



Community Fire Response Mechanisms

MUKURU FUATA NYAYO

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Mukuru Fuata Nyayo

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Centre for Urban Research and Innovation
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Executive Summary

Kenya Red Cross Society (KRCS) intends to develop sustainable community fire response by improving capacity and strategy in informal settlement community with Mukuru Fuata Nyayo Informal Settlement as a pilot. The report gives highlights of Fuata Nyayo informal settlement residents' perceptions on causes of fire and elaborate steps taken in responding to fire incidences in the settlements. The report studied 271 randomly sampled residents, 3 Focus Group Discussions and 11 key respondents. The respondents were drawn from the Red Cross Volunteers and the Community Health Volunteers Key Informant Interviews covering all the 11 villages in Fuata Nyayo informal settlements. Survey findings indicate that the major causes of fire in the settlement is illegal electricity connections, domestic violence, stoves, drunkenness, carelessness and theft related arsonists. It is noted that Fuata Nyayo A is more prone to Fire than the other villages.

Findings indicate that the entire community (women, youth and elderly) play complementary roles in responding to fire. They also showcase that there are some institutionalized strategies adopted by community in responding to fire in the settlement, some of the most notable strategies include raising of alarm, evacuation, control of the fire by switching off and disconnecting electricity main supply and demolition of structures. The members of community are active in helping one another put off fire and they also accommodate victims and help the victims with basic foodstuffs and other household needs which is done in collaboration with other actors

such as the Kenya Red Cross, Goal, G4S, KK security among other.

The capacity for community action can be strengthened through training and sensitization on appropriate techniques and procedures for fire mitigation. There is also need to provide community with basic fire control equipment and establish fire stations and sub-stations. KANU ground was proposed as an ideal area location for a community fire station due to availability of space and centrality. Other areas included various chief's camps within the village, which could be prioritized considering the location in relation to fire prone areas. The chiefs, village chairpersons and elected managers were proposed to take charge of the proposed community fire stations, since they were deemed to be the neutral defenders of the residents. Residents noted that fire response would improve greatly if there capacity to respond to fire can be built through training and provision of equipment. It was also proposed that there should also be some form of community fire sub-station in each village where all the village head is given some few fire response equipment to help them during fire breakout in all villages as they await response from the main community fire station.

The survey concludes that there does exist goodwill in initiating and embracing community fire station as the community is already playing some important roles in responding to fire in the settlement. This can be tapped and institutionalized in such a manner that there is clarity in terms of command and fairly systematized mechanism of responding to fire, taking into account the unique roles of the elderly, youth and women in responding to fire.

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The consorted efforts by the Community, Red Cross Team, CURI-University of Nairobi, FROG Design, and Spatial Collective in the availing and collecting data, analysis and synthesis of information and designing of models has yielded a blueprint that we hope can be transposed across the globe in helping communities fight fires in a more effective and efficient way.

Acronymns

AURAN- African Urban Risk Analysis Network

CBDM- Community Based Disaster Management

CBO- Community Based Organisation

CURI- Centre for Urban Research and innovation

FGD- Focus Group Discussion

FSMPOK- Fires Safety Management Policy of Kenya

IGAD- Intergovernmental Authority on Development

KRCS- Kenya Red Cross Society

LAFD- Los Angeles Fire Department

NDOC- National Disaster Operation Centre

NEMA - National Environmental Management Agency

NGO- Non- Governmental Organisation

SAARC- South Asian Association for Regional Cooperation

UN- United Nations

UNESCO- United Nation Educational, Scientific and Cultural Organization

UNISDR- United Nations International Strategy for Disaster Reduction

USAID- United States Agency for International Development

WDR-World Disaster Report

1. Introduction

Fire Disasters, Informal Settlements and Actors

1.1 Introduction

Urban community require effective, strategic skills as well as intangible information and tools, to evaluate and manage risk and, at the same time, increase their overall capacity for effective response in emergency situations such as fire, flood and acts of terrorism among others. Despite being vulnerable to fire incidences, many low income communities are often ill-prepared to deal with such incidences which have led to loss of lives and property. This calls for proper and systematic examination of their level of preparedness and their ability to effectively manage fire disasters.

The Kenya Red Cross Society (KRCS) in collaboration with partners such as The Kenya Government and communities living in informal settlements has been facilitating numerous projects aimed at raising awareness to the Kenyan public on current disaster related issues such as fire. The Red Cross Society works through networks and with communities with the aim of alleviating and prevention of human suffering and to save lives. Programming within the KRCS is placing emphasis on longer term development interventions and community resilience strengthening through

integrated interventions. In Nairobi, an urban disaster risk reduction intervention has been in place since 2008, initially with a focus on fire safety moving towards a more multi hazard approach. Currently this project is being implemented in 7 informal settlements in Nairobi targeting approximately 1,000,000 beneficiaries.

Nairobi, the Capital city of Kenya hosts up to 4.5 Million people of which 70% (3 Million) live in the informal settlements. The settlements are characterized by high poverty and unemployment levels coupled with the lack of access to quality housing and infrastructure. The mushrooming informal settlements in the city provide cheap housing to the ever increasing number of residents many from the rural areas. Most informal settlements are located along railway lines, road and riparian reserves in addition to flood and hazard prone areas.

Vulnerable urban communities are often associated with high concentrations of poverty, inequality and neglect. Many fire hazards occur in informal settlements of urban areas affecting millions of people each year through loss of life, serious injury and loss of assets and livelihoods. The combination of poverty, marginality, overcrowding and limited service provision if any, exposes residents to a range of prevailing hazards particularly informal dwelling fires. It is often a challenge to estimate how many fires occur in informal settlements each year, because many go unreported. Rapid and haphazard community and urban development has often placed houses dangerously close together, and when fires start, they spread easily and quickly. Given the density of many of these settlements,

evacuations are chaotic and dangerous. Pathways between houses are narrow and often blocked, and responders are often unable to access their houses in time. Despite the frequency and large-scale devastation of fire outbreaks in these urban communities, fires are often un-documented and actions to reduce fire risks are significantly ill coordinated.

Response to fires, especially in informal settlements, continues to be a daunting task due to the lack of publicly provided firefighting systems including the lack of water sources to douse fires, extreme crowding and high density of shelters coupled with combustibility of construction material and poor infrastructural development in informal settlement areas, including lack of access roads into the settlements.

Through this research, The Kenya Red Cross Society and partners aim to better understand the dynamics of fire hazards including the causes, fire responses and roles of the different actors including the communities in addressing the hazards. The outcomes will help to alleviate the suffering and losses encountered through fires in Mukuru informal settlements and other similar settings country-wide.

1.2 Fire Incidences in Nairobi Informal Settlements

Many fire hazards occur in informal settlements of urban areas affecting millions of people each year through loss of life, serious injury and loss of assets and livelihoods (Gachago, 2013). These seriously affect the community living and working in informal settlements. Slum communities are not static; they grow and change over time. According to Flynn (2009), the population size and characteristics can change including the building types and construction materials. Institutional change within the responsible departments was essential to address fires effectively.

Fire incidences in Kenya are commonplace in residential and commercial areas mainly in urban areas and slums to a large extent. These incidences are higher in informal settlements and markets that are ill equipped to manage disaster. Cases of fire incidences have been on the rise in Kenya as noted by the Kenya National Disaster Operation Centre (NDOC) and the Kenya Red Cross Society (KCRS). However, KCRS notes that the incidences could be higher because fires that the immediate community manages to put out are never reported, as are their damages.

Notable fire disasters in Nairobi include incidences in Kibera's Gatwekera slums and South B's Maasai and Kayaba slums. The latter incident has happened twice leaving in its wake two children dead and more than 5,000 houses burnt down. Deep Sea slum in Parklands

is another on the list of the affected. Yet, the worst single incident was on 20 February 2004 when fire gutted ramshackle tin houses in Mukuru Kwa Njenga slums, leaving 4,500 families homeless, most of them industry workers that are underpaid and have no access to proper housing and sewerage system. Other notable fire incidences include the Sinai fire in September 2011, which was caused by a fuel spill. Approximately 100 people were killed in the fire and at least 116 others were hospitalized with varying degrees of burns. The incident was not the first such pipeline accident in Kenya, with the Molo fire of 2009 resulting in at least 133 fatalities and hundreds more injured. The former Ministry of Local Government through local authorities handled most of the fire-fighting equipment, with the involvement of that of the Internal Security. And the Ministry of Public Works was supposed to deal with technical surveillance. With this, coordination to respond to infernos becomes cryptic, considering the way the Fire Department of the Nairobi City Council and other security firms tried to put out these fires.

Fire responses have been slow as noted in previous incidences. Reaching disaster spots in slums is a perennial problem. Many settlements have narrow winding paths often not motorable. Fire engines often lack essential equipment and water to fight fires in the informal settlements.

Most fires in the slums are usually attributed to electrical faults, attributed to illegal connections. Most of the informal settlements are built with stockpiles of corrugated iron sheets, pieces of wood and mud, and usually no water points, while they are so cramped that only muddy walkways and open sewage drains separate them,

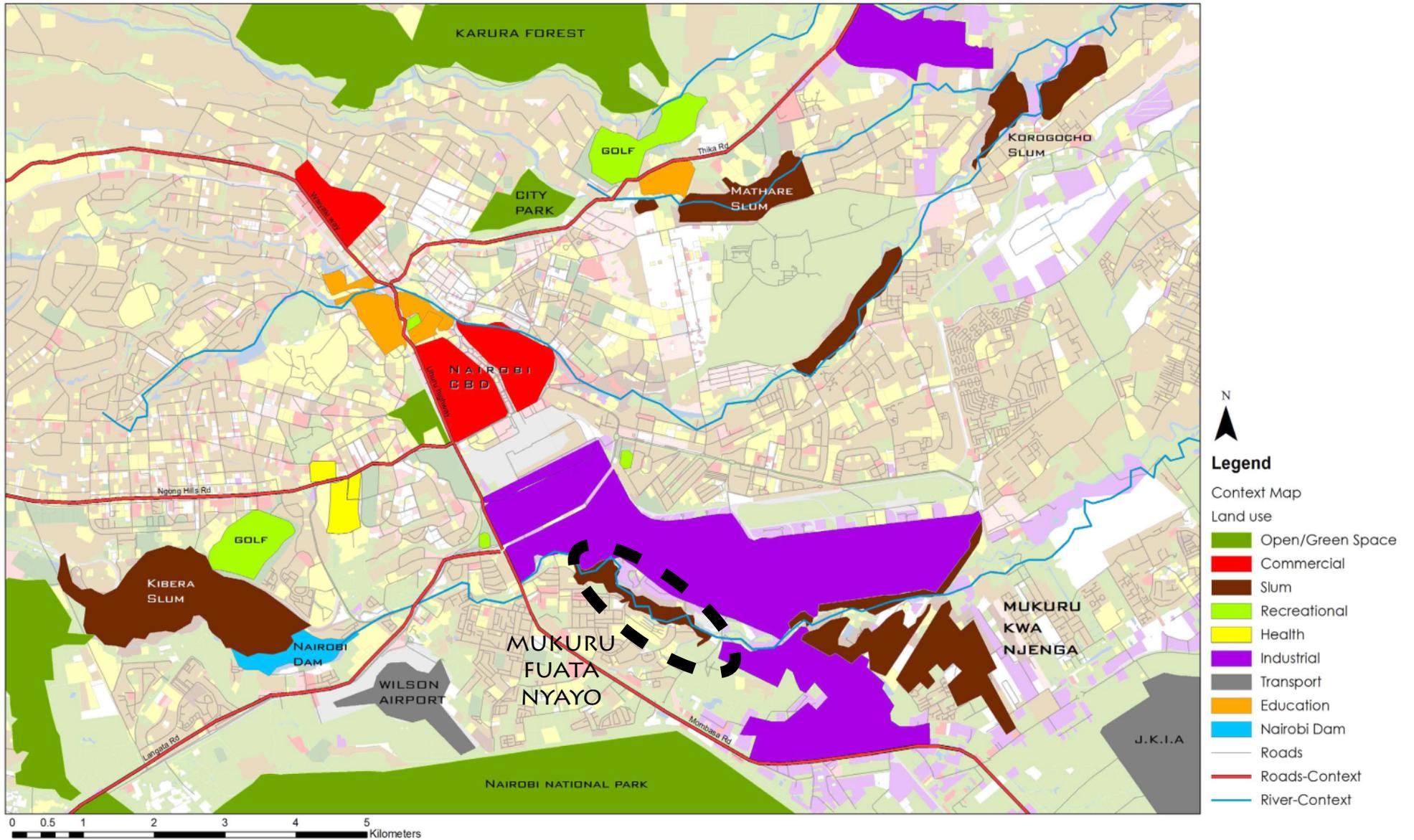
making wind-fanned fires a disaster in such setting.

Morrissey and Taylor (2006), pointed out that massive fires are a frequent occurrence in many slum and squatter settlements because of lack of publicly provided fire-fighting systems, extreme proximity and high density of shelters, narrow alleys impeding access by fire fighters, poorly wired electrical systems or use of kerosene stoves and lamps, lack of water sources to douse the flames, and combustibility of construction materials. This puts the residents of such settlements at a risk, which requires community driven strategies of addressing fire menace.

Study Objectives

1. To research and document historical and existing community operational mechanisms for responding to fires such as community level coordination, organization and responsibility delegation during fire response within Mukuru.
2. To identify system elements that are working well and could be replicated, as well as identifying elements that would benefit from further strengthening to enhance community level fire response.
3. To develop and design community level fire response stations, with an emphasis on low-tech, simple and sustainable solutions, through a consultative process with existing community fire responders trained by Kenya Red Cross Society.
4. To provide detailed specs of prototype options for future piloting along with anticipated coverage radius.

Map 1.1 Location Map, Mukuru Fuata Nyayo



2. Methodology

The Tools and Steps

2.1 Methodological Approach and Research Design

A participatory methodology was used during the entire assignment and ensured that the key stakeholders were adequately involved throughout the process. Consultative meetings were conducted with the KRCS officers and community stakeholders to obtain data and information regarding fire responses and associated dynamics. Community fire response mechanisms analysis provides an in-depth examination of fire incidents, causes, impact and responses in the Mukuru settlement. This necessitated an elaborate method which captured the historical elements of fire incidences in Mukuru, identifying and mapping out the existing community operational structures in responding to fire, the effectiveness of fire response, identification of existing community best practices in as far as fire response is concerned focusing on the role of community fire responders trained by KRCS, suitability analysis and proposal of community level fire response stations and proposing of a detailed specs of prototype option for future piloting along with anticipated coverage radius.

The assignment is an action research where the background information was informed the designing of a functional community fire response strategy. This was done by identifying and analyzing key players and structures necessary for addressing fire response

in slums which will objectively inform the basis for designing solutions with detailed specs. The designs can therefore be used by communities in other informal settlements in addressing incidences of fire, which is prevalent in such settlements.

The findings are instrumental in building longer term development interventions and improvement of community resilience. The study extrapolates how the trends in fire outbreaks may relate to demographics, socioeconomics and social cohesion.

2.2 Research Design

The research design involved the use of techniques, tools and instruments such as household questionnaires to individual key informant interviews and focus group discussions to get first hand information on community experiences with fire outbreaks. This was purposely done to capture every dynamic of the fire hazards and provide for progressive data collection that ensures that gaps from each stage are sufficiently filled. The community fire response mechanism study involved seven main stages; Inception phase, literature review, reconnaissance, preliminary data collection, Focus Group Discussion, Key Informant Interviews, and data analysis. The stages applied in this study are discussed in detail below.

a) Inception Phase:

The inception phase mainly entailed conceptualizing the terms of reference and the development of the inception report. The data needs of the project together with the work plan were drafted at this stage.

b) Community fires response: Global and Local Perspectives:

Published research, articles and other publications, which informed the literature review. Case studies; on other informal urban settings; and the various fire response mechanisms that are used by the communities in the identified areas. The secondary data was useful in documenting the historical aspects and any documented strategies, standards and benchmarks including best practices and measures which can be adopted in responding to fire incidences in informal settlements. Data from secondary sources included already published works from the client, Nairobi City County Government, National Disaster Management Authority, etc

c) Sampling

The sample selected was carefully considered to ensure that it was in line with variability of the subject under investigation which is community fire response which can assume aspects such as household's location, socio-economic profiles, building materials used, fire victimization experience, type/cause of fire etc. The variability of the community was examined in order to establish the sample size for the study. If found to be high (heterogeneous) from literature and interaction with the community under the subject of concern then the sample size was to be increased to accommodate this aspect but if the variability is low (homogeneous) then the team was to adjust the sample size accordingly in consultation with the Kenya Red Cross. The sample size was sized down to 264 for the household survey due to the limited timeline of the study. After detailing the sampling frame hoping it will be possible to get one

in conjunction with KRCS, the administrator such as the Chief and CURI network, the team used the systematic random sampling in selecting the households. For other category of respondents such as the Key informants, Focus Group Discussions, the team applied non-random sampling techniques by using convenient sampling in identifying relevant and knowledge respondents in the area with regard to their

The distribution of the samples was based on the village size and also on the fire occurrence in an area. The sample sizes for Fuata Nyayo A, B and C was increased due to the frequency of fire outbreaks in the areas as stated by the residents.

Table 2.1: Distribution of Sample Size

VILLAGE	NO. OF HOUSEHOLDS	SAMPLE SIZE
Hazina A	754	15
Hazina B	811	18
Shimo La Tewa	679	11
Fuata Nyayo A	1100	23
Fuata Nyayo B	1000	26
Fuata Nyayo C	800	20
Maasai Village	1984	40
Maringui-ini	2000	42
Kisii Village	2342	47
Hazina Market (Riverbank)	500	10
Maasai Mater	300	6

d) Training of Research Assistants

The training mainly involved familiarization of the research assistants with the data collection instruments. They were also informed of the requirements of the study and how to conduct the field survey. Being a technical study, the research assistants had training and experience in professions in the Built Environment i.e. urban planning.

e) Understanding Mukuru (Reconnaissance and Field Observation)

A pre-visit was conducted in order to create familiarity with the area and also test the data instruments. The exercise mainly involved a traverse through the settlement to establish the boundaries of the villages. The research team was able to meet the residents and establish baseline communication to aid in the data collection. The process was concluded with administration of 8 questionnaires and 3 interviews with the residents. The experience from this exercise led to the adjustment of the instruments accordingly. This exercise also entailed meeting with community leaders and the chief who participated in community awareness on the exercise.

f) Field Survey

The administration of household questionnaires took place on the course of four days in all the 11 villages of the Mukuru Fuata Nyayo Settlement. A total of 6 research assistants each accompanied by a community guide administered 66 questionnaires a day. Mapping was also undertaken at the same time mainly noting features such as water points, circulation routes, open spaces and social amenities.

The exercise was undertaken over a period of 4 days.

Community Conversations FGDs were organized after the household survey so as to fill the gaps from the field survey. The FGDs were designed to meet and talk to the people most affected by fire and those who also actively participate in community fire response. It sought to bring together groups of individuals from each village in Fuata Nyayo and compare the dynamics of community fire response all across. Three FGDs were organized for; Village Leaders (Chairpersons), Youth and Women over a period of 3 days. The FGDs brought into perspective different views from the residents and also captured information that was missed in the individual interviews.

Image 2.1 Focus Group Discussion with Women



3. Fire Response, Actors and Institutions: Global and Local Perspectives

This section reviews the global and local perspectives of fire hazards especially in urban low income neighbourhoods / settlements. Key information is presented on aspects such as fire vulnerability, fire incidences, causes, responses and the effectiveness of the same, this will be done by looking at various causes of fire in settlements, response mechanisms with focus on community driven response strategies and roles of other institutions and actors in fighting fire in informal settlements. It further analyses current system elements for scaling them up to be more efficient and effective so as to further strengthen and enhance community level fire response.

3.1 Overview

Fire is the rapid oxidation of a material in the exothermic chemical process of combustion releasing heat, light and various reactive products (Pyne, 1982). Fires start in three main ways i.e. accidents (misuse of appliances), deliberate ignition and equipment failure (electrical malfunction) and produce smoke and toxic gases which could be extremely fatal to those exposed to it hence the need for prevention and protection from spreading fires by for instance delaying ignition period to allow people more time to escape and

for the fire brigade to arrive at the incident.

The Department of Provincial and Local Government (DPLG) of Republic of South Africa defines informal settlement fires as fires that occur randomly within informal settlements, and run the risk of becoming out of control. These fires are due to various reasons including human negligence, malicious intent and natural occurrences.

Types of Fires

Wood, Paper and Material Fires; these are relatively easy to put out and contain and can be put out using water.

Electrical Fires; they are the most dangerous type of fire and also spread very quickly aided by the electricity connections. To put them out, electricity should be turned off, and then sand or dry powder extinguishers.

Gas Fires; Gas fires can be explosive which exacerbates the spread of fires. These fires can be put out using damp cloth or using dry powder extinguishers, however, it is important to isolate gas supply before putting out the fire.

According to the Grant, (2012), classification of fire depends mainly upon the fuel involved. Based on this, fire is classified in five classes as follows;

- **CLASS "A"** - These are fires fueled by ordinary combustible materials, such as wood, cloth, paper, and many plastics. This type of fire burns with an ember, leaves an ash, and is best extinguished by removing the heat side of the triangle. Extinguishers suitable for

Class “A” fires should be identified by a triangle containing the letter “A”; if color-coded the triangle will be green. These fires should be extinguished by using a dry chemical extinguisher. Water is effective in extinguishing these type fires, however, water extinguishers are rarely found especially in Medical Centers.

Class “B” fires should be identified by a square containing the letter “B”. If color-coded, the square is red. Either dry chemical or carbon dioxide extinguishers should be used to extinguish these type fires. Flammable liquids may re-ignite after being extinguished. Water should not be used for these kinds of fires.

- **CLASS “B”** - These are fires fueled by flammable liquids, combustible liquids, petroleum greases, tars, oils, oil-based paints, solvents, lacquers, alcohols and flammable gases. This type of fire burns on the surface of the fuels, and is best extinguished by a blanketing or smothering action. A fire of this type is fast spreading and capable of engulfing a large area in a very short time. Extinguishers suitable for

- **CLASS “C”** - These fires occur in energized electrical equipment, where the electrical non-conductivity of the extinguishing media is of importance. Blanketing or smothering this type of fire with a non-conducting extinguishing agent is of prime importance. Water, or solutions containing water, is never to be used on a Class “C” fire. Extinguishers suitable for Class “C” fires should be identified by a



Figure 2.1 Types of Extinguishers and their functions. Source bamfordtrading.com

circle containing the letter “C”; if color-coded, the circle is blue. Either dry chemical or carbon dioxide extinguishers should be used to extinguish these types of fires. Water should not be used. Extinguishers suitable for more than one of the three classes of fire A, B and C defined above may be identified by multiple symbols (ABC).

- **CLASS “D”** – These fires involve combustible metals, such as magnesium, titanium, zirconium, sodium, lithium and potassium. Generally the extinguishing agent is referred to as dry powder. A star containing the letter “D” should identify these extinguishers, if color-coded the star is yellow.

- **CLASS “K”** –These are fires in cooking appliances that involve combustible cooking media such as vegetable or animal oils and fats. The extinguishing agent is referred to as Wet Chemical. The letter “K” should identify these extinguishers.

Causes of Fires

Historically, many fires occurred in buildings due to the careless disposal of smoking material into wastepaper baskets. As a result of the no-smoking ban inside most buildings, such fires have become very uncommon. However, in today’s world of electronic office equipment, are as a result of an increase in fire incidents due to faulty electrical equipment and power distribution systems.

Many common causes of fire can be related to open flames,

electrical fires, cooking and spontaneous ignition and the Ignition of Waste Materials. Open Flames arise from such unsafe conditions as negligence in conducting hot work, such as welding, cutting or grinding; improper use of candles; improper handling of flammable or combustible liquids or flammable gases in near-to-potential ignition sources; and matches and cigarettes that are improperly disposed of, or left unattended near combustibles. Electrical fires arise from conditions including damaged electrical conductors, plug wires or extension cords; use of faulty, modified or unapproved electrical equipment; insufficient space or clearance between electrical heating equipment and combustibles; short or overloaded circuits; loose electrical connections; and lighting. Fires occurring as a result of cooking arise from such unsafe conditions including deep-frying in pots or pans on stove tops; unattended cooking appliances and combustibles located dangerously close to cooking equipment.

Spontaneous ignition and the ignition of Waste Materials occur when there is improper disposal of materials susceptible to spontaneous combustion, such as oily rags from wood finishing or polishing; accumulation of organic materials, such as green hay, grain or woodchips; and accumulation of waste combustible materials near potential sources of ignition (Pyne, 1982).

Institutional Framework on Management of Fire

There are various governmental and non-governmental agencies in Kenya involved in disaster management activities; but largely

in an uncoordinated, reactive and sectoral framework. This is also manifested in the ministries in the government of Kenya which have mainstreamed Disaster Management: in the Office of the President there is the National Disaster Operations Centre (NDOC), Arid Lands Resource Management Project (ARLMP) in the Ministry of Northern Kenya Development and Other Arid Lands, and in the Ministry of State for Special Programmes is the Department of Relief and Rehabilitation. The Ministry of Environment and Mineral Resources has the National Environmental Management Authority (NEMA). In addition, IGAD, UN Agencies and other bilateral partners and international NGOs play a significant role in disaster management in Kenya. In view of the lack of coordination, the National Policy for Disaster Management in Kenya was drafted in 2009 and recognized the roles of institutions that sought to harmonize and coordinate disaster management operations (Republic of Kenya, 2009).

Legislative Framework on Fire

The Republic of Kenya (2004) outlines relevant measures pertaining to disasters so as to strengthen the country's mechanism to manage disasters including identifying and setting aside land banks for the purposes of meeting urgent shelter requirements of refugees, returnees and internally displaced persons, including as appropriate, the construction of temporary housing with basic facilities taking into account gender specific needs. It also took into account undertaking delineation of high risk regions for different disasters for hazard mapping; Developing procedures for safe development of hill sides and application of environmental impact assessments; Promoting research in alternative less flammable

building materials; Promoting hazard resistant building designs and construction in zones prone to earth movement and flooding by enforcing building specifications and regulations; Promoting disaster prevention through timely and continuous maintenance of such services as storm water drains, fire alarm systems to reduce the impact of disasters; Establishing data banks and information systems on disasters and developing appropriate dissemination

A Review of past experiences of fire risk management and analysis of existing Acts, Codes, Regulations and Policies related to fire by the drafters of the unpublished, The draft Fires Safety Management Policy of Kenya (FSMPOK, 2011), showed that: outdated and inadequate codes, regulations and legislation; laxity in the enforcement of laws; lack of Public awareness; insufficient fire early warning systems; shortage of trained and qualified personnel; lack of national standardization of fire appliances and equipment; and lack of professionally designed fire detection and protection systems in domestic, commercial and industrial environments, have been the major impediment towards achievement of fire safety in the country

The draft Fire Safety Management Policy of Kenya (2011) was therefore designed to address the identified shortfalls in the management of fires risks in the country. The Policy lays down the goals, objectives, guidelines, coordinating structures, legal and institutional framework that will enhance the process of fire management in Kenya. The Policy also aims at providing institutional structures and building capacity to manage and cope with the

menace of fires risks. It has identified the major policy elements and strategies necessary to overcome the shortcomings of fire safety management. This Policy also advocates for the strengthening of fire and rescue services institutions and improving of coordination with other partners. It has recommended the review and harmonization of existing relevant policies and legislations in order to establish an institution with legal mandate to coordinate fire safety management in the Country.

FSMPOK, (2011) The pace, at which the stakeholders are taking to draft, approve and eventual legislation of the policy and many others in the country, is an indictment of the country's commitment to reform, as it purports to make great strides towards significantly reducing poverty and hence achieving the goal of Vision 2030 when disasters have in the recent past increased and thereby distracting the tempo of economic development in the country National Development Plan (2011).

3.2 Fires in Informal Settlements

Many fire hazards occur in informal settlements of urban areas affecting millions of people each year through loss of life, serious injury and loss of assets and livelihoods (Gachago, 2013). These seriously affect the community living and working in informal settlements. Slum communities aren't static; they grow and change over time. Population size and characteristics can change. Building types and construction materials can change. A change in department policy (i.e., personnel levels, inspection frequency) can affect performance. The fire department should take all of

these issues into consideration and compare its own community's characteristics and department policy over time (Flynn, 2009).

Informal settlements are the recipients of the city's externalities: noxious industry, waste materials, ill health, fires, crime and social dysfunction, and fragile, dangerous or polluted land that no one else wants. Slum fires are a major disaster killer in Kenya (AURAN, 2006). According to Gachago (2013), fire disasters remain a major threat to survival, dignity, livelihood and security of people and communities, in particular the poor like those living informal settlements.

Vulnerability in Informal Settlements

UNDP (2010) states that risk in urban areas is a combination of two factors: first, location and exposure to hazards; and second, increased vulnerability due to poor local governance, environmental degradation, and the overstretching of resources. The largely unplanned expansion of cities to accommodate rapid population growth, combined with inappropriate land-use planning and the failure of urban authorities to regulate building standards, contribute to the vulnerability of urban populations. Vulnerability is a set of conditions that affect the ability of countries, communities and individuals to prevent, mitigate, prepare for and respond to hazards (Ariyabandu and Wickramasinghe, 2003). It is seen that all individuals and communities are to varying degrees vulnerable to hazards and all have intrinsic capacities to reduce their vulnerability.

Most disaster-prone cities are unprepared for future disasters and ill-equipped to reduce associated risks. Policy makers face numerous

challenges with respect to urban risk management, including lack of adequate knowledge and administrative capacities; weak finances; lack of coordination between departments; weak law enforcement mechanisms; and corruption. Even though informal settlements, squatters, and slums have long been in existence, these settlements have grown in numbers and in spatial forms with the increase of the urban poor and their exclusion from formal housing sectors.

In many cases, with urban spatial growth, formerly independent administrative and political units of settlements have been incorporated to metropolitan cities, creating peripheral municipalities and generating new challenges in urban governance. The informal settlements lack formal site planning and service infrastructure that might reduce fire risk and at the same time make mitigation feasible (AURAN, 2006; Boraine et al., 2006). In slums, structures are developed with minimum compliance to sound planning requirements hence fire outbreaks end up getting out of control resulting in losses that could have been avoided (Gachago, 2013; Action Aid, 2006; AURAN, 2006).

Slums have numerous economic, social, as well as infrastructure problems that increase their vulnerability to fires. In addition, slum dwellers lack proper housing, water and sanitation and are exposed to serious health risks, and have limited access to credit and the formal job market maybe due to stigmatization, discrimination and geographic isolation all of which increase fire vulnerability (Gachago, 2013). Furthermore, they have limited access to social and economic networks. Slum areas in cities have high population densities and

high concentrations of social and economic deprivation, which may include broken families, unemployment, economic, physical and social exclusion making fire mitigation difficult (Gulyani and Bassett, 2007). Other vulnerability factors include faulty and mostly illegal electricity connections and use of flammable energy alternatives when the power is cut off cause fires, which destroy homes and displace, injure or kill many people (USAID, 2004).

Fuata Nyayo is one of the underprivileged neighbourhoods in Nairobi city. Most of the housing structures' building materials are temporary and highly inflammable increasing risks of fire hazards. Additionally high population densities coupled with lack of access roads make it easy for fire to spread between dwellings and difficult for emergency services to reach affected areas. This is compounded by lack of fire hydrants and water mains (Gachago, 2013).

3.3 History of fire Incidences in Mukuru

In 2010, the World Disaster Report (WDR) rated Kenya among the low-income countries most vulnerable to disasters, with vulnerability most rife in urban areas because of the state of informal settlements (Urban Margins, 2013).

A number of fire outbreaks have been experienced informal settlements Nairobi for instance a fire 8 March 2011 Deep Sea informal settlement in Westlands destroyed around 80-90 per cent of the settlement. Many families living in Deep Sea lost all of their belongings in the fire, including personal documents. In another

instance on May 2011, eight people were burnt to death when a fire gutted down a paints making factory that also doubled as a residential area in Kariobangi.

Many fire hazards occur in informal settlements of urban areas affecting millions of people each year through loss of life, serious injury and loss of assets and livelihoods (Gachago, 2013).

In Mukuru, fire outbreaks are bordering a common phenomenon; mainly due to the high number of fire outbreaks that have taken place in the informal settlement, bringing devastating effects. Most recently, in March 2015, a fire broke out in Mukuru Kayaba, leaving 693 homeless and 8 injured. Barely less than 24 hours after, two other fires outbreaks were reported in other Mukuru villages of Kwa Reuben and Fuata Nyayo (reliefweb.int/report/Kenya/Mukuru-kayaba-fire-outbreak-update-11th-march-2015).

In 28th February 2011, numerous structures were reported razed down by a fire in Mukuru village of Fuata Nyayo, with an estimated area of over 4 hectares affected (DREF, 2011).

However, it is the Mukuru Sinai fire of 2011 that went down in history as the worst to ever hit the informal settlement. The fire was as a result of petroleum spillage that flowed into the storm water drainage system leading to Mukuru Sinai area, and killed 120 people, including children and mothers, and burning hundreds of structures within the village (KRCS, 2011)

3.4 Community Fire Response Mechanisms

Response to fire incidents can depend on the type and intensity of fire (SAARC, 2010). All fire incidents can be divided in many ways depending on the cause of fire outbreak, but broadly there are two types of fires, one is natural and other is manmade. However, all residential and non-residential structural fires are largely manmade. Similarly, all industrial and chemical fires are due to explosions or fires made by humans or due to machine failures. (SAARC, 2010).

In Nairobi, the growing population seems to be outpacing the capacity of the city's emergency services. The city's fire department is overstretched with only three fire stations to serve the entire county, leaving residents to fend for themselves thus when fire breaks in informal settlements. At some point, the residents engage in very risky response activities. (Mbugua, 2015).

Disaster mitigation using government and institutional interventions alone is insufficient because they pay little attention to addressing the community dynamics, perceptions or priorities, and the aim of Community Based Disaster Management (CBDM) is to reduce vulnerabilities and strengthen people's capacities to cope with hazards (Sileche, 2012).

Categories of Community Fire Response

Community fire response mechanism is mainly due to recognition that community citizens would very likely be on their own during early stages of a fire outbreak (LAFD 2011). Thus, as Shaw and Okazaki (2004) note, it is crucial to motivate individuals to understand their own disaster risk and to take action against such risk as it is the people at the community or village level who suffer its adverse effects.

Good practices in community disaster response approaches may entail the tapping of traditional organizational structures and mechanisms (including formal and informal community leaders), and capability building activities with the community disaster committees and volunteers (Victoria, 2002).

Community Fire Response Mechanisms can either be coordinated or uncoordinated, depending on the particular community's level of organization in place. In informal settlements, emergency response to disasters, dominated as it is by the need to save lives and provide emergency, often results in the reproduction of the very conditions of risk and vulnerability that led to the disaster in the first place (<http://www.odihpn.org/humanitarian-exchange-magazine/issue-38/effective-response-reduces-risk>)

According to Kamengere (2012), community fire response in informal settlements include Voluntary community members, Non-Governmental Organizations, Community Based Organizations

and Informal Social Groups. These same systems exist in Mukuru informal settlements.

Voluntary community members generally include youths and slum dwellers, with local knowledge of the area, who are always the first to respond to any fire distress calls. People and local knowledge are the principal resources in fire response (Cumming, 2012). For example, during the Mukuru Sinai Oil Spill Fire in 2011, the community members were first to respond (KRCS, 2011). This included fetching of water from water points and the dirty Ngong' river with buckets to douse the fire, raising alarm through calls to authorities and fire rescue teams, salvaging of property, and saving of lives.

Community Based Organizations and Informal Social Groups that respond to fire incidents include churches, trained response individuals within the community, local administration and other community self-help groups. Their roles include evacuation, providing temporary sites for refuge and other necessities, information gathering, and search and rescue activities. (Herd, 2013)

NGO's and humanitarian organizations based in informal settlements also play a role in fire response, that include set up of evacuation centres, provision of necessities for affected families, setting up of information desks, conducting search and rescue exercises, among others. According to Cumming, 2012, NGO's response actions include search and rescue, first aid, setting up of trauma care

centres within the community, participating in putting out of fire and warning systems/calling for emergency services.

Effectiveness of Community based fire response mechanisms

Despite the high increasing number of fire incidents, response has always been a challenge. As Mbugua (2015) notes, community based response approaches to fire are as a result of the shortcomings of authorities fire response mechanisms. However, the community response mechanisms are hampered by the lack of basic fire fighting skills amongst the community, lack of direct and toll free emergency lines, lack of fire fighting equipment within the community and the general structural layout and economic activities of informal settlements.

According to Gachago (2013), the layout of informal settlements is characterized by close proximity and high density of shelters, narrow alleys impeding access by fire fighters, poorly wired electrical systems or use of kerosene stoves and lamps, lack of water sources to douse the flames, and combustibility of construction material; factors which contribute to fire outbreaks in informal settlements, and hamper community's response approaches.

Fire Mitigation Measures

Mitigation refers to the lessening or limitation of the adverse impacts of hazards and related disasters. The adverse impacts of hazards often cannot be prevented fully, but their scale or severity can be substantially lessened by various strategies and actions (UNISDR, 2012). While the common notions for having mitigation

measures is before and after a disaster, Twigg et al (2000) also specify that mitigation can take place at any time before, during or after a disaster.

Mitigation activities reduce the effects of unavoidable disasters or eliminate the probability of disaster occurrence (Sileche, 2012).

According to Sileche (2012), Mitigation measures include:

- Public education
- Building codes
- Using building regulations and safety codes, and
- Vulnerability analysis updates

Fire disaster mitigation measures range from the physical such as engineering works like bridges, protective dikes, embankments, and safe building design to the non-structural and policy interventions such as community risk assessment, community risk reduction planning, public awareness, food security programs, group savings, cooperatives, crop insurance, strengthening community disaster management organizations and advocacy on disasters and development issues, legislation and land use zoning (Victoria, 2002).

4. Understanding Mukuru Fuata Nyayo (Environment and Community Conversations)

This section discusses the findings of the survey, looking at the settlement profile with regards to fire causes, response and mitigation measures.

4.1 The Fuata Nyayo Community Profile

The background profiles to be covered include respondents' typologies, occupation, gender, age, village of residence/ occupation, length of stay and education level which were deemed important in understanding fire response mechanisms adopted by the respondents living in Fuata Nyayo informal settlement.

Sample Size

A total of 265 respondents were contacted and interviewed during the study. Of these, 69% were households and 31% were business operators. It is important to note that both households and enterprises in the settlement experience fire incidences. Households were more prone owing to related activities such as cooking and domestic violence.

Approximately 66% of the household respondents were

tenants while landlords accounted for 10%. This is important in understanding the fire response mechanism due to different stake and interest among various categories of residents.

Table 4.1: Respondents as per Village

Village	Frequency	%
Fuata Nyayo A	36	13.6
Fuata Nyayo B	30	11.1
Fuata Nyayo C	15	5.7
Kisii Village	51	19.2
Mariguini	32	12.1
Maasai Matter	6	2.2
River Bank (Hazina A)	10	3.8
Maasai Village	32	12.1
Hazina A	35	13.2
Hazina B	7	2.6
Shimo la Tewa	11	4.2
Total	265	100.0

Residency

A little over half the residents had only stayed in the settlement for less than 5 years (51%); 42.3% reporting to have stayed between 1-5 years and only 8.7% noted to have stayed for less than 1 year. This summed the total of residents that had been in the settlement for less than 10 years to a significant portion of 77%. The findings shows that living in informal settlement is not as temporary as such as it has around 50% who stay there for more than 5 years, hence need to develop some sustainable mechanisms of addressing

Figure 4.2: Length of Stay in Settlement



emergencies and calamities such as fire and flooding among others. At the same time it also signified that half the population of the settlement may not have a say or understanding of matters that happened over 5 years ago. Training programmes and sensitization on fire response mechanisms may have to be done every 3 Years so as to ensure everyone is in the picture.

Fuata Nyayo attracts residents and business operators for various reasons. Proximity to work places in the industrial area was the most significant reason at 38%. Affordable rent and security accounted for 33% and 10% respectively. The findings point at the centrality location of Fuata Nyayo which is strategic to those working around Industrial area and also not very far from Nairobi CBD. This may also help in understanding why people stay for years in the settlement.

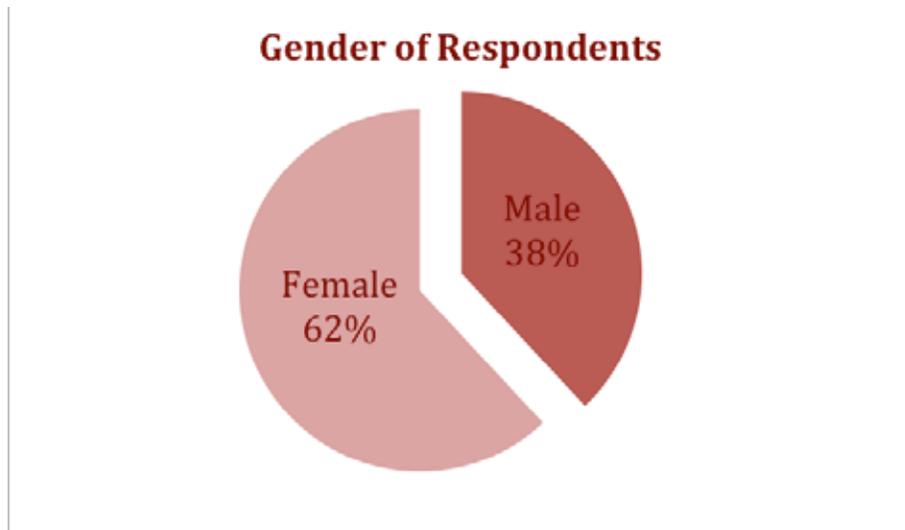
Table 4.2: Reasons for staying in Fuata Nyayo

Reasons for Living in Fuata Nyayo	Frequency	%
Proximity to work	102	37.6
Affordable rent	90	33.2
Security	29	10.7
Marriage	19	7.0
Availability of market for businesses	8	3.0
Less cases of fire	4	1.5
Availability of space	4	1.5
Other	3	1.1
Proximity to CBD	3	1.1
Born here	3	1.1
Accessibility to main road	2	0.7
Escaping floods	2	0.7
Strategic	2	0.7
Total	271	100

Demographic Profile

Most (62%) of the respondents were female. This may be attributed to the fact that data collection was done during the day, when most adult male members were at work. This also showcase that for fires that breakout during the day, the composition of first responders would be largely female. Fire disasters disrupt society with enormous damage to the human life, environment and economic resources affect women and men differently. Women are more vulnerable to the consequences of disasters because of their social role. This emphasizes the need to achieve gender equality in fire disaster reduction and integrate a gendered perspective to all policies and measures implemented in disaster management such as fires (ISDR, 2002; Ginige, et.al., 2009).

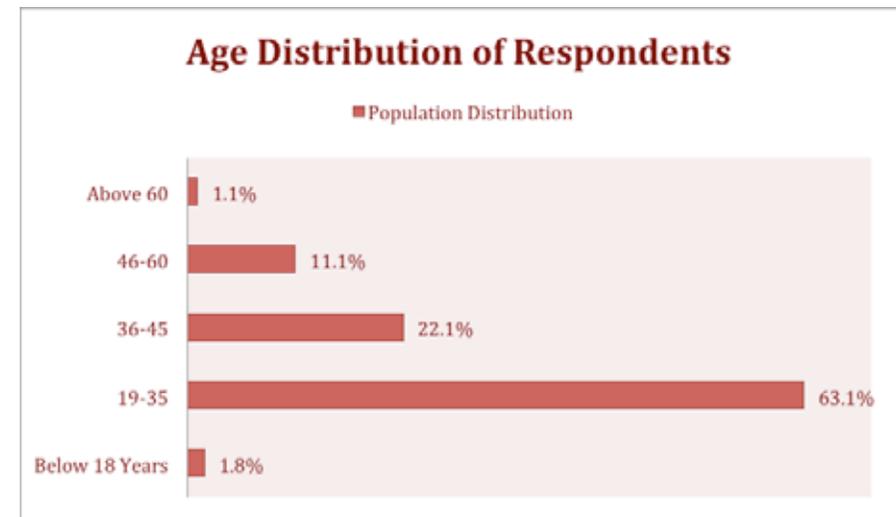
Figure 4.3: Gender of Respondents



Age:

Mukuru Fuata Nyayo has a large, young, vibrant population. The survey showcased that over two thirds of the decision making population is below 35 years old. The respondents' age distribution indicates that young age group as shown in the table below dominates the settlement. (64.9%) of the respondents were 35 years and below. Less than 1% was above 60 years old. Age dynamics is an important variable in appreciating the role distribution and allocation during emergencies where energy and quick action is required to save lives and salvage property. This is where youthfulness becomes critical. The wise counsel that comes with old age is also useful in such situations and the ratio of age distribution in the settlement is a good opportunity in addressing emergency cases such as fire.

Figure 4.4: Age of Respondents



Good fire response mechanisms require skills and ability to follow instructions and thus education analysis is key in achieving this. Literacy and education levels are critical in developing community driven fire response strategies Mukuru Fuata Nyayo has a relatively reasonable literacy levels with, over 85% of the respondents having attained some level of formal education, only 11.1% had no formal education. Out of those surveyed 39% and 35% had attained secondary and primary level of education respectively. It was also noted that 14% had attained tertiary level of education.

Flyers and posters can be used to sensitize the community with workshops and training programmes to deepen the understanding and methods of community fires response mechanisms.

Occupation

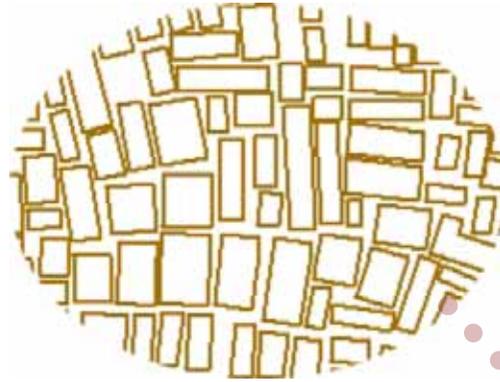
According to responders within the village at the time of the survey, majority (78%) were in informal employment, and 12% were in formal employment. Less than 10% were unemployed. It was also noted that 62% of those employed were working within the settlement while 29% worked outside the informal settlement, this may be highly attributed to the fact that the survey was conducted during the day and therefore those with day jobs out of the settlement were not taken into consideration. Working within the settlement can be an asset given the proximity of their work places and their residence that can facilitate quick response during fire incidences in the settlement.

4.2 The Built Environment (Housing and Settlement Fire Vulnerability Profile)

Settlement Layout

Informal settlements are tightly packed neighbourhoods varying in designs and typologies. Newer settlements tend to have a more organised and refined layout as residents and local leaders are more sensitive to the importance of structural order and access routes. This is characterised by structures having a coherent orientation and well-defined paths and routes. Layouts in older and less organised settlements manifest themselves in a much more organic manner. In the organic layout the structures are more tightly packed, there is no set structure orientation.

Organic areas are more prone to fire as the structures are close together therefore in the case of a fire outbreak fire easily spread out and due to the disorder in settlement design it is difficult to access areas and put out fires quickly. Mukuru Fuata nyayo A and B are both organic areas hence their susceptibility to fire

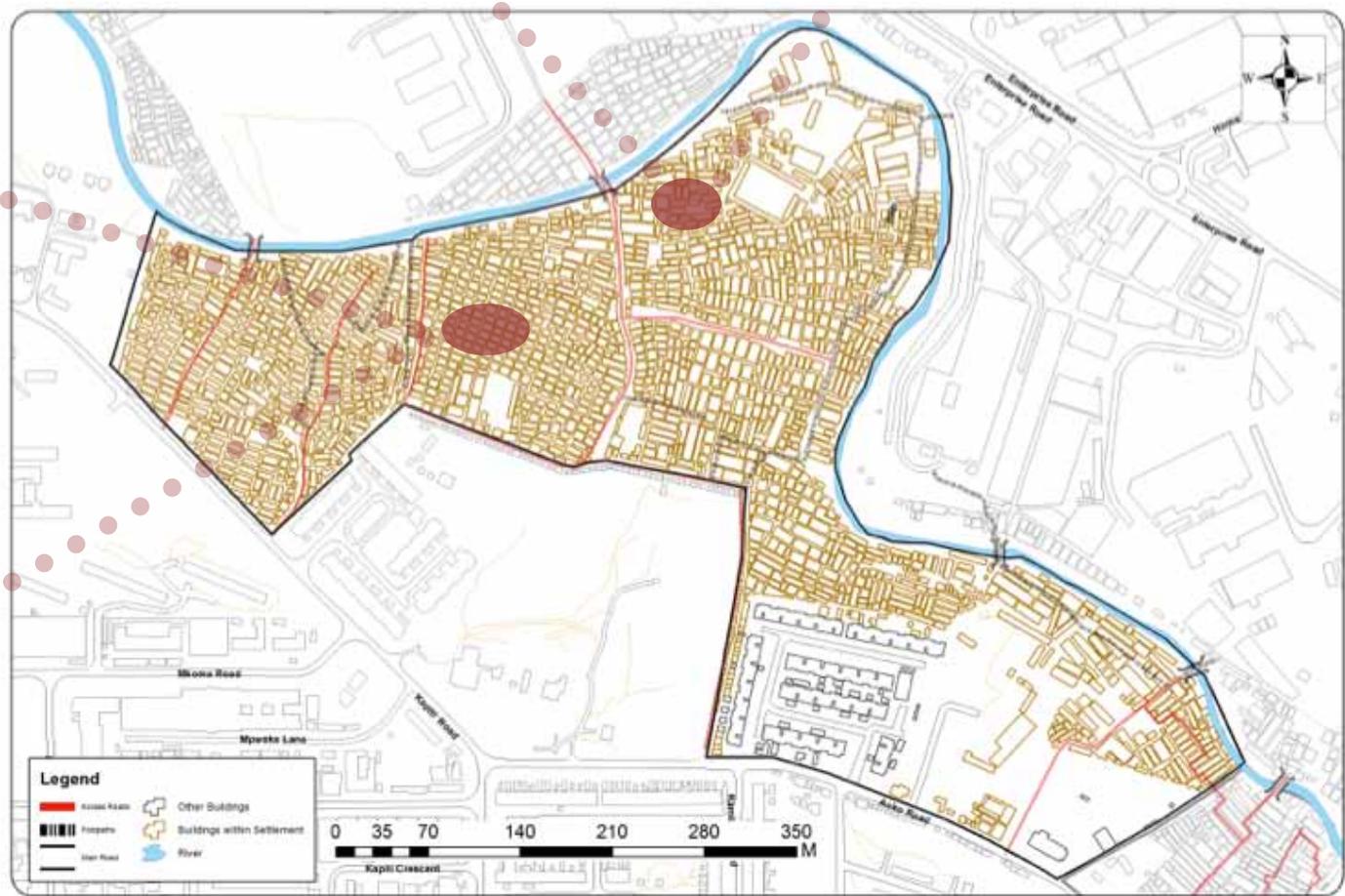
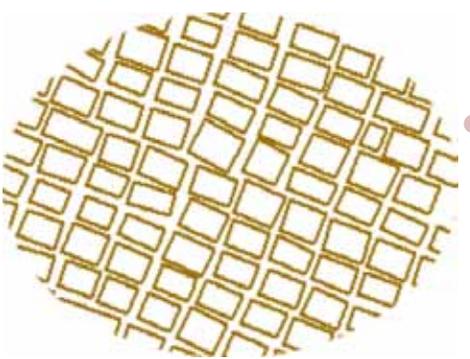


Organic Settlement Layout

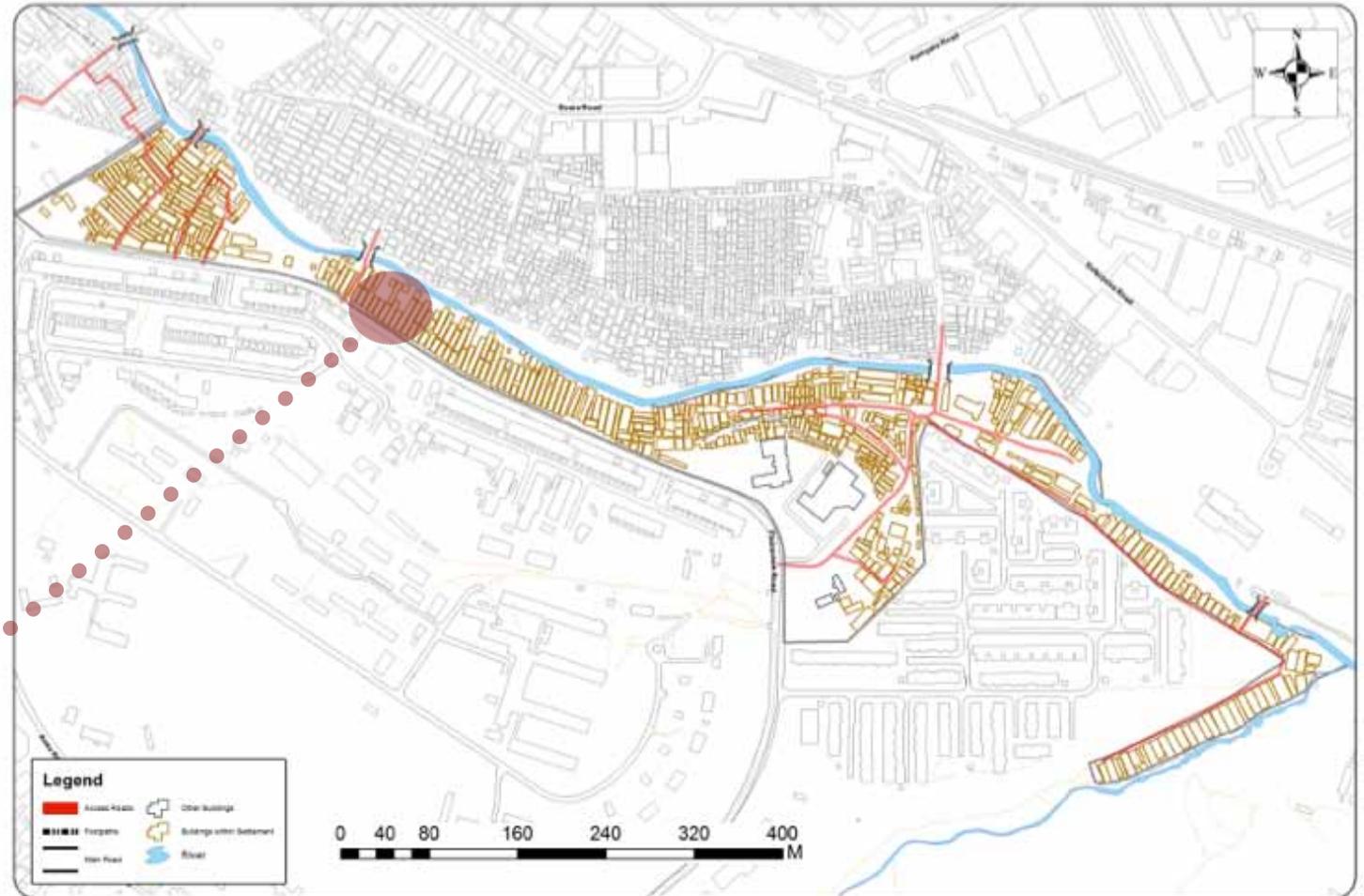
- Well defined settlement layout
- Structures have different building orientations
 - Narrow Path Ways
 - Numerous Dead ends
 - Structures tightly packed

Semi Organic Settlement Layout

- Semi defined settlement layout
- All structures have the same building orientation



Map 4.1 Structured Settlement Layout



Structured Settlement Layout
- Well defined settlement layout
- All structures have the same building orientation

Building Materials

Mukuru Fuata Nyayo’s building are largely of temporary nature with more than 80% of the structures were constructed using temporary material such as iron sheets, timber and carton. The settlement is prone to fire disasters, as some of these materials are highly flammable, the ability of iron sheets to conduct electricity also serves as a threat in the settlement. Fire disasters are a function of the type of housing including the building materials and the current user of the structure. Structures where hotels and food preparation is carried out fires are common. Similarly structures, which have carton or paper walls are more prone to fires compared to those, constructed with stone or concrete.

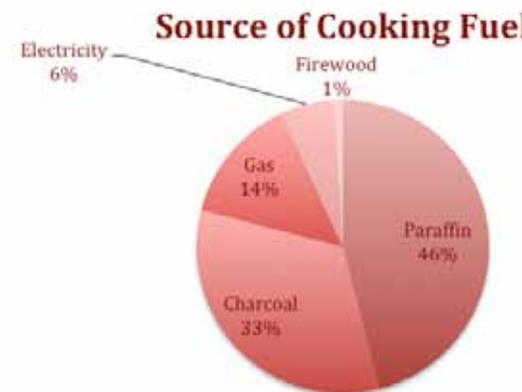
Table 4.3: Building Materials

Building Materials	Wall	Floor	Roof
Iron sheets	79.0	0	95.2
Carton	0.7	0	1.5
Stone	11.4	48.0	0.4
Brick/Concrete	4.4	41.6	1.5
Mud	1.1	9.4	0
Timber/Wood	2.6	0	1.1
Wire mesh	0.7	0	0
Total	100.0	100.0	100.0

Cooking Energy

The residents in Fuata Nyayo used various sources of energy for cooking and other domestic activities. The main source of cooking energy is the hazardous paraffin and charcoal with usage according to the survey constituting 46% and 33% respectively. Gas and electricity users were 14% and 5% respectively. Faults related to

Figure 4.5 Sources of cooking energy



cooking energy are highly associated with fire incidences in informal settlements and knowledge of variety of cooking energy sources is important in understanding the settlement’s fire vulnerability.

Tables 4.5: Areas Prone to Fire

Areas Prone to Fire	Percentage
Fuata Nyayo B	30.0%
Fuata Nyayo A	25.1%
Kayaba	14.1%
Mariguini	8.7%
Maasai village	7.0%
Kisii village	4.7%
Hazina A	1.4%
Masaai Mater	1.2%
River bank (Hazina A)	1.2%
South B	1.2%
Hazina B	0.5%
Shimo la Tewa	0.2%
Mandazi road	0.9%

4.3 Fire Dynamics (Causes and Responses)

Majority (90.9%) of the respondents noted to have experienced fire incidences at neighbourhood level as compared to (54.1%) who admitted to have experienced fire at their own household level. This shows that more than a half of the respondents had first hand experience of fire at their own household level. This may be crucial in appreciating the importance of developing fire prevention and response mechanism due to individuals past experience.

Causes of Fire

Illegal Electricity Connections:

Mukuru Fuata Nyayo is supplied by electricity through illegal ways whereby individuals and cartels have tapped into the main grid and are able to service the entire settlement through informal connections. Illegal electricity connections were cited as the main causes of fires within the settlement. 43% of the respondents observed that the “sambaza system” was to blame for many of the fires in the settlement. The electricity connections which are not professionally installed, with the materials used being hazardous as they are open wires, In the event of sparking fires easily spread in the village. At the same time the high electrical conductivity of iron sheets also increases the risk of the settlement in incidences of fire.

...faulty and illegal electrical connections using naked wires as well as carelessness in handling electrical appliances such as water heaters, was the main cause of fire breakout in the settlement
- Tony,
Mariguini Village

...though they (illegal electricity connections) don't trigger fire, they are catalyst for spread over wider area whenever fire breaks out...all structures connected to the electricity supply in the zone get affected in the process unless they get disconnected... sometimes this happens when it is too late
- Doreen Muthoni,
Fuata Nyayo A

...we use stoves, gas and electricity for cooking...we use electricity for heating and it is common for people to forget that their heaters are on when they leave the house...this will cause fire"
- Tito Muvengei,
Fuata Nyayo C village leader

...many times women will forget that the heater is on as they engage in talking with other women or shopping for the household...the heater would overheat and burn items nearby causing a fire..."
 - Cyrus Wandeto,
 Mariguini village elder

...this especially affected the men... drunkenness makes them forget they have put on stoves or candles, or at times they knock them over, resulting to fires when they make contact with curtains, clothes or mattresses
 -Jane Wambui, woman leader,
 Hazina market village

...drunkenness is also a cause of fire in the settlement, as it contributes to domestic fights and negligence and carelessness in handling stoves, gas and electrical appliances...
 -Patrick Maina

Cooking Appliances and Electronics

The careless use of kerosene stoves, gas and electricity including electrical appliances led to the frequent fires in the settlements. 30% of the residents interviewed pointed at the reckless use of electronic gadgets, while 13% maintained that cooking stoves contributed to fire incidences. Fire incidences resulting from cooking and electronics are often as a result of neglect and ignorance. Unattended cooking activities and electric appliance result to fires as there is no one to put it out at first sight.

Domestic Violence

Domestic violence was also to blame for the fires in the settlement. Occasionally during such incidences, couples result in using items such as stoves, which explode in the process, ignite nearby combustible material within the houses and causing damage to property including injuring other persons.

According to the field survey domestic violence was cited at 6% as a common causes of fire. This compares with other studies on causes of fire in slums as indicated in Gachago (2013) in her work on fire risk in Kiandutu slums in Thika.

Arson

Undocumented cases of arson have also been suspected to be a cause of fire in the settlement. Arson in informal settlements is attributed to politics, evictions and theft. Land-owners would use fires as a form of eviction strategies whereby settlements would

be set ablaze so as to render the people homeless and have them move out of the area. In some scenarios, thieves initiate fires so as to rob other homes as individuals evacuate their homes. Mr. Patrick Maina from Mariguini village narrated that in the year 2004 in Mariguini, thieves, who set a particular structure ablaze so as to get an opportunity to steal during response, caused fires in the settlement. Youths and hired goons from other places deliberately set structures on fire in-order to get an opportunity to

Table 4.5: Main Causes of Fire

Main Causes of Fire	Frequency	%
Faulty/illegal electricity connections	119	43
Careless use of electronics	82	30
Stove	37	13
Domestic violence	16	6
Gas cylinders	6	3
Leaving Children unattended	3	1
Drunkenness and use of drugs	2	1
Theft	1	1
No response	5	2
Total	271	100%

steal household items when houses were broken into to create fire breaks

4.4 Fire Response Mechanisms

The fire response mechanisms seems to be working well for the community but are not in themselves adequate in responding to various causes of fire and all magnitude of fires hence need for a

more institutionalized and effective community fire response known and adaptable to their situations and needs. 7% of the respondents noted the existence of fire fighting groups in various villages within the settlement.

Residents of Mukuru Fuata Nyayo were active participants in putting out fires within the settlement. More than 60% of those interviewed participated in fire extinguishing to save life and property. This is a reflection of good initiative and cohesive culture among the residents in helping one another during fire incidences, which is crucial in introducing community initiatives such as community fire response mechanism. Upon the outbreak of a fire, the residents played different roles to contain the situation. Some were mobilised to rescue people, raise alarm, and create firebreaks while other were tasked with maintaining security and order and outing out the fire. Gachago (2013) noted that communities continually adapt to crisis, coming up with creative solutions. They prioritize livelihoods and household assets rather than the quick fix.

During fire outbreaks individual and community roles were well defined. The first responder actions within the settlement include:

- **Raising Alarm:** women raise the alarm to the general public through shouts and cries, generally. Residents call and inform the local leaders such as the location's chief, and MCA, and the fire brigade as well. The local leaders (MCA and Chief) are useful since they have direct contact/connection with the County offices, the County Fire Department and other stakeholders such as the KRCS

- **Community Mobilisation:** The settlement leaders and elders play the role of mobilizing the community, especially mobilization of the youth in other clusters to help the affected village.
- **Evacuation and Rescue:** Announcements are made by the residents to evict children and vulnerable persons from the affected area.
- **Disconnection of electricity supply:** The youth disconnect the electricity supply as a preventative measure of the spread of fire.
- **Creating firebreaks:** Firebreaks are created by demolishing houses so as to prevent further spreading of the fire. The youth are instrumental in creating fire breaks by way of demolishing structures.
- **Fire fighting:** The women and youth fetch water from the river to put out fire as the men douse the fire. In some cases, sand is also used to put out the fire.
- **Creation of access routes for the fire brigade:** Elders also play the role of ensuring that roads are not blocked by people's property salvaged from homes, so as to provide easy access to the Fire Brigade.



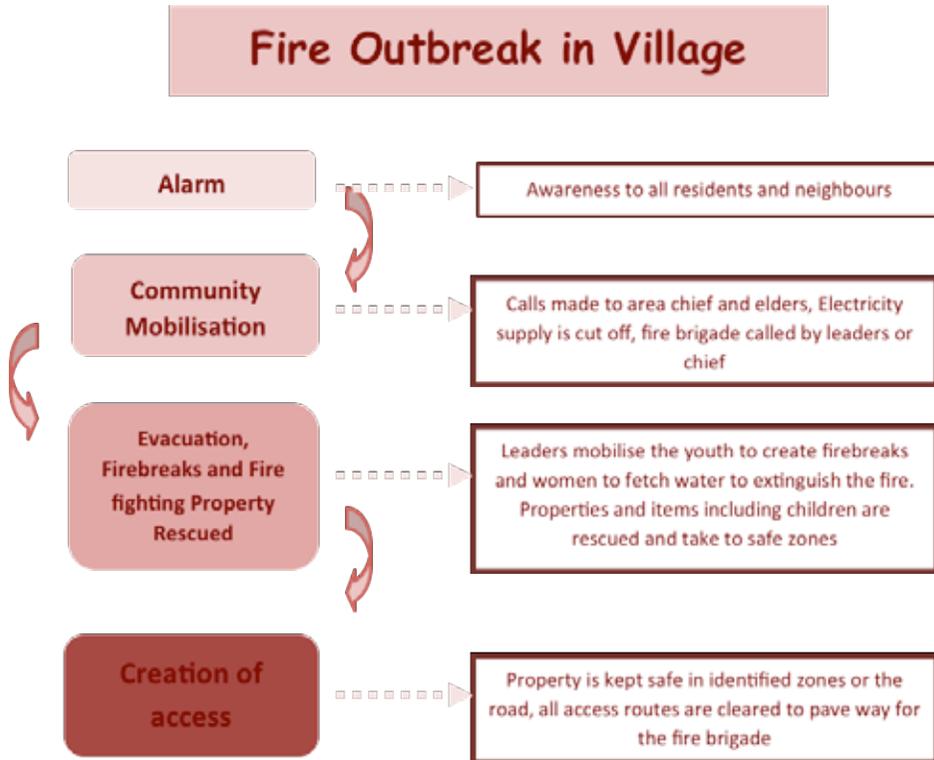
Image 4.1 Woman salvaging property, Mukuru Fuata Nyayo, 2011

Source: martinndugu.wordpress.com

“...The landlords have no say on whether their structures should be demolished during response, since prevention is paramount and should not be compromised...the landlords understand that demolishing houses is not done out of malice, but rather, as a preventive measure...”

- Village Leader

Figure 4.8: Community Response to Fire Hazard



- Nairobi Fire Brigade
- Kenya Red Cross Society
- Sonko Rescue Team
- National Youth Service
- Group 4 Security
- KK Security
- Churches
- Goal Kenya
- Police
- and other private companies.

The community are generally happy with most actors as majority (66%) noted actors effectiveness to be good, (13%) observed that the actor effectiveness was rated as fair with (14%) noting actors effectiveness to be poor. The recognition of the actors is important in developing a collaborative approach in responding to fire in a sustainable manner.

Actors and Roles

The community is the greatest actor in fighting fire within the settlement with roles defined for various members of the society. In the case of fire outbreaks external institutions and organizations are also involved with interventions and assistance ranging from putting off the fire, donation foodstuffs and household items, offering medical services, crowd control, accommodation and provision of fire sensors among others. The external actors include

Satisfaction levels



Figure 4.9 Perception of Effectiveness of Actors

Table 4.7 Actor Roles in Fire Response

Internal Actor	Roles
Youth	<ul style="list-style-type: none"> Demolishing structures so as to prevent further spreading of fire, and also to make it easier to access the affected structure and pour water. Ferrying water to the other youth on site. Evacuation and salvaging of property Breaking electricity connections. Evacuation and rescue. Salvaging of property.
Women	<ul style="list-style-type: none"> Raising fire alarms by wailing and shouts Ferrying water from homesteads and water points to the youth on site. Evacuating children and vulnerable members of the community. Giving out home appliances that are useful in putting out the fire, such as basins and buckets to the youth. Rescuing and administering first aid to the injured. Safeguarding the salvaged property from homesteads. <p>Headcount around the village to make sure that everyone is accounted for</p>
Men	<ul style="list-style-type: none"> Mobilizing the youths to the site to help put out the fire. Engaging in putting out the fire alongside the youth. Ferrying home appliances Ensuring the safety of salvaged home appliances and safety. Calling or informing the fire brigade service

Figure 4.10 Community perception on effectiveness of fire response



Community Fire Response Effectiveness

Currently the community has a structure and system in fire fighting which is relatively effective, 64% of the respondents colluded to the effectiveness of community fire response in Mukuru Fuata Nyayo. The settlement has been successful in putting out fires prior to the arrival of the fire brigade. Then again, only 36% of the respondents

have some sort of training in fire fighting.

The community's perception on the Fire Brigade's response time highlights a sense of scepticism on the ability of the fire brigade to respond in adequate time as 60% of those surveyed felt claimed that it takes the fire brigade more than an hour to respond to fire. A response of over an hour signifies the importance to capacitate the residents in responding to fire more effectively through training and equipment.

Perception on Fire Response

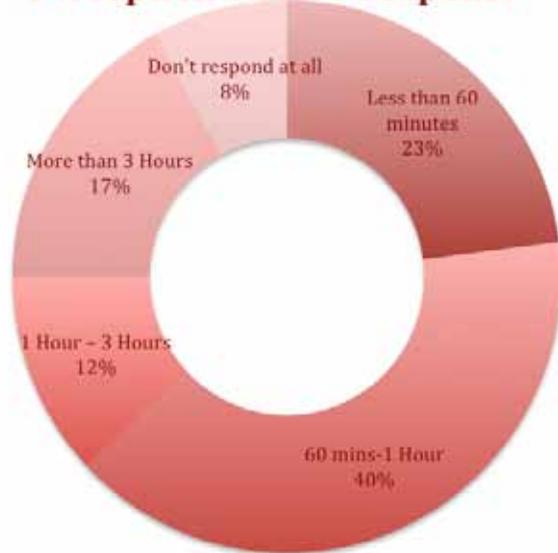


Figure 4.11: Perception of Fire Brigade Response Time

Type of Assistance from External Actors

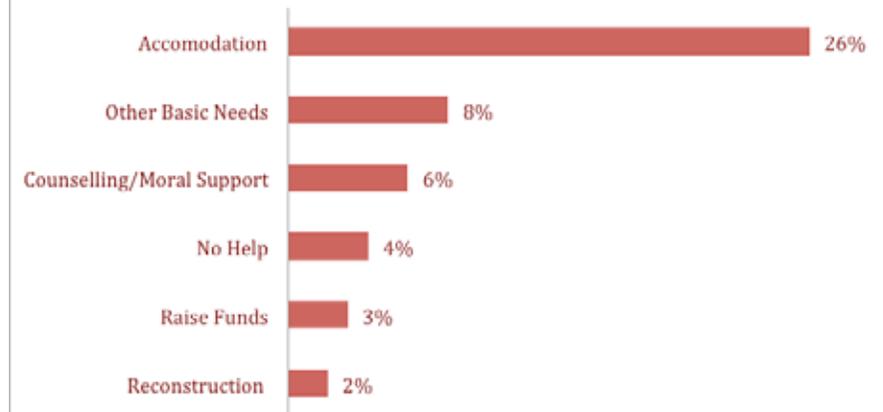


Figure 4.12 Community Support for Fire Victims

4.5 Challenges faced by the community during fire response

According to the household survey, lack of fire fighting equipment (33.5%) was noted as a major factor hindering fire fighting in the settlement. Others were listed as narrow roads which makes it hard to access the settlement during fire outbreak and inadequate water among others

1. Congestions and Poor Access Into the Settlement: The spatial arrangement of structures into congested clusters as well as encroachment of these structures into the access roads, making them too narrow for the fire engine to access in the event of fire, as well as for community members' access to the affected house(s) at times.

2. Inadequate water supply. There is inadequate water to extinguish fires during outbreaks. This forces the community to on sewage water from the open drainage channels and the dirty Ngong River. The use of contaminated water sources exposes the community to more risks and has negative health implications to the community.

3. Lack of tools and Basic Training in fire fighting: The residents are not adequately equipped with skills to combat fires whenever they occur. The residents have been forced to use simple tools and experience to control fires. The KRCS has conducted demonstrations, training and capacity building but this is not sufficient. According to the community responses, there has been initiatives to train the community on fire preparedness, though it has been faced with challenges. Reportedly, such initiatives have been operated without involvement of the entire community, and have also been hampered by corruption allegations, thus they have been inefficient. According to the women, fighting the fire in the settlement has called for experience, and not training. Additionally, the lack of equipment, leads to the use of unconventional means, which bring about injuries.

4. Slow or no response Failure of the Fire Brigade Service: As mentioned in the focus group discussions, the community maintained that the brigade was slow to respond to the fire alarms, often arriving late when fire had been put out, or spread over a wide area. At times, they have arrived with no water in the fire engine, to the wrath of the villagers.

5. Uncooperative Landlords: This comes in during the demolishing of structures in the event of fire, so as to prevent spread into unaffected homesteads. Some landlords were reluctant to have their structures demolished to create firebreaks, making it hard to stop the fire spread.

6. Unconventional and Illegal Electricity Connections: This is rampant in the settlement, due to existence of cartels that make a living out of these connections. According to the community, these connections facilitate the quick spread of fire during an outbreak. Illegal connections made it risky to extinguish fires using water and other tools.

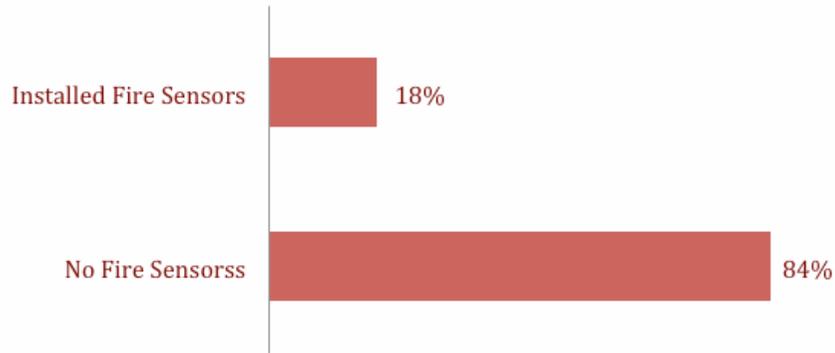
7. Theft and Loss of Property: Some of the residents took advantage of fires to steal from others. This discourages others from supporting the fire fighting activities as they protect their property from thugs. There were reports of theft of house appliances when evacuating and salvaging of property in the event of fire.

“...I have not seen the volunteers and fire fighters you talk about...”

Doreen Muthoni, A leader from Fuata Nyayo A village

Community Fire Mitigation Measures

Availability of Fire Sensors



Majority (85.2%) of the respondents noted that the community do not have any fire fighting equipment or facility. Or the few who pointed out that they have some fighting equipment listed buckets (13.3%), blankets and water tanks each at (.7%), fire extinguisher and water pipes accounting for (0.4%) respectively.

Various measures were taken by the community to reduce spread of fire, evacuation of people and salvaging of property. In order to reduce spread of fire, the community demolished houses and structures near the fire area (52.7%), pouring of water (27.2%) and electricity disconnection (5.7%). In order to evacuate people they focused on raising of alarm (29.4%), housing demolition (12.5%) and using created exit route (9.1%).

5. Up Scaling Community Fire Response

5.1 Response to Fires: The Changing Landscape

Initially the community members used to watch the fire raze down everything in the village, instead of engaging in fire fighting- according to Cyrus Wandeto from Mariguini village. There is a sense of oneness and the residents have a collective approach to respond to fire outbreaks and the first response is to collectively put out the fire before it spreads. In earlier years, the residents simply stayed put and watched properties get destroyed and then wait for landlords to rebuild the houses. He gave out an earlier experience in 1988-89 when a fire broke out in Commercial Village, where people salvaged property and stood by watching the fire burn everything in the village.

Today, the tale is different, residents are quick to mobilise and have the situation under control. The residents suggested that it would be a good idea to have a container of fire fighting equipment in the open spaces within the settlement, and that the people would collectively take care of the equipment, though there should be one person tasked with the responsibility of taking day to day care of the equipment.

5.2 Factors to Consider for Up Scaling Mechanisms

Community discussions during the FGDs, household surveys and key informant interviews to understand the views and needs of the residents to fight fire based on their own opinion. Upon analysis of their views and synthesis with the already on going community response mechanisms to fire it was considered that the most effective means would be on improving the current systems would be capacitating the community through training, facilitation and providing equipment and tools.

For longevity of the mechanisms and promotion of widespread use, there are certain factors are to be considered in the design of both soft and hard elements:

- **User Friendly:** The mechanisms should be simple enough to be employed and replicated in the informal settlement. The

What Works... Settlements Pros

- **Community mobilization and unity:** Where the community collectively responds to fire outbreaks.
- **Accrued Experience:** Past experience with fire fighting / local knowledge. Over time, The community has gathered experience and taught them effective ways to combat fires. The inter-village cooperation and collective approach helps in quick response and raising alerts
- **Attitude Change:** Tackling fires first as opposed to rescuing their individual property.

Young Voices
<ul style="list-style-type: none"> • <i>Have adequate water supply and water sources in all villages. Suggestions for water tanks as well as sinking of boreholes, since the settlement sits on a swampy area.</i> • <i>Train youth on fire preparedness and handling of fire, and certificates should be awarded.</i> • <i>Provide fire fighting equipment and protective gear such as gumboots and helmets.</i> • <i>Proper electricity installation and connections. Illegal electricity connections and use of naked wires contribute to further spread of fire, and endangered the lives of fire fighters.</i> • <i>Campaigns against alcohol abuse in the settlement, since alcohol is a contributor to domestic fights and negligence when handling cooking appliances.</i>
Female Voices
<ol style="list-style-type: none"> 1. <i>Fire education should involve the whole community and should not be selective as before. The women complained that there has never been any formal fire training and that the youth were hindered to go for any training due to corruption.</i> 2. <i>Fire Education and training should also include first aid.</i> 3. <i>Enhance inter-village cooperation, so as to promote solidarity and unity during any disasters that may befall the community, such as fire.</i> 4. <i>Have a fire centre within the settlement, fully equipped with fire fighting appliances, mostly water supply and fetching equipment such as light buckets, water pipes and equipment to be used for demolishing structures.</i> 5. <i>Provide fire extinguishers at 2-3 plot intervals, to help put out the fire during early stages of outbreak, and that people should be taught how to use them. The cluster leaders would then be tasked with role of ensuring their safety.</i> 6. <i>Identify space within Fuata Nyayo settlement to put up water tanks that would supply water for fire fighting purposes.</i> 7. <i>Campaign against community ills such as drunkenness and domestic fights, which contribute to fire outbreaks.</i> 8. <i>Regulate landlords during the construction of structure, to ensure wide access roads are maintained</i>
Male Voices
<ol style="list-style-type: none"> 1. <i>Sites have been identified where fire fighting stations and equipment can be located</i> 2. <i>Have dedicated telephone lines for emergency use and response</i> 3. <i>Train the youth on fire fighting and rescue operations. This will make the villages self sufficient and able to mitigate against fire outbreaks</i> 4. <i>Maintain wide road reserves to facilitate the fire brigade movement as well as other rescue efforts</i>

less complex the systems are the better as individuals can easily catch on and train others.

- **Ease of maintenance and sustenance:** Mechanisms to be used should be simple in maintenance and sustenance and designed to minimize vandalisms and cases of neglect. Complex systems and tools tend to be abandoned more often than simpler ones

- **Integration into daily use:** The most effective systems in informal settlements are those that are assimilated into daily use. This promotes the security equipment and improvement of skills. Tools that are not incorporated in daily use end up being forgotten/lost, vandalized etc.

- **Cost effectiveness:** The area of implementation is a low-income neighbourhood, therefore the affordability of the tools is paramount in cases where the community has to contribute. In instances where tools and processes are to be funded

Table 5.1 Community Voices on how to respond to fire

by external actors the rudiment of cost is still put into consideration as the tools, both soft and hard, should be cheap for better massive implementation.

- **Promotion of livelihood:** Including an aspect of development of livelihood and economic empowerment of individuals increases the lifetime of the tools as the added benefits act as an incentive to the community members to maintain and sustain the tools and equipment.

Community fire response mechanisms were classified into two broad categories

- **Soft Elements:** Response mechanism that are centred around people these are attributed more to skills behavior, roles, and soft infrastructure.

- **Hard Elements:** Response mechanism that involve

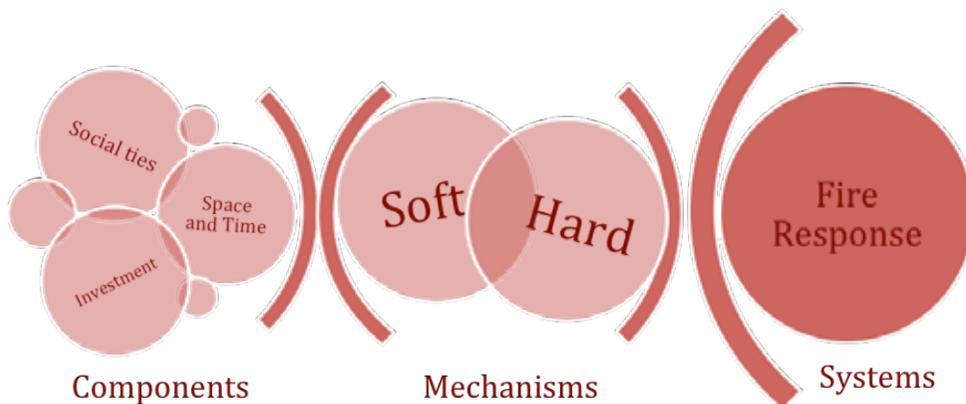


Figure 5.1 The system of community fire response mechanisms

infrastructure, physical elements

The mechanisms work with the social ties both within the settlement and with stakeholders outside, using finance and other non-monetary contributions over time and utilising various spaces at different levels and scopes.

5.4 Community Fire Response Mechanisms: Soft Elements

Training

Training involves building capacity of the community by sensitization of the entire population and also by selective training of key individuals so as to improve the response to fire. The study showcased that over half the population has only lived in Mukuru Fuata Nyayo for less than five years implying that if the trend is to continue, within half a decade, over 50% of the population would be lacking on the skills imparted during sensitization. Therefore, heavy capacity building and sensitization would need to take place every 3 years.

Training categories

- **General Public:** Training on general response to fire such as types of fires and the methods of extinguishing them, defining roles of various community members, methods of search and rescue.
- **First responder training:** Create a network of trained first responders. These should preferably be service providers working within the settlement. High risk areas to have more responders
- **School children:** Basic fire fighting skills should be taught to school going children as they are easy to mobilise and teach

during school sessions and through co curricular activities such as the Kenya Scouts. School going children can be taught how to raise the alarm in case of a fire through the meaning of different forms of whistleblowing. The pupils can then be trainers within their households during fire incidents.

First Responder team

A group of resident youth from the settlement from different villages to be identified and trained as first responders. Villages with greater fire incidence should have a larger number of respondents. They would have the responsibility of fighting fire in the event of an outbreak within the settlement. The team is to be manage and maintain fire fighting assets within the settlement. The team should be well known and easily identifiable by the general public. The first responder team should have ties to local leadership and other stakeholders that are connected to fire response.

Alert System

The alert system is currently based on shouts and wails and phone calls. This is suitable for mobilization but not for coordination. A method of communication that reaches masses at once this could be through a portable public address system and bulk messaging system. A public address system is suitable for crowd control and directing, whereby bulk messaging is more suited as a warning and notification system.

River Clean Up

The river bordering the settlement is an ideal source of water for fire fighting and also the most practical but the pollution has rendered it close to impossible to use with people only opting for it in the most dire situations. Rehabilitation and revitalisation of the river should be considered in the long run for aesthetic and functional purposes. This would be done through combined effort of the national and county government, development agencies, CBO's, NGO's and the corporate world in the form of CSR and marketing.

5.5 Community Fire Response Mechanism: Hard Elements

Fire fighting boxes –Street Level

Neighbourhood level boxes with basic fire fighting equipment

Twitter

Twitter is an inexpensive tool that may be employed for mass communication. In this specific case, residents would sign up on twitter for mobile, they will then receive the messages from the people they follow, directly on their phone without having to log into the internet. This model is currently in use in Lanet Umoja, Nakuru North District whereby the local chief, Francis Kariuki got the locals to sign up for twitter for mobile which he then uses as a tool for community policing-neighbourhood watch & crime-reporting activities.

such as whistles, fire extinguishers, demolition tools etc. The type of equipment in the boxes would depend on the hierarchy of the street, the safety and security of the area and the presence of a custodian

Integration of current utilities:

Current utilities such as communal toilets and water points should be integrated into the system of fire fighting. These public purpose areas should house basic fire fighting equipment but at a larger scale to that of the street boxes as security should be relatively be improved in these zones. The service providers should ideally be rained in the importance of fighting fire and the methods that can be used with regard to the service they provide.

Improve electricity supply

The current informal form of electricity in the settlement is hazardous as it is a cause of fire and also a catalyst of the same. Electricity service provision should be formalized and taken Kenya Power to officially begin supplying electricity. Current wiring may also be changed and use of improved material such as insulated wires to be used.

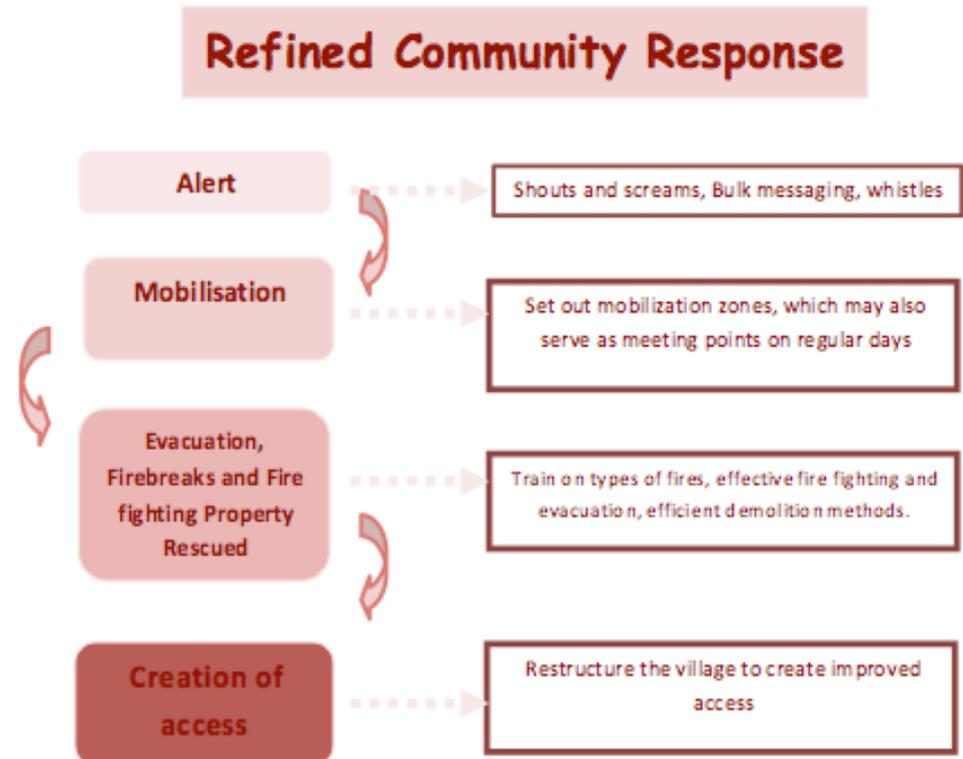
Redesign Structures

Structures to be built in ways that can easily be demolished and rebuilt. The structures could be designed and built in a way that they can easily be demolished when need be, in instances of fire outbreaks to form a fire break. The ease of demolishing will reduce

the time the youth take when bringing down house in fires and also the decrease damages and losses that occur. This and the ease of rebuilding will incentivize individuals to take down their structures whenever there is a fire with minimal hesitation.

Restructure settlement layout

The close proximity of houses to one another and the organic nature of settlement layout hasten the spread of fire and reduces accessibility. The settlement requires some sort of development



control by the local leaders where any new structures should follow a set guidelines such as the building line and plot coverage that are tailored to the informal settlements.

be owned and managed by the community and be incorporated into daily use so as to make them vibrant. The fire stations are to be spread out across the village with priority being to fire prone areas.

Community Fire Response Station:

These are fire stations based within the informal settlement but integrate it into the larger system. It would utilize the network within the settlement and link it up to that of the city fire stations

Activity	Current Response	Notes	Improvement
Alert	Shouts/ Screams	Effective for alert but not coordination and mobilisation	Bulk texting Whistling
	Telephone calls to MCAs, Local Leaders	Accessible to only a select few	
Mobilisation	Fire assembly points	All open spaces are fire assembly points	Increase Fire Assembly points
Evacuation	Basic evacuation of trapped	Untrained evacuation with minimal first aid skills	Trained recovery and rescue
Fire breaking	Demolition of houses	Ad hoc demolition of homes with certain landlords refusing to have structures demolished	Structure design for quicker demolition with minimal damage
			Improve demolition method
Fire fighting	Fire fighting with water and sand	Basic fire fighting with available tools and equipment	Training to improve fire Fighting
			Train a team of first responders
			Provide fire fighting equipment
			Provide a fire response stations
Salvaging Property	Salvaging property	Basic recovery of property	Improve protection of saved property
Accessibility	- Demolition of Houses	Happens after fire therefore not fully effective in stopping the spread of fire	- Redesigned Settlement Layout
			Development Control
			Create through way access routes

Table 5.3 Up scaling Community Fire Response Mechanism

5.6 Community Fire Response Station

The idea of a “fire station” according to Patrick Maina from Mariguini Village sets the framework for developing interventions that can be managed by the community. The location of stations would be identified, safeguarded and maintained by the community. Potential spaces would include open spaces, community halls, school and church compounds.

An overwhelming majority (98.5%) supported the idea of locating a community fire response centre in the Mukuru Fuata Nyayo. They noted that this will improve the fire fighting mechanism by equipping the community with necessary equipment and reducing response time taken to respond to fire incidences in the community. According to Kreimer et al, (2003) sometimes, initiatives started at a local level do well such that the government may pick them up and apply them elsewhere.

Various locations and sites for the fire response centre were given, with Hazina Chief’s camp getting highest approval, followed by KANU grounds, Mariguini chief’s camp and Maasai CDF. Upon further spatial suitability analysis in providing preferred alternatives and appropriate design of the proposed community fire station, based on planning, architectural and technical standards and benchmarks.

Design Issues/Challenges and Strategies:

1. Location/distribution of firefighting stations/facilities

Challenge: There is potential imbalance in location of firefighting stations due to a combination of factors including suitability of sites, availability of land, and local socio-political affluence. This tends to compromise social equity where access to fire safety is concerned.

Design Strategy: Rationalize the aspect of location and capacities of facilities using planning guidelines and site suitability analysis; negotiate these with the communities with a view of harmonizing the pragmatic possibilities with the ideal requirements

2. Poor accessibility of the settlement hence of the firefighting stations/facilities

Challenge: the low accessibility posed by irregular settlement patterns is a big fire risk; the predominantly organic form (morphology) with uneven street sizes broken street profiles compromises the free flow of services and rapid movement necessary during evacuation, especially for the vulnerable like women and children.

Design Strategy: There need to map and establish the popular routes of movement along which the firefighting facilities should be located. These routes shall be upgraded mainly by expansion to open up the settlement and anchor the network for fire safety. The immediate surroundings of such thoroughfares may only be used for temporary activities.

3. Poor access to Water and mode of supply for firefighting/Distance to water source

Challenge: most water points are informal with inadequate capacity/reserves to serve firefighting activities.

Design Strategy: Establish strategic locations where firefighting facilities shall be integrated with good water supply; need for augmentation of the connection to the trunk system.

4. Access to Land

Challenge: the general scarcity of land in informal coupled with size requirements and security of tenure pose a challenge in both location and design of firefighting facilities.

Design Strategy: There is need to negotiate with local leadership for acquisition and securing of viable sites. The design should explore integrating the firefighting facilities with land used for public/communal purposes (e.g local administration, schools) as long as that is functionally viable.

5. Lack of technical capacity

Challenge: the inadequacies among the community with respect to handling of equipment and rescue/evacuation of people, especially children, and property compromises fire safety.

Design Strategy: There is need for technical training to include use of equipment and space navigation in times of rapid response. The network of facilities and circulation need to be fully understood by the community at large but more so the community fire wardens/scouts. Participatory design, including validation process will also

serve as sensitization in this regard.

6. Security

Challenge: Vandalism poses real threat to availability and continued existence of firefighting facilities. Both the vandals and the indifferent parties that condone acts of vandalism contribute to the magnitude of the problem.

Design Strategy: sensitization of the communities on the need to safeguard firefighting facilities as a communal responsibility key to success. In addition both passive and active design interventions are recommended. Passive design will apply where the location and orientation of facilities will benefit from natural human surveillance to achieve of defensible spaces. Active design will make use of mechanical devices such as alarm systems, fencing, and CCTVs as deterrents of vandalism.

7. Planning and design space standards

Challenge: Land in informal settlements is scarce and of generally low quality makes the observation and adherence to space standards technically difficult. Thus the formal guidelines prescribed in manuals and handbooks are often unachievable. This may especially pose a challenge where development approval of the facilities by the local authority shall be required.

Design Strategy: It is useful to explore appropriate standards through benchmarking and case studies. The co-location and integration of firefighting facilities with other functions holding ample land is a

useful strategy to explore. Negotiations with the local authorities should also be initiated to explore appropriate standards to be applied in the design of facilities.

8. Management and Ownership of Fire Stations

Challenge: Ownership and maintenance of the fire station is a source of conflict and without adequate management may result end up being neglected and/or vandalized. The rapid change in residency in the informal settlement may create vacuums as to who manages the centre when a member leaves abruptly

Design Strategy: The fire station is to be owned by the community and the funding agency but is to be managed by a youth group based within the settlement. The youth group is to be vetted and if suitable, trained in fire fighting and would therefore form the network of first responders. Profits generated from activities with regard to equipment and assets of the fire response station being used for daily activities shall be shared between the youth group and the upkeep costs of the fire response station

9. Typology of stations

Challenge: Fires occurring in different forms and scale, coupled with the varying size and qualities of available sites, underscores that a single typology of station will suffice.

Design Strategy: Different types of stations shall be provided cater for different levels of services and to suit the size and qualities of their accommodating sites. A total of 6 typologies have been proposed in line with the foregoing.

10. Delivery model

Challenge: The success of this fire safety strategy will depend on how well the community is prepared for its operationalization. General acceptability and capacity issues remain the most critical of prerequisite action.

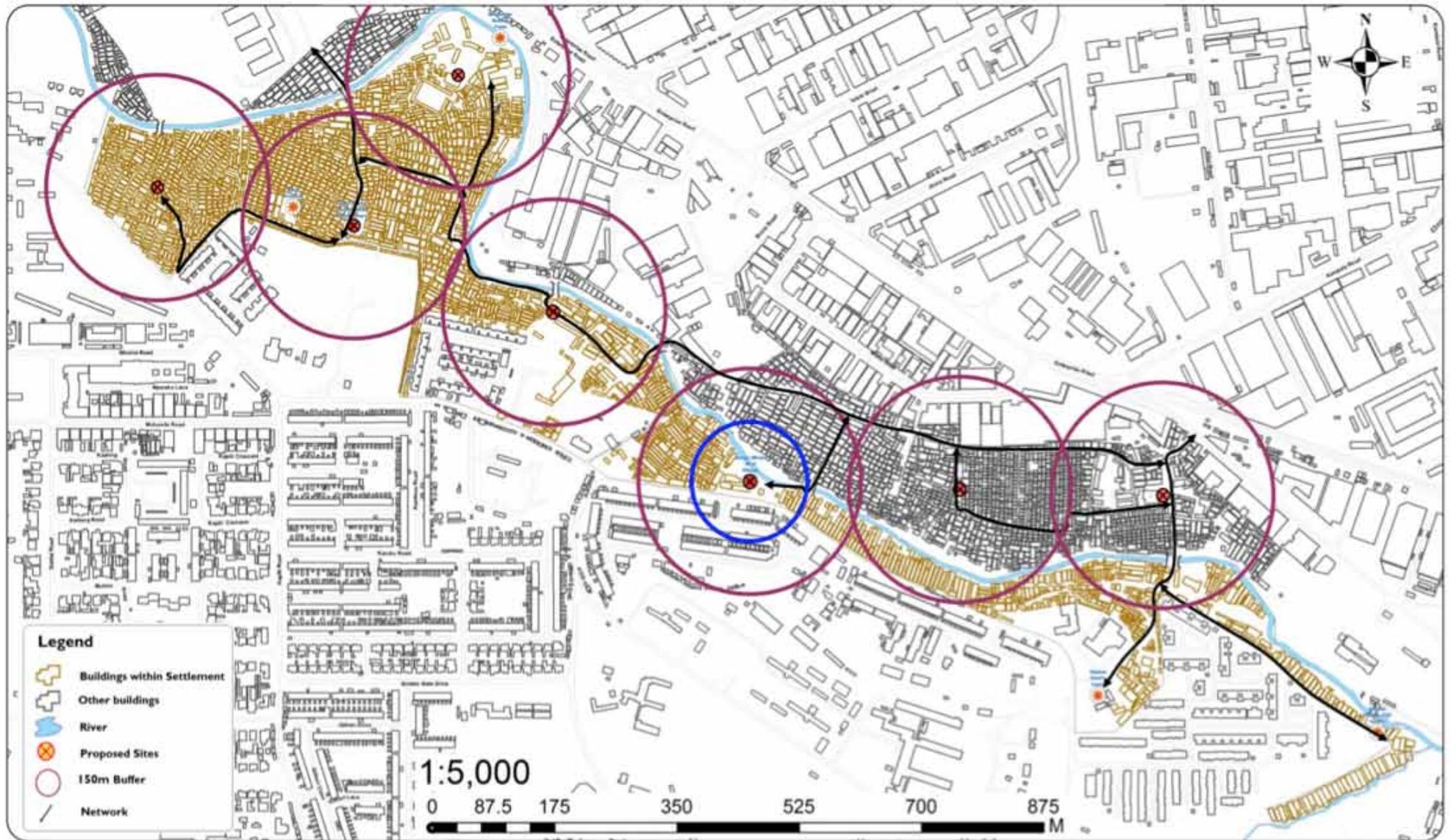
Design Strategy: The design adopted a participatory approach to generate the concepts, which added value to the aspect of acceptability. The implementation of the strategy shall be integrated with community structures in terms of operational institutional structures including CBOs, schools, churches and local administration. Sensitization, capacity building, and skills transfer shall happen through these.

11. Risk posed by irregular/informal electricity connections and user behaviours

Challenge: There are numerous illegal electricity connections that are reticulated at substandard levels; these often lead to electric faults that result into electrically-generated fires. This phenomenon coupled with the irregular nature of the settlement adds to the burden of fires in the informal settlements. A number of fires have also been caused by malpractices of electricity users such as overloading of power points.

Design Strategy: There is need to improve the electricity reticulation system as well as upgrade the quality of installations to reduce the risk of fires. There is also need for sensitization programmes targeting user behavior so that certain malpractices can be eradicated.

PROPOSED FIRE RESPONSE STATIONS



Map 5.1: Ideal Fire Station Location (150m buffer)

Proposed Settlement Interventions

The success of the firefighting strategy will depend on realization of several actions at the settlement level:

1. **Rationalization of location of facilities with respect to population distribution and vulnerability to fires** – it is hoped that such facilities should benefit the majority, hence their placement in more dense areas is likely to enhance equity service provision. However, absolute numbers may not make logical sense without linking this with vulnerability to fires of the various locations. This was used to qualify the final distribution of stations. In terms of layout, 2 location scenarios were explored: the first was based on a catchment of 6000 persons (1800) and a radius of about 100 metres. The second considered a catchment of about 9000 persons (2700 households) and a radius of about 150 metres. The second one was deemed optimal catchment and range for the proposed facilities. This strategy has articulated both pragmatic (based on available sites) and ideal (based on adoptive standards) for the same.
2. **Connectivity of facilities** – there should be effort to link the firefighting facilities to each other for synergistic purposes. This should be complemented with provision of alternative access to each facility but also the widening of strategic paths/routes of movement to enhance accessibility.
3. **Hierarchic service** – The firefighting services shall be structured to follow a hierarchy in terms of capacity; thus below the firefighting shall be smaller installations at strategic locations

integrated with facilities like ablution blocks.

4. **Integration with community services** – for a proactive approach, there shall be deliberate effort to integrate the stations with other community functions such as retail and community services. This is meant to serve as value addition to the firefighting facilities that will motivate the community to safeguard them out of the additional value.
5. **Safety** – the designs shall provide both passive and active safety measures; passive design will include natural surveillance while the active approach shall entail the use of deterrents and installations of lighting and alarm systems. This will safeguard the facilities against various criminal malpractices including vandalism.
6. **Integration with settlement management structures** – the design of this project shall be integrated with settlement management structures for implementation purposes. This will encourage ownership of the project as an aspect of sustainability.

Proposed Fire Station Typologies

Various propositions have been put forward in line with intended model of service as well as site suitability. It is worth noting, however, that these are not mutually exclusive and do share similarities in design features.

1. **Option I: Stand-alone Station** – placed at distinct locations with variety of firefighting tools; easy access, operation, and security surveillance are key to the success and effectiveness of this model



Image 5.2: Model 1- Stand alone station- Ground plus 1



Image 5.3: Model I - Stand Alone Fire Station. Ground Floor only

2. **Option II: Mixed use Station** – This integrates firefighting function with business and community use such as a water kiosk, a shop, service provision etc. for proactive ownership and management.



Image 5.4: Option II -Mixed Use Station

4. **Option III: The Water Tower** – This includes an elevated tank with provision for clip-on ladder and connection for hosepipe for use during firefighting. This tower will also be installed with radio and alarm equipment to link the local fire safety network with the urban fire system, thus serving a central role. The model may be integrated with a borehole for non-potable uses.



Image 5.5: Option III - Water tower Station



Image 5.6: Option V- Large Ground Integrated Centre

5. **Option IV: Mini Fire Engines-** Popularly known as Sky-go, can carry small capacity water reservoirs to put out relatively smaller fires; wagons can be detachable to allow for alternative uses of the tricycles within reasonable radius. They may also be linked to option 1

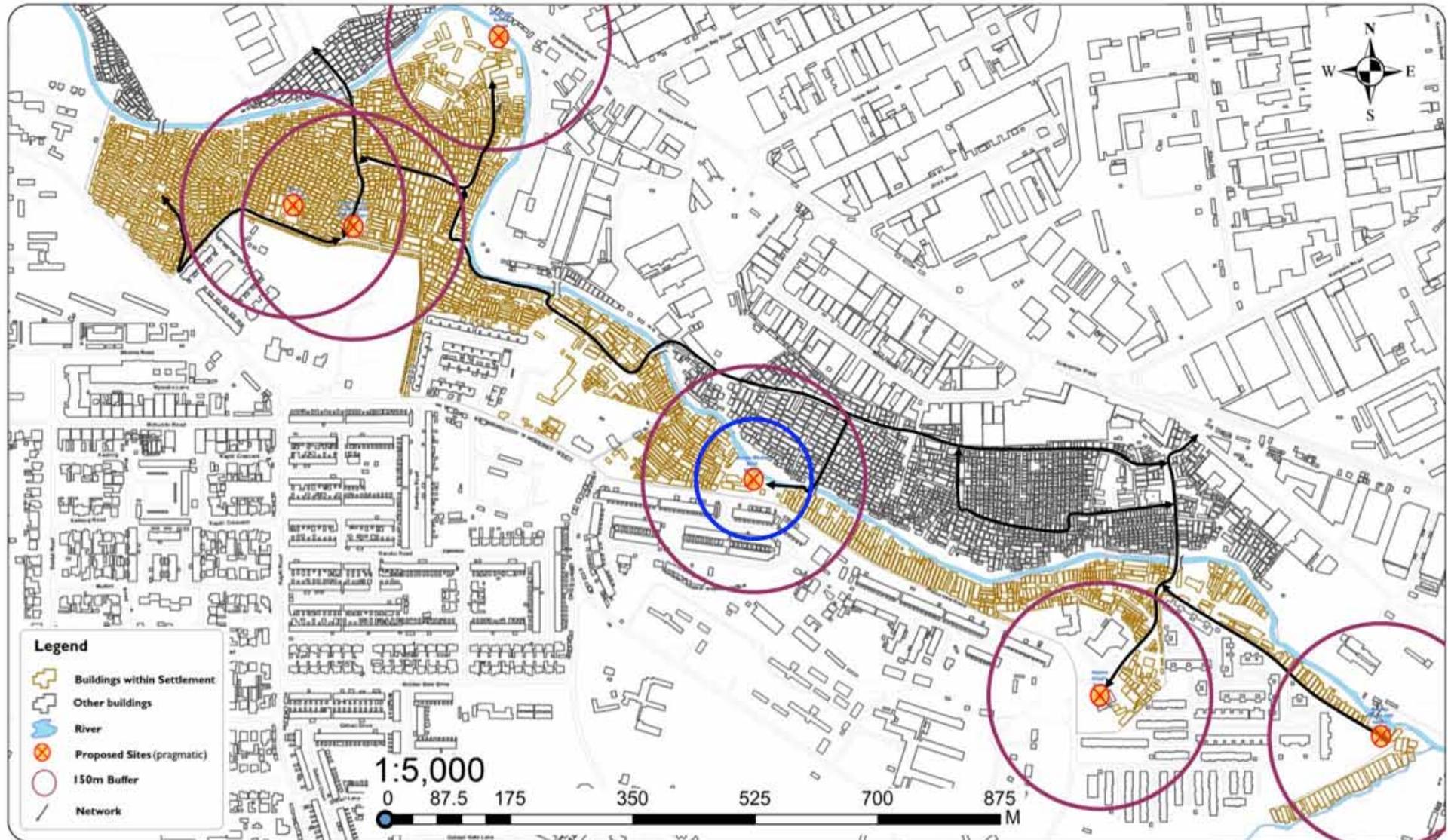
6. **Option V: Large Ground Integrated Station:** This mode includes a container with firefighting equipment, as well as provision for rescue point (–evacuation, fire assembly point, first aid and post-trauma counseling). Consider accommodation of the extra services using a tented set-up when such become necessary.

7. **Option VI: Facility Integrated station:** integrated with churches, schools etc. without interfering with the core functions of these facilities. The facility houses the response station that would undertake a more dormant nature than in the other models

Table 5.4: Location Suitability Evaluation Matrix

Site Suitability Evaluation Matrix						
Site Name (Tick Appropriately)	Bright Star School	KANU Grounds	Fuata Nyayo (near transformer)	Maasai CDF	Kisii Village/ Songa Mbele	Hazina Chief's Camp
Space Type	Playground	Playground	Commercial	Open space/utility	Open Space	Public purpose/open space
Location: Co-ordinates;	E: 0259679 N: 9855766	E: 0259383 N: 9855526	E: 0259466 N: 9855766	E: 0260037 N: 9855136	E: 0260534 N: 9854832	E: 0260934 N: 9854780
Size	3/4 acre	30x40m	19x22m	8x8m	20x50m	30x50m
Accessibility	Poor	Good	Good	Fair	Fair	Good
Ownership & Managemen	Private	Public	Public	Community Group	Community Group	Public
Services – water and electricity	Available	Available	Available	No Electricity	Available	Available
Strengths	Secure and Large size	Large size of land/secure/public owned	Public owned/	Potential for retrofitting/secure	Secure/Large size	Large Size and secure/public owned
Weaknesses	Not easily accessible	Prone to flooding	Prone to flooding	Size constraints	Not easily accessible	Compatibility of use
Suitable Facility Type (ref. Option I – Option VI)	III, IV, VI	II, III, IV, V	III, IV	I, IV, VI	IV, VI	I, IV, V
SCORE 1 Not Suitable; 3 Fairly Suitable; 5 Highly Suitable	3	5	2	3	4	4

PRAGMATIC PROPOSED FIRE RESPONSE STATIONS



Map 5.2: Pragmatic Proposed Sites of Community fire stations

INTEGRATION AND MANAGEMENT OF THE COMMUNITY FIRE RESPONSE STATIONS

Options	Integration with community Fire Response System	Impact on livelihoods	Management
Stand-alone container	Will provide ease of access to fire- fighting equipment, safe storage of equipment	Community members may be employed to safeguard it	Under the care of community/village leaders
Mixed use station	Will provide ease of access to fire-fighting equipment, Provide space for other important community facilities e.g. health, cyber café, grocery	There will be space for potential commercial activities NB. The space can be leased to women and youth from the settlement. The proceeds from lease of space can be used to support other community activities	Potentially under the care of youth groups or women groups operating in the settlement Ownership by community is expected to be strong because they own and manage the commercial enterprise within the fire response centre
Water Tower	It will complement sources of water to be used during fire fighting Can be used to supplement the fire engine water supply	Availability of water hence less loss of property in the event of a fire break Community members may be employed to safeguard it Availability of mobile fire response system (Sky-Go)	Under the care of community/village leaders The youth will operate the Sky-Go
Facility Integrated station	Will provide ease of access to fire- fighting equipment, safe storage of equipment It will give an opportunity to the facility users e.g. children or church members to interact and appreciate fire response systems	It will secure the host facility in the event of a fire	The facility managers in collaboration with the village leaders

Table 5.5: Integration and Management of the Community Fire Response Station

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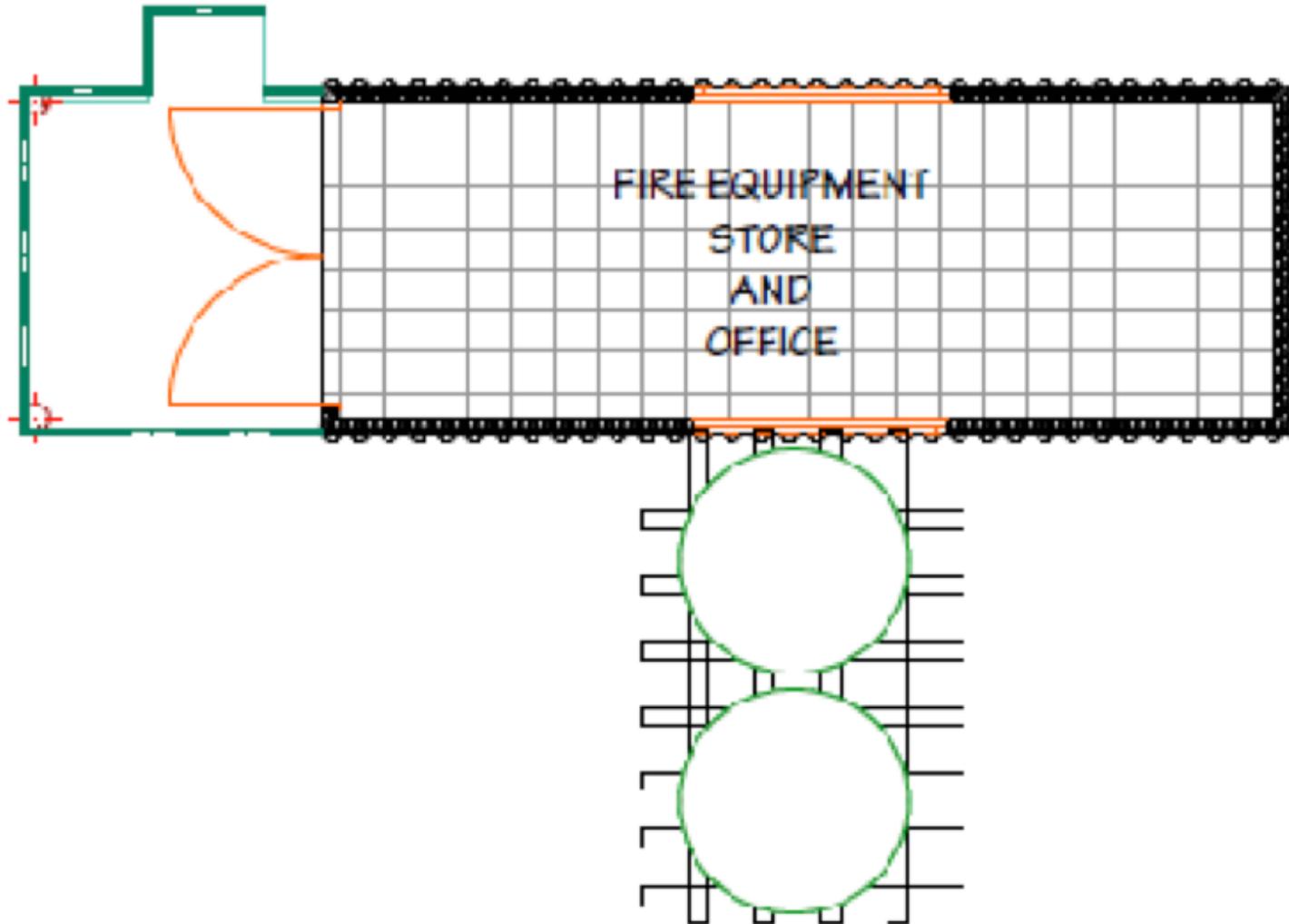
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approaches?

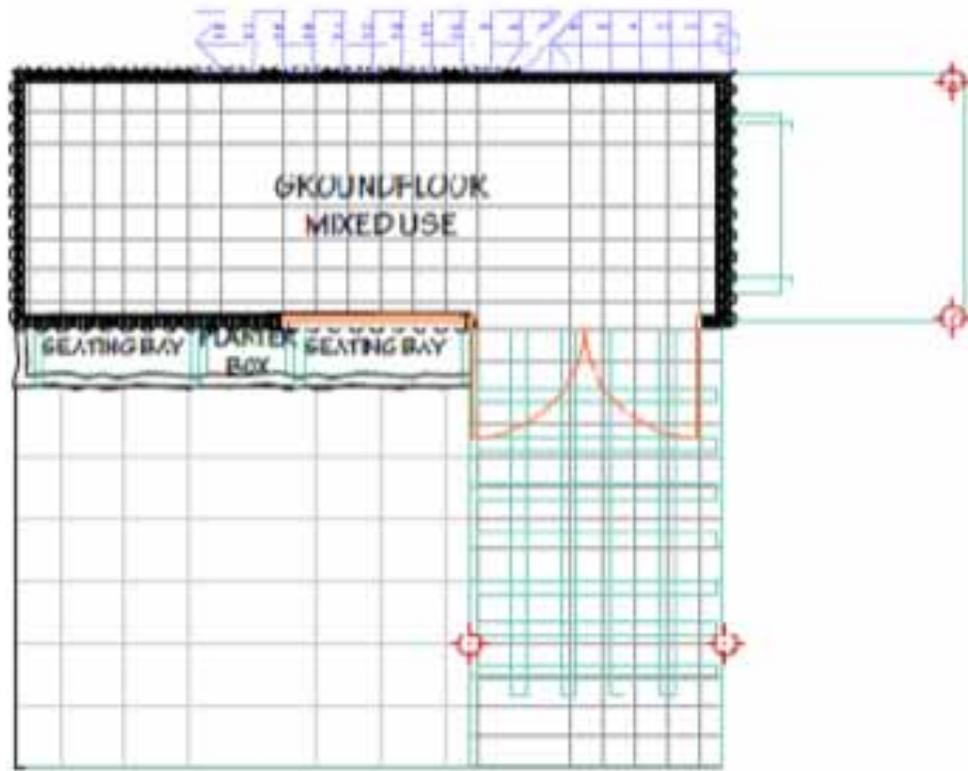
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Annex

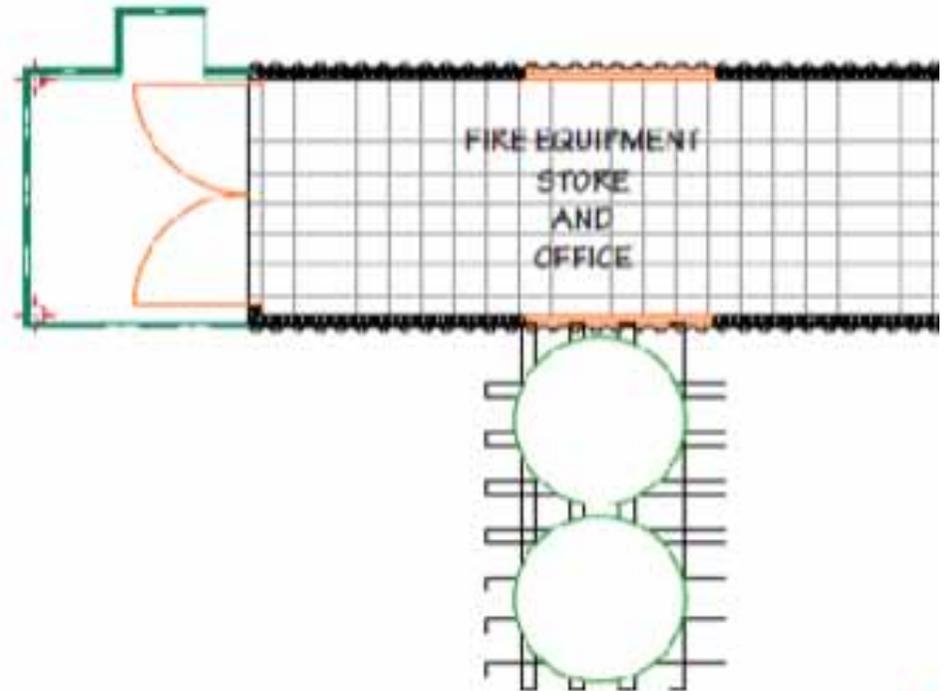
Option I - Stand Alone Fire Station Plan (Ground Only)



Option II- Mixed Use Station Plan A

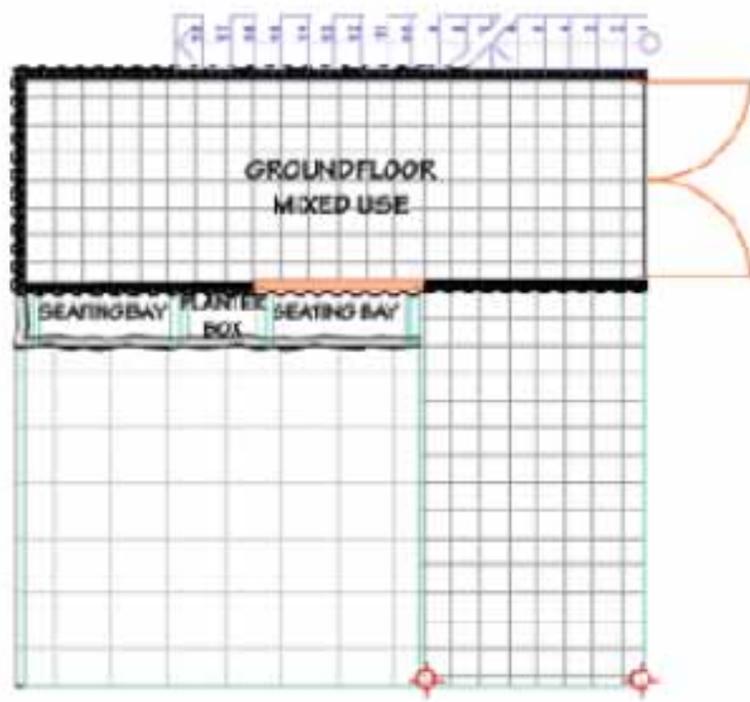


GROUND FLOOR PLAN

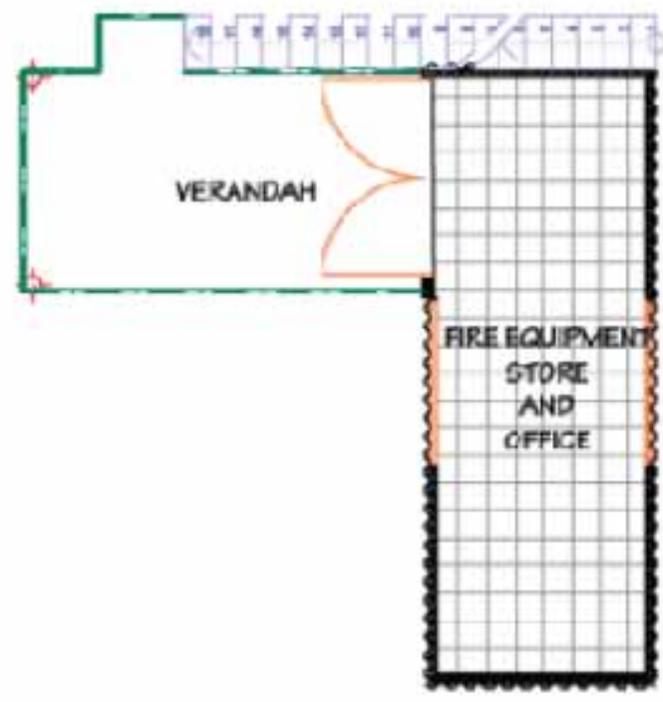


UPPER FLOOR PLAN

Option II- Mixed Use Station Plan B

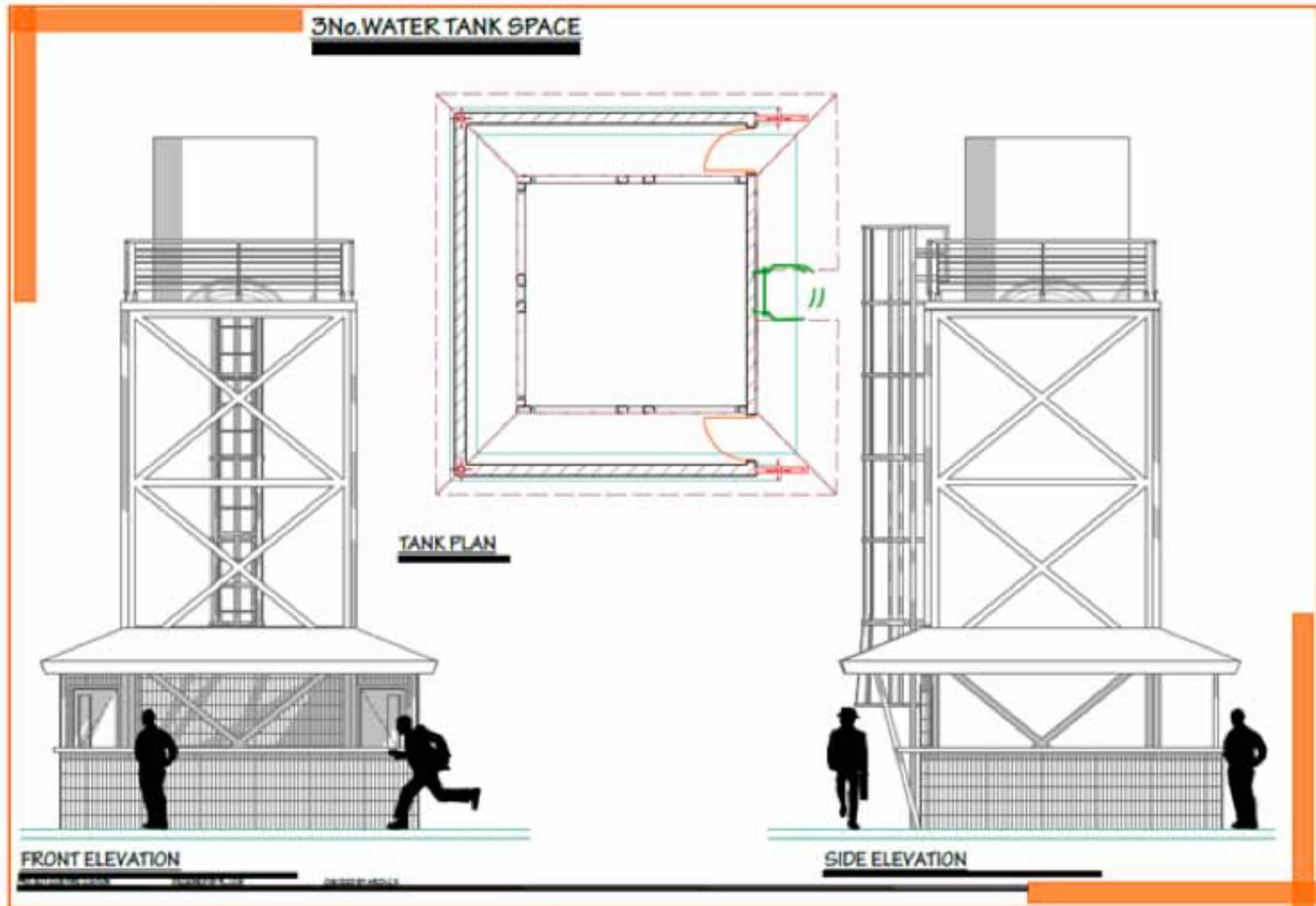


GROUND FLOOR PLAN

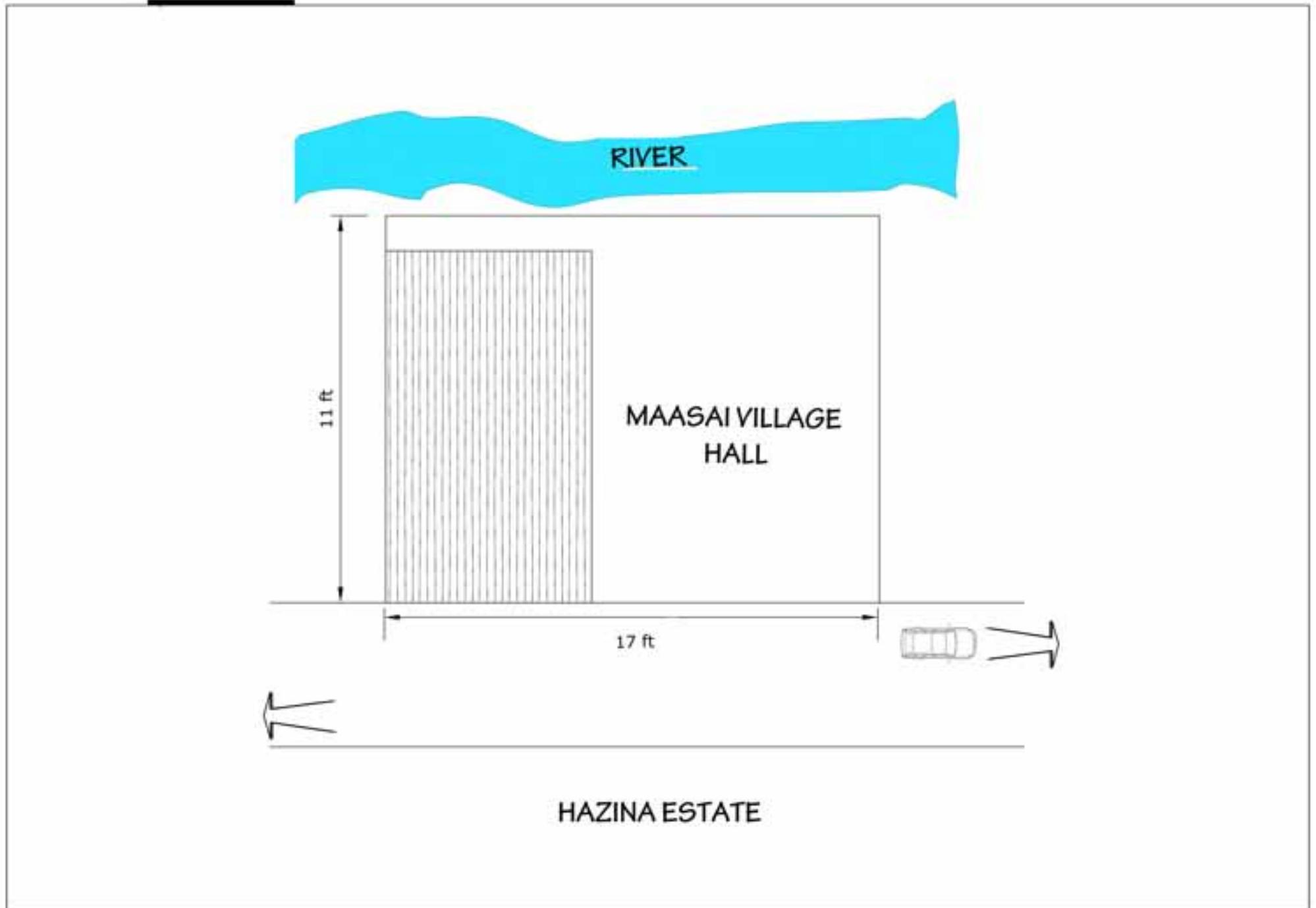


UPPER FLOOR PLAN

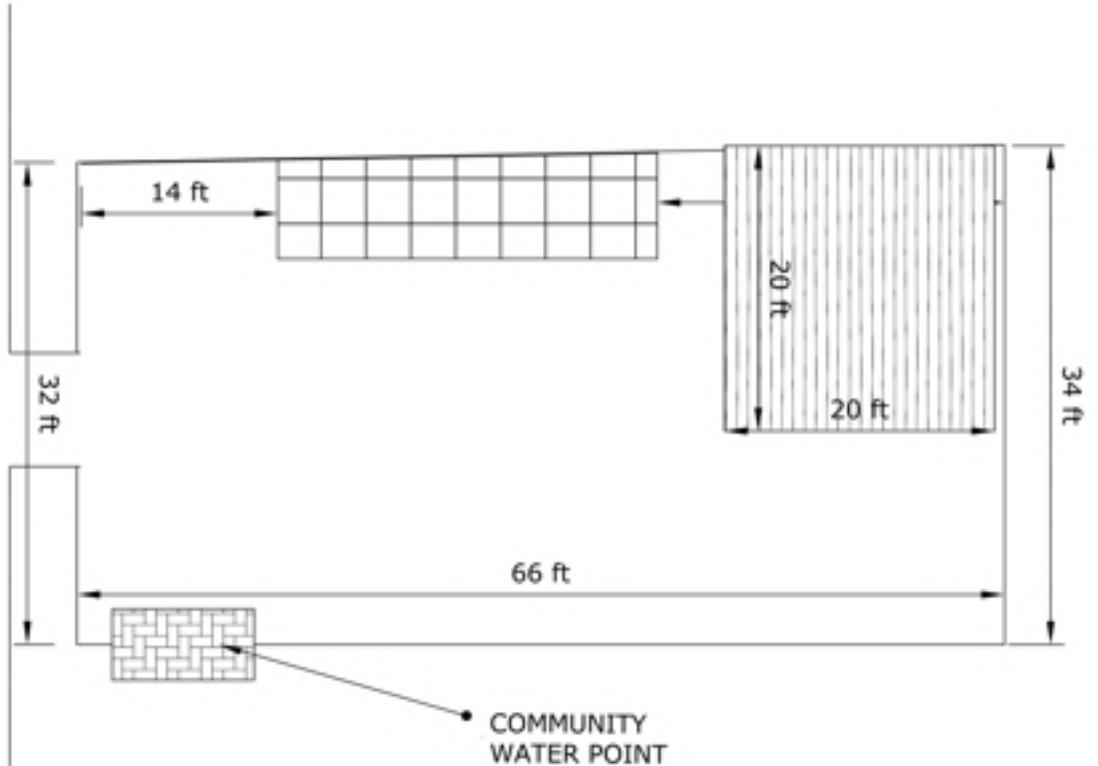
Option III- Water Tower Station Plan and Elevation



Masaai Village CDF Toilet Site Plan



KANU Grounds Site Plan



LEGEND

-  STRUCTURES
-  FIRE STATION

Bright Star School Site Plan

