

Final Report

OCA Accra/GARID - Nima and Akweteyman Mapping
Project
Accra, Ghana



Humanitarian
OpenStreetMap
Team



OpenStreetMap
Ghana

Humanitarian OpenStreetMap Team, Mobile Web Ghana and OpenStreetMap
Ghana

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Abbreviations

AMA	Accra Metropolitan Assembly
AOI	Area of Interest
CSOs	Civil Society Organizations
GARID	Greater Accra Resilience and Integrated Development
GFDRR	Global Facility for Disaster Reduction and Recovery
GIS	Geographical Information System
GSS	Ghana Statistical Service
GHA	Ghana Highways Authority
HOT	Humanitarian OpenStreetMap Team
JOSM	Java OpenStreetMap editor
MMDAs	Metropolitan, Municipal and District Assemblies
MWG	Mobile Web Ghana
MOH	Ministry of Health
NADMO	National Disaster Management Organization
NGOs	Non Governmental Organizations
ODK	OpenDataKit
OMK	OpenMapKit
OSM	OpenStreetMap
OSM Ghana	OpenStreetMap Ghana
POI	Points of Interest
Sq km	Square Kilometres
WB	The World Bank

Executive Summary

The Greater Accra Region is known to have a perennial flooding problem. In the rainy season of every year, some portions of the capital city, Accra, are flooded thereby posing danger to the environment and the community members of such areas. 60% of the population of Accra can be found along the Odaw river basin, which is known to be a flood-prone area. This therefore puts the many who dwell there at the mercy of flooding and other natural hazards.

The Greater Accra Resilience Integrated Development Project (GARID) was instituted to provide a solution to this problem. The project is comprised of the following components:

- Climate resilient drainage and flood mitigation measures
- Solid waste management capacity improvement
- Participatory upgrading of targeted flood-prone low-income communities and local government support
- Project management
- Contingent Emergency Response Component

The Open Cities Accra Project, which commenced work in Accra in June 2018, was also instituted to collect and curate accurate geospatial data in 4 communities located along the Odaw River Basin. The project was undertaken by three organizations namely, Humanitarian OpenStreetMap Team (HOT), Mobile Web Ghana, and OpenStreetMap Ghana. The areas of focus were Alogboshie, Alajo, Akweteyman, and Nima. One of the major goals of the OCA project is the provision of support for the GARID project through the creation of map data to inform participatory solid waste management, and informal settlement upgrading, in flood-prone areas. These constitute the second and third components of the GARID project. The final product of this project is expected to be useful to the consultants of the GARID project in the area of project design of future infrastructure and interventions.

From June 2018 to December 2019, the OCA team worked in four communities along the Odaw river basin, known to be flood-prone. These communities are Alogboshie, Alajo, Akweteyman, and Nima. The team with the help of its volunteers mapped all 4 communities remotely in OSM using collected drone (UAV) images. Field data collection was only done in Alogboshie for that phase of the project. For the GARID support project, the OCA team worked in Akweteyman and Nima. During the entire period that the first phase of the project was being undertaken in 2018, the OCA project team was in constant communication with the Greater Accra Resilience and Integrated Development (GARID)

project team. The GARID team provided guidance and direction throughout the mapping activities and will be the principal users of the collected data by the OCA Accra project. When the initial OCA Accra project came to an end in March 2019, the GARID team contracted the OCA team to complete data collection in Akweteyman and Nima communities which were not initially fully mapped.

The field data collection in Akweteyman covered a total land area of 1.43 sqkm. Whereas, in Nima, the field data collection covered a total land area of 2.14 sqkm. In all, it took the team a period of 8 weeks to finish the collection of data in the field, cleaning the data and uploading it unto the OpenStreetMap database. The field data collection exercises included collecting data on building footprints, drainage networks, flood history, roads, waterways, waterpoints, solid waste, health facilities, educational facilities, and points of interest.

The OCA team had a meeting with the Project Coordination Unit of the GARID project and a number of activities were mentioned to ensure continued coordination between the parties involved in this project. It was decided that the OCA team would be invited to have a meeting with the consultant who will be hired to make designs based on the data collected by the OCA team. The GARID project will be launched soon and the OCA team has been informed to prepare to present the work it has done in a video to all who will attend the event. There are a number of activities lined up to ensure the sustainability of the product of this project and also ensure its continued use. All these have been outlined in more detail in the “Sustainability Plan” session of this report.

Part 1: Project Overview

1.0: Background

GFDRR and OpenDRI

The Global Facility for Disaster Reduction and Recovery (GFDRR) is a partnership of the World Bank, United Nations, major donors, and recipient countries under the International Strategy for Disaster Reduction (ISDR) system to support the implementation of the Hyogo Framework for Action (HFA), launched in September 2006. GFDRR provides technical and financial assistance to help disaster-prone countries decrease their vulnerability and adapt to climate change. GFDRR works closely with UN agencies, client governments, World Bank regional offices, and other partners. GFDRR implements the majority of its activities in countries through the World Bank, in partnership with national, regional, and other international agencies. It is organized along three tracks of operation to achieve its development objectives at the global, regional and country levels.

To meet the needs of the rapidly changing world, GFDRR Innovation Lab supports the use of science, technology, and open data in promoting new ideas and the development of original tools to empower decision-making in vulnerable countries to strengthen their resilience. Recent innovations in the field have enabled better access to disaster and climate risk information and a greater capacity to create, manage, and use this information. Innovation Lab activities are designed and implemented in partnership with government institutions and key international and local partners, ensuring that all activities add value in planning, operational, and recovery activities.

In 2011, GFDRR Innovation Lab launched the Open Data for Resilience Initiative (OpenDRI) to apply the concepts of the global open data movement to the challenges of reducing vulnerability to natural hazards and the impacts of climate change. OpenDRI supports World Bank Regional Disaster Risk Management Teams to build capacity and long-term ownership of open data projects with client countries that are tailored to meet specific needs and goals of stakeholders.

Open Cities Africa

As urban populations grow and their vulnerability increases, managing urban growth in a way that fosters cities' resilience to natural hazards and the impacts of climate change

becomes an ever-greater challenge that requires detailed, up-to-date geographic data of the built environment.

Addressing this challenge requires innovative, open, and dynamic data collection and mapping processes that support the management of urban growth and disaster risk. Success is often contingent on local capacities and networks to maintain and utilize risk information, enabling policy environments to support effective data management and sharing, and targeted tools that can help translate data into meaningful action.

Building on the success of the Open Cities project in South Asia, the global Open Data for Resilience Initiative, and GFDRR's Code for Resilience, Open Cities Africa was carried out in 11 cities in Sub-Saharan Africa, to engage local government, civil society, and the private sector to develop the information infrastructure necessary to meet 21st-century urban resilience challenges. The project aligned with GFDRR's Resilient Cities Program¹ and implemented through a unique partnership between GFDRR and the World Bank, city governments, and a partner community comprised of regional scientific and technology organizations, development partners, and technology companies to support upcoming or ongoing World Bank supported activities in the selected cities. Following a competitive application process, a small team in each city received funding, targeted training, technical support, and mentorship to achieve the following objectives:

1. Create and/or collate and release open spatial data about the built environment, critical infrastructure, and natural hazards;
2. Develop targeted products and/or tools (e.g., visualization tools, atlas, map series, or web application) to assist key stakeholders to utilize risk information towards addressing natural disaster risk in the selected city;
3. Enhance the local capacity and institutional development necessary to support the design and implementation of evidence-driven urban resilience interventions; and
4. Promote peer mentorship and build regional networks across cities.

In each participating city, Open Cities Africa projects would inform decision-making or support action around a specific Problem Statement identified by the local city government and the regional World Bank teams.

Accra, Ghana

Accra is the capital of Ghana, covering an area of 225.67 sqkm (87.13 sq mi) with a current population projection of about 1,665,086² people. Approximately 56% of the population are under the age of 24. Available data also shows that about 45% of Accra's residents are

¹ <https://www.gfdrr.org/en/resilient-cities>

² <https://ama.gov.gh/theassembly.php>

immigrants that originally lived in other African countries³. The city is organized into both Local Government Administrative Areas and the merged conurbation forming the Metropolitan Area. Accra Metropolitan Assembly is an example of the former. The latter comprises 27 Local Government Administrations known as the Greater Accra Metropolitan Area (GAMA). The nomenclature of Local Governments is distinguished principally by population - a minimum population of 70,000, 95,000 and 250,000 for District, Municipal and Metropolitan Assemblies respectively. Every Local Government Administration has a distinct legal establishment (Legislative Instruments - LI) which is passed by the Parliament of Ghana. The city is saddled with problems such as overpopulation, traffic jams, solid and liquid waste problems, unplanned development, and flooding. In June 2018, the government invested two hundred million Ghana Cedis (GHS 200M) to de-silting major drains such as the Odaw and Korle lagoons, the Nima drains, the South Kaneshie drain, the Sakura drain, Kaneshie First light, and Odorkor drains, among others, that flood during the rainy seasons in Ghana⁴. With more than 10 people killed in Accra during the rainy season in 2018⁵, flooding is one of the major challenges confronting the inhabitants in Accra.

1.1 Scope of work

This GARID Support Project executed by the Open Cities Accra Project team was to complete the OCA project by filling the gap in detailed field-based mapping of Akweteyman and Nima, where community solid waste management program and community upgrading are planned under the GARID Project.

Nima and Akweteyman communities are plagued by perennial flooding affecting indigenes and those in neighboring communities. Solid waste management is still a challenge in these areas, hence the GARID programming to address these challenges. This additional mapping work was to fill in gaps for community mapping in order to bring all GARID selected communities to the same level of completeness in terms of mapped geospatial data that will inform other upcoming activities of the project.

³ <http://worldpopulationreview.com/world-cities/accra-population/>

⁴

<https://www.myjoyonline.com/news/2018/June-21st/accra-floods-govt-commits-ghs200m-to-projects-says-deputy-minister.php>

⁵ <https://www.pulse.com.gh/news/local/10-dead-after-heavy-rainfall-on-monday-id8524515.html>

Part 2: Data Collection Process

2.1 Area of Interest

Accra is the largest and the most populated city in Ghana. According to the 2010 Population and Housing Census, the total population of the city was 1,665,086⁶. The population growth rate in the Greater Accra Region is 3.1%⁷ which means as at 2018, the estimated population of the city was 2,036,889. Of the entire population of the people living in Accra, 60%⁸ live along the Odaw River Basin. The Odaw River Basin is known to be a flood prone area and considering the number of people who live there, the city stands to lose a huge percentage of its vital human resource and property if flooding in this area is not dealt with.

The areas of interest for this project were Akweteyman and Nima. These communities are 2 of the 3 areas of focus for 2 subcomponents of the GARID project. These subcomponents are:

- Subcomponent 2.1 - Community-level solid waste management
- Subcomponent 3.1 - Upgrading of Infrastructure and Services in Selected Vulnerable Communities

The total beneficiary population for these communities is estimated to be about 300,000 inhabitants.

⁶ <https://ama.gov.gh/theassembly.php>

⁷ <http://www2.statsghana.gov.gh/nada/index.php/catalog/51>

⁸

<http://documents.worldbank.org/curated/en/887301539624730401/pdf/Concept-Project-Information-Dокумент-Integrated-Safeguards-Data-Sheet-Greater-Accra-Climate-Resilient-and-Integrated-Development-Project-P164330.pdf>

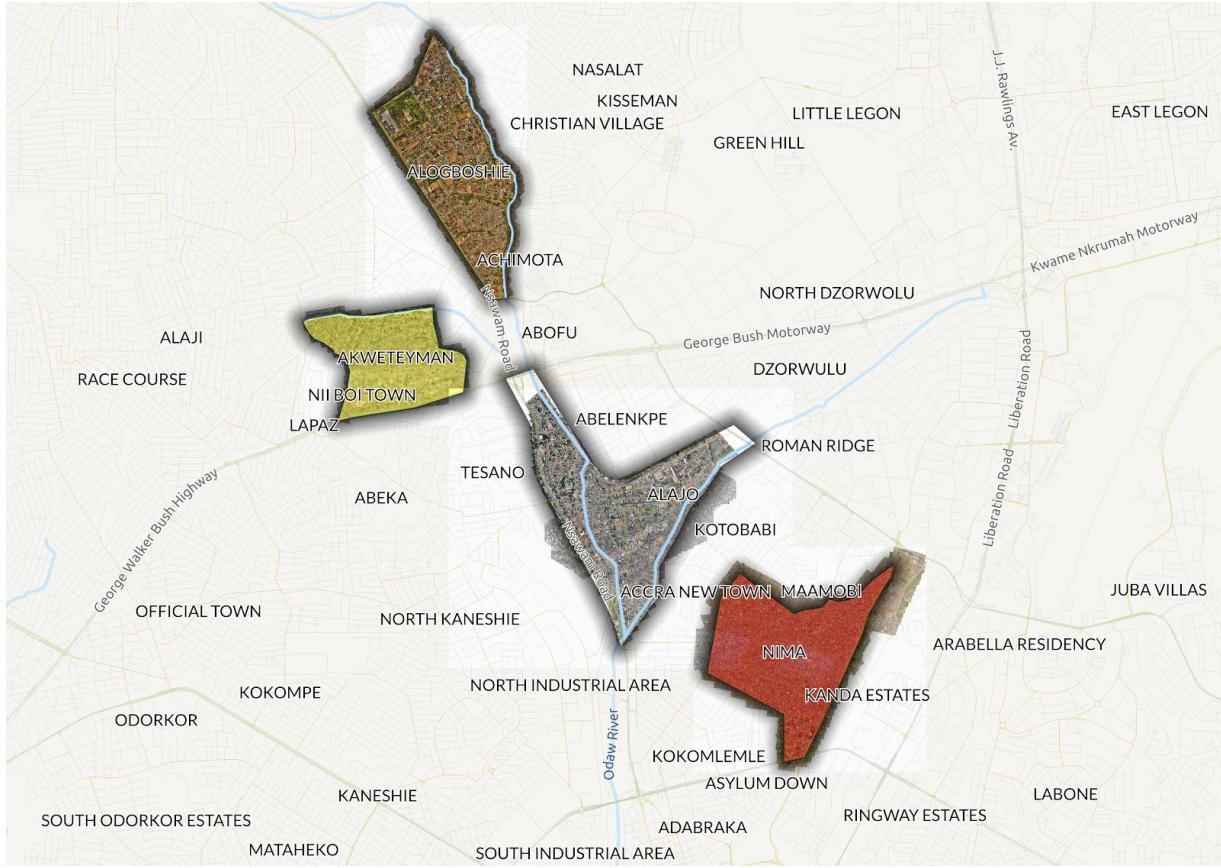


Fig 1 - GARID Support Project areas of interest (Nima And Akweteyman)

2.2 Field Data Collection

Data collection, both remotely and from the field, was very essential to the achievement of the goals of this project. Accurate and up-to-date data was collected in the two areas of focus of the project to support the GARID project.





Fig 2 - Field data collection

From the beginning of the project, steps were taken to ensure that we had a series of seamless data collection exercises. Such activities are listed below:

UAV imagery capture:

At the start of the project, the OCA Accra team conducted an assessment of available satellite images of the areas of interest. We realized that the quality of images were poor (even for Bing and ESRI Satellite images) making it difficult for remote mapping. Hence, we contracted the services of a local contractor to capture aerial images. We encountered a challenge initially in our attempt to capture the drone imagery of Nima because the President's residence is located in the area hence we had to obtain clearance from National Security. Also, we had to obtain permission from the Ghana Civil Aviation Authority (GCAA), because they are the regulators of all aviation matters and not because the area is a flight zone. With help from the GARID team and the Ministry of Inner Cities and Zongos Development, we were able to obtain the necessary clearance and permit to capture the UAV imagery of Nima. Experienced and guided mappers used the *Replace Geometry* function in JOSM to align and map new structures preventing massive deletion and keeping object history in OSM.

Bing Imagery	Drone Imagery
	
<i>Akweteyman</i>	
	
<i>Nima</i>	

Fig 3 - UAV / Drone images captured

Recruitment of Mappers:

A call for volunteer-mappers was sent out to all YouthMappers mailing lists, OSM Ghana Community mailing list and Faculty heads of some institutions, Linux Accra User Group and some other open source communities, etc. We also posted the call for application on social media platforms.

We set a target to recruit 40 mappers for the project, but eventually we recruited 60 mappers. Those who turned up for the interview were 43 and the rest of the mappers were assigned by the stakeholder organizations and government institutions to be part of the data collection exercise. Mappers from previous data collection during Open Cities Accra were engaged as team leaders on the field.

Gender integration was a prominent component of this project therefore we made a conscious effort to give more priority to female mappers in the data collection phase of the project. We ensured the fair representation of minorities on the basis of economic standing, educational level, gender, etc.

After getting the desired number of mappers we needed, we invited them to the 4-day training program at Mobile Web Ghana. Below are institutions that provided the mapping exercise with mappers:

- MICZD
- Ayawaso East
- Okaikwei North
- Assemblyman - Akweyman
- Assemblywoman - Nii Boi Town

Training of Mappers:

The volunteer mappers were taken through an intensive 4-day training in the following:

- Mapping with OSM iD editor
- Mapping with JOSM
- Remote mapping with the HOT Tasking Manager
- Introduction to street level imagery using Mapillary
- Mobile tools:
 - OpenDataKit
 - OpenMapKit
 - OsmAnd
 - MAPS.ME
 - Mapillary
- Introduction to GIS and using QGIS

During the 4-day training that the mappers undergone in preparation towards field data collection for Akweteyman and Nima, they were taught how to collect geospatial data in the field with free and open source software. During the training period, they were taken out on two occasions to test their skills and understanding of the data collection tools and applications to be used. Also, they were assessed based on their ability to work together in teams.



Fig 4 - Training of volunteer mappers and field test mapping

Remote Mapping

Remote mapping of Nima for the GARID Support project involved the tracing of building footprints and other visible infrastructure over a UAV image. This creates geodata in OpenStreetMap database that is accessible to all under the Open Data Commons Open Data Licence⁹.

The Tasking Manager is the tool for coordination of volunteers and organization of groups to map on OpenStreetMap. It has been initially designed and built by and for the Humanitarian OSM Team (HOT), and is nowadays used by many other communities and organizations. The purpose of the tool is to divide up a mapping job into smaller tasks that can be completed rapidly. It shows which areas need to be mapped and which areas need the mapping validated. This approach facilitates the distribution of tasks to the various mappers. It also allows control of the progress and the homogeneity of the work done. The

⁹ <https://www.openstreetmap.org/copyright>

task for Nima was created on the HOT Tasking Manager¹⁰. The task was made private hence those who remotely mapped Nima had to receive an invitation from the OCA team before they could participate. Remote mapping was done in preparation for field data collection. Remote mapping was done largely by OSM community members in Ghana including OpenStreetMap Ghana and YouthMappers.

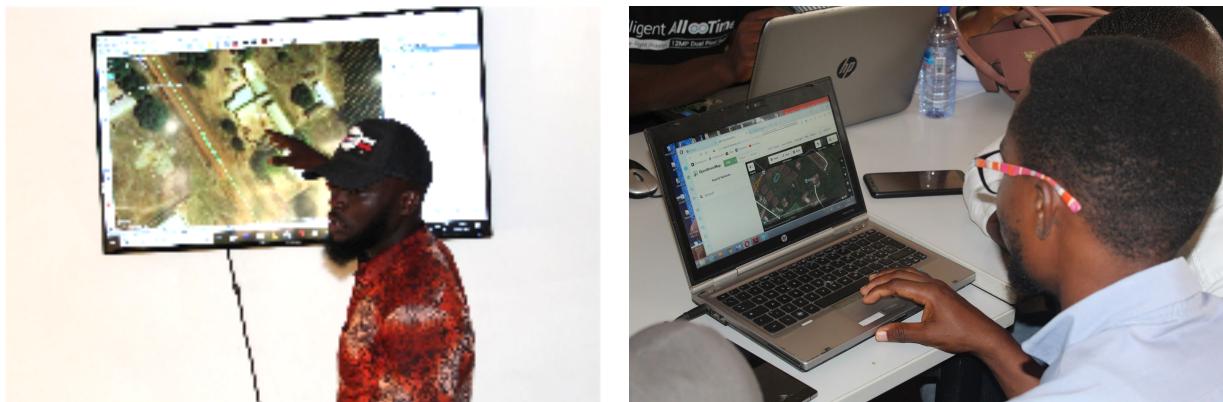


Fig 5 - Remote Mapping by mappers

Field Mapping

During field mapping, mappers used OpenMapKit (OMK) and OpenDataKit (ODK) to collect data on buildings and other features. OsmAnd was used to locate sections assigned by the mapping supervisor to various teams as well as to record GPS traces. They were also given measuring rods and tape measures to measure the depth and width of drains. The project field mapping team recorded measurement for other indicators such as flood history depth. This was not measured, but recorded using information obtained by interviewing community members.

Generally, we expected the mappers to go to the field, observe geospatial features and record details about them. However, a considerable aspect of their work in the field involved interacting with community members and asking questions. For example, the mappers were tasked to collect flood history data from the field. This data cannot be merely observed and recorded. They had to ask questions and politely solicit answers. Therefore, before they went into the field to work, they were taken through a session during the 4-day training program on how to interact with community members. They were taught the exact things to say: introduce themselves, the project and then proceed to ask the vital questions. This was done to alleviate any suspicions and assumptions that community members might have about the mappers and their work in their community.

¹⁰ <https://tasks.hotosm.org>

Also, it would make it easier for community members to open up about the environmental problems they face.



Fig 6 - Field mapping with volunteer mappers



Fig 7 - Engagement with community members in the field

Mapping in Akweteyman started on October 1st, 2019 and lasted for a week. There was an earlier survey in Akweteyman in February 2019 which focused specifically on Places of Interest (POI). The current mapping exercise for the GARID support project phase sought to record the physical properties of all buildings that were found in Akweteyman only. Thus include the building levels, the building material, the house address number, the roof material, the purpose for which the building is being used (residential, commercial, church, etc). Akweteyman was mapped by 55 volunteer mappers out of the 60 people who participated in the training.



Fig 8 - Mappers testing forms before going into the field

Mapping in Nima started on October 10th, 2019. Unlike Akweteyman, this was the first field mapping in Nima so the undertaking activities included Point of Interests (POIs), mapping of drains, mapping of physical properties of buildings, Flood History survey and hazardous points. The field mapping lasted four (4) weeks. Comparatively, Nima is the biggest communities by size among the four communities under the OCA project namely Alogboshie, Alajo, Akweteyman and Nima. A total of 58 volunteer mappers were available for the field data collection in the community.

There were two separate debriefings at Mobile Web Ghana in the course of field mapping in Nima. The first one was in relation to help us access the progress of mapping and address any challenges from the field and the second was to discuss issues if there were any and with respect to omissions during the field mapping in Nima we identified during the cleaning of data that was coming from the field data collection.



Fig 9 - Drain mapping on the field by volunteer mappers

Street-level images

Street-level images offer detailed information from the horizontal point of view which aerial images doesn't offer. The OCA Accra team received a Garmin VIRB device which was generously leased to the team by Map Uganda¹¹ for temporal use.

The images were uploaded to Mapillary, a crowdsourcing platform and community for the collection of street-level images by everyone across the globe which can be reused in projects such as OpenStreetMap.

¹¹ <https://mapuganda.org>

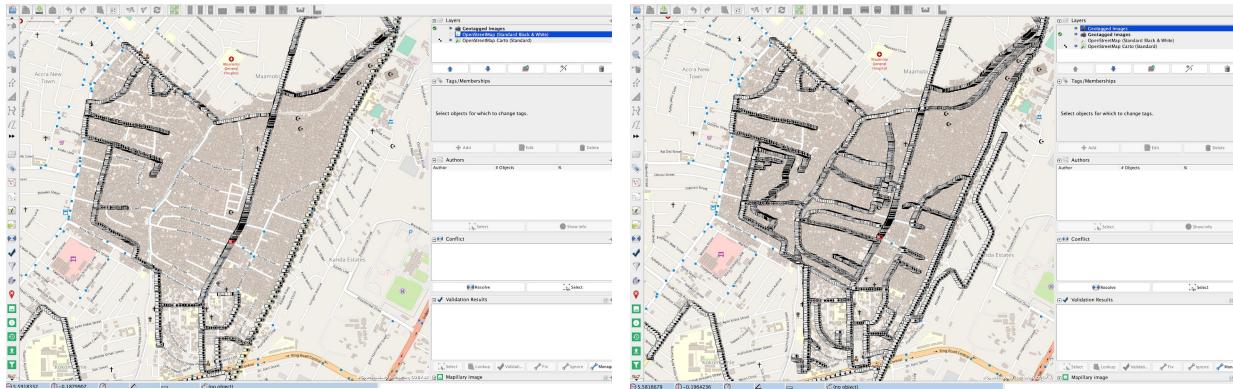


Fig 10 - Mapillary images Captured by OSM Ghana vs images during the GARID Support project

OSM Ghana had taken some street level images of Nima and had made it available on mapillary before the commencement of this project. However, just some sections of the communities was covered, so we had to take some new images to complete the entire route in the community.

These street-level images were further used in addition with field validation to ensure maximum level of data quality and integrity.

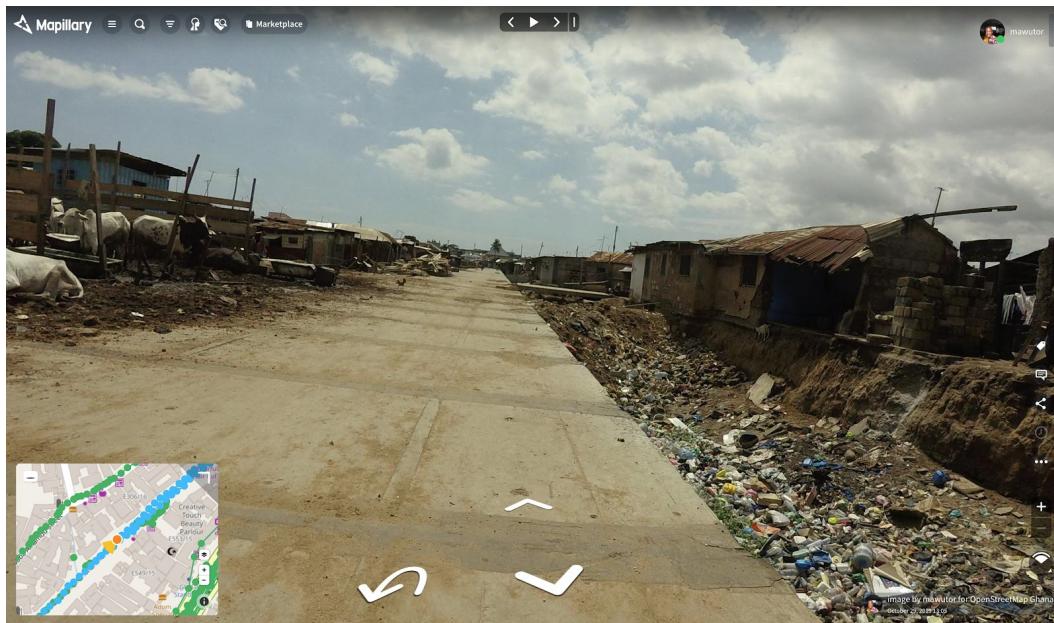


Fig 11 - Street-level image as uploaded to Mapillary¹² (Nima)

¹² <https://www.mapillary.com/map/im/3rO7q6bTCvOD1h9dqDRleg>

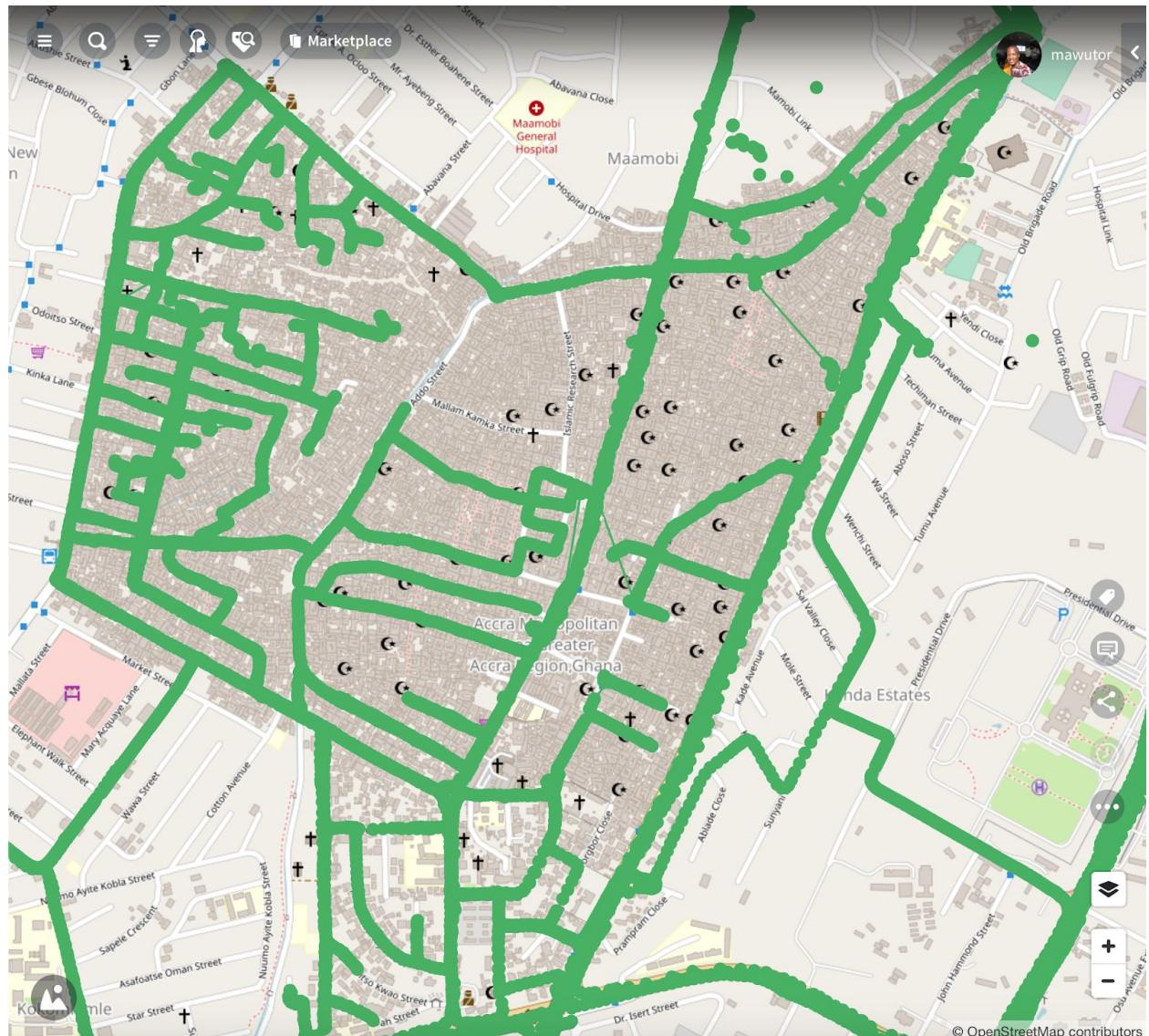


Fig 12 - Street-level images as uploaded to Mapillary (Nima)

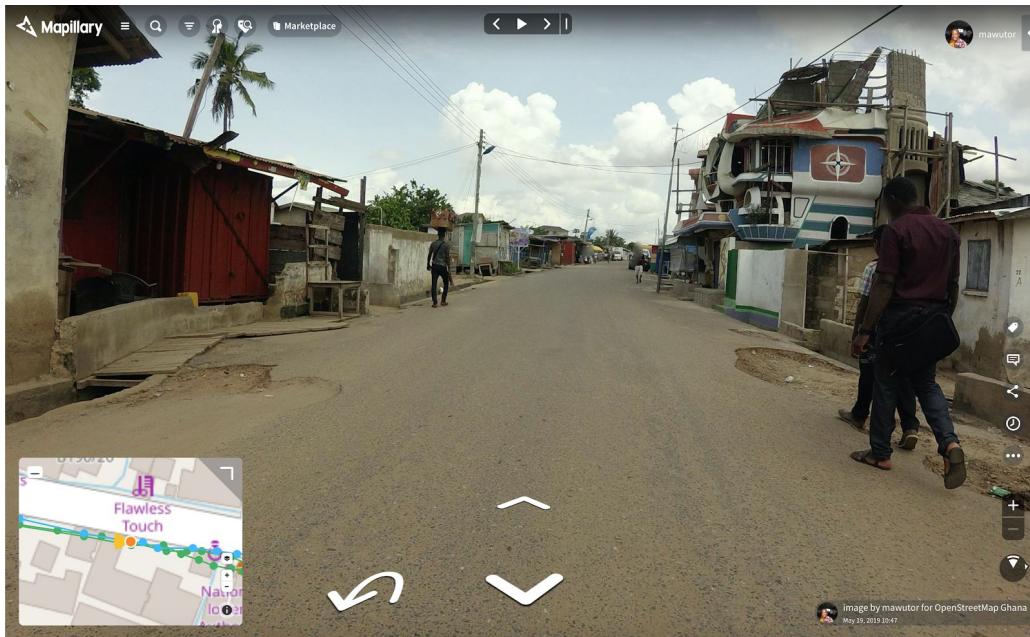


Fig 13 - Street-level image as uploaded to Mapillary¹³ (Akweteyman)

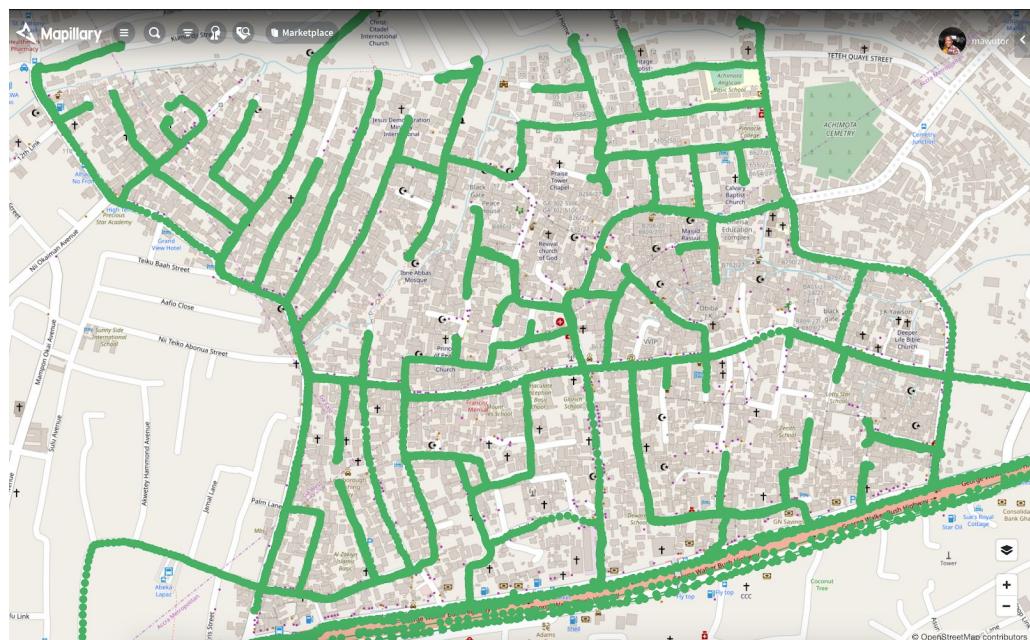


Fig 14 - Street-level image as uploaded to Mapillary (Akweteyman)

13

https://www.mapillary.com/app/?lat=5.612992001666666&lng=-0.2339323794444445&z=19.075385294198668&tab=uploads&focus=photo&pKey=NbMwAj0o_tFAsyleT0TUZQ

Hazardous Hotspots Mapping

Hazardous hotspots are defined as “all spaces that have been polluted as a result of the dumping or spillage of chemical or organic substances classified as hazardous by the Environmental Protection Agency”¹⁴. This includes waste dumping sites (both official and unofficial site), waste basket, toilets, waste disposal, waste (trash, plastic, organic, e-waste).

The team of mappers working in the field for this project used the Accra Solid Waste form¹⁵ to collect data on solid waste and all hazardous hosposts from the two communities (Akweteyman and Nima).

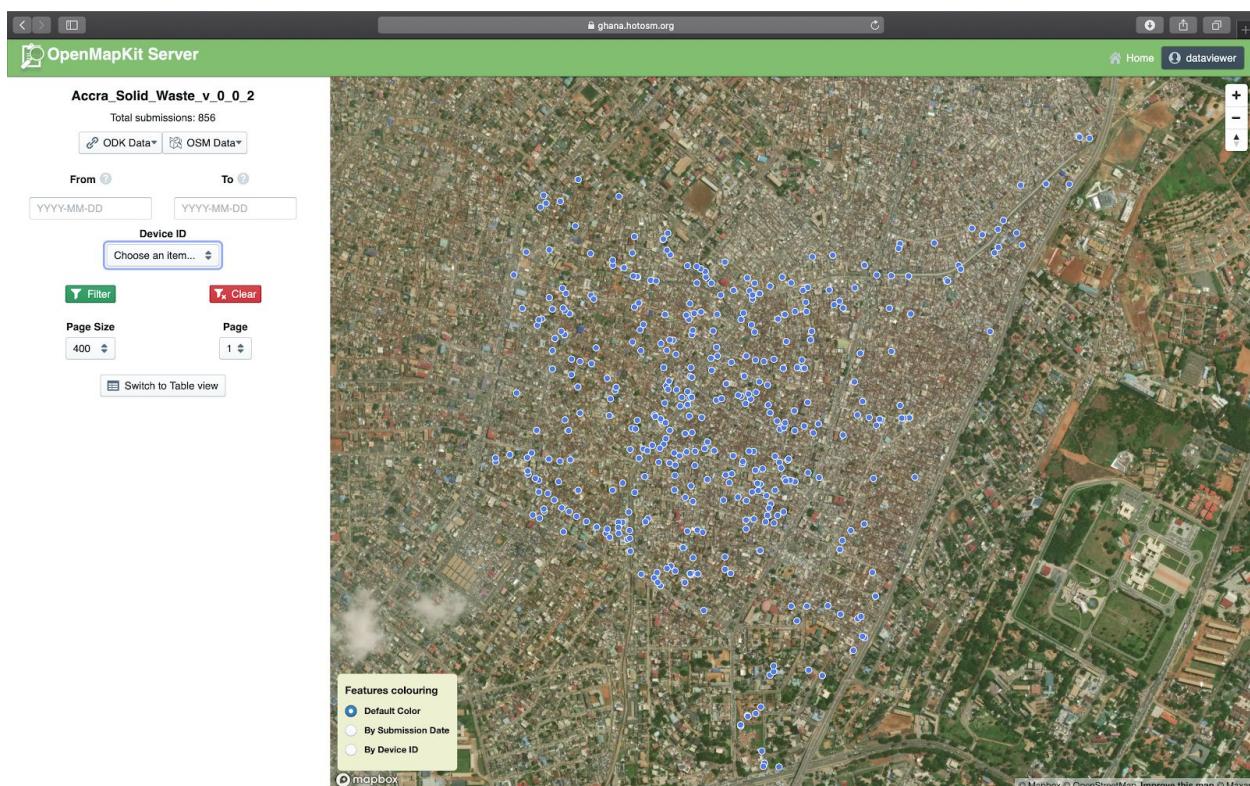


Fig 15 - Total number of solid waste points collected in Nima¹⁶ from OMK server

¹⁴ Mohammed Alhassan (MICZD)

¹⁵<https://ghana.hotosm.org/omk/pages/#/>

¹⁶https://ghana.hotosm.org/omk/pages/#/submissions/accra_solid_waste_v_0_0_2

MAP OF WASTE TYPE IN NIMA

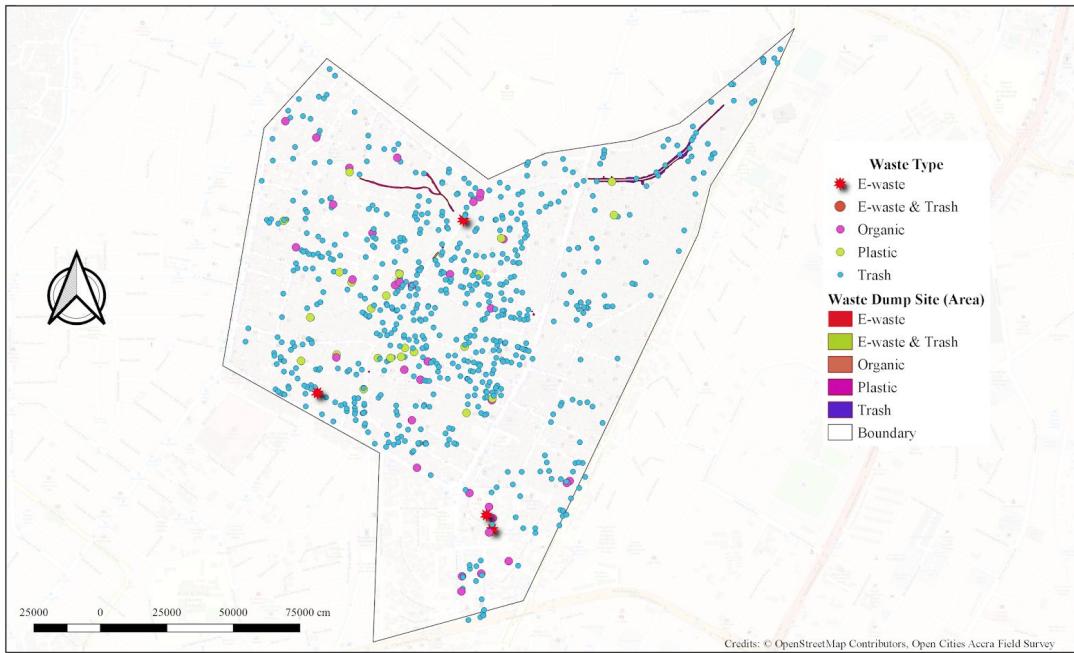
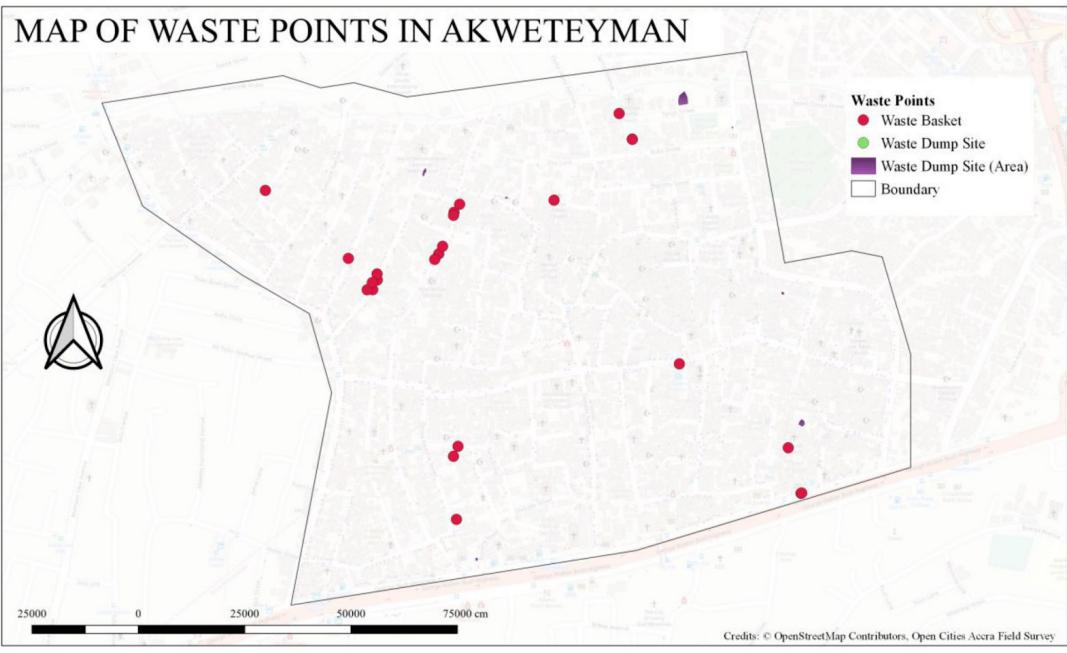


Fig 16 - Waste map Nima

MAP OF WASTE POINTS IN AKWETEYMAN



Foot note:

Waste dump site - official or unofficial dumping area used by one or more households
 Waste disposal - medium sized waste bins typically for bagged up household or industrial waste
 Waste basket or bin - single small container accessible for pedestrians

Fig 17 - Waste map Akweteyman

In all, 856 solid waste points were identified during the field data collection. These points were collected using the Accra Solid Waste form. The type of solid waste points collected in the field can be found in Table 1 below:

list name	name	label
sanitation_tags	addr:city	Name of city
sanitation_tags	addr:community	Name of community
sanitation_tags	addr:suburb	Name of suburb/neighbourhood
sanitation_tags	addr:street	Name of street
sanitation_tags	amenity	What kind of waste site is this?
sanitation_tags	waste	What type of waste is put here? (Not for toilets)
sanitation_tags	toilets:disposal	What kind of toilet is this?
sanitation_tags	toilets:handwashing	Is there a hand washing point at this toilet?
sanitation_tags	access	Who is allowed access to this toilet?
sanitation_tags	fee	Is there a fee to use the toilet or the waste disposal point?
sanitation_tags	name	What is the name of the waste disposal or toilet facility?
sanitation_tags	operator	Name of entity operating the waste disposal or toilet facility?
addr:city	Accra	Accra
addr:community	Akweteyman	Akweteyman
addr:community	Nima	Nima
amenity	waste_dump_site	Waste dump site (official or unofficial dumping area used by one or more households)
amenity	waste_disposal	Waste disposal (medium sized waste bins typically for bagged up household or industrial waste)
amenity	toilets	Toilet (NOTE: only map public toilets)
amenity	waste_basket	Waste basket or bin (single small container accessible for pedestrians)
amenity	recycling	Recyclable waste collection
toilets:disposal	flush	Flushing
toilets:disposal	pitlatrine	Pit latrine
toilets:disposal	bucket	Waste drops into a container which is removed periodically
toilets:disposal	chemical	Chemical
toilets:num_chambers	1	One
toilets:num_chambers	2	Two
toilets:num_chambers	3	Three
toilets:num_chambers	4	Four
toilets:num_chambers	5	Five
toilets:num_chambers	6	Six
toilets:num_chambers	7	Seven
toilets:num_chambers	8	Eight
toilets:handwashing	yes	Yes

toilets:handwashing	no	No
access	yes	General public
access	customers	Customers only
access	permissive	Private but access is not restricted
fee	yes	Yes
fee	no	No
toilets:wheelchair	yes	Yes
toilets:wheel_chair	no	No
toilets:wheel_chair	limited	Limited (some can access while other can't)
waste	trash	Trash (Rubbish)
waste	plastic	Plastic
waste	organic	organic (food waste)
waste	e-waste	e-Waste (such as collection of computer parts)



Fig 18 - Street level and drone imagery depicting hazardous points with cattle rearing

The solid waste point in the akweteyman community were collected from the first phase of the OCA project, we handed over a printed map to the Chief's Palace and Assemblyman to identify areas of issues in relation to flooding and waste points . Data indicated on these print maps shall be digitized.



Fig 19 - Meeting with the Chief in Akweteyman

2.3: Data QA/QC

The data collected from the field was uploaded to OpenMapKit server cloud server¹⁷. However, the data was one time uploaded to an offline server via Portable OpenStreetMap (POSM)¹⁸ server in the field, because we had issues with one of the forms that were created for data collection. As of 14th November 2019, data quality for Nima and Akweteyman was great with only minor tagging modifications needed during the data cleaning phase. Map Campaigner, Osmose, OSMCha, and JOSM were used to assess the quality of data uploaded to OSM by the OCA Accra team by an independent team project team. The data QA/QC process included activities discussed in the subsections below:

Data cleaning

The data cleaning team was made up of 15 mappers (10 males and 5 females). The data cleaners were trained as a group and supervised by a mapping supervisor, checking their individual data cleaning quality for prompt feedback. The training focused on advanced features and functionalities of the JOSM software that helped them in their work and improved efficiency. Some of these features included expert mode, filters, relations and plugins such as To-do list and Open Data. They were assigned portions of the data from the field downloaded from POSM and OpenMapkit server and assigned by the mapping supervisor/technical lead. Google Drive was used as central storage and for dissemination of raw data to be cleaned and Google Sheets was used to track progress and status of assigned data before final approval for upload to OpenStreetMap. This made it possible for us to work both in-person and remotely. Telegram¹⁹ was used by the data cleaning team to communicate and share screenshots of issues and problems encountered for best

¹⁷ <https://ghana.hotosm.org/>

¹⁸ https://wiki.openstreetmap.org/wiki/Portable_OpenStreetMap

¹⁹ <https://telegram.org/>

solutions either from supervisors or peers. Telegram was used because of the flexibility to use it as a stand alone application and seamless sharing of files. Issues that needs data collectors to clarify are also forwarded to the data collectors or team leaders for further clarifications when required.

Data Cleaning Process

- A **raw** data file is assigned
- A **final** version cleaned and validated is uploaded
- Supervisor **reviews** the **final** data and authorises upload to OpenStreetMap

Tools used:

- JOSM
- QGIS Desktop
- LibreOffice Suite - (Writer and Calc)
- Google Drive - (Docs and Sheets)

Observations during data cleaning

During data cleaning, the following observations were made:

- Misspelled Street names
- Building roof materials collected as wood
- Multiple house numbers and building names
- Same community name on dispersed buildings
- Unidentified street addresses added to buildings

Data validation

Field data validation was conducted after data was uploaded to OpenStreetMap. OsmAnd mobile application was mostly used to check the validity of attributes collected in the field. Street level images captured using Mapillary were as well used to validate data collected from the field.

fixme attributes were also added to items to be further validated during data cleaning. Some of these include the location of facilities which can not be clearly determined from street-level or aerial images.



Fig 20 - OsmAnd for field validation and Mapillary images captured (Green dots)

Data Validation with Street-level images

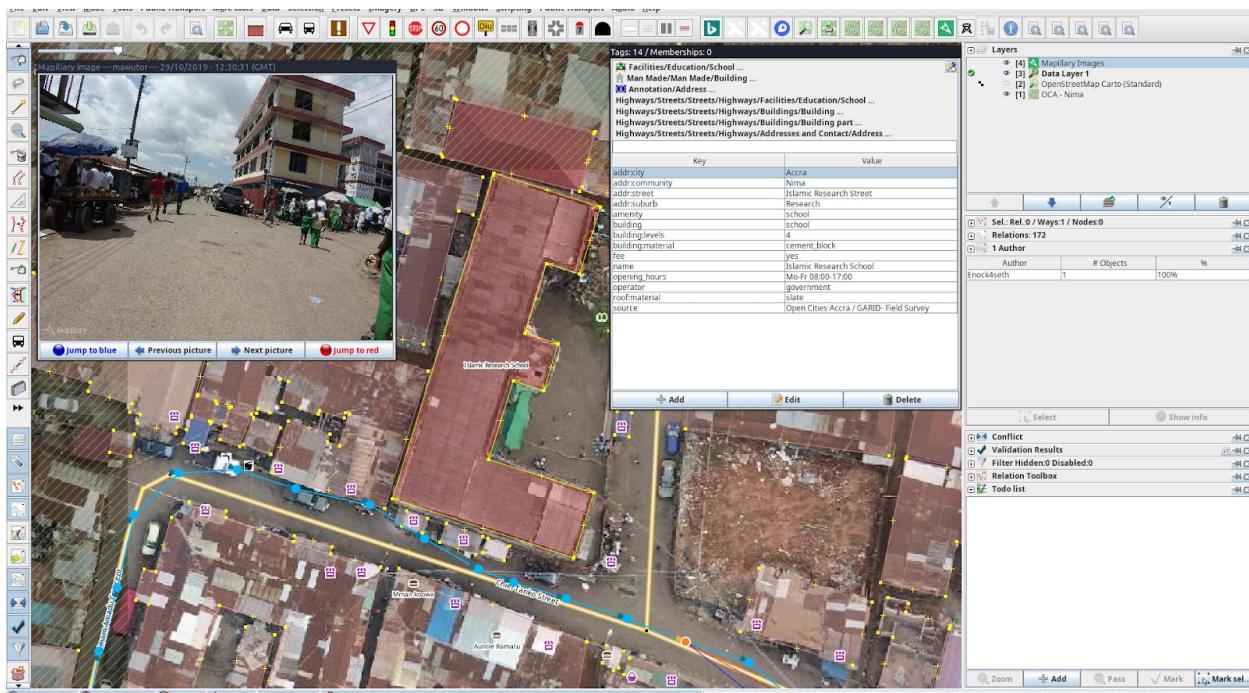


Fig 21 - Validating field data remotely with street-level images on Mapillary

Findings

1. Over one hundred features were randomly surveyed for validation from drains to buildings by observing and comparing attributes collected as mapped into OpenStreetMap.
2. Most buildings didn't have house numbers. There were a few buildings that had random house numbers, which were mapped during the field mapping exercise.
3. Not all streets had visible street signs or names.
4. We found out some footways were mapped as service ways which was either as a result of remote mapping using high resolution images. These were corrected and updated in OSM.

2.4: Geospatial Data Overview

The OCA Accra team collected data in the following categories with individual attributes as documented in section '*2.2 Field Data Collection*' section, based on the data model developed by the project team and the project stakeholders.

The table below summarizes the extent of mapping and/or data collection in the various project areas of interest:

Layers / Communities	Akweteyman	Nima	# of features
Buildings	Field	Field and Remote	Nima: 10,407
Drain Segments	n/a	Field and Remote	Nima: 43.43 km
Drain Points	n/a	Field and Remote	Nima: 2805
Health Facilities	n/a	Field and Remote	Nima: 31
Educational Facilities	n/a	Field and Remote	Nima: 59

Flood History Points	n/a	Field and Remote	Nima: 200
Solid Waste	n/a	Field and Remote	Nima: 407
Water Points	n/a	Field and Remote	Nima: 220
Financial Facilities	n/a	Field and Remote	Nima: 102
Roads and Paths	n/a	Field and Remote	Nima: 32.96 km

Below is an overview of some of the feature attributes collected and the related attribute completeness²⁰ in Nima community as of November 28, 2019:

Features Mapped	Attributes	Total Features	Attribute set count	% set
01 Buildings		10,407		
	building		10,407	100.00%
	building:level		6,640	63.80%
	building:material		6,629	63.70%
	building:roof		6,576	63.19%
	name		293	2.82%
	addr:housenumber		311	2.99%
	addr:street		3,847	36.97%
	addr:community		6,749	64.85%
	Average % set			49.79%
02 Education Facilities		59		
	addr:city		59	100.00%
	addr:community		33	55.93%
	addr:suburb		36	61.02%
	addr:street		33	55.93%
	name		56	94.92%

²⁰

<https://docs.google.com/spreadsheets/d/1HIT4qSywq30YV8QxSJnxFkbREPH9ygZRp-HINJjVhuk/edit#gid=309822229>

	amenity		59	100.00%
	operator		31	52.54%
	opening_hours		25	42.37%
	capacity		6	10.17%
	fee		27	45.76%
	phone		11	18.64%
	Average % set			57.94%
03 Health Facilities		31		
	addr:city		23	74.19%
	addr:community		23	74.19%
	addr:suburb		22	70.97%
	addr:street		24	77.42%
	name		30	96.77%
	amenity		31	100.00%
	emergency		11	35.48%
	bed_count		2	6.45%
	dispensing		13	41.94%
	opening_hours		13	41.94%
	operator		16	51.61%
	operator_name		5	16.13%
	phone		11	35.48%
	description		3	9.68%
	Average % set			52.30%

04 Drain Segments		798		
	depth		553	69.30%
	culvert:channels		9	1.13%
	culvert:multiple_channels		22	2.76%
	culvert:profile_closed		22	2.76%
	diameter		101	12.66%
	drain:bottom_width		98	12.28%
	drain:cover_type		145	18.17%

	drain:ele		186	23.31%
	drain:distance		43	5.39%
	drain:material		638	79.95%
	width		400	50.13%
	reference:feature		663	83.08%
	reference:feature_type		307	38.47%
	drain:profile_open		613	76.82%
	drain:top_width		144	18.05%
	Average % set			32.95%
05 Drain Points		771		
	blockage_type		16	2.08%
	comment		25	3.24%
	covered		2	0.26%
	damage_type		23	2.98%
	description		4	0.52%
	drain:point_feature		767	99.48%
	material		758	98.31%
	Average % set			29.55%
07 Financial Facilities		102		
	addr:city		96	94.12%
	addr:community		94	92.16%
	addr:suburb		80	78.43%
	addr:street		86	84.31%
	amenity		100	98.04%
	name		61	59.80%
	operator		10	9.80%
	network		52	50.98%
	opening_hours		34	33.33%
	Average % set			66.78%

08. Solid Waste		407		
	addr:city		406	99.75%
	addr:community		404	99.26%
	addr:suburb		253	62.16%
	addr:street		142	34.89%
	amenity		407	100.00%
	waste		407	100.00%
	toilets:disposal		6	1.47%
	toilets:handwashing		3	0.74%
	access		9	2.21%
	fee		97	23.83%
	name		2	0.49%
	operator		11	2.70%
	Average % set			43.96%
09. Water Points		220		
	addr:city		216	98.18%
	addr:community		219	99.55%
	addr:suburb		183	83.18%
	addr:street		122	55.45%
	amenity		220	100.00%
	man_made		215	97.73%
	natural		0	0.00%
	drinking_water		209	95.00%
	pump		192	87.27%
	operational_status		197	89.55%
	name		5	2.27%
	Average % set			73.47%

06 Flood History			200		
	consent		199	99.50%	
	location		200	100.00%	
	dwelling_type		199	99.50%	
	building_use		200	100.00%	
	years_in_house		172	86.00%	
	address.community		164	82.00%	
	address.suburb		199	99.50%	
	addr:street		50	25.00%	
	addr:landmark		124	62.00%	
	experienced_flood		193	96.50%	
	flood_history.flood_source		39	19.50%	
	flood_history.flood_event.flood_year		40	20.00%	
	flood_history.flood_depth		41	20.50%	
	flood_history.flood_cause		14	7.00%	
	flood_history.0.flood_source		15	7.50%	
	flood_history.0.flood_event.flood_year		15	7.50%	
	flood_history.0.flood_depth		16	8.00%	
	flood_history.0.flood_cause		5	2.50%	
	flood_history.1.flood_source		9	4.50%	
	flood_history.1.flood_event.flood_year		8	4.00%	
	flood_history.1.flood_depth		9	4.50%	
	flood_history.1.flood_cause		5	2.50%	
	moved_house		155	77.50%	
	moved_year		9	4.50%	
	comment		18	9.00%	
	Average % set				41.96%

Part 3: Project Results

3.1: Monitoring and Evaluation

The project's monitoring and evaluation component centred on tracking the different indicators of the various themes of the project. These themes included data collection and release, data product development, and capacity strengthening and institutional development. These were tracked on a monthly basis from start to end of the project.

Theme 1: Data Collection and Release

The focus under this theme was to track the number of data layers collected and their associated attributes versus the amount of area mapped using a participatory approach.

Number	Indicator	Metric	Target	Data Source	Disaggregation
1.1	Amount of area remote mapped using a participatory approach, that has been validated	2.14		OpenStreetMap	Nima
1.2	Number of features remote mapped	10407	10,000	OpenStreetMap	Nima
1.3	Amount of area field mapped using a participatory approach, that has been validated	3.57		OpenStreetMap	Nima: 2.14 sqkm Akweteman: 1.43 sqkm
1.4	Number of geospatial layers developed relevant to the resilience problem identified	10	10	OMK Server	Nima: 10 Akweteman: 1
1.5	Number of attributes collected relevant to the resilience problem identified	130		OMK Server ODK Forms OMK Forms	Buildings: 14 Drain Segments: 35 Drain Points: 8 Health Facilities: 12 Educational Facilities: 11 Financial Facilities: 9 Flood History: 11 Solid Waste: 14 Water Points: 11 House Number: 5
1.6	Number of government or other pre-existing datasets used relevant to	1	5	Ayawaso East	Building footprints Orthophoto

	the resilience problem identified				
1.7	Number of people attending presentations who are made aware of the data product	336	500		Male: Female:

Theme 2: Capacity Strengthening and Institutional Development

Theme 2 focused on tracking the number of events held together with the number of people attending these events and how this in turn strengthens stakeholders and other institutions in the city at large.

Number	Indicator	Metric	Target	Data Source	Disaggregation
2.1	Number of training events held	3	2	Attendance List	Training of mappers Field Data Cleaning Field Data Validation
2.2	Number of people trained	82	100	Observation during session	Male:53 Female:29
2.3	Number of people participating in remote mapping	25	50	HOT Tasking Manager	OpenStreetMap community
2.4	Number of people participating in community mapping activities	115	120	Attendance List	Disaggregated by: Female: 44 Male:75
2.5	Number of stakeholder groups consulted (in planning activities, etc.)	5	10	Email and Letters	Disaggregated by: topic, stakeholder group GARID MICZD Ayawaso East Municipal Okakwei North Municipal Akweteyman Assemblyman Nima Assemblymen
2.6	Number of women engaged in identification of hazardous hotspots	23	30	Attendance List	Field Mappers OCA

3.2: Stakeholder and Community Engagement

Stakeholder engagement was integral to the achievement of the goals of the GARID Support Project undertaken by the OCA team. For our work to have a direct impact on people living in the areas of interest, we had to involve the various government institutions that are already working in these communities. As already stated above, it had to take the intervention of government institutions that are stakeholders of this project for us to secure the necessary permit to even take the UAV image of Nima. It was also very important for us to engage with community members because they are the direct beneficiaries of the end product of the project. This was indeed one of the core objectives of this project. This makes them key stakeholders of the project.

When we opened online applications for volunteer-mappers to apply to be part of this project, we had very few members of the 2 areas of focus. We made a conscious effort to reach out to some community members with the intention of giving them high priority in the selection process to no avail. But with the help of the District Assemblies, the MICZD and referral from old mappers, we were able to get 6 and 8 volunteer-mappers from the Akweteyman and Nima respectively. All of them were taken through the capacity building sessions that were held for the rest of the mappers and later taken to the field to actively participate in the data collection. We were able to also meet with the Assemblyman and the Traditional Rulers of Akweteyman to share with them the work we intended to do in their community and also we shared one of the printed maps with them.



Fig 22 - GARID PCU and OCA Team meets elders of Akweteyman

In October 2019, the OCA team met up with some officials of NADMO to share the work we have done in past OCA Accra activities and currently Nima. At the meeting, we spoke at length about the data we are producing and our desire to partner with NADMO on this project. Below are a few points we took from our interaction with the NADMO team:

- NADMO requires data on schools and churches since they serve as safe havens during flooding.
- NADMO is also interested in demographic data
- The team at NADMO would like to have another meeting where we can brief them on more technical things like data collection.
- The NADMO team suggested that MMDAs could use the data we have collected to collect property rates and other internally generated funds
- The NADMO team suggested that they could help us engage disaster response groups in the various communities
- The NADMO team also suggested that we synchronize our data with that of the Ghana Meteorological Agency and the Hydrological Services Department
- NADMO is seeking support from the project to institutionalise the data application we have developed. They are interested in building the capacity of all their regional members to use our data application and also to acquire technical training on OSM.

Other Data Sources

The project didn't have access to any existing datasets from the various stakeholders throughout the project. However we were promised some datasets by the Ayawaso Waso Municipal Assembly of which the project team has delivered a USB thumb drive for the collection of such data.

3.4: Project Outcome

Project Products

One of the core project outputs is the increased awareness about community mapping approaches, tools, and methodologies to our project stakeholders, students and the community members. This has been achieved through the engagement sessions, training sessions and participation in the project mapping activities. This current project has specifically produced:

- Drone images for Nima
- Field mapped data in Nima and Akweteyman

As part of the previous OCA Accra mapping activities in Alogboshie, Alajo and Akweteyman, the following products were produced:

- Drone images
- Field mapped data
- Digital product²¹
- Static Maps (.pdf and .jpg)

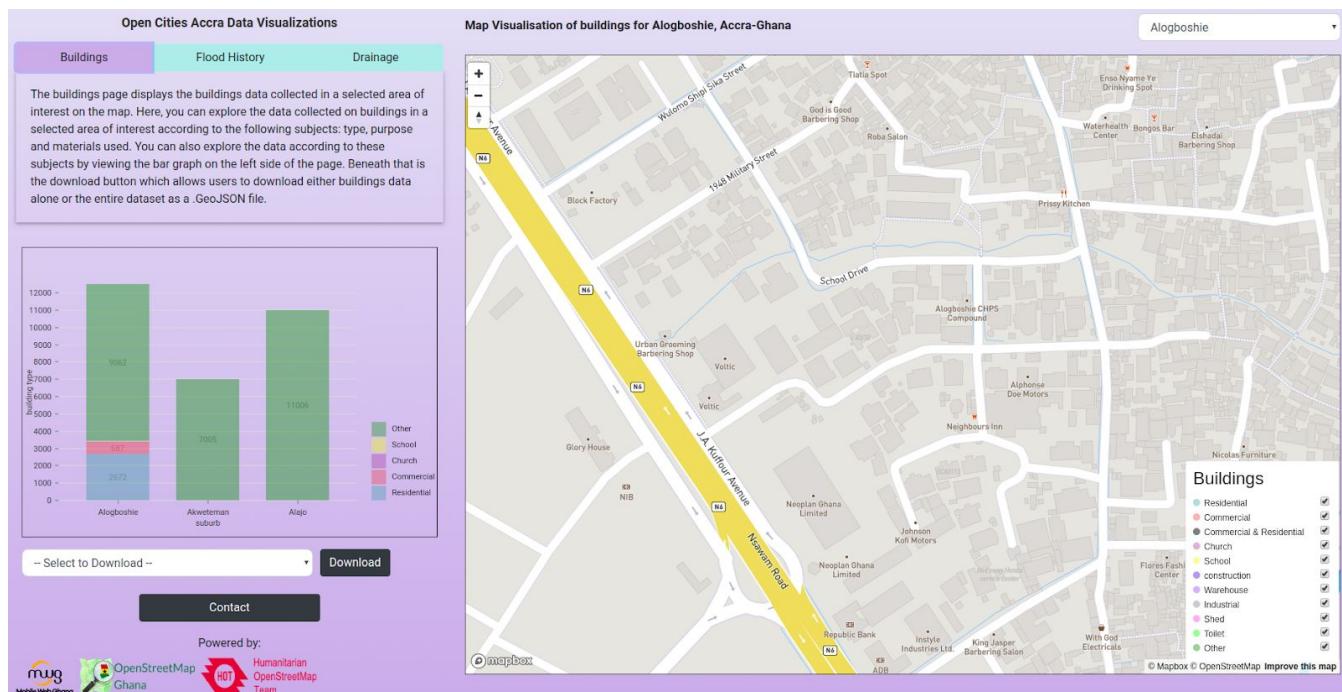


Fig 23 - Screenshot of digital product

²¹ <https://ocav1-app.herokuapp.com/>

Open Cities Accra - Akweteyman – General Map



Fig 24 - Example of maps produced

Part 4: Project Experiences

This session of the report is dedicated to highlighting the challenges and success stories of the GARID Support project. The Open Cities Accra team having already undertaken a similar exercise in 2018, the experience we gained from the challenges we overcame last year helped us totally eliminate those challenges for this project. For example, in the 1st phase of the project we encountered challenges with community entry, UAV image capture in Nima etc. All of these were dealt with accordingly in this project hence they didn't recur.

4.1: Challenges

However, we still encountered a few challenges. The challenges we encountered had a lot to do with the weather – a factor that is beyond the control of any human being. It rained a few days during the field data collection. This meant that on those days, no field work was done.

Secondly, for some strange reason, a total of sixteen mappers fell six (9 females and 7 males) during the course of the data collection exercise. This meant that the rest had to double up their effort and cover as much area as we were scheduled to cover during the brief absence of their colleagues.

We also had access to few or no available datasets from stakeholders on the communities of interest.

4.2: Successes

During this project, we registered a number of success throughout all that activities we did. These are:

Capacity Building: Throughout the course of the project, we have been able to train over 60 mappers who had little or no knowledge of OpenStreetMap prior to being part of the project. The essence of the capacity building component of the project is to ensure that as many people are introduced to the power of OpenStreetMap and learn how to contribute their quota to enhancing the platform. This feat gives us so much fulfilment knowing that we have grown the community of mappers in Ghana to a considerable extent. Some of the volunteer mappers have also gone on to become ardent and active contributors to OSM in Ghana - and this commendable.

Stakeholder Engagement: Our engagement with the major stakeholders of this project: Ministry of Inner-city and Zongo Development, Ayawaso East and West Assemblies, GARID team etc. helped made our entry into the community smoother and less stressful. We had access to GARID community liaisons who were very helpful. Also, we had the opportunity in meeting with the team at NADMO. They were very impressed with the work we had done, they gave some guidance as to how we should collected flood history data and we also discussed a possible collaboration later.

4.3: Lessons Learned

During the course of the project, the OCA Accra team had a number of lessons learned through working with various stakeholders and open mapping tools and processes. These include:

- **Remote Mapping:**

The OCA Accra team observed publicly imagery available to the OpenStreetMap community were very out of date. Hence drone imagery used for this was very useful and important to getting quality and good representation of information on the ground.

- **Capacity building:**

The team learned from trainings held preceding data collection and incorporated feedback from the test field data collection exercises in the early stages of the project helped reduce errors during the field data collection.

- **Community Involvement:**

We are very grateful to the assemblies, government institutions etc. who made it possible for us to involve members of the community at different levels of the project. We had some community members participate fully in the data collection exercise. Also, thanks to our community liaison in Akweteyman and Nima, we had the opportunity to present maps to the traditional leaders of the area.

- **Data Upload:**

For this project, we didn't use the offline POSM form initial field data uploads because of the lessons we learnt from the 1st phase of the Open Cities Accra project. It was difficult to have access to a source of power in the field which slowed down the process of data upload. This time around we made use of an online server called OpenMapKit server was used which made data upload easier. Every data was uploaded directly to the server irrespective of our location.

- **Dialogue**

In the field we learnt that dialogue has the power to dissolve doubts and calm tempers. A soft response and peaceful dialogue yielded the desired results of community members sharing their experience with us. The mappers explained to the residents what the project was about. Prior to the field data collection exercise, we took the mappers through a session on how to engage residents this yielded the desired results.

Part 5: Recommendations and Sustainability Plan

5.1: Recommendations

Donor funded projects often have a short life span, within which it is required to make a certain level of impact based on the goals set for the project. However, most of these projects are started with the aim of making sustainable impact transcending the funding period - with which the funding model is often at odds. The OCA Accra team is well aware of this fact and will be working to achieve the desired impact in making available up-to-date open data on OpenStreetMap in relation Disaster Risk Management (DRM) work in Accra. We are a team of passionate social change agents committed to helping build a community of people interested in working to reduce the negative impact of flooding in various communities. The benefits of this project are tremendous hence it will be more beneficial if the project is sustained beyond the months that it has been in existence. Below is a list of some of the benefits of the project that the OCA team believes if sustained can make a huge impact in the DRM work in slum areas of Accra and even beyond:

- **Accurate geospatial data:** Data collection was integral to the fulfilment of the goals of this project. Hence, it was the most intensive activity of this project. There were systems in place to ensure that the data collected was accurate and up-to-date so that it would be useful to policy makers and development partners of this nation. We recommend that policy makers (ministries and assemblies) leverage this data to make data-driven decisions to help curb the occurrences of natural hazards in the areas of interest and also reduce the effect these hazards on community members and the environment as a whole. This data was made available for free, reuse and redistribution on the OpenStreetMap platform. This makes the data available to individuals who may need it to develop some very useful innovations.
- **Capacity building and stakeholder engagement:** One of the goals of the GARID Support project was to be able to create a community of people who are passionate about the frequent occurrence of flooding in Accra and are willing to use simple technological tools to solve the problems caused by flooding. Hence, we conducted a number of capacity building exercises for volunteer-mappers and government institutions. With the skills these individuals have acquired, they will be able to contribute to solving Accra's perennial flooding challenges.

- **Strengthening of the community of humanitarian mappers** and further growing the OpenStreetMap, GIS, Open Data and participatory mapping communities in Ghana. Also creating awareness through visualizations of data collected.
- **Expanding the use of the digital tool developed through the OCA Accra project for further use by NADMO:** Our meeting with NADMO gave us a good perspective so far as the digital tool we are developing with the data collected from the field is concerned. The team at NADMO mentioned a number of data points that they are interested in and would be very helpful to them in their work. With regard to this, they made a few recommendations for the data they would like us to collect and which they don't have already and will be very useful to them. The recommendations are as follows:
 - ❖ Population data
 - ❖ Number of people living in Household data
 - ❖ Safe Havens
 - ❖ Historical costs (the amount of money and property lost due to flooding)
 - ❖ Flood history (should be recorded by month and year)

It was also proposed to engage NADMO community representatives, who are mostly liaisons between NADMO and various communities in training, capacity building and data collection in our future actives; same applies to staff. It was also recommended that we institutionalize the data and product of - and NADMO can take lead on that. NADMO is interested in institutionalizing the OCA data application if they get support from the project partners and other funding agencies. This will ensure that the data application is used by NADMO throughout the country.

The team will continue to rely on the stakeholders of the project to be able to achieve the above-listed goals and make the desired impact. We need the help of, especially, government stakeholders whose work border on DRM. The following are some of such stakeholders:

1. Accra Metropolitan Assembly
2. Land Use and Spatial Planning Authority
3. Ministry of Inner City and Zongo Development
4. Community Members of Focus Areas
5. Youth Mappers in Ghana
6. Ghana Statistical Services
7. National Disaster Management Organization (NADMO)

5.2: Sustainability plan

Going forward the OCA team will remain at the helm of affairs so far as this project is concerned. Mobile Web Ghana, OSM Ghana and Humanitarian OpenStreetMap Team will remain implementing partners of the project. Indicating that the execution of the plan for the project is purely the responsibility of this team.

The other actors of this project who we have earlier classified as stakeholders are as follows:

1. Accra Metropolitan Assembly
2. Land Use and Spatial Planning Authority (LUSPA)
3. Ministry of Inner City and Zongo Development
4. Community Members of Focus Areas
5. Ghana Statistical Services
6. National Disaster Management Organization (NADMO)
7. Youth Mappers in Ghana

In our engagement with members of staff of the above institutions, we came to the conclusion that what most of them lack is the technical know-how to collect geospatial data and make sense of them. Also, most of them do not have accurate and up-to-date geospatial data available to help them take data-driven decisions that are more impactful than decisions taken based on assumptions. As resources and time will allow, we plan to keep engaging all stakeholders so as to find some ways for providing technical support in the implementation of open mapping projects and the use of geospatial data.

Also, the OCA team had a meeting with the GARID PCU to explore other ways of ensuring continued collaboration amongst all the parties involved in this project. At the meeting, these were some of the agreements that we came to:

- It was agreed that the OCA team would participate in a possible project launch which would have an exhibition mounted where the team could provide some visuals and video of our work.
- It was also agreed that the OCA team could participate in some of the stakeholder engagements in other communities to be rolled out (for Component 2.1) by making presentations on some of our work (same materials used for the exhibition at the launch).
- It was stated that there could be an opportunity for collaboration in the preparation of flood maps under Component 3.3 for the ICMC and Joint basin

management plans using some of the OCA team members as facilitators of the plan preparation.

Conclusion

The Open Cities Accra project has been largely successfully as the team was able to achieve the goals that were set before the commencement of the project. The experience we have had is one that has made us very much aware of the plight of members of the general public who live in communities that are prone to flooding and other natural hazards. It has also emphasized the importance of stakeholder engagement, community participation and the use of technology in solving some of the world's most pertinent problems. In all of this, we cannot undermine the importance of Open Data and Free and Open Source Software (FOSS) since one of the goals of the project is to make the data collected in all the areas of interest available online for free on the OpenStreetMap platform.

Some of the most remarkable feats achieved during the project include:

- Community of skilled mappers:- we were able to build the capacity of about 60 mappers and reached out to both students and stakeholders to make them aware of the importance of open, accessible and up-to-date geospatial data for disaster risk response, management and analysis.
- Curated Disaster Related Management Data Repository:- Through the project, we have been able to create and curate open data on buildings, drains, drainage points and economic activities in a format that is easily accessible to stakeholders and the public at large.

It has been an amazing experience for all team members of the GARID Support project in Nima and Akweteyman. We are very grateful to the mappers and everyone we have interacted with in the course of this project and look forward to further collaborations and reuse of data collected in several fields.

Appendix

Open Cities Accra OSM Data Model and Tagging

From consultations with stakeholders, the below data model was developed and used to conduct field data collection in Nima and Akweteyman.

01. POI		
addr:city	Accra	
addr:community	<AKweteyman>	
addr:community	<Nima>	
addr:suburb	<name of suburb>	
addr:street	street name	
addr:housenumber	address number of the building, ie 25,H/25 19A	
Amenity	Bar,Fast_food,food_court,fuel,pub,restaurant,college,university,kindergarten,library,school,bus_station,car_rental,car_wash,parking_space,taxi,parking,tick_validator,atm,bank,bureau_de_change,clinic,dentist,doctor,hospital,nursing_home,pharmacy,social_facility,veterinary,art_centre,brothel,casino,cinema,community_center,nightclub,gambling,social_centre,studio,baking_oven,beach,court_house,embassy,fire_station,grave_yard,internet_cafe,market_place,place_of_worship,police,post_office,public_bath,shower,shelter,toilets,town_hall,waste_basket,waste_disposal,waste_transfer_station,water_point,telco_masts	https://wiki.openstreetmap.org/wiki/Key:amenity

02. Drainage

Note: This form will include mapping of roads

(i) Drainage Segment Features

geotrace	drain_line	<i>A geotrace of the feature being mapped</i>
refence_feature_present	yes, no	
feature_type	highway, bridge	
highway	primary, secondary, tertiary, trunk, unclassified, residential, service, path	

name	<name of highway or bridge>	
Surface		
surface	asphalt, concrete, gravel, unpaved	
smoothness	good, intermediate, bad, very_bad, horrible	
oneway	yes, no	(direction of traffic, NOT the number of lanes!)
width	<number>	(in meters of street width)
elevation_from_road	<number>	
drain_type	drain, ditch, culvert, decommissioned	
problem_decommissioned_drain	<text>	Problem with the drain
distance_from_road	<number>	If drain is parallel to road
profile_open	open_rectangular, trapezoid, elliptical, elliptical_trapezoid, rectangular_elliptical, tabulated	For drains
profile_closed	round, boxed_rectangular, other (describe and take photo)	For culverts
multiple_channels	yes, no	For culverts
number_channels	<number>	For culverts
covered	yes, no	For drains and ditches
cover_type	concrete, grating, wood, other	
depth	<number>	in cm, from the lip of the lowest side to the bottom of the drain.
width_boxed	<number>	For rectangular
bottom_width	<number>	For trapezoid, tabulated, elliptical_trapezoid
top_width	<number>	For trapezoid, tabulated, elliptical, elliptical_trapezoid
diameter	<number>	For closed_round
elliptical_portion_depth	<number>	For elliptical portion of the drain
covered	yes, no	
width	<number> of meters wide	For ditches, drains
depth	number> of meters deep	For ditches, drains
diameter	# of meters in diameter	For culverts
material	concrete, rock, steel, plastic, asphalt, other	For drains, culverts

concrete_smoothness	normal, rough, very rough	<i>For material=concrete</i>
steel_type	corrugated, flat	<i>For material=steel</i>
Image	<photograph of the feature>	
comment	<text>	<i>Anything special or problematic about the drain</i>

(ii) Drainage Point Features

geopoint	feature_location	
feature_type	Silt_trap, culvert_entrance, outflow, ends, begins, pipe_inflow, building_drain, drain_bridge, crossing_pipe, damage_or_blockage, private_property, spillway, other	<i>Mapping features in the drain</i>
damage_type	blockage, erosion, broken_concrete, other	
blockage_type	rubbish, plants, other	<i>For blockage</i>
covered_silt_trap	yes, no	<i>For silt traps</i>
material	concrete, steel, plastic, asphalt, sand, plants, gravel, other	
image	Image of the feature	
comment	<text>	<i>If there is anything special or problematic about the feature</i>

04. Waterpoints

addr:city	Accra	
addr:community	<AKweteyman>	
addr:community	<Nima>	
addr:suburb	<name of suburb>	<i>Get list of suburb</i>
addr:street	<street name>	
amenity	drinking_water, water_point	
name	<name of water point>	
man_made	water_well, water_tap, bore_hole, water_pump, protected_spring, water_works, storage_tank	
pump	powered, manual, no	
natural	creek, stream, spring, water	
drinking_water	yes, no	
operational_status	operational, closed, needs_maintenance	http://wiki.openstreetmap.org/wiki/Humanitarian_OSM_Tags/operational_status

		https://taginfo.openstreetmap.org/keys/operational_status#values
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05. Solid waste

addr:city	Accra	
addr:community	<AKweteyman>	
addr:community	<Nima>	
addr:suburb	<name of suburb>	
amenity	toilets, waste_dump_site, waste_disposal, recycling, waste_basket,	<i>Toilets mapped only for public toilets:</i> https://wiki.openstreetmap.org/wiki/Tag:amenity%3Dtoilets
toilets:num_chambers	# of toilets	
toilets:disposal	flush, pit_latrine, bucket, chemical	
toilets:wheelchair	yes, no, limited	
toilets:handwashing	yes, no	
access	public, customers, permissive (private but access is not restricted)	
landuse	Landfill <>refuse_dump, transfer_station>>	
dump:official	yes, no	
waste	mixed, trash, plastic, organic (food waste), e-waste, other	https://wiki.openstreetmap.org/wiki/Key:waste
name	<name of toilet or waste facility>	
operator	<name of operator of facility>	

06. Flood History (Not to upload to OSM - be collected door-to-door as and when there is someone to respond to these questions)

addr:city	Accra	
addr:community	<AKweteyman>	
addr:community	<Nima>	
addr:suburb	<name of suburb>	
dwelling_type	Formal_house, formal_apartment, informal_house	Take note
building		
flood_year	<year flood was experienced>	
flood_depth	finger width (0-2cm), Ankle deep (2-10cm), Mid	

	shin deep (10-30cm), Keen deep (30-50cm), Waist deep_(60cm-1m), Chest deep (1-1.5m), Person height (1.5-2m), Over person height (2m+)	
flood_cause	<free text>	<i>What caused the flood?</i>
flood_effects	disease_outbreak, death, household_displacement, other	<i>How did the flood affect the community/neighbourhood</i>
community_coping	<how did you cope>	
organisations_responding	<list of organisations that responded>	
		Do you have a safe assembly point? YES/ No? If Y the capture point. Sh

07. Health Facilities

addr:city	Accra	
addr:community	AKweteyman	
addr:community	<Nima>	
addr:suburb	<name of Suburb>	
addr:street	<street name>	
name	name of hospital	
operator	<name of operator>	
amenity	clinic, doctors, hospital, dentist, pharmacy	Find out about CHPS
opening_hours	<days/times of opening>	
bed_count	(for hospitals and clinics; the number of beds)	
healthcare:specialty	community, emergency, general, women, traditional, paediatrics, geriatrics, mental_health, social_care	
emergency	yes, no	
description	<text field>	

08. Education Facilities

addr:city	Accra	
addr:community	<AKweteyman>	
addr:suburb	<name of suburb>	
addr:street	<street name>	
name	name of school	

amenity	kindergarten, school, college, university	<i>Technical and vocational institutes are included in the tag college</i>
opening_hours	<days/times of opening>	
operator	<name of operator (operating authority)>	
capacity	<number of students/pupils>	
fee	yes, no	
religion	<if the school is associated with a particular religion>	

09. Financial Facilities

addr:city	Accra	
addr:community	<AKweteyman>	
addr:community	<Nima>	
addr:suburb	<name of suburb>	
addr:street	<street name>	
amenity	mobile_money_agent, atm, bureau_de_change, bank,microfinance_bank, sacco, money_transfer, post_office	rural
name	<name of facility>	
operator	<bank name>	
network	<p><if mobile money> MTN_mobile_money, AirtelTigo _mobile_money, vodafone_cash</p> <p><if atm> Visa, Mastercard, Maestro, Interswitch, other?</p>	<i>Multiple selection type</i>
opening_hours	Example: “Mo-Su 08:00-22:00”, “24/7”, “Mo-Fr 08:30-20:00; Sa,Su 08:00-15:00”	

10. Land Use

addr:city	Accra	
addr:community	<AKweteyman>	
addr:community	<Nima>	
addr:suburb	<name of suburb>	
addr:street	<street name>	
landuse	commercial, construction, industrial, residential, retail, farmland, cemetery, depot, farmyard, forest, landfill, military, plant_nursery, recreation_ground, religious	

name	<name of facility>	
operator	<name of operator>	
owner	<name of Owner>	

11. Road Transportation

name	<Bus stop or Terminal name>	
amenity	bus_station, bus_stop	