

**Historical Fire Trends and Municipal
Fire Response Research in Mukuru
Fuata Nyayo and across the city of
Nairobi, Kenya**



Acknowledgment

This report was presented to the Kenya Red Cross Society on December 15th, 2015 by Spatial Collective Limited. The research and report were supported by the Kenya Red Cross Society (KRCS) and the American Red Cross Society. The authors would like to acknowledge the following organizations for providing data for this research: the Emergency Operations Centre at the KRCS; the Monitoring & Evaluation Unit at the KRCS; the Nairobi Fire Brigade; the Makadara District Commissioner's office; and the National Disaster Operations Centre. Finally, thanks to the following organizations for participating in interviews: the KRCS EOC & Nairobi branch; the Nairobi Fire Brigade; the National Disaster Operations Centre; the National Youth Service; the Kenya Defence Forces; members of the Community Based Disaster Response Team; community members from affected areas; G4S Fire Services; KK Security Fire Services; and Radar Security, Fire Security.



Table of Contents

A	Introduction and Research Questions	5
B	Summary of Findings	7
C	Methodology and data used	9
D	Objective 1: Historical fire incidents, including location, causes and impacts in Mukuru Fuata Nyayo	14
E	Objective 2: Existing municipal response mechanisms, including opportunities and challenges	21
F	Objective 3: Linkages between the municipal and community-based fire response mechanism	31
G	Objective 4: How socio-economic characteristics relate to fire outbreaks and response	35
H	Conclusions & Recommendations	37

List of maps

Map 1: Number of fires reported by the EOC and the Fire Department since 2010 in Mukuru Fuata Nyayo	18
Map 2: Access roads to Mukuru Fuata Nyayo informal settlement	27
Map 3: Estimated buffer zone (red) outside of the reach of fire trucks in Mukuru Fuata Nyayo	28
Map 4: Emergency vehicles access roads and estimated at-risk areas out of reach of emergency vehicle	29

List of acronyms

CBD	Central Business District
CBDRT	Community-Based Disaster Response Team
CSR	Corporate Social Responsibility
DC	District Commissioner
EOC	Emergency Operations Centre
FFF	Firefighters Forum
KRCS	Kenya Red Cross Society
MCI	Mass Casualty Incident
NCC	Nairobi City County
NDMU	National Disaster Management Unit
NDOC	National Disaster Operations Centre
NYS	National Youth Service
UNDP	United Nations Development Programme
URR	Urban Risk Reduction project



Introduction to Research Questions

A. Introduction and Research Questions

In 2008, the Kenya Red Cross Society (KRCS) began an Urban Risk Reduction (URR) project in seven of Nairobi's informal settlements. Since that time, the KRCS and its partners - both government, private sector, and non-governmental organizations - have been working to build the capacity of local communities to respond to risks and disasters posed by living in the geographically and socially marginalized areas of Nairobi. A recent addition to this work is a focus on "emerging technologies for emerging needs" - with a recognition that technological innovation offers advances in communication and information sharing that were previously inaccessible to many communities around the world and can be used to reduce the impact of disasters.

To support this work, Spatial Collective Ltd was contracted by the KRCS to conduct research into Historical Fire Trends & Municipal Fire Response, with a focus on Mukuru Fuata Nyayo (the project site) in Nairobi, Kenya. The assignment involved collecting and analyzing primary and secondary data on historical fires, which was defined in consultation between Spatial Collective and the KRCS team as twenty-years (1995-2015). Spatial Collective reviewed data with this aim. The research was carried out between October 1st and December 15th, 2015.

The overall aim of the report is to support advocacy for increased focus on disaster risk management as part of fire response. As outlined in the Terms of References, the objectives of this assignment were to:

1. To research and document historical fire incidents, including location, causes and impact in Mukuru Fuata Nyayo
2. To research and document existing municipal response mechanisms, as well as current opportunities and challenges related to fire response in Mukuru Fuata Nyayo and the broader Nairobi;
3. To study the linkages between the municipal and community-based fire response mechanisms;
4. To comment on how socio-economic characteristics (demographics, community development & social cohesion) relate to fire outbreaks and response;





Summary of Findings

B. Summary of Findings

Mukuru is an informal settlement located in Nairobi's industrial area. Mukuru is comprised of 3 main areas: Mukuru kwa Njenga, Mukuru kwa Ruben and Kayaba. The informal area's location provides both opportunities and risks: economic opportunities for residents because of its proximity to jobs in factories, but risks due to the location of homes next to hazardous material in the same industrial facilities. The risks in Mukuru's villages are clear: fires lead to destruction of property and loss of life. Many of these incidents, and the impact on the livelihoods and wellbeing of local residents, are not recorded in sufficient detail to detect trends and design solutions.

The findings of this study are summarized here and are based on a review and analysis of secondary and primary data research, combined with interviews with the relevant stakeholders (see methodology and data sources in section C):

- I. Historical fires are difficult to report against because responders do not (or have not been) collecting data systematically and the records at the Fire Brigade and the District Commissioner's office are not digitized. Information on causes and impacts of fires in the informal settlements are not collected by the Fire Brigade due to lack of resources for information management.
- II. According to the KRCS Emergency Operations Centre (EOC), there were 558 documented fires in Nairobi for the period of January 2011 to October 2015. Of the 558 fires, 250 or 44.8% were in slum areas, including 42 in Mukuru (7.5% of all fires in Nairobi); 265 were in other areas around Nairobi.
- III. Residents are the first responders, and often the only responders, to fire outbreaks. According to the Fire Brigade data from the project site, 56% of fires were put out by the public.
- IV. Government responders are under-resourced and are centralized in Nairobi's Central Business District. Response times are extremely long (sometimes several hours).
- V. Coordination in fire mitigation in informal settlements, especially Mukuru Fuata Nyayo, is often initiated by the Kenya Red Cross Society.
- VI. Inadequate mobilization of resources, lack of access roads and structure density are three of the most cited challenges in fire response in the informal settlements.
- VII. The main causes of fires in Mukuru Fuata Nyayo and across the informal settlements in Nairobi are electrical faults, cooking stoves and arson.



Methodology and data used

C. Methodology and data used

To adequately answer the questions put forth by the Kenya Red Cross Society, Spatial Collective used a multi-step approach. To research and document historical fire occurrences, causes and impact in the targeted pilot project site, including geo-referencing past outbreaks, we began by collecting all the relevant statistical and geospatial data for the project site. In order to determine the location of past fires, we cross checked the geographic data provided in the datasets by service providers (see list below). Where we could not reference the specific fire location, we stored the location and reviewed it for further inspection through consultations with the Nairobi branch disaster response team, as well as the Community Based Disaster Response Team (CBDRT) and other community members in Mukuru.

To achieve the second and third objectives - to research and document existing municipal and community response mechanisms related to fire response in Mukuru and the broader Nairobi context - Spatial Collective collected and reviewed existing literature, newspaper articles and archives dealing with fire response mechanisms in Nairobi and in the project site. We also conducted key informant interviews with relevant stakeholders, including:

For the analysis, we conducted both statistical and GIS analysis of both primary and secondary data sources; primary data source collection through interviews and GPS data collection; and carried out GIS map creation and analysis.

- a Duty Officer and Instructor at the Fire Brigade;
- officers at the National Disaster Operations Centre (NDOC);
- an officer from the National Youth Service;
- a colonel from the Kenya Defence Forces;
- members of the KRCS disaster response team and the Nairobi branch;
- members of the CBDRT;
- community members from affected areas;
- G4S Fire Services;
- KK Security Fire Services;
- Radar Security, Fire Security;

In addition to the literature review and interviews, we conducted interviews around several past fire occurrences in order to further our understanding into fire response mechanisms, and specifically to learn about the communication channels, and stakeholders involved in response. Through triangulating these three data sources, we aimed to understand the role and capacities of responders, needs of the community members, and challenges and opportunities as related to current fire response mechanisms.

Finally, we conducted both statistical and GIS analysis of both primary and secondary data sources; primary data source collection through interviews and GPS data collection; and carried out GIS map creation and analysis.

We collected and analysed the following secondary data:

- Kenya Red Cross Emergency Operations Centre (EOC) Incident data, which covers a period of January 2011 to October 2015. This dataset is maintained by the EOC officers. The implementation of the digital system began in 2011; before that time, data were not collected and stored systematically.
- Nairobi Fire Brigade Incident data. The Nairobi Fire Brigade keeps paper-based records in two separate locations: an incident Occurrence Book (OB) and a paper-file with supporting documentation. The Fire Brigade staff was only able to retrieve information from January 2010 to October 2015 in Mukuru Fuata Nyayo due to the time-consuming manual process of retrieving information and the lack of resources dedicated to information management at the Fire Brigade.
- Data from the Makadara District Commissioner's (DC) office were available from 2007 to 2013. After 2013, Mukuru was transferred to Starehe sub-county and we were not able to access the records for Starehe in the time available for this study. Information from communities is recorded by the local government officials: Assistant Chiefs, Chiefs and the District Officer; this is done in the form of weekly incident reports, submitted as letter to the DC's office. The letter records events in the community, such as accidents, crimes, deaths and fires. There is no standard format from the letter and it is in hard-copy, in a narrative format. Retrieving the information from the incident reports requires a manual review of all of the letters from the time period in question.
- The National Disaster Operations Center (NDOC) provided us with nationwide data on fires from January 2015 to date. In the past, they maintained an online database through a project in collaboration with the United Nations Development Programme (UNDP), however the data from 2008-2014 is no longer accessible to NDOC. In January 2015, the NDOC data officers began storing their information in excel based on the type of incident (fire, drought, etc.).
- Data from the National Archives. A review of the national archive data revealed that the information was of little value for locating historical fire records. This is because the information is all stored on microfilm and a manual review of microfilm records was outside of the scope of this research.
- The Nation Media Archives. The Nation Media Archives is a digitized archival library of all of the Daily Nation publications from 1959-to-date. In the project site, the archives only contained information on seven major fires (from 1959-to-date) and was therefore not an adequate source of information.
- OpenStreetMap (OSM) data was retrieved from the OSM database and used as a baselayer for the analysis, including features such as roads, building extraction, water points, health centres, toilets, etc.



We also included the following primary data sets:

- KRCS baseline survey of a sample households in the project site for the Fire Sensor for Safer Urban Communities Project, conducted by the KRCS Monitoring and Evaluation Unit and published September 2015;
- Key informant interviews, conducted between September and December 2015;
- Mapping access roads into Mukuru, carried out in collaboration with the KRCS Nairobi Branch Disaster Response team in November 2015.

Challenges and limitations of available data and approach

- We were not able to validate the findings through observation of the operations of the Fire Brigade, police, ambulance and the CBDRT because of the timeframe for the research, as well as other ongoing research activities. This will be mitigated by the review and synthesis of the findings from all of the complementary consultancies which will be carried out by the KRCS.
- Data sharing between fire response agencies was challenging, especially in case of the government agencies. We have identified a need for a broader discussion between responders on the importance of data sharing and the development of data sharing guidelines or protocols. Kenya Red Cross Society is auxiliary to government and has strong relationships for response with the government agency responsible for disaster management, including fires, however agreements that govern data-sharing are not clear at the moment.
- Spatial Collective and KRCS attempted to retrieve data for the past 20 years, however our review revealed limited systematic data collection by any of the fire response agencies. The Fire Brigade and the DC's office still keep paper-based records and the Fire Brigade does not systematically document fire causes, impacts and response. The KRCS has the most comprehensive dataset, however the data only covers the more recent fires, from 2011 to date.

- Due to locational inaccuracies and limited descriptions of locations of fires, the accurate spatial distribution of fires in informal settlements is difficult to determine.
- There are discrepancies in terms of different dates, location and responders between the KRCS and the Fire Brigade datasets. This can be attributed to limited data collection capacity at the Fire Brigade. Data sharing agreements (as outlined above) and improved data capture systems will help to mitigate this challenge in the future.
- This project was not able to cover datasets from all other agencies, such as the police and district commissioner's office in Starehe (relevant for 2014 and 2015 data) or the archived reports from the Makadara DC's office (for data prior to 2007). We were not able to reach these responders during the course of the research.





Objective 1:

Historical fire incidents, including location, causes and impacts in Mukuru Fuata Nyayo

D. Objective 1:

Historical fire incidents, including location, causes and impacts in Mukuru Fuata Nyayo

Key finding: Available data is accurate to the village level in Mukuru and across the city of Nairobi. Different data sources have different numbers of fires within similar timeframes (approximately 2010 - 2015).

The primary deliverable in this assignment was to document/map historical fire occurrences and trends, as well as determine causes and impacts of fires in Mukuru Fuata Nyayo. To research historical fire occurrences, we first collected all of the available and relevant secondary data-sets, namely:

- **EOC incidents data**
- **Nairobi Fire Service, Fire Brigade incidents data**
- **NDOC fire incident data;**
- **Records from the Makadara DC's office;**
- **KRCS household survey.**

Two of the datasets we reviewed were not in an accessible format or did not have sufficient coverage of fires in Mukuru to include in this study: Kenya National Archives and Daily Nation Archives data.

Secondly, to more accurately geo-reference the fires in 2015, we conducted primary data collection through stakeholder interviews and GPS mapping of fire locations. Thirdly, to answer the question of causes and impacts of fires in Mukuru, we analyzed EOC data, specifically, the situation reports column, and the KRCS household survey data for the Fire Sensors project. Additionally, we conducted first-hand interviews with community members, Community Based Disaster Response Team members, the Nairobi Fire Brigade staff, and local community residents who were affected by several fires over the past year.

Location of fires

In the dataset provided by the EOC, there were 558 documented fires in Nairobi for the period of January 2011 to October 2015. Of those 558 fires, 250 or 44.8% were in slum areas, including 42 (7.5% of all fires in Nairobi) in Mukuru; 265 were in other areas around Nairobi. Additionally, in the EOC dataset, 41 were not properly classified because the EOC dataset was initially covering an area classified as Lower Eastern which included some areas that were not inside of Nairobi County. In 2012, the EOC changed this classification to map fires only in Nairobi.

The Nairobi Fire Brigade dataset includes information on 67 incidents in the project site and surrounding area for the period January 2010 - October 2015.

The only information that the Fire Brigade provided on these fires was: date; time of call (reported to the fire department); address, accurate to the village level (e.g. Mukuru Kaiyaba near Crescent hospital); dispatched appliances (e.g. 3 fire engines, 1 ambulance); response time; and services rendered (e.g. fire extinguished by NCC firemen using two lines of delivery hose).

Data obtained from the Makadara DC's office included 48 fire incidents in Fuata Nyayo and its surrounding villages for the period 2007-2013. The dataset described the location of fires by recording the village in which the incident occurred (e.g. Area of Tragedy: Fuata Nyayo).

The National Disaster Operations Center (NDOC) collects data mainly at a national level and disaggregated incidents by county. The 2015 data includes information about the date and generalized locations of fires (e.g. Mukuru kwa Kayaba, Mathare, etc). One-hundred and fifty five (155) incidents were recorded in Nairobi county in 2015 of which 47% (73 incidents) occurred in slums while 53% (82 incidents) occurred in other areas in Nairobi; of those incidents in slums, 13 were located in Mukuru and 3 in Fuata Nyayo in 2015 (for a total of 16 incidents).

Causes of fires

As outlined in further detail on [page 24](#), the Fire Brigade does not conduct an investigation into the cause or extent of damage of fires in the slums; according to the protocols of the Fire Brigade, such an investigation is part of a fire report. A fire report is a service that is payable to the Fire Brigade and they do not have the resources to conduct these investigations for slum fires. According to the National Contingency Plan to Manage Possible Effects of the 4th March 2013 Electioneering, the Fire Brigade identified the following as main causes of fire: electricity/electrical appliances, smoking and smoking materials; arson; unethical practices by some contractors; terrorism; and poor housekeeping¹. As mentioned, this is not supported by information collected during fire response but is based on anecdotal experience of the fire responders.

During interviews with community members, we also found that electrical faults were perceived to be the most common cause of fires in the area; a second cause that was reported was arson.

The EOC database does contain causes of fires, however, only 102 causes out of 558 fire incidents in Nairobi were documented (456 fires do not have recorded causes). For Mukuru informal settlement three (3) out of 42 fire incidents have causes documented (37 fires do not have causes documented).

Analysis of data from the DC's office shows that electric faults (17 incidents) are the most commonly recorded cause of fires in Fuata Nyayo and its surrounding villages; other notable causes of fire include: unattended home appliances (13 incidents), unestablished causes (9 incidents) and domestic issues (3 incidents).

¹ Ministry of State for Provincial Administration and Internal Security & Ministry of State for Special Programmes. *The National Contingency Plan to manage Possible Effects of 4th March 2013 Electioneering*. January 2013. Accessed online <http://bit.ly/1TJgoPm> , November 21, 2015



Impacts of fires

The Fire Brigade does not conduct an investigation into the impact or extent of damage of fires in the slums because they do not have the resources to do so.

The EOC database does contains impacts of fires. They include minor casualties, critical casualties, rescued, missing and dead people, and damage to the households.

For example, 192 out of 558 fire incidents in Nairobi have household damage recorded (366 do not). In Mukuru specifically, 18 fires have impacts to households documented out of 42 fires. Additionally, there were 55 minor and three critical casualties, as well as three deaths reported in 42 fires in Mukuru since 2011.

NDOC reported 33 deaths and 96 injuries in Nairobi area due to fires.

According to data from the DC's office, approximately 4,000 houses are reported to have been destroyed by fires in the area of study between 2007-2013 and over 14,000 people were documented as victims of the fires.

Summary of findings:

- Due to limited description of locations of fires, the accurate spatial distribution of fires in informal settlements are difficult to determine.
- Fire reports from various actors often differ in terms of location, date and impact of fires (people affected, property destroyed). Reconciling the reports (verifying dates, exact location and individuals and property affected) is challenging as community members and first responders are not able to accurately recall past incidents.
- The main cause of fires in Mukuru are: illegal electric connection, cooking stoves and arson.

- The negative impact of fires is exacerbated by the structure density and often strong winds.
- The greatest impacts of fires are loss of property, death and injuries.

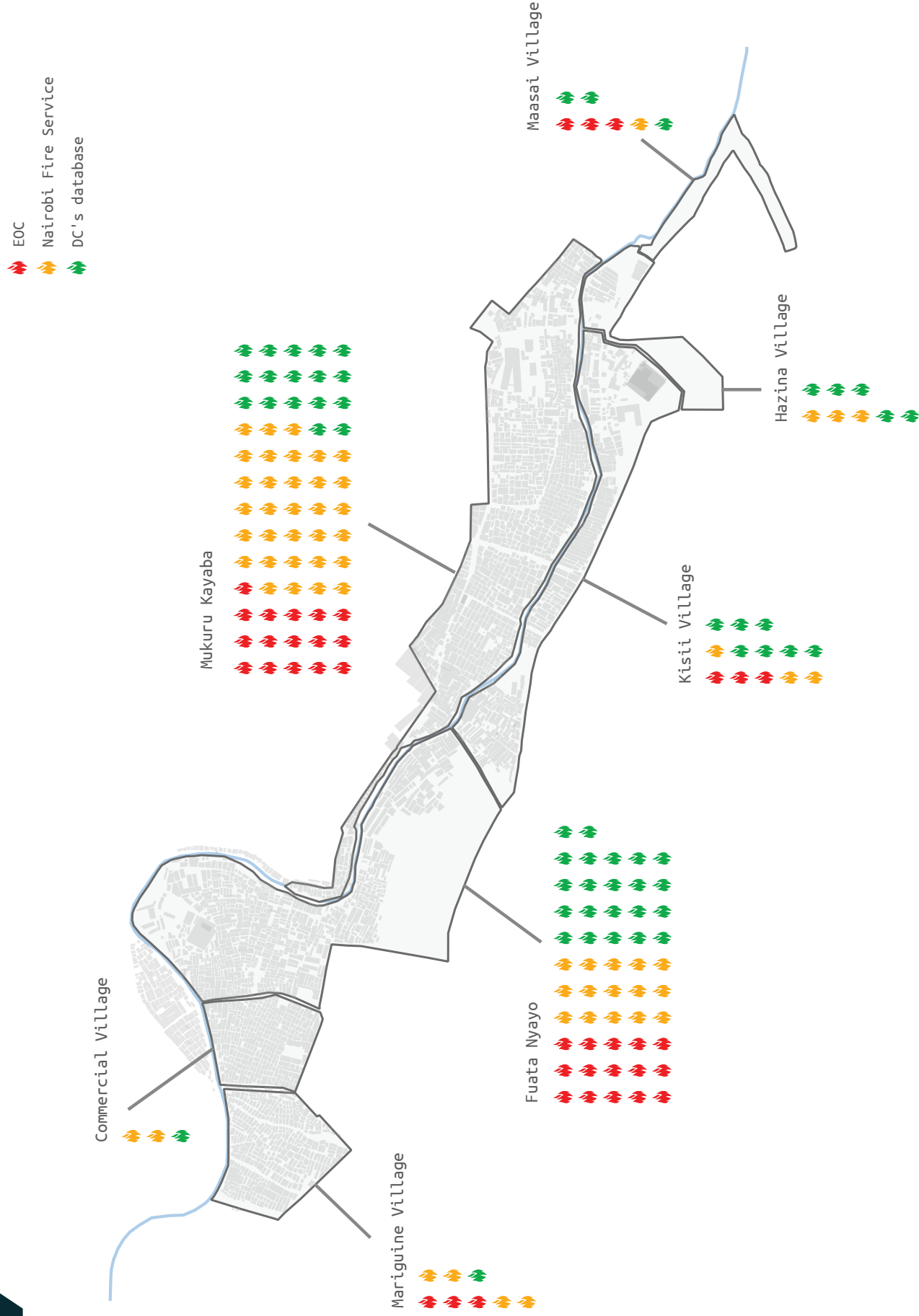
Challenges:

- Acquiring relevant data from authorities proved to be time-intensive and unreliable due to the manual nature of data capture and storage.
- Historical fires are difficult to document because responders are not (or have not been) collecting data systematically and records are not digitized: post emergency data collection should be improved at all levels and across all stakeholders.

Recommendations:

- KRCS should invest in an improved system for data capture and entry, and specifically develop procedures for collecting post emergency data on location (with a GPS coordinate), damage, impact.
- Invest in a improved information management at the Nairobi Fire Brigade, including data collection during operations and after a fire; there is an urgent need to develop a digitized information management system in order to improve the overall operations of the Fire Brigade.

Map 1



Map 1: Number of fires reported by the EOC (since 2011), the Fire Department (since 2010) and District Commissioner's office (2007 - 2013) in Mukuru Fuata Nyayo and its environs

Chart

Number of fires reported by the EOC, Fire Department and the DC's office since 2007 in Mukuru Fuata Nyayo and its environs

Village Name	EOC Data	Fire Station Data	DC's office Data
Fuata Nyayo Village	15	17	20
Mukuru Kayaba Village	16	32	17
Kisii Village	3	3	7
Masai Village	3	1	3
Commercial Village	0	2	1
Hazina Village	0	3	5
Mariguine Village	3	4	1



Objective 2:

Existing municipal response mechanisms, including opportunities and challenges

E. Objective 2:

Existing municipal response mechanisms, including opportunities and challenges

Key finding: Government responders do not have adequate resources to respond to fire incidents in Nairobi County.

Who responds to fire in Nairobi

Nairobi County Fire Brigade is the primary service provider responsible for preventing and responding to fires in the city; this power is granted to the county under the Local Government Act of the Laws of Kenya. The local county has the power to “establish and maintain one or more fire brigades and to take all necessary steps for the prevention and extinguishing of fires and to compensate the owners of property demolished or damaged for the purpose of preventing or extinguishing fires.”² Depending on the incident, other service providers are called in to support the operation (secondary response):

- Community responders are the first on the scene of any fire in the informal settlements. Community-based Disaster Response Teams (CBDRT) have been established and trained by the Kenya Red Cross Society. The CBDRT is equipped with basic fire fighting and first aid equipment. If the fire is not large, the CBDRT can put out the fire on their own.
- The National Disaster Operations Centre (NDOC) is involved if the incident is beyond the control of the Nairobi Fire Brigade. The NDOC can mobilize resources from a cross-section of government agencies. The NDOC is a Department under the Ministry of Interior and Coordination of National Government, and is chaired by a military officer. It is set-up in 1998 as an interagency body and is staffed twenty-four hours a day, seven days a week by officers from: the Ministry of Defence, Ministry of Health, the National Police Service, Kenya Prisons Service, National Youth Services and the Ministry of Agriculture, Livestock and Fisheries. The NDOC is responsible for “search and rescue in the event of a disaster including undertaking rapid assessments, collection and dissemination of data, coordination of response.”

² Kenya Law website: <http://www.kenyalaw.org:8181/exist/kenyalex/actview.xql?actid=CAP.%20265> Accessed December 1, 2015

- The National Disaster Management Unit is a unit of the National Police Service incorporating the regular and administration police, and can be called upon to mobilize police resources. The NDMU was established after the Westgate terrorist attack in on September 23, 2013. The NDMU is an inter-agency response unit that aims to address the lack of proper leadership, coordination and control during a mass casualty incident (MCI). According to an interview with the Acting Director, Pius Masai, the NDMU has a focus on mitigation and preparedness, and has a response plan that is set at the national level through a working document.³
- The National Youth Service (NYS) has fire response resources and is contacted if the fire is beyond the capacity of the Nairobi Fire Brigade, and is mobilized by the NDOC or the NDMU.
- Kenya Airports Authority responds to fire in and around the Jomo Kenyatta International Airport.
- Private firms offer fire services within Nairobi, primarily serving clients who pay for services through annual fees. Private responders include: G4S, KK Security, Radar Security, Ultimate Security and ICT Fire and Rescue.

Search and rescue responders:

Other government and private sector actors support fire response; these include:

- The police are called to the scene if a death or if the cause of the incident is suspicious (arson, etc.).
- Nairobi City County Ambulance provides medical first aid on the scene of fires in Nairobi.
- The Kenya Red Cross Society (KRCS) is often the first point of contact for a fire report, due to its presence in many communities across Kenya and its reputation for rapid response. KRCS mans a 24-hour Emergency Operations Centre (EOC) and Ambulance Dispatch. The Red Cross does not operate fire trucks but provides emergency first aid and ambulance services in the informal settlements and across the city.

³ Africa54 newscast, April, 2015: <https://www.youtube.com/watch?v=pjzfKu8iVz4> interview with NDMU Acting Director, Pius Masai. Accessed December 1, 2015

What resources are available for fire response

Nairobi Fire Brigade

The Nairobi Fire Brigade is the primary service provider responsible for fire response in the Nairobi City County. The Chief Fire Officer coordinates fire and rescue response across the city. The Fire Brigade has three fire stations throughout the city: in the Central Business District (CBD) along Tom Mboya street, in Industrial Area on Enterprise Road, and at Kenya Breweries in Ruaraka. The county fire services are centralized in the CBD fire station and any dispatch of resources is coordinated out of the central office. The station at Industrial Area does not have its own fire engine or dispatch, and serves mainly as a training centre. The station in Ruaraka is owned by Kenya Breweries and is leased to the City County; it does not have a fully-operational fire engine.

Within the county fire brigade, there are 5 fire response vehicles that are based in the CBD:

- 1 fire engine with a capacity of 10,000 litres of water;
- 1 engine with a telescopic ladder with a water tower and rescue equipment, which is used only for fires in high-rise buildings;
- 3 rapid intervention vehicles, for smaller incidents such as car fires.

The smaller rapid intervention vehicles (land cruisers) are only equipped to handle smaller incidents such as car fires and do not have the capacity (water and other resources) for responding to fires that involve multiple structures in the informal settlements.

The fact that the Fire Brigade has only one main fire engine means that the county firefighters can only respond to one incident at a time. This contributes to unacceptably long response times - and in many cases no response - when incidents happen concurrently.

According to studies, there are approximately 100 firefighters employed by the city.⁴ During an interview, the Fire Brigade reported that they have a total of 156 people, including support staff. Firefighters work in three shifts a day, with a single duty officer responsible for coordinating the crew on shift. A total of about 20 firefighters work on each shift, across the three fire stations. The day shift works from 9:00 until 17:00. The evening shift works from 17:00 until 9:00; the third shift is the group on off-days.

In 2014, the Fire Brigade had records of approximately 4,000 fire hydrants across the city; most of which are not maintained and are no longer functional.⁵ According to the Fire Department, there are many challenges related to maintaining the fire hydrants. The first is that when roads are re-tarmacked they are covered up by contractors. A second challenge is that other organizations, such as private water tenders, have access to the fire hydrants and deplete the available water; a third, related challenge is other departments within the City County view the hydrants as 'just another water point' and therefore do not prioritize and maintain emergency water reserves and access to the hydrants. The Fire Brigade relies on open water sources, such as swimming pools and rivers, to replenish at the scene of a fire.

⁴ Shileche, Sammy Shikoli (June, 2015) *Assessment of Use of GIS Technology in Fire Control. Case Study: Nairobi County. University of Nairobi, School of Engineering, Project Report for Master of Science in GIS.*

⁵ *Ibid.*

The Fire Brigade is financed through the County, but also raises funds through its fire services. There are two types of charges the Fire Brigade raises: the first is a charge for a fire call, which is determined by the resources and time used to extinguish the fire. According to the City County website, “[t]he owner of Premises should pay for Firefighting services whether the owner requested for the attendance or not”⁶; the second is a charge for the preparation of a fire report. According to the Duty Officer at Nairobi Fire Brigade, a fire report contains an investigation of the fire cause and the extent of the damage. A fire report is not prepared for every incident; it is instead prepared at the request of the client (structure owner) and is usually requested to support an insurance claim.

In the case of fires in the informal settlements, the Fire Brigade is not able to collect payment from the structure owner. Thus, the Fire Brigade has little incentive to respond to incidents in the informal settlements. Furthermore, fire reports, which contain an investigation of fire cause, are rarely ever prepared for fires in the informal settlements. The records at the Nairobi Fire Brigade do not contain comprehensive information about fire cause for incidents across the city.

Other government fire responders

The National Disaster Operations Centre (NDOC) is located at Nyayo House 3rd floor, North Wing. They have a staff of 38 individuals, from various government agencies. They run two emergency telephone numbers and can mobilize government resources, such as:

- National Youth Service (NYS) is a secondary responder, with trained firefighters and equipment. NYS fire responders are stationed in Ruaraka, opposite, Utalii hotel along Thika Superhighway. They have twelve operational fire engines (two with 10,000 litre capacity and ten with 7,000 litre capacity), two of which are staffed twenty-four hours a day, in twelve hour shifts (6:00 - 18:00 and 18:00 - 6:00). Each of the two trucks has a five person crew, and one commander. One truck is stationed in Ruaraka and the other has been stationed at Wilson Airport on standby. NYS draw water from access points at their base and from the Kenya Defence Forces base at Kahawa barracks.
- The Military is also a secondary responder and has trained firefighters and four fire engines. The four engines are stationed around the city: two at their barracks in Kahawa, one in Eastleigh and one in Embakasi. All four engines have a capacity of 5,000 litres of water.

Search and rescue resources

The Nairobi City County Ambulance service is also located along Tom Mboya Street, in the same compound as the Fire Brigade. The Ambulance service has 2 ambulances and they often accompany the Fire Brigade when responding to an incident. The Ambulance service provides first aid and emergency medical services, along with transfer to hospitals for casualties.

⁶ Bylaws, Nairobi City County website. <http://www.nairobi.go.ke/home/common-city-laws-and-regulations/by-laws> Accessed on December 1, 2015.

The National Police Service is comprised of both the Administrative and regular police. Police stations are distributed throughout the city, with one station per ward. To further decentralize, police posts are located within the ward and their location is based on population figures as well as the location of crime. Police are often one of the first to arrive on scene of a fire due to their decentralized structure and location. The police can help secure a fire site and conduct investigation into suspicious fires or fires that involve a death.

Private resources

In Kenya, private firms are called upon by the government to assist in fire fighting when the capacity of the government responders is overwhelmed. The NDOC or NDMU can request this assistance; occasionally the KCRS also requests support from private service providers. Support from the private sector is garnered through the Firefighters Forum (FFF), a quarterly meeting of firefighting stakeholders. The forum was established by KCRS in 2009 and is now hosted by the Ministry of Interior and Coordination of National Government and the Office of the President.

The private sector offers services in the informal settlements through corporate social responsibility (CSR) initiatives or on humanitarian grounds. Some of the resources available from the private sector include:

- G4S Fire Services has five fire stations in Nairobi: at the United Nations Office of Nairobi (UNON) in Gigiri, the Serena Hotel, at East African Breweries (Ruaraka), in Industrial Area and near Nyayo Stadium (the HQ). They have one fire engine at each of the five fire stations, and one additional ladder engine in Industrial area. G4S has about 66 firefighters on staff; they work in shifts: the day shift 8:30 - 16:30 and the night shift, 16:30 - 8:30, and a shift that is off duty. Each fire station has about 15 firefighters.
- KK Security Fire Services has mobile bases for their fire engines in four locations: in Gigiri near the UN; on Thika Road at Kenya Breweries; on Mombasa Road, near general Motors; and at Lunga Lunga. They also have a fire engine stationed in Karen, for a total of five fire engines. Each engine carries 11 firefighters, who work on twelve-hour shifts. They have a target response time of 10 minutes for fire in locations within a 10 kilometer radius of where the fire engine is based. KK Security has private arrangements with water tenders for clean water and whenever they have an incident, they call a water tender to supply water at the scene if the engine runs out. In Industrial area, some of KK Security's clients also have a water reservoir so they draw on that water source in the event of a fire.
- Radar Security has two fire bases in Nairobi, one in Runda, next Runda Water and another along Thika Road, near the GSU roundabout. Each of the fire bases has one fire engine with 3,500 litre capacity; the engines also have foam drums for petrol station fires and portable fire extinguishers. The engines are staffed by a team of 5 firefighters per shift twelve-hour shifts, and they have both a day shift and a night shift. To access water for the fire engines,

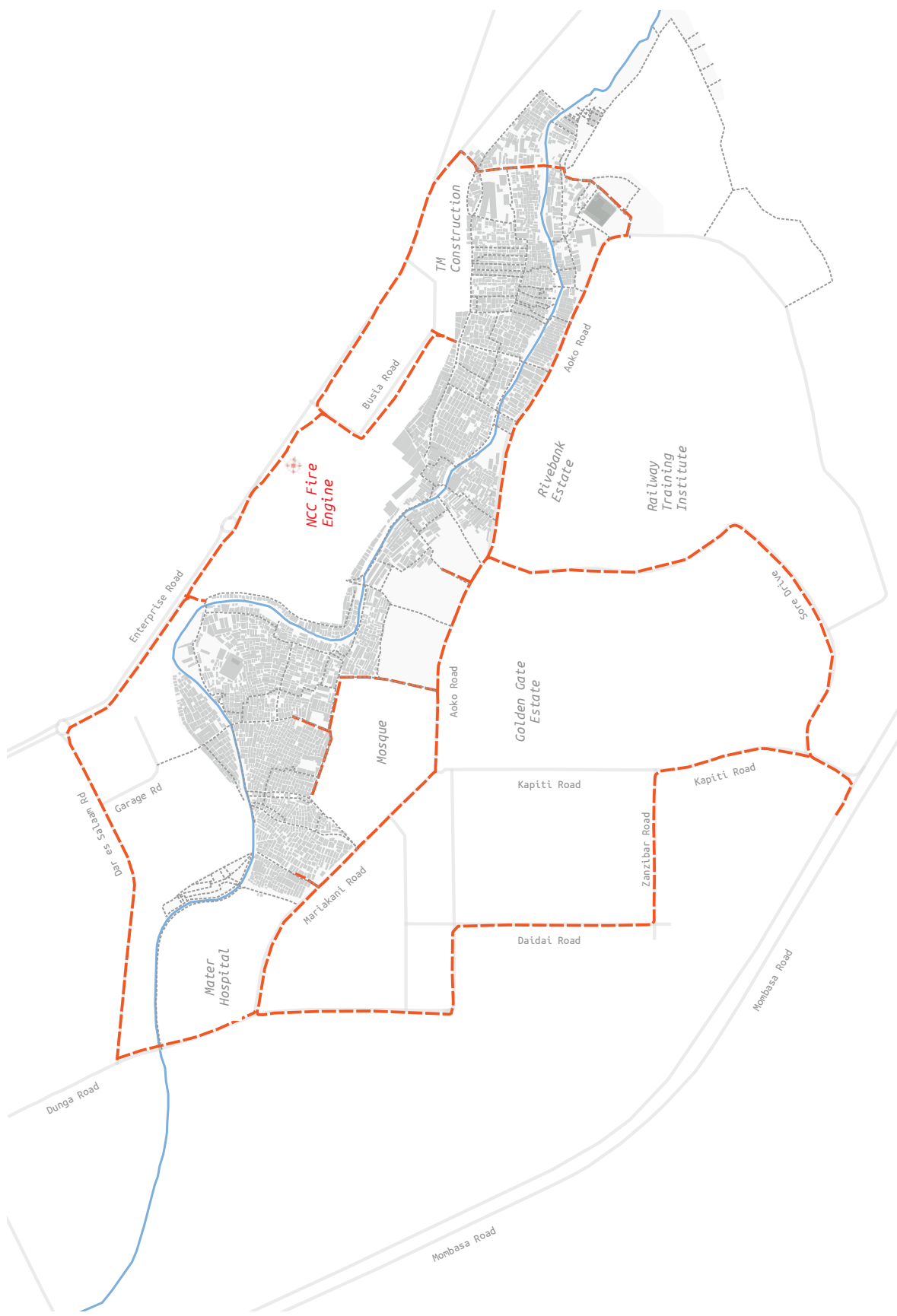
If government declares an incident a disaster, they will respond. In cases of smaller fires in the informal settlements, if a crew is available they will respond with the engine but will retreat after the engine is empty if they cannot secure a guarantee of payment.

Challenges:

- All of the literature reviewed and the individuals interviewed mentioned traffic in Nairobi as a major challenge for fire response. Furthermore, there is limited accessibility for engines and responders to reach the densely populated areas in the informal settlements. Traffic delays and poor accessibility increase response times and thus increase the damage of fire incidents.
- The primary responder to fires is the Nairobi Fire Brigade, yet the Brigade experiences significant resource constraints, both in terms of human and physical resources.
- Incident command coordination is lacking between the various public and private sector response agencies in case of larger incidents.
- Access to water for the Nairobi Fire Brigade is a challenge; they often need to rely on open water sources to replenish at the scene of a fire.

Opportunities:

- In line with the implementation of the Kenyan Constitution, the NCC is devolving services to the local level. There has been some activity in the project site based on the URR activities, such as road expansion and there is evidence that KRCS can influence local service provision. There is an opportunity for KRCS to advocate for devolution of fire services.



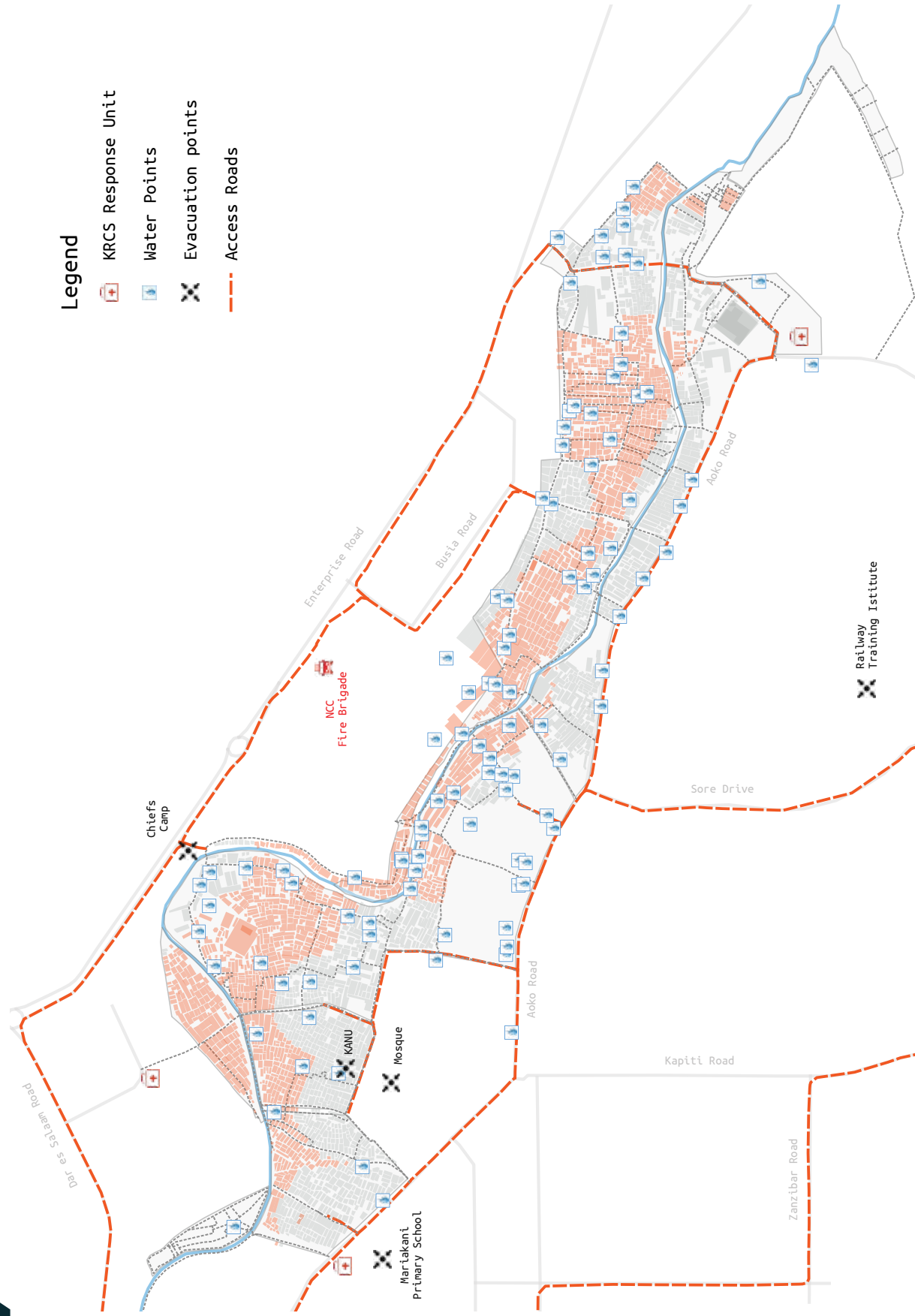
Access roads to Mukuru Fuata Nyayo informal settlement



Estimated buffer zone (red) out of reach of fire trucks in Mukuru Fuata Nyayo

Out of 3,331 structures, 1,831 (55%) of the structures are out of reach of fire trucks in case of a fire.

This analysis considers the routes accessible by fire trucks, length of fire hose (approximately 50 meters) and the reach of the stream of water (approximately 25 meters).



Emergency vehicles access roads and estimated at-risk areas (out of reach of emergency vehicle: red buffer zone), water points and emergency assembly points, and KRCS' response units in Mukuru Fuata Nyayo



Objective 3:

Linkages between
the municipal and
community-based
fire response
mechanism

F. Objective 3:

Linkages between the municipal and community-based fire response mechanism

Key finding: Fifty-six percent of fires in Mukuru were put out by community-based responders, with little or no support from the government service providers

Community-based disaster responders in Mukuru and across Nairobi are the first responders to fires, and to any disaster. The devolution of government services has not yet borne results for the residents of the informal settlements. The County government has prioritized local service delivery but has not adequately financed or operationalized the decentralization. Since at least 2013, Nairobi county has documented the need for decentralized fire services however little action has been taken toward establishing county-operated fire stations at the constituency level across the city. Governor Evans Kidero is quoted as saying that the city requires at least twenty-six fire engines to service its population of over 4 million residents⁷; to date, the city remains with only one operational engine to respond to the majority of fires.

In the absence of government services, local residents are placed in the position of first responders. The first responders in Mukuru are supported by the KRCS. In 2008, the KRCS initiated the Nairobi Urban Risk Reduction (URR) project in seven sites, including Mukuru Fuata Nyayo. The importance of community response is also acknowledged and supported by the National and County governments. For example, the Fuata Nyayo urban risk reduction unit is hosted at the chief's camp. The Fire Brigade also provides training to community-based responders⁸ however it is unclear how often this training is carried out and where in the city this training has been carried out.

Not only are the community members the first responders, but they often put out fires before any other resources arrive on scene. According to data provided by the Nairobi Fire Brigade on incidents between January 2010 and October 2015 in the project site, 37.5% (24 fires) of reported fires (N = 64) were put out by the community before the Fire Brigade arrived on scene; a further 18.75% (12 fires) were not attended to by the Fire Brigade because of lack of access to the site or hostility from the local community, and we thus assume that the fires were put out by members of the public. The majority of the fires (56.25%) in the project site between 2010 and 2015 were extinguished by members of the public, with limited or no support by the Fire Brigade.

Despite the extensive training of local residents, there are still fire risks that are inherent to living in the informal settlements. Material used to construct buildings is highly flammable (wood, etc), and structure density and illegal electrical connections (for which only the positive electrical wire is used) are common contributing factors to fire outbreaks.

⁷ Nairobi Governor Evans Kidero to upgrade fire department, in the Standard Digital, July 10, 2013. <http://www.standardmedia.co.ke/article/2000088002/nairobi-governor-evans-kidero-to-upgrade-fire-department> Accessed November 20, 2015

⁸ Fighting fire in Nairobi, in Voices of America, July 13, 2013 <http://www.voanews.com/content/fighting-fire-in-nairobi/1700945.html> Accessed November 20, 2015

Additionally, common responses of the public during a fire outbreak include: collecting water from the river using jerry cans, breaking water pipes to collect water from the nearest source, establishing a human chain to move water with jerry cans, and turning off the electrical source for the area.

Other more detrimental responses include: running back into the house to retrieve valuables, crowding to view the scene of the fire, destroying surrounding houses in order to create a fire break and throwing the materials into the street thereby blocking the way for ambulances and fire engines, and stealing valuables from houses in the surrounding area during the chaos.

There are established links between the community responders and government service providers. Based on our interviews with the Nairobi URR team, members of the community affected by fires and of the CBDRT, communication between the community and responders typically following the chain of events described below:

- 1. A citizen calls the EOC and reports a fire*
- 2. EOC asks for the caller's details and calls them back (to save airtime)*
- 3. An officer at the EOC call back the community member and records the details of the fire*
- 4. The EOC calls the Nairobi Fire Brigade and passes on the details of the fire size, location and response so far*
- 5. EOC dispatches an ambulance to the scene*
- 6. The EOC alerts the KRCS Nairobi branch, who has the technical disaster response team*
- 7. Nairobi branch of KRCS contacts the chair of the CBDRT and dispatches the technical disaster response team as necessary. The Nairobi Branch is in contact with the chair of the CBDRT to get updates on the response and their requirements on the ground*
- 8. EOC continues to coordinating with the Fire Brigade*
- 9. The EOC calls the National Disaster Operation Center (NDOC) and notifies them of the fire*
- 10. The NDOC mobilizes the military, the police and the National Youth Service, if necessary*
- 11. The EOC calls Kenya Power and Lighting Company, if necessary*
- 12. The EOC calls the police to ensure they have been notified*
- 13. The EOC calls the private fire response agencies, if necessary*

From the perspective of the Fire Brigade, the steps in a typical fire call are less clear. They receive reports from: citizen, local government officials or the EOC calls to report a fire. The Duty Officer records the details of the fire call and activates the available resources. If there are multiple fires at the same time, the Duty Officer will prioritize, usually based on the closest fire location. If the fire is in the informal settlements, the Duty Officer will liaise with the EOC and the Nairobi Branch of the KRCS to determine the extent of the fire and the resources already dispatched by KRCS.

The EOC and Fire Brigade both noted that when a large incident occurs, they are often overwhelmed with calls from community members. The number for the EOC and the Fire Brigade is widely distributed within the project site and community members call the EOC, the Fire Brigade and the Nairobi branch, often simultaneously. The Fire Brigade is reported to be more likely to respond if the KRCS is on scene because the KRCS responders are trusted and respected within the community and can provide security for the NCC responders.

Challenges reported by the community members include:

- Illegal electrical connections, which pose the greatest fire risk
- There is limited accessibility to many areas in the informal settlements because of high density of houses and small roads. Lack of access is compounded by the traffic in Nairobi.
- The Fire Brigade is located in the CBD, which is several kilometers from the project site.
- Mobilization of resources for large fires, with only one engine available within the city.
- Late response of the government agencies - NCC or NYS - leads to conflict in the communities. Sometimes the fire engines or firefighters are stoned or harassed by community members and are thus reluctant to attend fire outbreaks in the informal settlements.





Objective 4:

How socio-economic characteristics relate to fire outbreaks and response

F. Objective 4:

How socio-economic characteristics relate to fire outbreaks and response

Africa's informal settlements are amongst the starkest examples of urban poverty in the world. In many African countries the settlements are growing and governments are struggling to provide even the most fundamental services to their populations.

Nairobi itself is experiencing rapid urbanization which brings with it several complex challenges. Insufficient and poor infrastructure, environmental degradation, overburdened public services, lack of security and corruption are only some of the problems that citizens face every day. According to some estimates, half of Nairobi's population lives in two hundred of the city's informal settlements.

Mukuru Fuata Nyayo is an informal settlement/village located in the South-East of Nairobi with a population size of approximately 10,000 people.⁶ To a certain extent, it is a typical informal settlement in Nairobi, associated with the lack of basic public services such as access to clean water and sanitation or fire response; sustainable waste management and hazard mitigation; sufficient living space, security of tenure and durable housing; access to adequate education and health services, and security. Situated in an industrial area, it offers living space to mostly poor working class families employed in the surrounding factories, with the average household size of four people.⁷ Like many other informal settlements in Nairobi, demographics of Mukuru tends to illustrate what is often referred to as Africa's youth bulge, where significant percentages of the population are young. Most of the slum inhabitants have either primary or secondary school education and majority of the households are either tin-shacks or mud-huts.

Informal settlements bear the brunt of the effects of the damage inflicted by fires; for example, in Nairobi 44.8% of fires recorded by the KRCS between 2011 - 2015 were in the informal settlements, and yet the informal settlements occupy less than 10% of the land in Nairobi. Among other things, the areas lack proper fire preparedness and response infrastructure: access routes and evacuation points, fire hydrants or adequate water points, and are densely populated with fire prone materials. Government interventions are often missing or are inadequate to solve the problem of fires in informal settlements. In the absence of government intervention, non-governmental organizations, community-based organizations and various self-help groups have formed and responded to the missing provision of public services in Mukuru and broader Nairobi.

⁶ KRCS census data

⁷ KRCS census data



These groups, including the KRCS, are filling in the gap left by the absence of the state. Through collective action, they organize efforts to combat fires, provide first aid, and oversee rebuilding efforts. Their work has profound impact on the lives of the citizens, however, under-resourced and often ill-prepared, they fight an uphill battle trying to mitigate the causes and effects of fires and the loss of property and human lives.

There is ample opportunity and need to find alternative - or improve existing - fire response mechanisms, as well as, in providing adequate resources, training and sensitization to communities to better deal with fire emergencies, and in establishing long term partnerships between community-based groups and the county government.

H. Conclusions & Recommendations

1. Service providers should invest in improved data management systems. The KRCS EOC can collect GPS locations of fires from responders during post-fire assessment. Accurate, up-to-date GPS readings of locations will also help to direct responders to the fire (if captured on site during the fire). Post emergency data collection should improve at all levels, across all responders.
2. Develop data-sharing guidelines between relevant government agencies to capture data during and post-incident (both so KRCS has more accurate data but also so the KRCS can share their information with the government responders).
3. Provide adequate resources, training and sensitization to communities to better deal with fire emergencies in the lack of official alternatives in terms of response. Communities are under resourced and more training and sensitization is required for them to better deal with fire emergencies.
4. There is a need for more government resources both throughout the city as well as in informal settlements. The Nairobi Fire Brigade should prioritized decentralization of services and increase the number of fire engines and staff across the city.

