GEOHAZARD IN FREETOWN

By

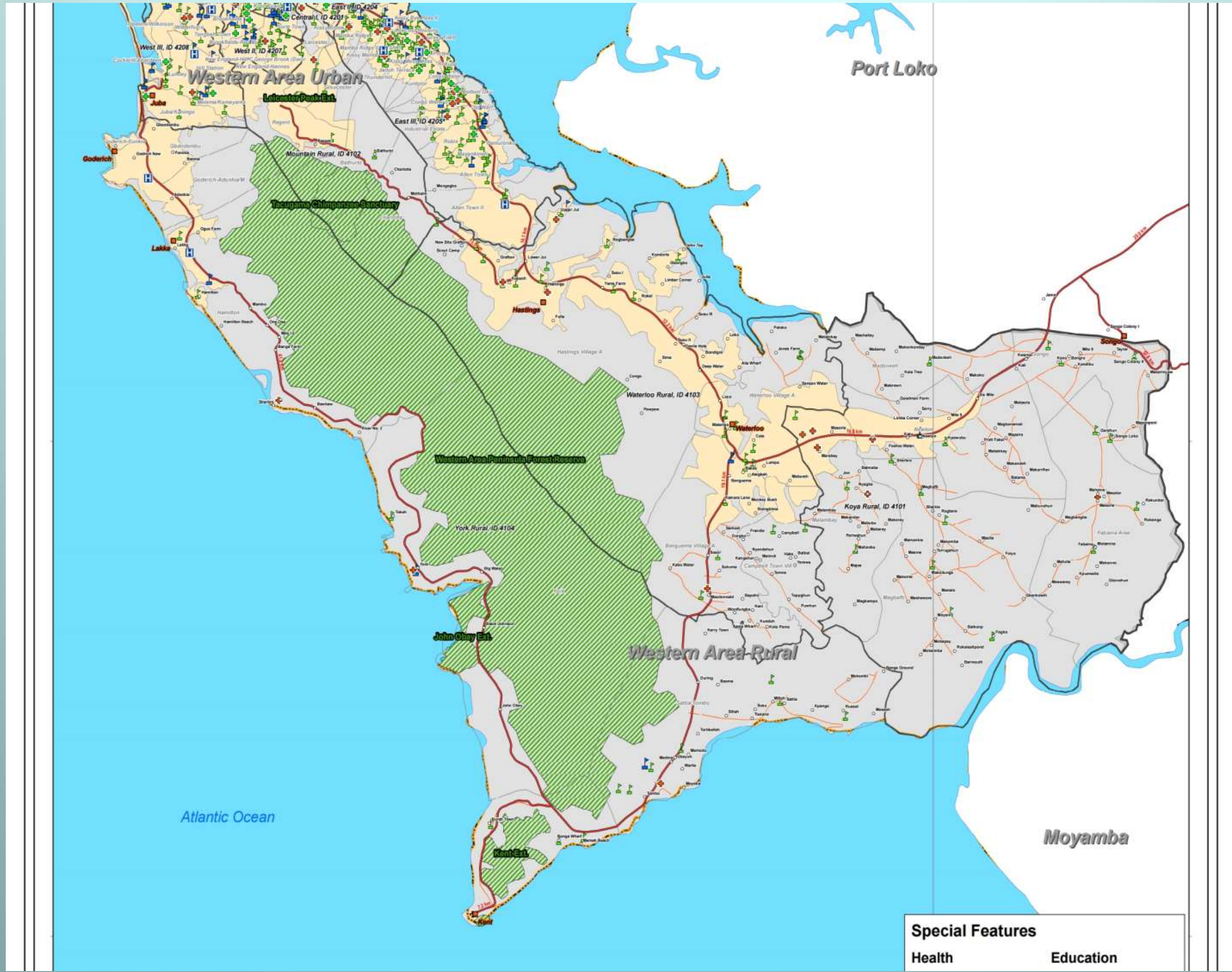
Ing. OBA DAVIES

GEOHAZARD IN FREETOWN

- Overview of Freetown
- What is Geohazard
- Geohazard events within Freetown and Contributing Factors
- How can we mitigate geohazard
- Institutional Capacity to tackle geohazard
- SLIE Contribution

GEOHAZARD IN FREETOWN

Overview of Freetown



Map of Freetown

GEOHAZARD IN FREETOWN

Overview of Freetown

- Freetown Municipality - urban population was 772 873 according to the Census made in 2004 and published in 2006
- In 2008, population estimated at approximately 1,000,000 on an annual growth rate of 6.5%,
- Estimated at 1,055,964 @ 2015 Census
- Current population growth rate is just over 2% and will peak in year 2020 at 2.14%
- Population increase, uncontrolled development - resulted in reclaiming land in coastal areas & flood plains; excavate into hilly areas for foundations for houses create unstable slopes - increase siltation and the risk of landslides

Uncontrolled Development in the Hills – Leicester Area, 2019

Uncontrolled Development in the Hills – Moyiba Town, 2012

GEOHAZARD IN FREETOWN

What is Geohazard

- ”Geohazard is the term related to Natural Hazard studies and indicates a geomorphological, geological, or environmental processes, phenomena, and conditions that are potentially dangerous or pose a level of threat to human life, health and property or to the environment."

"Geohazards include sub-aerial and submarine processes, such as earthquake, volcanic eruptions, floods, erosion, debris flows, rock-falls and other types of landslide and Tsunami. Human induced processes may also be considered as geohazards."

GEOHAZARD IN FREETOWN

Geohazard events within Freetown

- **Activities that trigger Geohazards (Landslide and Flooding)**
- **Rainfall, Erosion, Improper waste / Garbage Disposal**

.

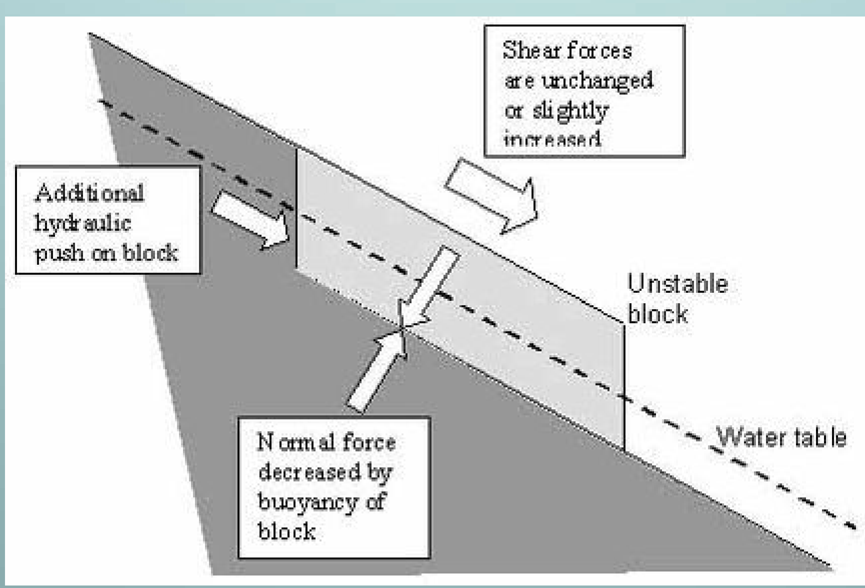
- Topography and Geology

.

- Occurrence of actual Geohazard events

On-site Impacts

- Land-Slides: Landslides can have many causes but can only have one trigger



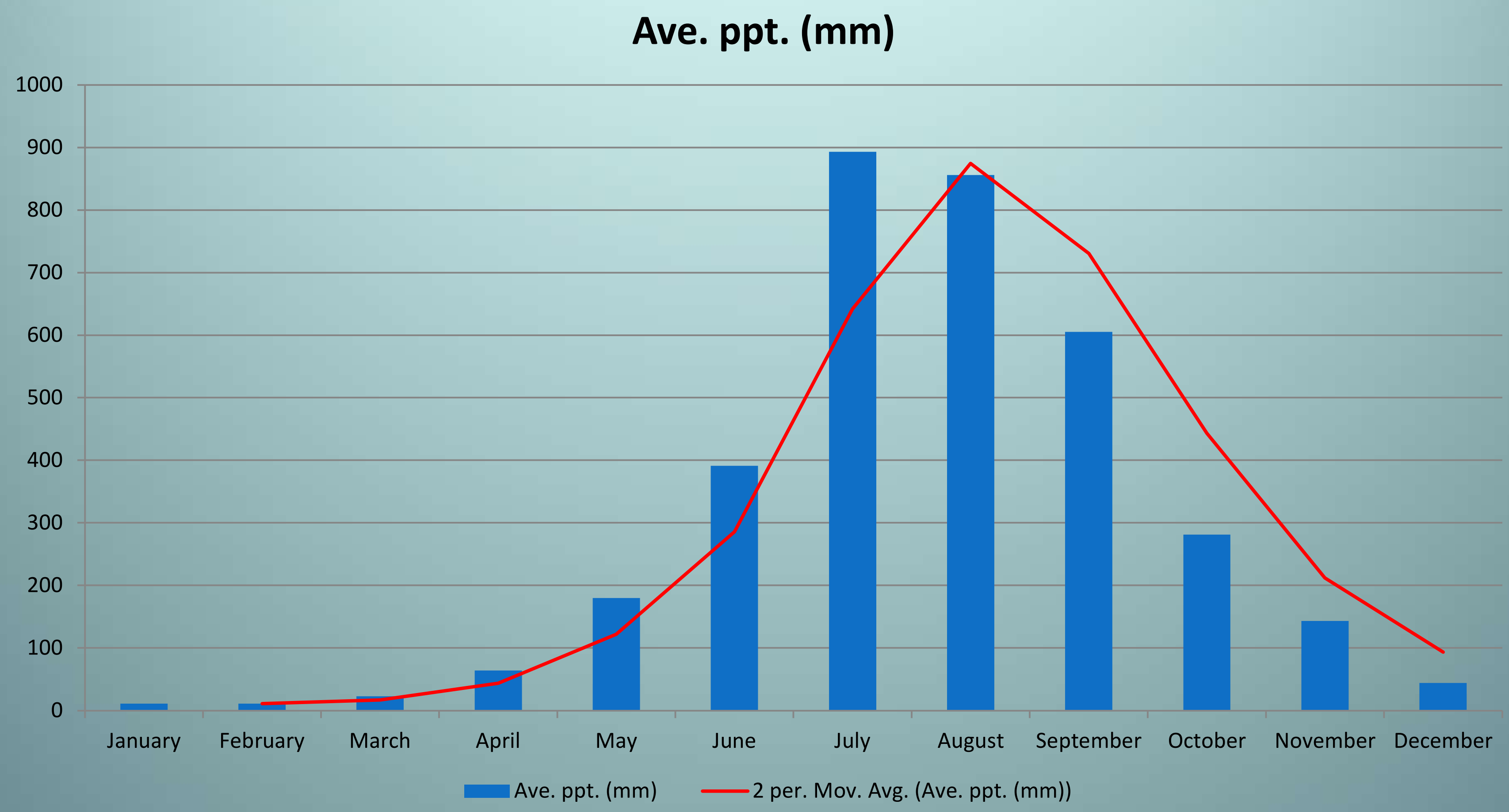
Impact of soil Erosion by water on the infrastructure of Freetown

- **Causes of Land-slides**
- **Geological causes**
- Weathered materials
- Permeability contrasts
- Material contrasts
- Rainfall
- **Morphological causes**
- Fluvial erosion
- Wave erosion
- Erosion of lateral margins
- Subterranean erosion
- Vegetation change
- Erosion

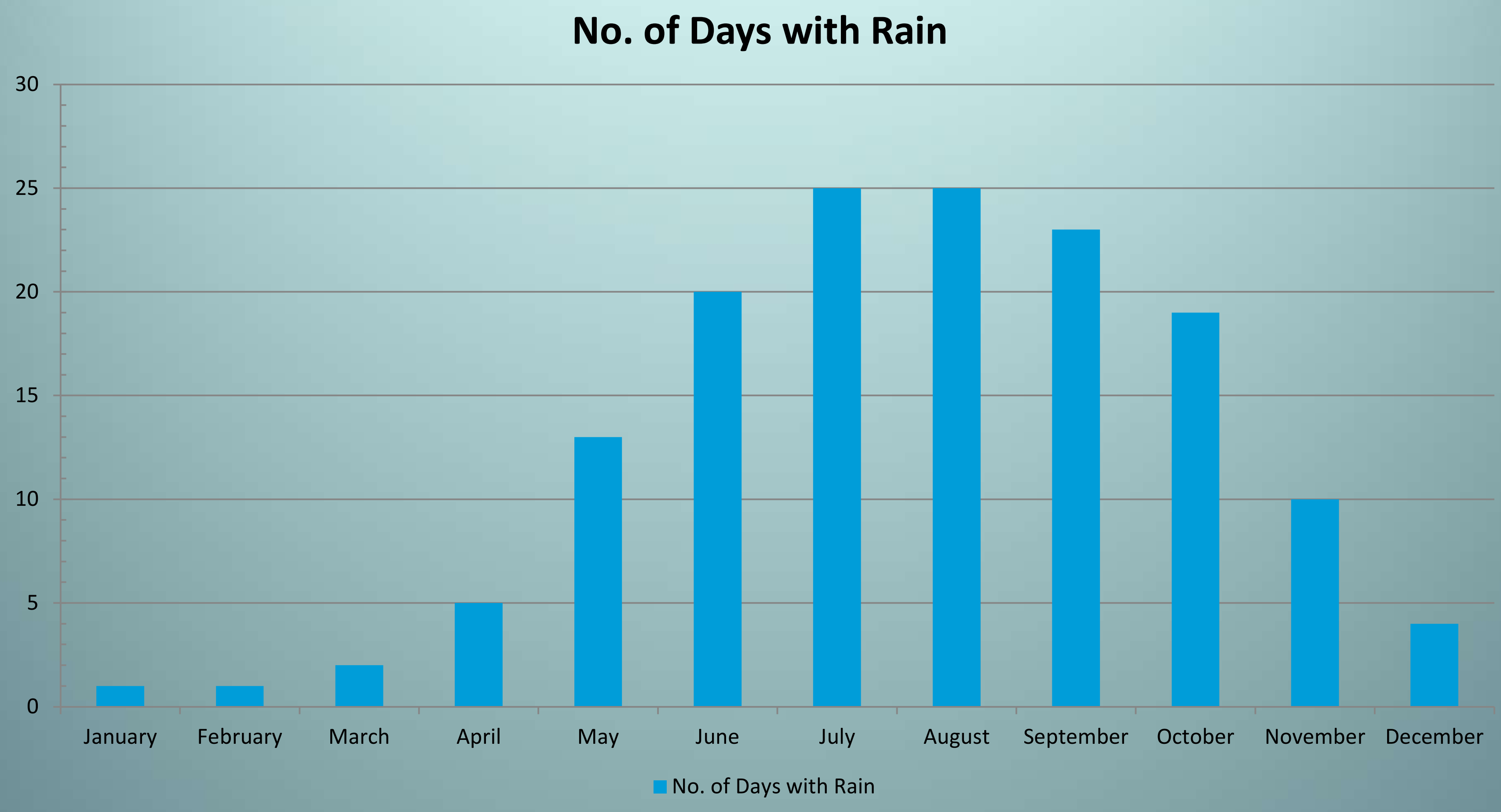
Impact of soil Erosion by water on the infrastructure of Freetown

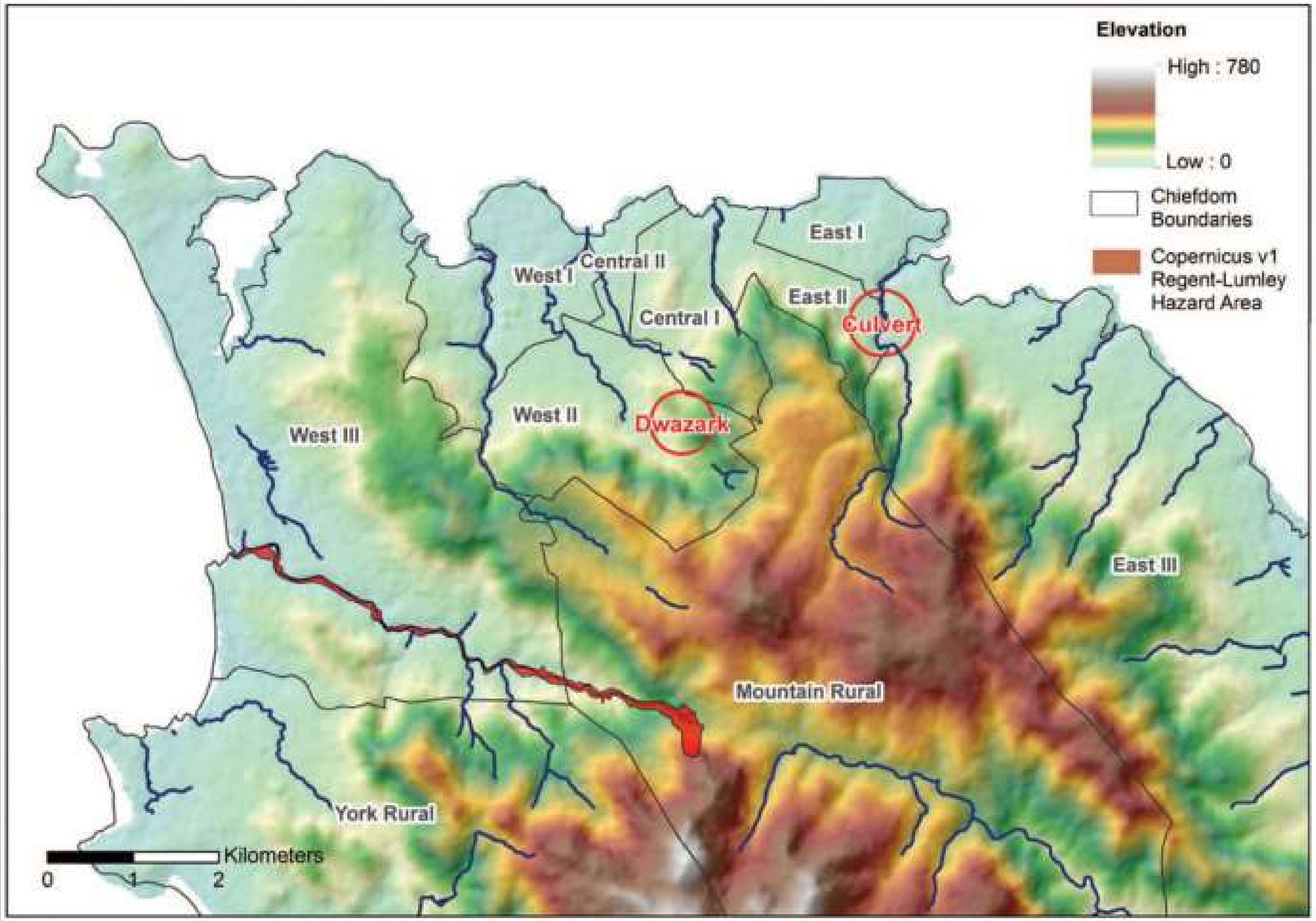
- **Causes of Land-slides contd.**
- **Physical causes**
- Intense rainfall
- Prolonged precipitation
- Ground water changes
- Soil pore water pressure
- Surface runoff
- Soil erosion
- **Human causes**
- Land use change
- Mining
- Quarrying
- Deforestation
- Land use pattern

Impact of soil Erosion by water on the infrastructure of Freetown



Impact of soil Erosion by water on the infrastructure of Freetown





Source: World Bank, Arup (2017).

Topographic Elevation of Western Area and Location of the Regent Landslide (shown in red) and the Flooded Areas in Dwazark and Culvert (circled in red).

Quarrying of Gabbroic rock for commercialisation of aggregate

Site of Charlotte Landslide

Flooding at Kroo Bay

Slum Dwellings at Kroo Bay

Erosion of Stream Bank, Savage Street Bridge

Flooding at Pademba Road – Mends Street junction

Slope failure and Rock fall (September 2016)
along the Regent - Grafton road (Bathurst village)

Siltation in road gutters

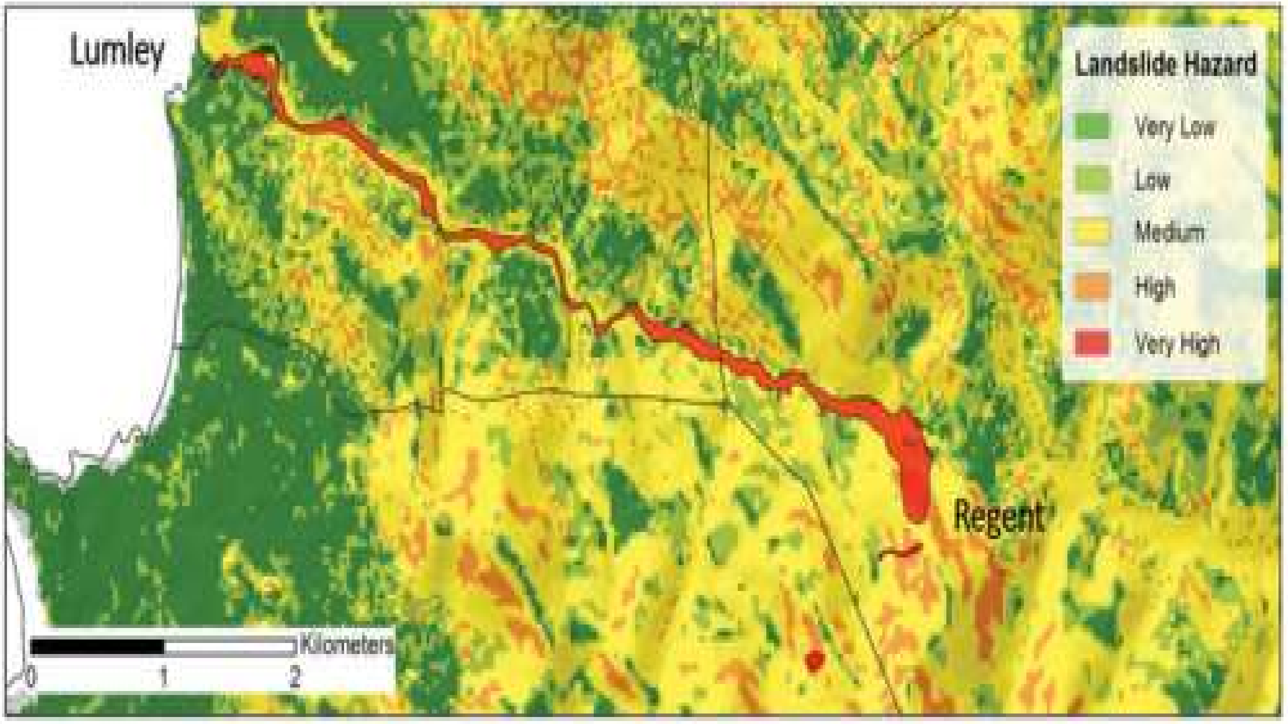
GEOHAZARD IN FREETOWN

Different Types of Soil movement in Landslide

Shallow slip Failure – FBC
Mount Aureol, 2019

Deep Slip Failure – Regent
Landslide , 2017

Landslide Area Mapped Over a Qualitative Hazard Map



Source: ONS—World Bank Ongoing Multi-City Hazard and Risk Study for three cities in Sierra Leone conducted by Arup (March–November 2017).

Erosion along stream bed – Regent landslide area

GEOHAZARD IN FREETOWN

Flooding at SLRA Compound

Click to Play

GEOHAZARD IN FREETOWN

White water stream to FBC

Click to Play

GEOHAZARD IN FREETOWN

Road Erosion around Culvert

GEOHAZARD IN FREETOWN

Fourah Bay Road

GEOHAZARD IN FREETOWN

Mitigation of Road Geohazard

- **LAWS, Policies and Regulations**
- Acts, regulations and policies are adequate
- Overlapping of responsibilities in some Acts
- Strict enforcement is required where road geohazards can be mitigated

GEOHAZARD IN FREETOWN

Mitigation of Road Geohazard

- **DESIGNS**
- Modern methods for slope protection are not considered in road designs
- Slope protection designs also provides beautification of the roads
- SLRA should develop a design standard for slopes along road alignment

GEOHAZARD IN FREETOWN

Mitigation of Road Geohazard

- **Sensitization and Education**
- Communities needs to be sensitize and properly educated on the adverse effect of road geohazards
- Media communications, jingles and local authorities can be useful
- Actions and decisions of today are crucial for the future

GEOHAZARD IN FREETOWN

Capacity to tackle Geohazard events

- **A Big Challenge**
- There is no documented framework for management of road geohazards
- SLRA has personnel and some equipment to respond to road geohazard but no structure
- FCC has no definite framework; only respond as and when need arises regarding road geohazards. Has a structure for garbage clearing and disposal
- Other institutions e.g. EPA and SLP have no clear operational direction towards road geohazard

GEOHAZARD IN FREETOWN

Capacity to tackle Geohazard events

- **Institutional set-up (Office of National Security)**
- The Office of National Security (ONS) coordinates all forms of emergencies in recent times
- They are responsible for control and licensing of private Security Companies (National Security and Central Intelligence Act – 2002)

GEOHAZARD IN FREETOWN

Capacity to tackle Geohazard events

- **Institutional set-up (Sierra Leone Roads Authority)**
- Generally, manage all roads related activities
- Reactive action to road geohazards emergency situation as deemed fit
- Proactive measures for routine maintenance (drainage clearing) based on available funding

GEOHAZARD IN FREETOWN

Capacity to tackle Geohazard events

- **Institutional set-up (Environmental Protection Agency)**
- Taken proactive action towards geohazard after August 2017 landslide
- Conducting studies on potential hazard areas
- Map out disaster prone areas within Freetown

GEOHAZARD IN FREETOWN

Capacity to tackle Geohazard events

- **Institutional set-up (Sierra Leone Police)**
- Provides support to ONS and other institutions
- Traffic diversion and control
- Secure lives and properties where needed

GEOHAZARD IN FREETOWN

Capacity to tackle Geohazard events

- **Institutional set-up (Freetown City Council)**
- Responsible for the Freetown municipality
- Coordinates relief items in geohazard emergency situations
- supervised general cleaning and clearing of garbage/waste and disposal
- Have a standing contract with MASADA

GEOHAZARD IN FREETOWN

Capacity to tackle Geohazard events

- **Institutional set-up (Road Maintenance Fund Administration)**
- Responsible to manage and administer the fund
- Source funds for road maintenance activities - from RUC on fuel, Vehicle License & Registration fees, Investment, donations or grants, any other sources allocated
- Effectively monitor the use of monies allocated from the fund

GEOHAZARD IN FREETOWN

Capacity to tackle Geohazard events

- **Institutional set-up (Private Institutions)**
- Example MASADA contracted by FCC for garbage collection and disposal
- Construction companies are contracted for road maintenance activities (Drainage clearing, premix patching, etc) by SLRA

GEOHAZARD IN FREETOWN

Capacity to tackle Geohazard events

- **Relevant Data (e.g. Meteorological, Studies / Research, Design)**
- Meteorological department unable to give public alert
- Non-existence of Weather & Environmental data locally for approx 30 years
- Modern methods for slope protection are not considered in road designs
- Research/ studies are not done for data collection by key institutions

GEOHAZARD IN FREETOWN

Capacity to tackle Geohazard events

- **Stand-alone Institution**
- Set up a geohazard risk management centre in the Ministry of Transport and Aviation
- setting-up a road geohazard risk management department within the organization structure of SLRA

GEOHAZARD IN FREETOWN

Capacity to tackle Geohazard events

- **Funding for resilient Infrastructure against Geohazards**
- No specific budgetary provisions exist within institutional budget of MDAs.
- Other operational contingencies are used in cases of emergencies
- Ministry of Finance provides funds to address emergency situation to institution(s)

GEOHAZARD IN FREETOWN

Capacity to tackle Geohazard events

- **Funding for resilient Infrastructure against Geohazards contd.**
- Government usually calls on donor agencies for support
- ONS may rally round private companies; locally operating INGOs/NGOs and regional / world institutions for support
- Individuals sometimes make contributions based on public appeal

GEOHAZARD IN FREETOWN

SLIE

Contribution

- Biennial conference (2016) - The theme "Natural Disaster Risk Management and Preparedness: an Engineering Perspective for Resilience"

Some views expressed at the conference

- Setting up a National Communication Centre for the interception and dissemination of early warning information concerning hazards
- Establishing an Emergency Operation Center (EOC) for prompt response to any emergency situation
- To transform the Disaster Management Department (DMD) of the Office of National Security (ONS) into a statutory agency, in order to ensure effective coordination and management of disasters
- Engineers have not been used for their expertise.

GEOHAZARD IN FREETOWN

SUMMARY

Adapted from: SIERRA LEONE ENGINEERS "DISASTROUS TO EXCLUDE US FROM THE DISASTER MANAGEMENT" by Ing. A. Keili

- Sierra Leone experiences recurring natural hazards - meteorological hazards (tropical storm thunder and lightning) and Hydrological hazards (landslide, flooding and erosion).
- Manmade disasters (e.g. deforestation, coastal sand mining, artisanal aggregate mining)
- The hazards are climate related – also having impacts to all terrestrial, wetland and coastal ecosystems.

GEOHAZARD IN FREETOWN

SUMMARY

Adapted from: SIERRA LEONE ENGINEERS "DISASTROUS TO EXCLUDE US FROM THE DISASTER MANAGEMENT“ by Ing. A. Keili

- Recent natural disasters indicated the country's vulnerability to climate change
- Previous urban development is on the flat land adjacent to the coast
- Recent urban developments are spreading up the steep hillsides - construction of houses in an unplanned manner
- Stop continuation of practices that may induce geohazards or subjected to strict monitoring and control.
- Increases the vulnerability to landslides and other geohazards

GEOHAZARD IN FREETOWN

SUMMARY

Adapted from: SIERRA LEONE ENGINEERS "DISASTROUS TO EXCLUDE US FROM THE DISASTER MANAGEMENT" by Ing. A. Keili

- Engineers should be fully involve in the phases of disaster mitigation, prevention, preparedness, response, and recovery if Sierra Leone is to meaningfully address problems of natural disaster management and mitigate the risk of geohazards.

GEOHAZARD IN FREETOWN

THANK YOU
FOR YOUR
ATTENTION