Makerere University Sponge Campus: absorbing the floods

Key Outcomes:
1) Reduce flash-flood risk and improve storm-water management in low-lying urban areas
2) Create a blueprint for Sponge projects across Africa to advocate for green, sustainable and climate resilient cities
3) Improve the wellbeing and livelihoods of flood-prone urban residents

Problem background

Kampala is one of the fastest growing cities in Africa, a hub generating 65% of the national GDP with an annual population growth of 4%. This influx of residents and prosperous economic growth, has led to a rapid urbanisation throughout the Greater Kampala metropolitan Area (GKMA). Over the last two decades, the city has undergone a construction spree where natural drainage systems (wetlands) in the low-lying areas have been encroached upon. While the numerous steep hills have seen major developments and a growing impermeable road network and courtyards.

These large impermeable urban surfaces together with intense rainfall events are causing devastating flash floods bringing with it large economic, environmental and social problems. In 2018 alone, the city experienced various fatalities, widespread property damages and major traffic disruptions. The worst affected residents by these floods are concomitantly the city's poorest, usually living in these low-lying areas of the city.

Given Kampala's steep topography, the densely urbanised landscape and the increasingly frequent torrential downpours, innovative storm-water management solutions must be explored on the numerous hillside areas of Kampala. Emphasising green 'Sponge City' infrastructures, not only supports the sustainable development of the city, but offers an effective alternative to conventional highly-engineered solutions creating a significant positive impact on flood prevention, water sustainability and wellbeing of urban residents.

What is a Sponge City?

Sponge City refers to a sustainable urban development that includes flood control, water conservation, water quality improvement and natural ecosystem protection. As the name implies, it tries to give cities “sponge” like properties (through green infrastructures) in order to absorb water and store it for later purposes.

This concept became very popular in China, a country that has seen the rate of urban flooding more than double in recent years. Currently, 16 cities are being transformed into pilot sites to tackle major water challenges.

For the Makerere Sponge Campus Project, RAIN has identified several **Sponge City measures** and traditional water harvesting practices that can be implemented widely across the university grounds. These are a few examples:

Intervention	Description	Example photo
Gabions	These structures can be used to slow down surface runoff in steep and unprotected areas. A trench can be built below to collect stormwater to allow for infiltration to the sub-base.	
Rooftop harvesting & cisterns	These systems capture runoff from larger buildings or from paved surfaces (e.g. patios, driveways). They can be placed above or below ground.	
Bioswales	Shallow depressions that accept flows from small, gently sloping drainage areas. Designed with a planting soil mix and a variety of plants. They convey stormwater when maximum ponding depth is exceeded. May or may not have an underdrain system.	

Raingardens	Similar to bioswales (at a bigger scale), but generally excavated into native soils and with only modest soil amendments, such as compost and/or sand and no underdrain. These practices are well-suited for installation in existing squares and parks.	
Pervious asphalt/pavement	Similar to traditional blacktop or concrete pavement, but has less fine aggregate to increase void space. These spaces allow stormwater to percolate through the asphalt to the underlying sub-base.	
Infiltration pits/trenches	Excavations filled with stone to provide void space. The voids between the stone allow for storage and infiltration into the soil below. These can allow to be used effectively along buildings, parking lots, roadways and inside roundabouts.	

Project rationale

In Uganda, previous and current government plans for urban drainage system are not working with nature but against it. There are many ingrained reasons why grey, highly-engineered and large-scale drainage developments are preferred but can be distilled to these motives: mind-set issue, no observable available alternatives and contractor lobbying.

Since governments are prone to listen to top educational institutions, Makerere University will not only become a pioneer at showcasing 'Sponge City' measures on its own grounds, but it will trigger government authorities to follow suit by joining the 'green alternative' to flood prevention at national level. Additionally, Makerere will undoubtedly receive increased media attention and improved public image thanks to its mindfulness and commitment to helping flood-prone communities further downstream.

Project Site details

This section gives an initial overview of the main characteristics of the Makerere University campus that were gathered from the Makerere University Master Plan.

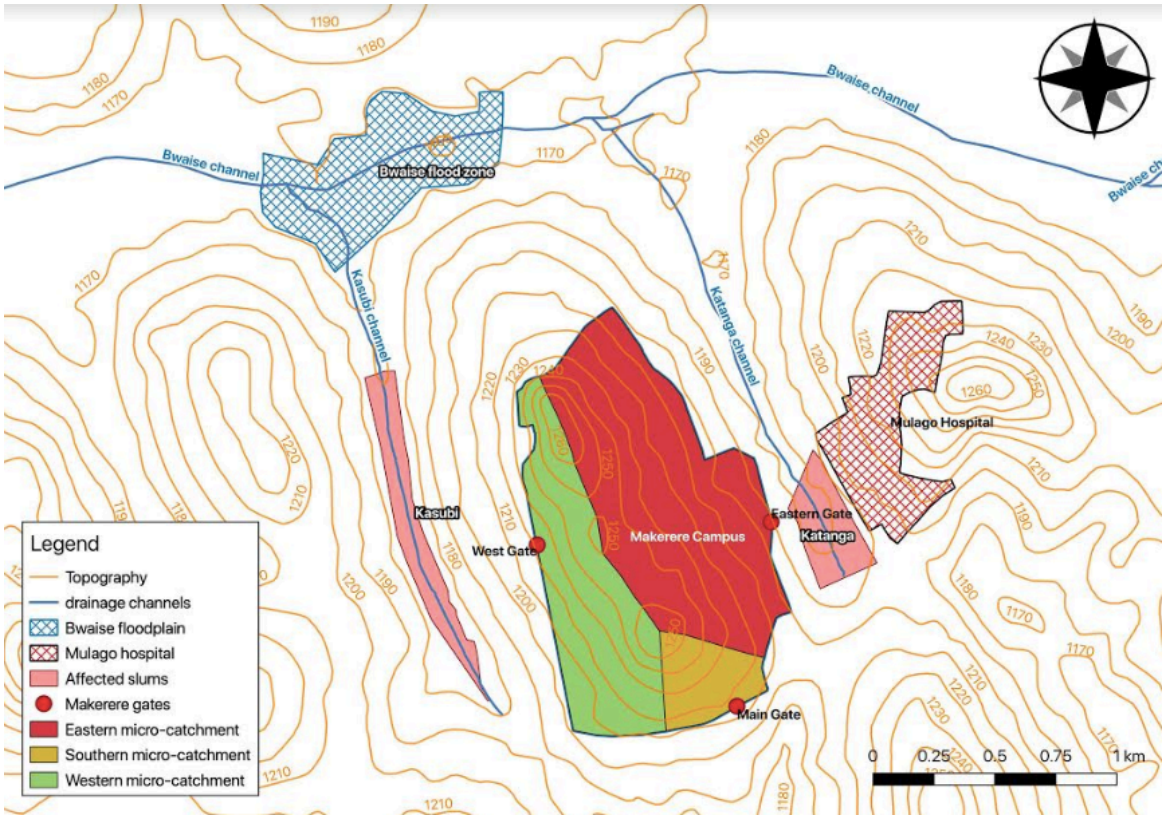

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Fig 1. Topography map depicting Makerere Campus in the middle and its 3 identified micro-catchments and adjacent affected areas along the channels leading to Bwaise

1	Campus size	1,194,000m2
2	No. of buildings	547
3	Built up area	98,542 m2
4	Road network length	18km
5	Total constructed surface incl. roads	197,542 m2

We identified 3 micro catchments within the university ground as depicted in fig.1 with 3 different main outflows: the west, east and south (main gate). From the interviews conducted by RAIN around the low-lying areas of the campus, we found that the most affected areas by water runoff coming from Makerere are Kikoni (Kasubi Slum in particular), the settlements along the Katanga Channel and finally Bwaise. From the table above we are positive that from the total constructed surface we can intercept about 50-65% of the rainwater.

The Sponge Campus project would follow a 'three-pronged' approach to enhance the flood resilience level of the city. This strategy aims to achieve the following:

1) **Upstream** - intercepting water at the top of the hill and building structures to divert and slow down the speed of urban surface runoff rushing to the foothill.
2) **Midstream** – storing as much runoff as possible with an array of high-storage capacity green infrastructures to further reduce water flow and achieve water retention. This water can be used for multiple uses such as flushing toilets.
3) **Downstream**- these areas need local drainage improvements to liberate any excess stormwater in combination with numerous Sponge infrastructures to optimise water recycling and reuse of valuable rainwater.

Goals & outcomes

A close collaboration between RAIN and Makerere University can achieve the following goals:

- Reduce storm-water runoff significantly in order to decrease the frequency and severity of flash-floods around the university's low-lying residential areas: Kikoni (Kasubi Slum) and Bwaise
- Create Africa's first 'Sponge City' university campus and make Makerere University the pioneer of green infrastructure development in fighting urban floods
- Attract local and international attention to the project and spark interest amongst urban authorities to reproduce 'Sponge' like interventions in other urban centres
- MUS (Multiple Use Water Services) in an urban context. Develop a campus with an extensive array of 3R (Retention, Recycle and Reuse) water management infrastructures whereby rainwater is collected and used for numerous ways e.g. toilets, gardening, cleaning etc. A secondary aim here is to create awareness of water conservation practise across the country.
- Student and academic staff involvement in the project implementation can motivate future leaders in water and land management

Methodology & Activities

The following are some preliminary phases that RAIN envisions in collaboration with Makerere University for this Sponge Campus Project. These will be discussed and revised further down the line of out cooperation.

To arrive at a way forward, we propose a discussion with the key decision makers from Makerere University Departments (Environmental Management, Engineering, Estates etc.) at the start of the project. Tentatively, the steps below will be followed. This methodology will need to be elaborated and concretised at the start of the project (and roles agreed between partners), when more details become available to us. From the objectives of the project, we propose the following phases and activities for the assignment:

1. **Inception** - aimed to set the stage for the assignment:
    - Consultations with key decision makers from different university departments to agree roles, discuss next steps and formalise an agreement to move forward
    - Gain access and permission to enter university grounds for measuring sites, analysing buildings and conducting interviews
    - GIS maps analysis to identify potential intervention sites
    - Refining approach and methodology
    - Organise an event to recruit interested students to get involved in the project. Potential for internship positions at Aidenvironment/RAIN where students can interact with (and learn from) experts in the field of water resources management

2. **Field visits and research**:
    - determine issues by conducting interviews on campus
    - measure and map out selected intervention sites with the help of motivated university students
    - stakeholder analysis in field
    - Potential guest lecture

3. **Designing, budgeting and construction plans**:
    - RAIN together with engineering students can design Sponge measures for proposed sites

4. **Validation of construction plans:**
    - The compiled plans will be presented to the university and donor, for validation and final input. Final comments will then be processed into final drafts that will be flagged the partners for funding and support.

5. **Final Report, lessons learnt and project implementation**

Budget

This section will be determined once the nature, timeframe and scale of the collaboration between RAIN and Makerere University has been discussed by both parties in the month of May 2019.

Local expertise

The project will be implemented by the '3R Consortium' of water organisations with RAIN/ Aidenvironment at the lead. RAIN has offices in Amsterdam, Indonesia and Kampala, providing an expansive network of contacts, thereby facilitating a smooth on-site implementation as well as technical backstopping and management support.

More information?
Contact us to find out what we can do for you.

RAIN/ Aidenvironment
Plot 99 Luthuli Ave,
P.O. Box 6662 Kampala, Uganda
kisekka@rainfoundation.org / +256(0) 393 20 88 17
rainfoundation.org; aidenvironment.org