

The question was open and participants were not shown the list of 15 hazards from section 1.2. Hazards have evidently have some further impact on areas within the development. This change cumulatively is reshaping the neighbourhood’s social fabric impacting cohesion, safety and crime.

A significant number of Household survey participants (24/58 people) (Appendix 18) identified community cohesion, safety and crime as a problem, making it the third most mentioned hazard. Theft, conflict, and feelings of insecurity especially at night were of key concern. Specifically considering Two Rivers, increased lighting and security personnel is said to have had a positive effect on local safety. However, concerning cohesion there is a pertinent question of whether Two Rivers is inclusive or exclusive to various social and income groups. Its mandate suggests that it is open to the wider public, though it clearly caters to various social and income groups.

**APPENDIX 23: RUAKA HAZARD ANALYSIS NEIGHBOURHOOD PERCEPTION - FULL REPORTING**

**Community Safety and Cohesion**

Research indicates that Ruaka is in a process of change, influencing and being influenced by large developments such as Two Rivers Development. This change cumulatively is reshaping the neighbourhood’s social fabric impacting cohesion, safety and crime.

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the rapid development that Ruaka and the surrounding area is experiencing. Participants unanimously felt that Two Rivers had not impacted this hazard. This is an important issue for the city, largely beyond the responsibility of Two Rivers. The general consensus from focus group participants and key informant interviews is that Two Rivers is well-built and compliant with up-to-date standards. Fire Hazards was not considered a risk issue in any focus groups. It was thought to be stable and low risk in the past present and in the future. Three focus groups noted that the Two Rivers development had good fire safety planning put in place (smoke detectors, access/connection to fire brigade, fire safety equipment). Female higher income focus group participants discussed the potential of the Two Rivers’ fire safety provisions benefiting the community at large, such as fire brigade and ambulance services.

**Physical Services**

Water shortage, waste and wastewater overcapacity are thought to be worsening due to population growth, which is thought to be a result of urban development growth in the area. A number of developments in the area may be attracting people to reside in Ruaka, not just Two Rivers. This situation raises the important question as to ‘Who is responsible for supporting local infrastructure when a development contributes to population growth in the area?’ The developer or the local government?”

The majority of focus group discussions felt that water shortage has been a consistently problematic hazard, which is expected to worsen over time. Focus groups stated that Two Rivers has had no direct impact on water shortage in Ruaka due to the implementation of an independent water management system. It is suggested that it is self-sufficient and that ‘they don’t ‘compete’ with the residents of Ruaka’ (Male Low Income Group). However, for many other infrastructure-related hazards ‘population growth’ has consistently been linked to exacerbating existing services and provisions.

Waste and Wastewater overcapacity is considered to have drastically shifted from a low risk issue to high risk in the present and future by three of the four focus groups. Poor city drainage, planning, and lack of sewer lines in the face of population growth have been noted as contributing factors. Contamination of ground water was noted and pollution of River Ruaka considered as a continuing issue (by hotels, and landlords). Participants felt Two Rivers not to have directly impacted waste and wastewater capacity due to the implementation of its own waste management systems. Residents hoped that the Two Rivers Development may influence the construction of a sewer line (Female Higher Income).

**Environmental**

Neighbourhood consultation made no direct link between Two Rivers Development, land and water pollution or flooding, presumably due to its isolated location from Ruaka. This does not mean that there is not a link, just that there is not the perception of a link.

All groups identified the loss of vegetation to accommodate Two Rivers Development. This was of concern to the groups, despite the project being built on private land. The groups noted there was degradation and loss of natural beauty (Male Higher Income). Based on the data it could be suggested that the continual building up of Ruaka and shortage of space to plant trees has made the area vulnerable to the types of public health issues that communities lacking in green space often face.

Air pollution was not considered a hazard in the past but is currently, and is anticipated to escalate further in the future. Two of the four groups believe that Two Rivers has had some negative impact on air pollution. While not deemed the primary driver, they did note that additional traffic and congestion leading to the development. Additional traffic is largely attributed to population growth generally.

Land and water pollution was considered low in the past but overwhelmingly believed to be on a negative trajectory. This is largely attributed to the rise in population, which has resulted in additional garbage/waste production. River Ruaka was considered clean in the past with water drinkable, however it is now considered polluted and unsafe for consumption. Sewage and solid waste is thought to be dumped into the river (Female Higher Income and Female Lower Income), which has affected water quality. Three focus groups noted the lack of a dump-site resulting in illegal dumping and burning of waste, which has worsened air quality. Perception of flooding was divided, whilst higher income participants felt risk was increasing over time, lower income participants thought it was improving. The former felt that urban growth in Ruaka was often poorly planned, leading to inappropriate drainage, while the latter felt that urban developments had introduced improved standards of construction and improved drainage.

**Mobility and traffic hazards**

Congestion was considered as a key risk issue that is worsening over time and is expected to continue to deteriorate into the future, as a result of increased population. It is suggested that narrow roads (Male Lower Income, and inadequate parking spaces (Male Higher Income) teamed with increased traffic (Female Lower Income) has worsened congestion over time. However, both female groups did note that the northern and southern bypasses have alleviated some of the congestion, but anticipate that traffic will continue to increase in the future. Congestion around the entry/exit of the development was noted as being a concern (Female Higher Income) with additional safety screening at these check points adding to the wait time and exacerbating causing congestion. The roundabout close to Two Rivers is said to have improved congestion of the area (Male Lower Income).

Traffic fatalities are thought to be worsening over time, however the groups felt that action was being taken to improve matters. The main cause of fatalities was related to inadequate support for pedestrians on new bypasses and roads. This includes lack of foot paths/foot bridges; speed bumps to slow vehicles down (Female Lower Income); few pedestrian crossings; inadequate signage (Female Higher Income) and road signage (Male Higher Income). It was believed that flyovers would be built to counter this hazard. Research suggests that Two Rivers Development has not influenced a rise in fatalities. One group suggested a positive impact as roads designed around the development have been well planned, thus reducing the incidence of accidents.

**Other hazards**

High cost of living was the issue that came up most in the household surveys as a negative impact of Two Rivers (14/58). Adequate Education/schools (5/58) and Poverty (4/58) were also mentioned.

Female focus group participants identified drugs/alcohol as an escalating risk in the community. HIV/AIDS and Homosexuality (which was regarded as a negative impact) were identified by one focus group (Female Higher Income) as a potential hazard. These risks were attributed to newcomers in the area and to a change in social and cultural lifestyles. Female lower income noted that an increase in pubs and a decrease in people attending churches had resulted in alcohol consumption rising. It is important to note, as the population increase seems to have occurred rapidly over a relatively short period of time, which has meant that established residents have not developed connections with newer residents. As a result there seems to be a sense of distrust and development of xenophobic behaviour. This could escalate and has the potential to impact local cohesion.
APPENDIX 24: RUAKA RISK NETWORK ALTERNATIVE VIEW

**Traffic congestion**
- Increased Co2 emissions
- Competition at entry/exit points. Good planning by TRD

**Increased population**
- Growing population putting strain on housing market
- Many residents unable to afford houses thus being forced to move to areas outside of Ruaka

**Housing price hike**
- Attraction of TRD and other local developments contribute to rise in daytime and permanent population
- TRD offers local employment opps. Also through to put some strain on existing businesses as more people prefer to shop at TRD

**Displacement**
- Raise profile and attractiveness of area
- Increased lights and security reducing crime. Thieves think shoppers are well off which may increase crime

**Damage to local business**
- Inadequate waste management
- Not raised in neighbourhood consultation but project study suggest risk

**Livelihood disturbance**
- Increased population putting strain on existing exhausted services and infrastructure. Project-level investigation suggests possible direct impact

**TWO RIVERS**
- Boreholes and water tanks unsuitable
- Inadequate waste management
- Waste/waste water overcapacity
- Infrastructure collapse/damage

**Vegetation destruction**
- Vegetation loss when site cleared. TRD compensating somewhat with replanting

**Community cohesion, crime and violence**
- Increased population making area more attractive, increased crime

**Water shortage**
- Additional population putting strain on existing exhausted services and infrastructure. Project-level investigation suggests possible direct impact

**Water pollution**
- Not raised in neighbourhood consultation but project study suggest risk

**Air pollution**
- Not raised in neighbourhood consultation but project study suggest risk

**Flooding**
- Lack of sewerage provisions

**Inadequate planning/systems & provisions**
- Inadequate waste management

**Infrastructure collapse/damage**
- Planning enforcement inadequate