SIERRA LEONE

RAPID DAMAGE AND LOSS ASSESSMENT OF AUGUST 14TH, 2017 LANDSLIDES AND FLOODS IN THE WESTERN AREA

WORLD BANK GROUP

GFDRR
Global Facility for Disaster Reduction and Recovery

United Nations

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Experience the 14th August 2017 landslide and flood affected area in virtual reality.

The image on the cover page shows the main landslide at Regent; it is a mosaic of aerial photographs captured by a drone survey carried out by the local consultancy Edward Davies Associates LTD.

FOREWORD

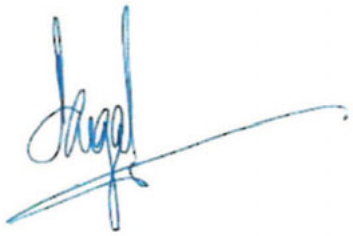
The landslides and floods of 14th August 2017 devastated a large cross-section of Freetown. An estimated 6,000 people were affected, of which 1,141 have been declared dead or missing and more than 3,000 people have lost their homes. While housing, health and social protection sector accounted for almost 80% of the total damages and losses, almost every sector of the urban economy was impacted. The livelihood impacts on affected communities are widespread still materializing as the recovery process commences.

The Government of Sierra Leone requested the World Bank and United Nations support to conduct a comprehensive rapid Damage and Loss Assessment (DaLA). The purpose of DaLA was two-fold, first to quantify damages and losses and second to make preliminary estimations for mobilizing funds and launching immediate recovery. The report intends to help the government formulate a strategic recovery plan, mobilize and prioritize resources.

The total economic value of the effects of the landslide and floods is estimated by this report is at about USD 31.65 million (SLL 237 billion), while the preliminary cost of resilient recovery needs is estimated at about USD 82.41 million (SLL 618 billion).

We are very grateful for the efforts of all Government agencies, private sector, civil society organizations, and development partners who were involved in preparing this report. Both the World Bank and United Nations system are mobilizing to support the government to effectively plan, coordinate and finance the recovery efforts, building on the strengths of key stakeholders. We will continue working together to address the needs of those most affected and support the recovery process to ensure sustainable and resilient recovery outcomes are achieved.

Mr. Parminder Brar
Country Manager
The World Bank



Mr. Sunil Saigal
Resident Coordinator
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ACKNOWLEDGMENTS

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UN Office of the High Commissioner for Refugees (UNHCR), UN Office for Project Services (UNOPS), UN Population Fund (UNFPA), UN Women, UNAIDS, International Organization of Migration (IOM), U.K. Department for International Development (DFID), World Food Programme (WFP), and World Health Organization (WHO).

Crucial research and mapping support inputs were received from Arup and INTEGEMS who led the collection of information about the nature of the hazards and their impacts, field visits and collected survey data to provide inputs to the Damage and Loss Assessment Reporting. Immediate post-disaster aerial photos of the main Regent landslide area were collected by a drone survey carried out by Track Your Build (TYB). This was followed by a drone survey with ground control provided by Edward Davies Associates (EDA). The latter survey covered the full 7 km corridor of the main landslide, and can be used to make remote quantitative survey measurements. The team is also grateful for the support provided by British Geological Survey, National Minerals Agency (NMA), and JBA Risk Management Limited during the study.

The sole responsibility of this publication lies with the author(s). The World Bank is not responsible for any use that may be made of the information contained therein.

To all the contributors, the team expresses its deepest gratitude and appreciation. To all the contributors, the team expresses its gratitude and appreciation, especially to the local communities and affected populations. This report would not have been possible without their trust and engagement.

ABBREVIATIONS AND ACRONYMS

[USD 1 = SLL 7500]

ACP–EU NDRR	Africa Caribbean Pacific–European Union Natural Disaster Risk Reduction
BBB	Build Back Better
BSL	Bank of Sierra Leone
DaLA	Damage and Loss Assessment
DFID	U.K. Department for International Development
EDSA	Electricity Distribution and Supply Authority
EGTC	Electricity Generation and Transmission Company
EU	European Union
EVD	Ebola Virus Disease
FCC	Freetown City Council
FSM	Fecal Sludge Management
GDP	Gross Domestic Product
GFDRR	Global Facility for Disaster Reduction and Recovery
GVWC	Guma Valley Water Company
HDW	Hand Dug Well
km	Kilometers
LC	Local Council
m	Meter
mm	Millimeter
MDAs	Ministries, Departments, and Agencies
MEST	Ministry of Education, Science, and Technology
MoWR	Ministry of Water Resources
NGO	Nongovernmental organization
NMA	Nationals Minerals Agency
NPAA	National Protected Area Authority
ONS	Office of National Security
PDNA	Post-Disaster Needs Assessment
SLL	Sierra Leone Leone
SSN	Social Safety Net
TNTC	Too Numerous to Count
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations International Children's Emergency Fund
UNOPS	United Nations Office for Project Services
USD	United States Dollar
WASH	Water Supply, Sanitation, and Hygiene
WFP	World Food Programme
WHO	World Health Organization
WSP	Water and Sanitation Program

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EXECUTIVE SUMMARY

A massive *landslide* in the Western Area Rural of Sierra Leone on August 14, 2017, slipped into the Babadorie River Valley and exacerbated existing *flooding* in the Western Area Rural and Urban (Freetown), affecting about 6,000 people of which 1,141 have been declared dead or missing.

Following three days of intense rainfall, a mountain valley side slope in the Regent area below Sugar Loaf, the highest peak in the north of the Western Area Peninsula, collapsed and caused a major landslide. According to eye witness accounts, the landslide took place in two stages—with the lower part of the slope slipping into the valley, and 10 minutes later, the upper part of the slope. The two-stage slip, and particularly the second, comprising a mix of clayey soil and boulders of all sizes (up to 40 cubic meters) traveling from high up the slope, would have had tremendous energy and momentum. *Residents reported a large 'tidal wave' of material advancing down the river channel immediately after the landslide as the debris pushed the flood water in front of it.*

The damage and loss caused by the landslide and subsequent debris flow along the Babadorie River Valley differed significantly from that caused by the flooding in other valleys across Freetown City. The main landslide caused major destruction in infrastructure, including buildings, bridges, schools, and health facilities in the Regent, Malama/Kamayama, Juba/Kaningo, and Lumley areas. Flooding in areas outside the landslide zone affected 55 percent of the households in the Culvert and Dwazark neighborhoods of Freetown on the same day.[1] The value of real estate damages and losses was higher than that of the other infrastructure sectors, which is typical of a disaster caused by a natural hazard event in an urban area (Figure 1).

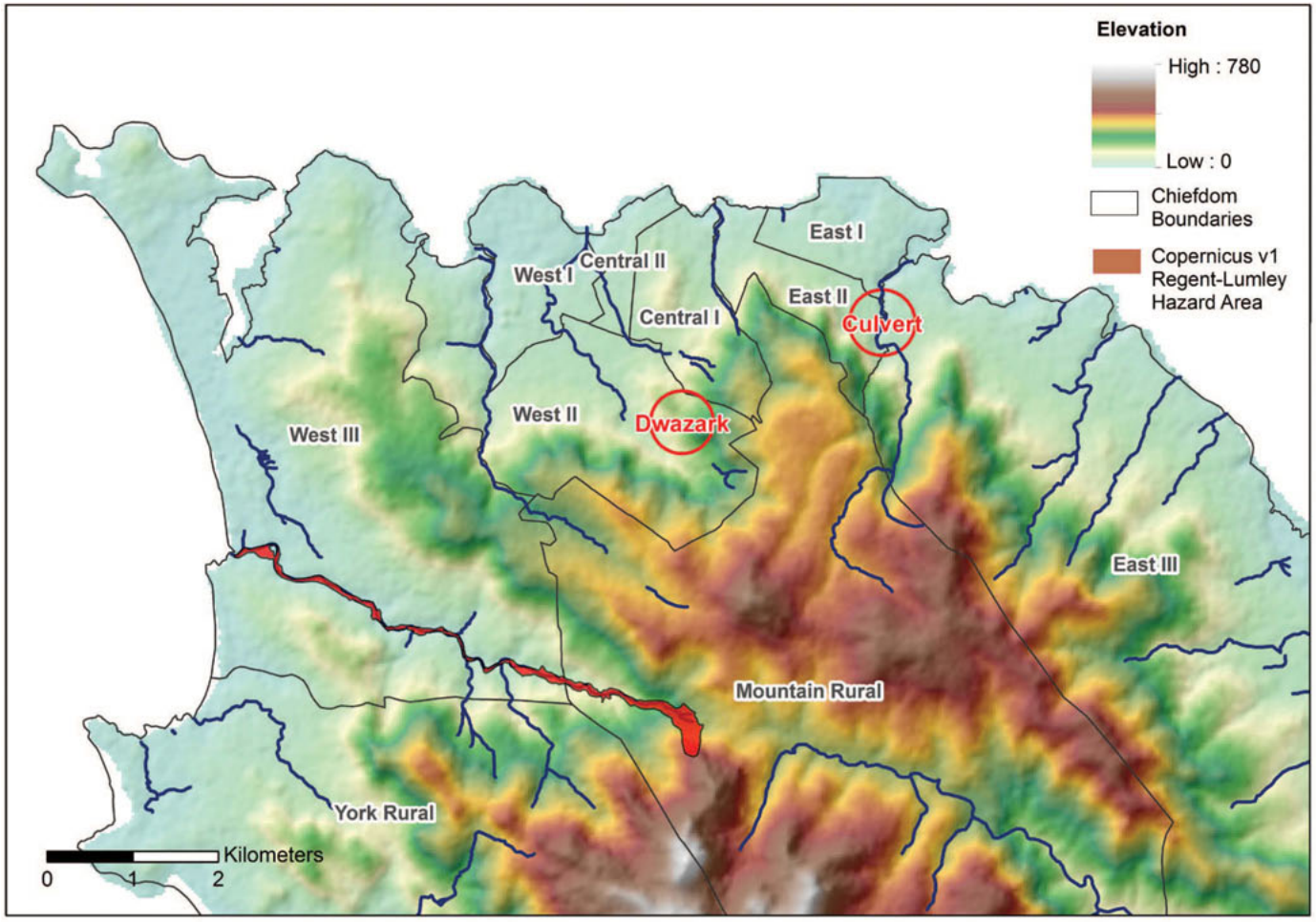
Damage impact also varied by geography, with lower income settlements being at the recipient end of the floods. Based on the satellite imagery and ward-level census data, differences in the quality of housing can be clearly distinguished along the water course and area of impact. The more upstream housing close to the landslide in Regent were better built and larger in size, whereas closer to the ocean, informal settlements dominated the urban landscape (Figure 2).

The Government of Sierra Leone requested the World Bank's support to conduct a comprehensive rapid Damage and Loss Assessment (DaLA), in partnership with the United Nations (UN). The DaLA was carried out from August 24 to September 8, 2017, with the objective of estimating damages and losses and of making preliminary estimations for mobilizing funds and launching immediate recovery. The assessment covers ten sectors, four cross-cutting areas, and preliminary recommendations for immediate, medium-, and long-term needs. UN agencies and other development partners will support the formulation of a programmatic plan covering key institutional, policy, financing, and implementation actions.

This DaLA is a living document and, as such, is subject to revisions as additional data become available. The report has sought to outline what is desirable and what is possible. The next step is to commence upon a recovery framework, which the UN will lead with the government, to guide and coordinate recovery and reconstruction efforts.

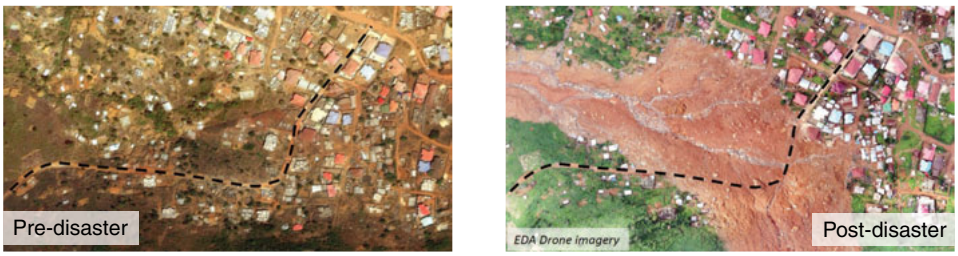
[1] According to the Office of National Security registration report of August 31, 2017.

Figure 1: 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).



Source: World Bank, Arup (2017).

FIGURE 2: Pre- and Post-Disaster Aerial Imagery of Regent Landslide Area



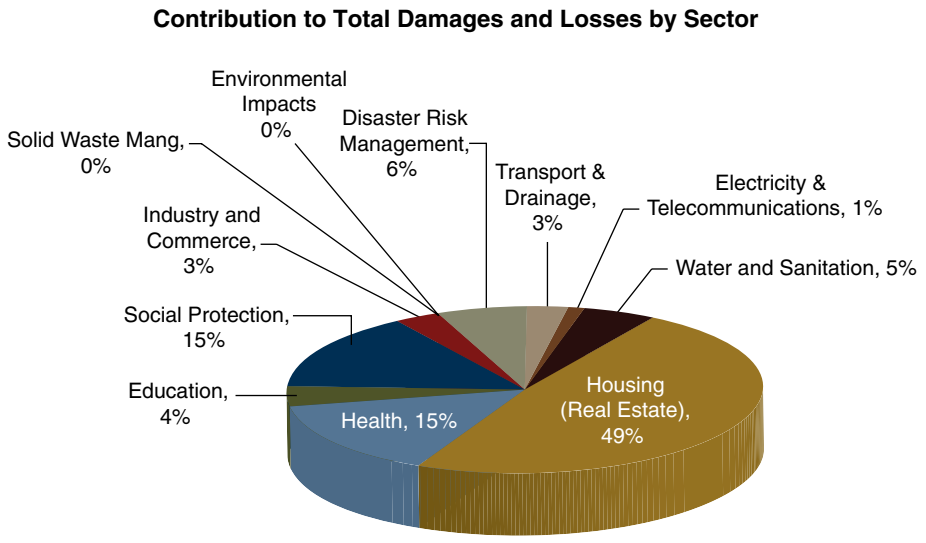
Source: Digital Globe (2017); EDA (2017).

TABLE 1: Estimated Damages and Losses per Sector

Sector	Damages		Loss		Total	
	SLL Billion	USD Million	SLL Billion	USD Million	SLL Billion	USD Million
Housing (real estate)	106.08	14.14	9.38	1.25	115.46	15.39
Transport and drainage	7.35	0.98	—	—	7.35	0.98
Electricity and telecommunications	1.30	0.17	0.75	0.10	2.05	0.27
Water and sanitation	5.67	0.76	6.63	0.88	12.30	1.64
Health	0.18	0.02	35.01	4.67	35.19	4.69
Education	3.92	0.52	5.25	0.70	9.17	1.22
Social protection	—	—	35.96	4.85	35.96	4.85
Industry and commerce	1.25	0.17	4.88	0.65	6.13	0.82
Solid waste management	—	—	—	—	—	—
Environmental impacts	0.05	0.01	—	—	0.05	0.01
Disaster risk management	—	—	13.35	1.78	13.35	1.78
Total	**125.8**	**16.77**	**111.6**	**14.88**	**237.37**	**31.65**

Source: Assessment Team (2017).

FIGURE 3: Distribution of Damages and Losses by Sector

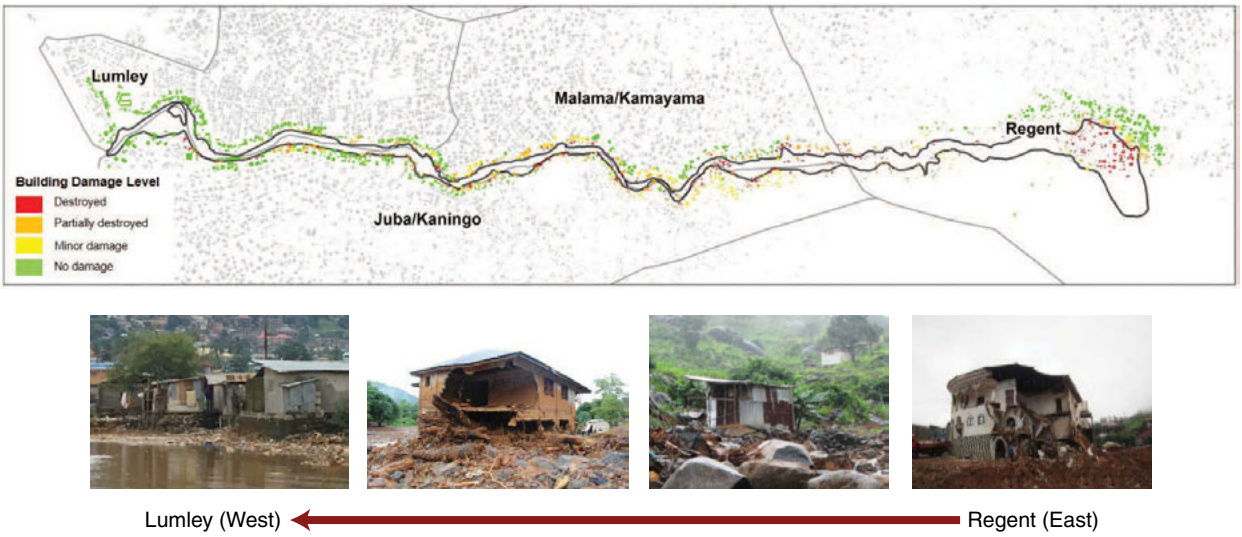


Source: World Bank Assessment Team (2017).

Summary of Damages and Losses

The total economic value of the effects of the landslide and floods is estimated at about SLL 237.37 billion (USD 31.65 million). Table 1 and Figure 3 summarizes the disaster effects within the different sectors: housing (real estate), amounting to SLL 115.46 billion (USD 15.39 million), followed by social protection amounting to SLL 35.96 billion (USD 4.85 million) and health SLL 35.19 billion (USD 4.69 million), and of the total damage and loss, respectively. These three sectors represent almost 80% of the total damages and losses as shown in Figure 3. The landslide and floods had a major impact on road and pedestrian connectivity. The productive sectors have sustained lower amounts in damages and losses,

FIGURE 4: Building Damage Regent to Lumley Based on Field Survey Data



Source: World Bank, Arup, INTEGEMS (2017).

but the harm to these sectors significantly affects the population's quality of life and living conditions.

Based on the sector reports, below is a summary of quantitative effects by sector on infrastructure systems, assets, the economy, and livelihoods.

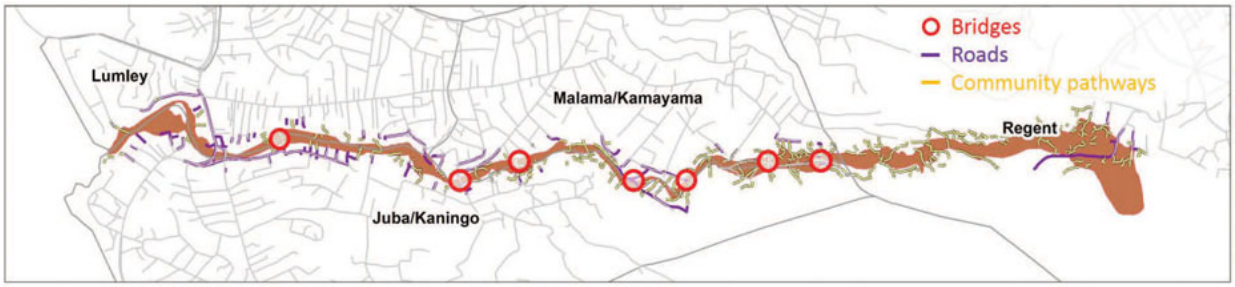
Real Estate (Housing) and Urban Development

Regent experienced the most devastating impact of the landslide, with 349 buildings destroyed, but debris also exacted harsh downstream damage and destruction. The landslide and floods affected a total of 901 buildings (residential/commercial, mixed-use, and public) covering 116,766 square meters, from Sugar Loaf Mountain (Western Area Rural) to Lumley Creek (Western Area Urban) (Figure 4). Of these, 769 buildings were residential and 27 commercial, while the remaining were mixed-use, apart from a church and an orphanage. Of the 901 total buildings affected, 349 buildings of about 34,178 square meters were destroyed; 263 buildings of about 38,384 square meters were moderately damaged; and the remaining 289 buildings suffered minor damages. Families who lost their homes are either staying with host families or living in temporary shelters. Same-day flooding in the Culvert and Dwarzak neighborhoods of Freetown mainly affected household assets, damaging buildings minimally. Together, the damages and losses from the landslide and flooding are estimated at USD 15.4 million.

Transport

Connectivity among and accessibility between communities (Regent, Motormeh, Pentagon, Kamayama, and Kaningo) were lost because of collapsed bridges and damaged access roads. Eight road and pedestrian bridges connecting Kamayama and Kaningo were moderately damaged or destroyed; two road bridges along the river channel between Regent and Charlotte were impacted; and about 5.5 kilometers of feeder roads were damaged. In sum, this amounts to a total cost of almost USD 1 million in damaged bridges and roads (Figure 5). Although the economic losses associated with lack of connectivity could far exceed the cost of the physical damage, these losses have not been assessed for lack of suitable data. Reconstruction efforts should firstly focus on a functional review of the transport infrastructure system prior to any repair, replacement or reinforcement of damaged or destroyed assets (such as roads and bridges). Moreover, the effective integration of relief culverts at locations within the transport infrastructure system should be considered to improve drainage and reduce future impact from floods.

FIGURE 5: Affected Roads, Bridges, and Pathways by Regent-Lumley Landslide



Source: World Bank, Arup, UNOPS, SLRA (2017).

Electricity and Telecommunications

The effect on the energy sector was more pronounced in the low-lying areas, where the Electricity Distribution and Supply Authority (EDSA) had transformers, poles, and cables. Outages occurred in Regent, Kamayamaa/Malama, Juba/Kaningo, and Lumley, partly due to EDSA responsibly taking certain areas temporarily off the grid to avoid electrical accidents; most of these have been reinstated to date. As of September 8, 2017, 372 households were still without electricity. In the same substation, 25 transformers, numerous conductors, low voltage poles, switchgear (Ring Main Unit), and low voltage panel transformers and accessories were affected by the floods. The total costs associated with damage to EDSA's infrastructure amounts to about USD 174,000. An additional USD 99,000 is required to extend electricity coverage to shelters and to replace household electricity meters. The telecom network has not been damaged, neither by the landslide and debris flow nor by the widespread flooding, as most towers and masts are built at height and there were no towers in the affected areas.

Water and Sanitation

Nearly 40 percent of households within the affected area rely on drinking water from dug wells, and although 34 percent were protected, the severity of the flooding leads to concern over water quality. Lack of appropriate disposal of human waste from pit latrines and toilets that flush to open drains combined with the flood waters, heightened the risk of cholera and other water-borne diseases. This necessitates the immediate provision of alternative drinking water supplies and testing of wells located in the flood zone. The event damaged parts of the piped water network and cracked the reservoir of the Babadorie water treatment system, which caused service interruption to 737 households. Floods also entered the Charlotte water system, requiring the clearing of boulders and desilting of the weir. Without considering the potential health cost, about USD 1.64 million of damages and losses to the water and sanitation infrastructure has been estimated during this assessment. A functional review of the water and sanitation system in this area should be first conducted that can then enable the real resilient recovery and longer term needs to be defined. When considering the resilient recovery needs, the bill is likely to amount to over USD 11 million.

Health

The landslide and flood had a moderate impact on the health system and constrained the health system's capacity to deliver essential services. In the disaster-struck areas identified by the government, six health facilities were affected and need to be reviewed for relocation. While the estimated direct damage is only approximately USD 25 thousand, the larger cost of losses at almost USD 4.7 million is associated with emergency response to control the spreading of diseases and to provide temporary health care in affected areas. The more comprehensive needs of the health sector in the Western Area are significantly larger and bilateral, multilateral, and philanthropic donors have to date committed in-cash and in-kind resources to the emergency response.

Education

The disaster affected 59 schools in 41 buildings mainly due to floods in the Regent, Kamayamaa/ Malama, Juba/Kaningo, Lumley, Dwarzak, and Culvert communities. Based on the initial rapid assessment by the Ministry of Education, Science, and Technology, one school was destroyed and numerous schools experienced minor damage to the buildings (34 schools), their water and sanitation infrastructure (38), their furniture (35), and their teaching (36) and learning materials (42). The assessed cost of this damage amounts to almost USD 0.52 million. An additional USD 0.7 million is being spent to compensate for losses by establishing alternative schools, to refurbish schools serving as temporary shelters, and to ensure schools are ready to support timely placement and re-integration of displaced students and teachers. In the longer term, capacities to respond to and prepare for emergencies need to be built in the education sector. The estimated education needs are valued at just over USD 2 million.

Social Protection

The government designated social protection as one of its disaster response strategies to mitigate the landslide and flooding effects on Western Area residents. The government, with support from the donor partners, is providing, among other measures, temporary housing and relief to the affected households and individuals. The U.K. Department for International Development and the World Food Programme also plan to provide cash and in-kind transfers in the short term to help affected individuals and households stabilize and regain livelihood activities. In the medium to long term, measures should be explored for the affected households to be mainstreamed in the national social safety nets program, subject to availability of funding and alignment with the safety net's target population. Estimated needs are valued at 6.57 million USD.

Economic Effects and Impact on Livelihoods

The disaster impacted economic activities and generated losses to the livelihoods of affected households, especially those displaced. In affected areas, wholesale and retail/petty trade, followed by services (including finance, transport, and hospitality), and agriculture in the rural part of the Western Area are the predominant economic activities. A total of 27 commercial buildings were destroyed with a total value of commercial asset loss estimated at USD 167 thousand. The total number of dead or missing workers is estimated at 365, comprising 262 workers in Regent and 103 workers in other affected areas; for the 2,057 displaced workers, pursuing income-earning activities is difficult. The estimated total value of livelihood loss for dead or missing workers is about USD 225 thousand, with the Martomeh community in Regent sustaining the largest economic losses (USD 161 thousand). The net livelihood loss to displaced workers is estimated at USD 680 thousand, though this depends on how quickly displaced workers return to work.

Households have different vulnerabilities and the impact of livelihood loss is more pronounced for those who were vulnerable before the landslide (i.e., agriculture-dependent population and retailers/ petty traders). Most of the affected households had low incomes and profit margins, working largely in wholesale and retail/petty trade, farming, and fishing. In this context, support can prevent the near-poor from falling into poverty and help the poor better navigate the shock. A comprehensive livelihood assessment is recommended to define the needs and to identify the priorities for guiding the recovery efforts, accompanied by the immediate provision of food and temporary shelter. A small livelihood support grant can help people and business re-start, especially where they have lost everything.

Macroeconomic Impact

The effect of the landslide and floods on economic growth is likely to be negligible, as the incident was localized in a few communities. The government had limited fiscal space to respond to the landslide and flooding incident as the domestic borrowing requirement had almost reached its limit (2 percent of GDP) while payment arrears to suppliers and contractors continued to accrue. Although the fiscal authorities had allocated SLL 48 billion (USD 6.4 million) as a contingency fund to respond to such events, hardly any funding was available when the disaster struck on August 14, 2017. The Office of National Security, including the military and the police, and the Ministries of Health, Energy, Education, and Water Resources have been implementing extra-budgetary spending to respond to the disaster. The full effect of the fiscal impact is expected be felt by the end of the third quarter of 2017 when Ministries, Departments, and Agencies are expected to request additional funding to implement earmarked programs.

The August 14 disaster events significantly impacted budget implementation, with adverse impacts on revenue mobilization expected to exacerbate the problems. The inflow of relief items into the country is expected to lead to a sharp increase in duty waivers and exemptions since a majority of the relief items will be treated as aid or donated items. Further, revenue mobilization in 2017 is likely to be minimally lower as a result of the deaths. Overall, the fiscal deficit is expected to widen by the end of 2017, largely because of expenditure overruns in response to the disaster.

Environmental Impact

The disaster events led to the loss of both tangible and intangible environmental assets in the Western Area Peninsula National Park. The Park covers about 17,000 hectares of closed forest and is one of the eight biodiversity hot spots of the country, hosting about 80–90 percent of Sierra Leone's terrestrial biodiversity. About 9 hectares of the national park were affected, with a loss of 4.38 hectares of primary Upper Guinean Forest cover. The total damages and losses to the environmental sector resulting from the landslide is estimated at USD 7 thousand and overall recovery needs of the sector are estimated at more than USD 1.85 million.

Solid Waste Management

Tons of waste discharged into the river ending in the sea, after the Granville Brook dumpsite deposited waste materials. Immediate recovery efforts should focus on cleaning both the river and drainage channels and restore the beaches from debris and waste. There is a need for a longer term waste management strategy, which must include the closure of the two existing dumpsites in the city, and the development of one or more appropriately sited landfill sites that can be developed into engineered landfills. Otherwise, the impact of the disaster on overall waste management is mostly noticed in the disruption of ongoing waste collection by a private sector company contracted by the central government. Combined short-, medium-, and long-term recovery and resilience needs in this sector are estimated at 1.99 million USD.

Summary of Recovery and Reconstruction Needs

Instruments such as DaLA provide a basis for the preliminary identification of recovery needs. However, more detailed sectoral assessments are required for a comprehensive disaster recovery framework.

For recovery efforts, USD 82.41 million is needed: USD 16.72 million for urgent short-term relief (0–3 months), USD 23.82 million for early recovery over the medium term (3–12 months), and USD 41.86 million for long-term resilient recovery (1–3 years). Based on international good practice for recovery and reconstruction, it is critical to prevent actions that end up creating disaster risks by conducting hazard assessments, increasing public awareness, and investing in the principle of Build Back Better (BBB). Such issues as institutional capacity,

TABLE 2: Short-, Medium-, and Long-Term Needs Cost per Sector

Sector	Needs						Total	
	Short-Term		Medium-Term		Long-Term			
	SLL Billion	USD Million	SLL Billion	USD Million	SLL Billion	USD Million	SLL Billion	USD Million
Housing (real estate)	14.97	2.00	17.25	2.30	67.50*	9.00*	99.72	13.30
Transport	6.26	0.84	29.32	3.90	4.88	0.65	40.46	5.39
Social protection	21.50	2.87	27.74	3.70	—	—	49.24	6.57
Health	43.82	5.84	18.74	2.50	20.83	2.78	83.39	11.12
Education	7.18	0.96	5.80	0.77	2.18	0.29	15.16	2.02
Water & sanitation	9.98	1.33	28.50	3.80	45.61	6.08	84.08	11.21
Electricity & telecom	1.46	0.19	0.31	0.04	4.95	0.66	6.72	0.90
Environment	—	—	2.63	0.35	11.25	1.50	13.88	1.85
Solid waste management	0.75	0.10	6.68	0.89	7.50	1.00	14.93	1.99
Disaster risk management	19.50	2.60	41.69	5.56	149.25	19.90	210.40	28.06
Total	**125.42**	**16.72**	**178.67**	**23.82**	**313.97**	**41.86**	**618.06**	**82.41**

**9* million USD/67.50 billion SLL is calculated based on an assumption that the Government of Sierra Leone would focus on the poor households in the affected area for providing safer housing solutions.
Note: Sanitation needs require a more detailed analysis and long term solutions therefore they have not been included in these calculations.
Source: Assessment Team (2017).

planning, financing, and harmonization of national and local government priorities have been identified as being key to Sierra Leone's recovery. The recurrent issues of technical and institutional capacity gaps in all sectors can be addressed through the formation of a centralized technical capacity within the current government structure. A strong, centralized capacity would underpin many of these institutional gaps, due to the multitude of actors in the ten sectors, and would anchor the resilient recovery planning and prioritization with more consistent technical designs. The next steps will be to finalize the recovery strategy, mobilize internal and external resources to finance reconstruction, and accelerate the preparation and implementation of recovery activities.

Short-term priorities to be implemented within the first three months include response, relief, and logistics systems, and measures to enhance multi-hazard risk information. Medium- (4–12 months) to long-term priorities (1–3 years) include sectoral master planning, territorial planning, improvements in legal and institutional arrangements, measures to mainstream disaster risk reduction in the development sectors (particularly housing and public infrastructure), social sectors (health and education), and livelihoods.

2

INTRODUCTION

2.1 Country Profile

Sierra Leone is situated on the West Coast of Africa and is one of the poorest countries in Sub-Saharan Africa and globally, with a per capita gross domestic product of USD 684 in 2015.[2] It is ranked 179 out of 188 countries on the United Nations 2016 Human Development Index,[3] and chronic malnutrition is still on the rise with 44 percent of children below 5 being stunted in 2010, up from 40 percent in 2005.[4] Per capita gross domestic product (GDP) stagnated after independence in 1961, contracted by 3.4 percent on average during the civil war (1991–2001) and increased by an average of 5.9 percent from 2002 to 2014. The country was severely affected by twin shocks in 2014, the Ebola Virus Outbreak and the downturn of international prices of iron ore, the combination of which caused the economy to contract by more than 20 percent,[5] plunging the country into economic and social turmoil. It has yet to recover.

Despite a topography that facilitates easy access to, and export of, natural resources, Sierra Leone remains a very fragile country[6] with weak institutions. The decade-long civil war was rooted in regional inequality that grew out of a highly-centralized system of government. It displaced more than 2 million people[7] and deeply impacted Sierra Leone's economic and social development. Decentralization was supposed to deliver social, political and economic inclusion and to reduce ethnic divide. Local Councils (LCs) abolished in 1972 were re-established by the Local Government Act of 2004.[8] But their ability to deliver decentralized services is compromised by incomplete and politicized reform efforts and by the continued power of chiefs and other local elites.

Agriculture is the main source of livelihood in Sierra Leone, particularly for the poor, contributing almost 50 percent of increases in GDP between 2001 to 2014. Agriculture employs more than half of the country's formal and informal workforce. Much of the decline in rural poverty has been driven by agriculture, although the small percentage of rural households working in nonagricultural activities experienced an even greater poverty reduction. Further gains in enhancing agricultural productivity and therefore poverty reduction could be made if input markets for seeds, fertilizers and pesticides were improved along with better storage and processing capacities, and feeder roads linking rural producers and urban markets, particularly around the capital, Freetown.

Although the incidence of poverty decreased between 2003 and 2011 by almost 13 percentage points, the number of poor remained nearly constant at around 3.3 million because of population

2 World Bank (2017).

3 UNDP (2016).

4 UNICEF (2012).

5 World Bank (2017).

6 Transparency International Corrupt Perceptions Index (2016) places Sierra Leone 123 out of 176 countries.

7 City governments have been unable to deliver adequate infrastructure and services commensurate with the pace of urbanization (World Bank 2010).

8 This Act provides the main legal framework for Local Councils. There are 19 Local Councils, made up of five City Councils and one municipal council in urban areas and 13 district councils in the predominantly rural areas.

growth. In 2011, the estimated incidence of poverty was 53.8 percent,[9] with three quarters of the poor residing in rural areas, despite the gains made in poverty reduction attributed to agriculture. Urban areas outside the capital, Freetown, experienced the most significant decline in poverty from 79.9 percent in 2003 to 39.9 percent in 2011. Freetown was the only area to experience an increase in poverty between 2003 and 2011, from 14 to 21 percent, but poverty rates remain well below the rest of the country. The increase in poverty in Freetown is believed to have been mainly driven by three factors: in-migration, the slow creation of well-paid jobs, and inflation.

The country's young, urbanizing, and growing population needs employment opportunities. According to the 2015 census, 45.8 percent of the population is under the age of 15 and 74.8 percent is under the age of 35. The share of the population living in urban areas almost doubled from 21 percent in 1967 to almost 40 percent in 2015, with a high concentration in the capital, Freetown, which has grown to a population of about 1 million. Although jobs in manufacturing are concentrated in Freetown, the majority are informal (72 percent) or unpaid (8 percent). The service sector accounted for about 33 percent of the labor force in 2014 (mostly in Freetown), but its contribution to GDP declined from 30 percent in 2001 to 20 percent in 2015. More than half the individuals aged 15–35 participate in the labor force, and 91 percent of these are self-employed.

The combination of population growth, fiscal space, governance, and institutional capacity has posed challenges in allocating land and providing services in urban areas. Each year, more than a 100,000 people migrate to urban areas in search of employment. Yet, there are large deficits in municipal infrastructure[10] and services and unclear accountability for the provision of services (in theory, Local Councils provide services but in practice, central government ministries continue to deliver services). While City Councils are autonomous legal entities that are governed by Elected Councils and that have their own expenditure budgets and revenue resources, they have limited resources to advance densification. This inhibits more cost-effective service delivery, development of new revenue streams and prolongs reliance on central transfers. Within that limited fiscal envelop and with no incentives, local governments are struggling to deliver services to standards and levels commensurate with their budgets.

2.2 Vulnerability to Disasters

Sierra Leone is prone to natural disasters, mainly recurrent floods, drought, and landslides, which are likely to be exacerbated by climate change. The Notre Dame Global Adaption Index ranks Sierra Leone 158 out of 182 countries and territories in terms of vulnerability to climate change.[11] With 13 percent of its area and more than 35 percent of the population at risk, the mortality risk from multiple hazards is high. In the last 15 years, four major floods have affected over 220,000 people and caused severe economic damage. Exposure to natural disasters is likely to worsen in the coming years, given the low level of Sierra Leone's development and capacity to cope with extreme events.

Freetown is a coastal city located on the mountainous Sierra Leone peninsula, in the west of the country. The peninsula is around 38 km (24 miles) long and 16 km (10 miles) wide with the city mainly occupying the northern and eastern areas, but with accelerating ribbon development and expansion into the more elevated, steeper and forested central mountain belt. The highest peak near the city is Sugar Loaf, at 795 m above sea level, with the highest mountain on the peninsula, in the south, reaching 912 m above sea level. Around the mountains, the coastal plains form a gentler topography which is cut by several watercourses draining the hilly areas behind. Mangrove swamps are found in a number of lagoons around the coast.

[9] Statistics Sierra Leone (2012).

[10] Sierra Leone's infrastructure compares poorly to the rest of Sub-Saharan Africa, ranked 46 out of 54 countries on the African Development Bank's Infrastructure Development Index in 2016 (African Development Bank 2016).

[11] Notre Dame Global Adaptation Index (http://index.gain.org/ranking/vulnerability).

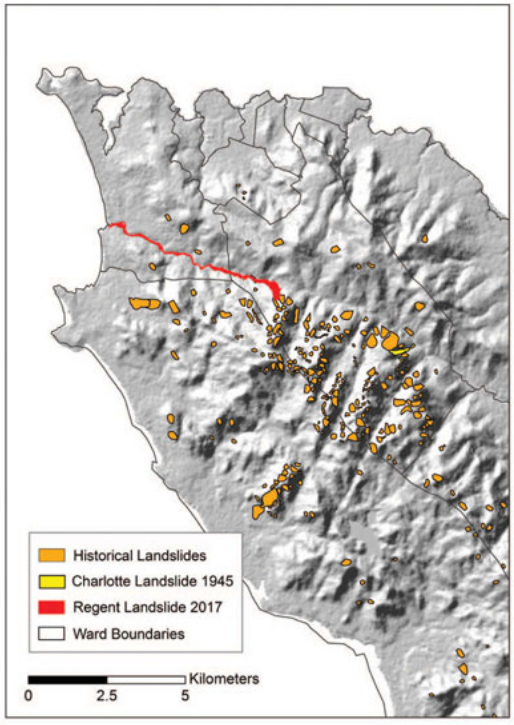
Dense forest covers the highest areas while many of the lower slopes have been deforested leaving a cover of sparse forest, grasslands and built-up urbanization. Sierra Leone has a tropical monsoon climate—wetter than the more typical West African tropical wet and dry climate—and has an extended rainy season from May to November, which brings torrential downpours with over 4,000 mm annual precipitation. The climate is tropical and humid all year but hotter and dryer between December and March. Freetown is generally cooler than the hinterland due to its coastal position.

The central highlands, in particular, and other slopes around the city are steep and subject to ongoing slope instability. This is a natural process and part of evolving valley formation but made worse by man-made interventions. Both published and unpublished sources as well as aerial photographic and field studies indicate many old, degraded landslide complexes mantling the slopes of the central highlands, and relating to both historic and ancient landslides (Figure 6).

The climatic conditions (temperature and rainfall) are conducive for extensive tropical weathering of the bedrock, decomposing competent rock into a mix of soil and relic corestones (the 'saprolite' horizon) over many 1000s of years. The combination of the high relief, with steep slopes formed in weathered rock, and a wet tropical climate means that some areas of Freetown are highly susceptible to landslides. These areas have been identified on recent Qualitative Landslide Hazard maps generated for ONS in the study supported by the World Bank.

The flooding hazard in and around Freetown is found along and adjacent to the many watercourses that run through the city, draining the hilly areas. These watercourses change as they run downslope. Nearer the top, narrower valleys tend, after rain, to produce very turbulent fast-flowing water flows. As the rivers descend to the lower elevations of the coastal plain, the river channels widen and flows slow. At the mouths of the rivers, the channels open out into a low-lying, delta-shaped alluvial floodplain and mudflats.

FIGURE 6: Historical Landslides in Western Area



Source: British Geological Survey, Natural Environment Research Council (2017).

After heavy rains, the runoff very quickly enters the river systems and levels can rise rapidly. Flooding is common among all reaches of the rivers, but particularly so at the river mouths where many temporary constructions have been built. Obstruction in the drainage channels can very quickly cause waters to back up and cause further localized flooding.

2.3 Description of Landslides and Floods

2.3.1 Regent Landslide and Babadorie River Channel Debris Flow

Following three days of intense rainfall, a mountain valley side slope in the Regent area below Sugar Loaf, the highest peak in the north of the peninsula, collapsed and caused a major landslide on August 14, 2017. Although visibility was reduced by an enveloping mist, several eyewitnesses report that the landslide took place in two stages. The first at 6:50 A.M., to a low rumbling noise like a passing airplane, is thought to have been the lower part of the slope slipping into the valley. How far this extended and the included materials' volume is difficult to discern in the aftermath. The adjacent slopes have a change in gradient and a more convex lower terrace or bulge, with evidence to suggest this could be the residual debris of earlier, now degraded land-slipped material. It may have been this lower terrace which slipped first in the recent event. The second more destructive stage took place around 10 minutes later and was accompanied by a large explosive noise and ground trembling followed by boulders of all sizes and uprooted trees flying and falling to the ground. Sparks were seen as the boulders crashed against each. This second slip is thought to have been from the upper part of the slope, released by loss of support from the buttressing effect of the lower slope and releasing huge volumes of soil and rock, which slipped along large planar joints in the fresh and weathered bedrock. These joint planes are natural features and present in most rock masses; in the now exposed rock within the hill scar, very prominent continuous steeply dipping joint sets can be seen trending very approximately along the valley alignment.

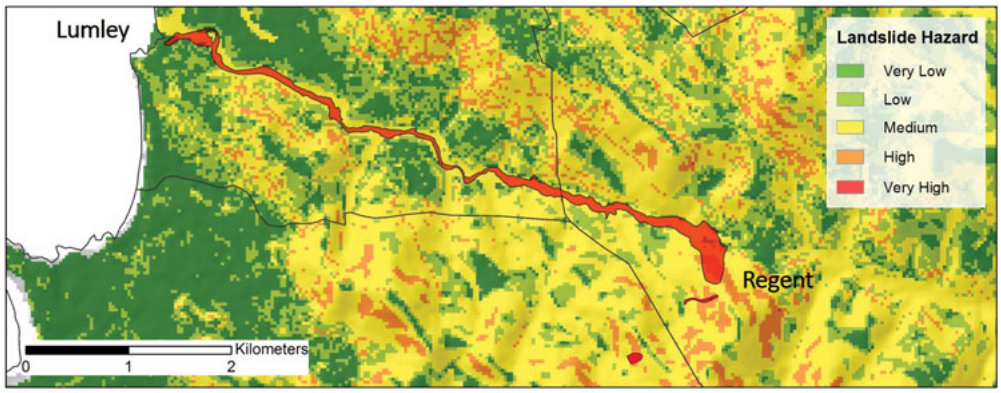
The two-stage slip, and particularly the second, comprising a mix of clayey soil and boulders of all sizes (up to 40 cubic meters) traveling from high up the slope, would have had tremendous energy and momentum. The lower Regent area at the base of the hill slope has been completely destroyed and there are few buildings remaining in this area. The debris travelled up the opposite side of the valley and then down toward the main river channel which runs to Lumley Beach.

Prior to the landslide on August 14, several hours of intense rainfall predisposed the lower Regent area to flooding. Runoff from the surrounding slopes formed very fast-flowing and deep water along the usually small stream courses which cut through the area. These floodwaters were draining down the main river channel toward Kamayama/Malama, Juba/Kaningo and Lumley and were joined by water from other river courses that join the Babadorie Valley downstream from Regent. Buildings along the river channel were inundated and people were in the process of evacuating, some unsuccessfully, before the landslide. Water was around 5–6 m deeper than usual in the Kamayama/Malama area. Because the first bodies were found at Lumley around 7 A.M., about the same time as the second stage of the landslide, flooding (not the landslide) is the attribution.

The landslide(s) thus slipped and dropped with great kinetic energy into a deep, fast-flowing and fully flooded area. It is thought that this, together with the weight and momentum of the material falling, helped to saturate and liquefy the clayey soil component of the slip material and to facilitate its travel across the valley to the north side and down the Babadorie River valley a considerable distance; large boulders are now littering the river channel as far as Kamayama/Malama and toward Juba/Kaningo. Some likely were ripped from the ground surface and river banks along the channel, but many are likely to have come all the way from Regent (Figure 7).

Kamayama/Malama residents report a large 'tidal wave' of material advancing down the river channel immediately after the landslide as the debris pushed the flood water in front of it. This saturated and highly mobile debris flow carrying soft clay (mud), boulders,

FIGURE 7: 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).

tree trunks and building debris, together with the wall of water in front of it, caused the complete destruction or considerable damage to buildings downstream from the main landslide area. The river channel has been changed and is now much wider than before. Previously there was only one watercourse but this now divides in several locations. There are a number of new nick points (steps) in the river bed and some of the riverside slopes are in very unstable conditions.

2.3.2 Other Landslides

Four other known landslides took place in the Regent, Goderich and Tacugama areas on the same day as the main Regent landslide. One is a long linear feature on the other side of the hill from the Regent slip, possibly down a shallow stream course. Another is further to the southwest and is a wider feature (which appears relatively shallow, involving surface soils that have slipped downslope into a watercourse running at right angles to the slip direction), with the slipped material then running down the watercourse. Being an undeveloped area, neither event caused loss of life or damage to buildings or infrastructure. There is some loss of forest but these areas do not appear from satellite imagery to be densely forested. Neither slip was visited by the World Bank team due to time and access constraints. Satellite images showing their location and extent are below/in section 6.1.1.

The two other known landslides were in the Tacugama area and are located near the chimp sanctuary and Kongo Reservoir. These were inspected by Arup together with the British Geological Survey and local geologists from the National Mineral Agency and the Sierra Leone Institution of Geoscientists. This area is very densely forested with no development apart from the sanctuary, access road and the reservoir. These landslides were first noticed by a ranger patrol on August 17, 2017, on or within a few days of the Regent slip.

One of the slips is of moderate size, with a back scar around 8 to 10 m high, forming an arcuate depression approximately 30 m across but running out down a narrower channel approximately 10 m wide and around 100 m long to a river course at the bottom of the valley. The top of the back scar is around 130 m downslope from the chimp sanctuary offices and eco-lodges.

The second slip is much smaller, more of a slump, with minimal run-out and only around 10 m wide with a back scar of approximately 2 to 3 m height. Both slips in this area appear to be through the weathered soil/rock horizon (saprolite) above bedrock and are not controlled by major discontinuities in the rock mass.

2.3.3 Flooding

Following the heavy rains of August 14, 2017, Freetown experienced flooding in several locations. These included the Culvert area at the mouth of the Glanville Brook Watercourse, where one of the city

rubbish dumps is sited, and parts of Mountain Cut and Dwarzak. During site visits, it was possible to determine some of the effects of the flooding and possible height and lateral extent of the floodwaters. However, there were difficulties in attributing these observations directly to the events of August 14. During the mission, flooding was experienced again at Culvert on August 26 and along the Congo River Channel on September 3. Other locations may have flooded on these subsequent dates.

Flooding is a much more common hazard than large-scale landslides and regularly affects parts of Freetown during the rainy season. The loss of life and damages resulting from the flooding is a very small percentage of the overall losses. The latter are dominated by the combined landslide and flooding event at Regent–Lumley.

2.4 Geological and Meteorological Causes of the Disaster

Rainfall patterns and intensity vary across the peninsula because of atmospheric conditions and localized topography. However, accurate rainfall data is not widely available for different locations across Freetown due to a limited number of weather stations. There is one at Lungi airport and another in Wilberforce. Thus, rainfall in certain catchments cannot be determined.

Data from the available weather stations has not been reviewed and would require some specialist meteorological interpretation. However, JBA Consulting, Arup's flood modelling partners, have provided information on the weather conditions leading up the August 14th, as summarized below.

- *National Oceanic and Atmospheric Administration's satellites captured the rainfall intensity, recording 7-day total rainfall anomalies of up to 100 mm more than usual for the week of August 10–16.* This represents nearly 200 percent of the typical rainfall for that period. In addition, over a longer preceding period, the U.S. National Weather Service's Climate Prediction Center states that 1,040 mm of rain fell in Sierra Leone from July 1 to August 14, 2017. This represents three times the amount expected for this period.
- *Monsoon rains in 2017 clearly have been more frequent and intense than usual.* Very high rainfall levels have also been seen in other countries around the world this year.
- *The link between rainfall and landslides, unlike the direct link between rainfall and flooding, is not so direct.* Water is certainly a trigger in many landslides as saturated soils have lower effective strength than dry soils and are less able to stand at steeper angles. However, there are other factors involved in landslides including the nature of the bedrock, the structural discontinuities within the bedrock and their orientation, the thickness of soil cover, the depth and nature of the weathered bedrock zone and the topography of the slope. Deforestation cannot be attributed directly as the landslide trigger in this case, particularly as the main part of the slide is observed to be within the rock mass, but deforestation does not help the local environment and changes the way in which rainfall infiltrates or runs-out down slopes, as well as removing the near surface binding effects of the root systems.
- *The exact mechanism of the Regent landslide is not known but reports suggest a two-stage event.* The toe of the slope is believed to have slipped first, potentially due to oversaturation following the rains. If the lower slope was comprised of relic slip debris from previous sliding, this would have had a higher soil component than the upper slope, and been more susceptible to the effects of wetting. Observations of the large back scar left after the slip indicate the presence of parallel sheet joint sets striking approximately parallel with the slope face. Water seepages were noted along these sheet joints and it is possible that the heavy rains allowed water to enter this joint system, weakening or softening any clay infilling material along the joints and leading to an overall loss of rock mass strength. When the lower slope slipped away, there would have been less support to the upper slope, which also subsequently slipped, much more catastrophically.

- *The three August 14 landslides in the Regent area occurred in locations designated by Qualitative Landslide Hazard maps for Freetown as 'High Hazard'.*
- *As above, the exact mechanism of the landslide has not been conclusively determined although eye witness accounts and post-event observations indicate a two-stage event.* The causes are likely to be a combination of the slope height and geometry, the nature of the bedrock and weathered rock profile and the structural discontinuities, together with high levels of water both at the toe of the slope and infiltrating along sheet joints in the rock mass.

2.5 Overall Impact of the Event

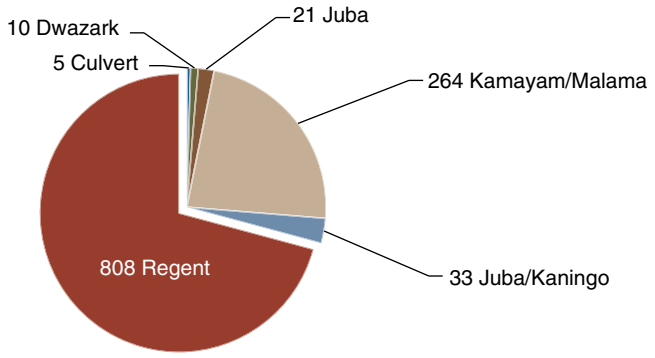
2.5.1 Regent–Lumley Combined Landslide and Flooding

Along the Babadorie River Channel from the landslide zone at Regent to the river mouth, the area is divided into wards, and their respective damage is here detailed. The northern side contains the Regent, Kamayama/Malama and Lumley Wards and represents the upper, middle and lower reaches of the river channel. On the southern side, the Juba/Kaningo Ward covers a greater extent along the channel, with varying impacts within the ward.

According to Government figures, the total number of confirmed dead or missing people was 1,141. Substantiated numbers remain scarce since households' numbers per destroyed building is uncertain. About 6,000 individuals are reported affected (~1,616 households). The Government estimated that 80 percent of that amount is related to flood victims with more than 3,000 people having lost their homes. The 1,141 dead or missing people are distributed in six communities as follows: Regent suffered the greater impact with 808; Kamayama/Malama had the second largest affectation with 264; in the sections where the valley becomes wider and gentler the human losses were lower, Kaningo—33; Juba—21 (Figure 8).

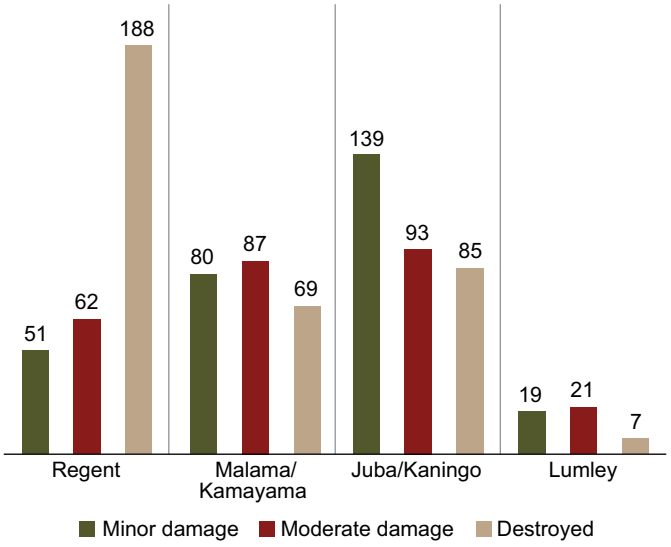
Building damage is classified as: destroyed (50–100 percent damage); moderate damage (20–50 percent damage); and minor damage (less than 20 percent damage). Damage was assessed through a number of means, including: pre- and post-event satellite or drone imagery in tandem with the Open Street Map building dataset with available Office of National Security—ONS data and from field surveys by INTEGEMS with a GPS-linked, GIS-based smartphone survey application. Information from different sources has been cross-checked where possible, and is still subject to revision, up or down (Figure 9).

FIGURE 8: Number of People Dead or Missing



Source: ONS—Registration pillar (August 2017).

FIGURE 9: Building Damage Regent to Lumley per Field Survey Data



Source: World Bank; Arup and INTEGEMS (August 2017).

Although there were a few of the larger concrete reinforced buildings in Kamayama/Malama and Juba/Kaningo, most were either of informal or of masonry construction. Residential buildings in the Western Area Rural are made of more durable construction materials, and are predominantly not shared units—most of these have been built in the last 15 years. The legal status by way of land or construction permits (split between two ministries) remains unclear. Detached single family homes in this area make up 37 percent of the residential building stock, of which almost half are owner-occupied homes inside private compounds. Building walls are predominantly constructed with cement blocks or mud bricks, while the roofing is made of zinc sheets. By contrast, in the Western Area Urban (where Freetown is located), buildings are made of less durable construction materials and are predominantly shared. Severe overcrowding is the norm, with an average of more than 10 people living in a single dwelling. Almost 60 percent of the households are renters. About 40 percent of the housing stock is made with cement block walls and zinc sheet roofs, and 35 percent have walls made from mud bricks.

Nearly all the poor in the Western Area live in informal housing, with almost 60 percent in neighborhoods with extremely deficient municipal infrastructure and services. Informal housing is a manifestation of the tradeoffs made by residents between available shelter options that can be afforded: both in terms of locations that allow them to earn their livelihoods, as well as with respect to the low consumption of less durable residential floor space per household in neighborhoods where living conditions are squalid (Figure 10).

Regent Ward suffered the greatest impact. It is thought that most of the impact in this ward was due directly to the landslide event and the effect of the subsequent debris run-out into an already flooded river course. However, it is also likely that some lives were lost due to the flooding before the landslide initiated. The currently reported number of dead and missing from Regent Ward is 808 persons (from a total of 1,141 on August 14). Of the buildings, 188 were destroyed completely, 62 were moderate damaged and 51 had minor damage. There was a higher proportion of the larger, more expensive reinforced concrete frame type properties in the Regent area, than in the other wards. There was also many other masonry and informal properties within the landslide run-out area. In addition, an unmade road traversing the base of the slope and connecting properties on the south side of the valley with Regent was destroyed and possibly a culvert/bridge crossing for this road over the stream course.

The Regent area is at a much higher elevation than further downstream toward Kamayama/Malama. After sliding to the toe of the hillside, the landslide debris met the floodwaters in the valley and continued a short distance up the other side before being turned to the west and flowing downhill. The debris flow scoured the river valley floor and sides, eroding further material, including boulders. The river banks along this section, before the gradient levels out toward Kamayama/Malama, were significantly impacted, with residual unstable side slopes, some with damaged properties above. Buildings located along the river channel have been mostly destroyed and partial or minor damage was suffered by others further up the side slope. The debris flow pushed the floodwater and residents reported a 'tidal wave' or 'wall' of material including mud, boulders and tree trunks impossible to escape.

The boundary between Regent and Kamayama/Malama/Juba/Kaningo Wards marks the transition from the steeper, narrower section of the valley to a wider and gentler one. Before the landslide, the valley was already inundated with fast flowing water around 4–6 m above the usual level. Other watercourses join the Babadorie River downstream from Regent and contributed to the volume of water.

Currently, 264 persons are reported dead or missing in Kamayama/Malama, though attributions to prior flooding or to the landslide is not known. A total of 69 buildings were destroyed completely, 87 moderate damaged and 80 suffered minor damage. In addition, six footbridges across the river between the Kamayama/Malama and Juba/Kaningo Wards were destroyed completely, together with local access tracks across the valley bottom, agricultural plots and a football pitch.

FIGURE 10: Construction Typology by Wards in Landslide Affected Region

Source: World Bank, Arup and INTEGEMS (2017).

Satellite imagery pre- and post-event very clearly shows the damage caused by the debris flow to the valley floor as it advanced downstream from Regent. The river channel has changed considerably and is now much wider (100 m as shown in Figure 12) with the river course dividing in a number of locations, from its previous single course. Although Kamayama/Malama is at least 3 km from the landslide zone, it was still severely affected by the run-out and the force of the debris being carried down the channel. Several properties can still be seen in and adjacent to the river channel, but are mostly completely destroyed (i.e., >50 percent damage). The riverbed is now littered with boulders of all sizes up to around 8 or 10 cubic meters (but more typically 1 to 5 cubic meters), and the debris flow was able to carry these a considerable distance. Toward Juba/Kaningo (Sheriff Drive) the boulder sizes and frequency decrease with the flooding and mud

PHOTO 1: Photographs of Regent Landslide Area and Immediately Downstream along River Course

Source: Arup (2017).

deposition becomes more significant. It is likely though that tree trunks and lighter objects, including building materials, were carried further than the boulders (Figure 11).

In Juba/Kaningo Ward, 33 persons were reported dead or missing, 85 buildings were completely destroyed, 93 moderate damaged and 139 suffered minor damage. These building numbers are higher than reported for Kamayama/Malama (while the dead/missing total is lower). This likely is due to the population density downstream and the longer extent of Juba/Kaningo Ward along the Babadorie River Valley. It is not known how far downstream the effects of the debris flow reached and where the flooding became more significant. The statistics suggest somewhere along the Lumley/Juba/Kaningo stretch of the river.

At Lumley, both the human cost and building damage was lower: 21 dead or missing persons were reported for Juba. In the Lumley Ward, 7 buildings were destroyed completely, 21 moderately damaged and 19 suffered minor damage. At the mouth of the river, debris from the flooded houses has collected and needs to be removed. Contamination from this material and other sources upstream is likely. The water level was very high at Lumley, and a satellite image taken post-event shows a footbridge near the river mouth completely submerged.

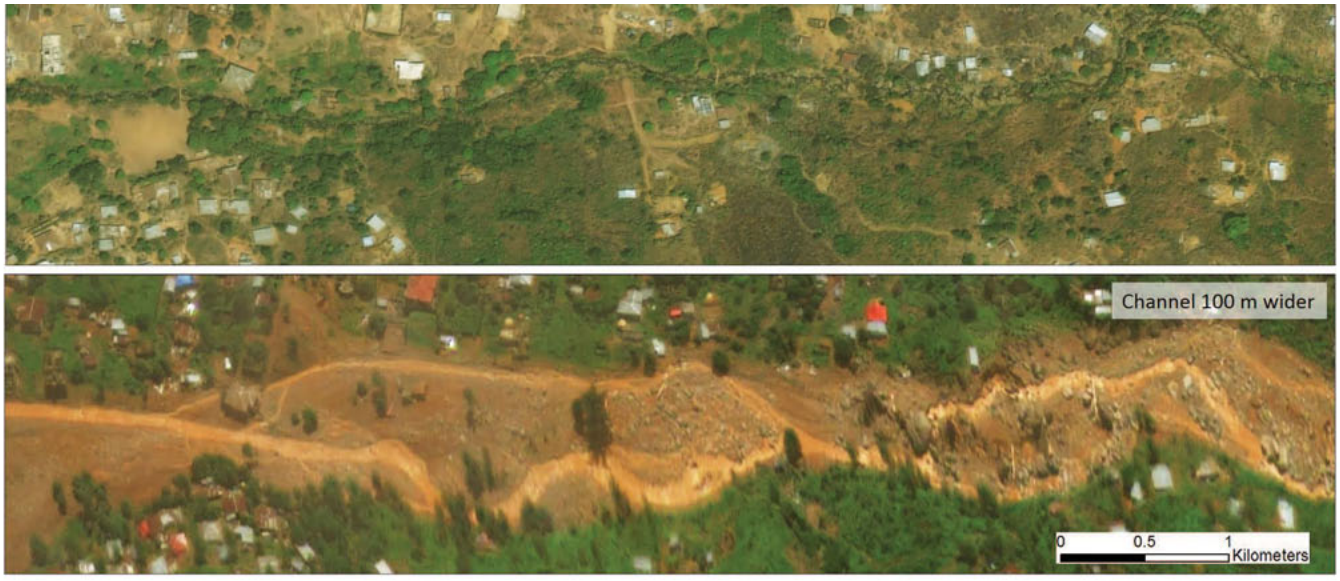
2.5.2 Flooding at Other Locations across the City

Severe flooding was experienced at Culvert, Mountain Cut and Dwarzak from the prior three days of intense rainfall. At the river mouths, the flows spread out across the level floodplain and mudflats, inundating most of the low-lying community buildings. There were a total of 15 recorded deaths or still missing people from Culvert and Dwarzak. While this is typical or even reasonably high for significant flooding events, it is considerably less than those suffered between Regent and Lumley (Figure 13 and Figure 14).

FIGURE 11: Pre- and Post-Disaster Satellite Imagery Showing the Affected Area from Regent to Lumley

Source: Adapted from Digital Globe satellite imagery by World Bank, Arup (2017).

FIGURE 12: Pre- and Post-Disaster Satellite Imagery Showing the Widening of River Channel Downstream



Source: Adapted from Digital Globe satellite imagery by World Bank, Arup (2017).

FIGURE 13: Flood Hazard in Western Area Urban, Northern Freetown—Examples of Recent Widespread Flooding from Culvert and Congo Town Regions

Note: The flood hazard changes as you move from the high mountains in the south to the lower lying flat land in the north (as indicated by the arrow).
Source: World Bank, Arup (2017).

FIGURE 14: Flood Damage in Culvert

Source: Arup (2017).

2.6 Immediate Response and Relief Efforts

Immediately following the disaster, a national emergency was declared and the government of Sierra Leone initiated its emergency response mechanism, under the leadership of the Office of National Security (ONS). A command center was established around Regent district, the epicenter of the landslide, to ensure optimal coordination of efforts.

ONS organized the response into 10 pillars headed by the sector-specific ministry to ensure better coordination for the disaster assessment and emergency response: Coordination (headed by Sierra Leone Office of National Security), Logistics Pillar (headed by the Republic of Sierra Leone Armed Forces), Food and Nutrition Pillar (headed by the Sierra Leone Ministry of Health and Sanitation), Security and Safety Pillar (headed by Sierra Leone Police), Registering pillar (headed by Sierra Leone Ministry of Social Welfare Gender and Children's Affairs), Shelter pillar (headed by Sierra Leone Ministry of Lands, Country Planning and Environment), Health and Burial (headed by Sierra Leone Ministry of Health), Social Mobilization and Communication (headed by Sierra Leone Ministry of Information and Communication), Protection and Psychosocial (headed by Sierra Leone Ministry of Social Welfare, Gender and Children's Affairs), WASH pillar (headed by Sierra Leone Ministry of Water Resources).

The United Nations Resident Coordinator designated the Country Director and Representative of the World Food Programme (WFP) as Incident Manager. To support the UN response, a UNDisaster Assessment and Coordination Team was deployed to Sierra Leone. The team helped with coordination, information management, and needs assessment activities. In terms of field coordination, meetings were held at the ONS twice a day and the UN Country Team also met daily to ensure coordination at the level of the United Nations.

Humanitarian agencies have been actively engaged in several critical areas. These include identifying and recording casualties to developing emergency response plans; physical rehabilitation for those injured; providing emergency WASH, health, shelter and protection assistance; assessing damages and needs; the distributions of food and nonfood items; support to affected communities; and supporting affected children, including provision of psychosocial support.

In response to the emergency, a UN assessment identified 16 locations where food, shelter, and water and sanitation have been identified as main priorities. WFP's main logistics base at Port Loko has been instrumental in mobilizing equipment and supplies for the response.

Following the immediate rescue operations, the humanitarian response was implemented at three levels: (i) support affected communities and mitigation of resurgence and potential risks; (ii) support victims in temporary displacement centers; and (iii) mitigate potential risks, such as cholera or other outbreaks. Displaced victims have been given the option to be housed in communities or be voluntarily relocated to a more permanent shelter solution. Two sites have been selected for voluntary relocation: The Old Skool compound in Hill Station and Juba Barracks in Lumley.[12]

Almost USD 13 million has been mobilized so far. In addition, the World Bank has committed USD 10 million in budget support to the government and USD 3 million is being re-directed as part of ongoing projects.

[12] UNOCHA (2017).

3

SCOPE OF THE ASSESSMENT

3.1 Objectives of the Assessment

The assessment's principal goal is to help the government of Sierra Leone estimate the effects and impact of the August 14 landslide and floods in the Western Area. Its intention is to help the government formulate a strategic recovery plan, mobilize resources, and prioritize and sequence direct resources to meet the needs of the most affected.

The Ministry of Finance requested World Bank support to conduct a rapid needs assessment. The World Bank and the Global Facility for Disaster Reduction and Recovery (GFDRR) mobilized a multi-sectoral team of experts to work with the government, the United Nations (UN), other development partners, and civil society organizations.

This report quantifies damages and losses in infrastructure and social sectors (real estate and urban development, transport, electricity, telecommunications, water and sanitation, health, education, social protection) and in cross-sectoral areas (environment, waste management, disaster risk management and gender). It also analyzes the macroeconomic, poverty, and welfare impacts. The assessment identifies preliminary needs and recommendations for a recovery and reconstruction strategy.

3.2 Approach and Scope

The assessment applied the United Nations Economic Commission for Latin America and the Caribbean DaLA and Post-Disaster Needs Assessment (PDNA) methodologies to suit the specific context and scale of the disaster. The impact of the landslide and floods on each sector is costed in three main categories: (i) damages, (ii) losses, and (iii) preliminary needs to inform recovery and reconstruction.

Damage to infrastructure and physical assets quantifies public- and private-sector infrastructure and assets destroyed in the disaster. Damage includes either total or partial destruction of the assets. The assessment assumes certain damage will occur to flooded buildings, given that exposure to floodwaters will require repairs or replacement. The DaLA estimates include damages to building content. Losses due to disruption of access to goods and services are defined as changes in economic flows and higher production arising from the disaster. They occur until full economic recovery and reconstruction are achieved, in some cases lasting for several years; typical losses include a decline in output in productive sectors. Losses also include additional costs incurred by the government for emergency response and relief efforts. Disaster effects

include a qualitative assessment of the increased risks and vulnerabilities resulting from the event.

The assessment encompasses economic and social impacts. Economic impact at the macro level includes an estimation of the disaster's likely effects on economic performance and potential temporary macroeconomic imbalances. Social impacts include estimations of the disaster's likely effect on households, community livelihoods, employment, and vulnerability.

The preliminary recovery needs comprise the short-term government interventions designed to kick-start all affected functions, and those required in the medium and long term to ensure an approach to enable greater resilience and preparedness in the future.

Assessments of the disaster's effects and impacts also assist in determining recovery needs, considering "build back better" (BBB) principles. BBB seeks to reduce vulnerability and improve living conditions, while promoting more effective and sustainable reconstruction. It examines the suitability and sustainability of reconstruction activities. These identified recovery needs inform short-, medium-, and long-term recovery and reconstruction interventions through a recovery strategy.

3.2.1 Data Collection

The Assessment Team developed a multi-pronged approach for damage determination, classification, collation, quantification, and validation to capture the data of different sectors. Each Sector Team collected the respective pre-disaster baseline data to compare with post-disaster conditions and evaluated the disaster effects and impacts. Satellite imagery, drone surveys, and field visits were conducted to assess the destruction of housing, infrastructure, and social amenities and to estimate the impact on the production of goods and the delivery of services.

3.2.2 Quantification

Most sectors have valued the damages to infrastructure and assets, and the losses due to changes in financial flows (in U.S. dollars). Cross-sectoral linkages helped preempt double or multiple counting in estimating the value of the event's effects.

The assessment addressed cross-cutting issues, such as disaster risk reduction, environment, waste management, and gender. Further, for each sector, the disaster was examined in qualitative terms and outlined for potential and emerging issues.

Each sector has specified recovery needs and posited implementation arrangements. This includes costs for reconstructing destroyed assets, providing services, improving specifications and risk reduction measures. The cost of recovery needs has not been estimated at the replacement value; rather, a cost estimate has been provided based on fiscal prudence and acceptable levels of recovery. The total cost of recovery, which includes the cost of reconstructing destroyed assets, has been determined by aggregating the cost of recovery needs of all sectors. An overarching strategy for the recovery program covers all the sectors.

3.2.3 Validation

A robust damage validation was carried out on the data provided by the government. It included: (i) desk review and detailed analysis of pre-disaster asset and infrastructure baseline data by the sector teams; (ii) determination of percentage-based damage in sectors, such as housing and the private sector for certain communities, based on household survey and census data; (iii) analytical validation of damage data by sector teams, employing techniques and plausibility checks such as relative-to-baseline analyses, disaggregated analysis, and comparisons across vertical and horizontal streams of communities; and (iv) limited, sample-based physical validation by the sector teams.

3.2.4 Limitations and Caveats

The Assessment Team, to support the government in responding rapidly to the disaster, accelerated processes and used available data. The assessment was carried out in two weeks (from August 24 to September 8, 2017). Sector assessment teams faced challenges in the quality and accessibility of data. The ONS Registration and Verification Pillar also had challenges in consolidating and validating the information. In response, surveys, interviews, drone flights, and other complementary methods assisted sectoral teams with the interpretation and analysis of the available data. Data provided by the ministries were translated and shared with the sectoral teams. Specific constraints are described in the sectoral chapters.

The rapid assessment lays out an overarching assessment and orientation toward initiating the recovery planning process. It is neither intended to replace the sector assessments nor purport to be comprehensive or prescriptive. This rapid assessment also recognizes further assessment and planning may be required for agencies, donors, and international finance institutions to develop their recovery strategies and programs, particularly for sector-specific interventions.

4

DAMAGES AND LOSSES PER SECTORS

4.1 Real Estate (Housing) and Urban Development Sector

4.1.1 Sector Context

Freetown dominates Sierra Leone's urban landscape with 14 percent of the country's population and generates 18.7 percent of the national economy. It is in one of the country's four divisions, known as the Western Area, which is divided into Western Area Urban and Western Area Rural. Home to about 1 million people, Freetown's population has been growing at 3.01 percent since 1985, and is expected to be 2 million people in less than a decade. Not only is Freetown Sierra Leone's largest city, it is also the central hub of economic activity in the country that has grown steadily in and around Freetown.

Freetown's infrastructure systems and service delivery have been unable to keep up with a growth in population and poverty which increased by 7 percent over the last decade. The physical environment is deteriorating rapidly, and the footprint of the built-up area is expanding into Western Area Rural due to low density unplanned sprawl. It is in this Western Rural area where lies the Sugar Loaf Mountain.

Urban development challenges of Freetown are compounded by its location and geography. Freetown is situated in a relatively small space between steep mountains and the sea, in a country with the highest annual rainfall in Africa. Factors that raise the city's exposure and vulnerability to natural hazards, in addition to climate change, include: topography; proximity to waterways; rapid increase in built-up areas on deforested hillsides upstream of natural drainage channels; downstream construction on vacant land in flood plains; and use of unsafe construction techniques most often in high-risk areas, etc.

Highly fragmented governance in the urban area makes not only urban planning challenging but also effective response to shocks and recovery difficult. Many municipal functions are managed by multiple central agencies. This impedes both effective management of the interdependent, capital-intensive, infrastructure systems (e.g., fecal sludge management, drainage, sewage, and solid waste management) and the coordination of multifaceted urban development operations (e.g., land development, residential/commercial/industrial real estate development, local economic development, local urban public space revitalization, and social service provision).

It is important to understand the large difference in quality of construction and amount of consumption of built-up areas per households between the rural and urban areas. Residential buildings in the Western Area Rural are made of more durable construction materials, and are predominantly not shared units—most of these have been built in the last 15 years. The legal status by way of land or construction permits (split between two ministries) remains unclear. Detached single family homes in this area make up 37 percent of the residential building stock, of which almost half are owner-occupied homes inside private compounds. Building walls are predominantly constructed with cement blocks or mud bricks, while the roofing is made of zinc sheets. By contract, in the Western Area Urban (where Freetown is located), buildings are made of less durable construction materials and are predominantly shared. Severe overcrowding is the norm, with an average of more than 10 people living in a single dwelling. Almost 60 percent of the households are renters. About 40 percent of the housing stock is made

with cement block walls and zinc sheet roofs, and 35 percent have walls made from mud bricks.

Nearly all the poor in the Western Area live in informal housing, with almost 60 percent in neighborhoods with extremely deficient municipal infrastructure systems and service outputs. Informal housing is a manifestation of the tradeoffs made by residents between available shelter options that can be afforded: both in terms of locations that allow them to earn their livelihoods, as well as with respect to the low consumption of less durable residential floor space per household in neighborhoods where living conditions are squalid.

4.1.2 Methodology

Immediately following the landslide and flooding of August 14, 2017, numerous international agencies produced and shared pre- and post-disaster maps and satellite imagery. The location of pre-event buildings around the Regent Landslide was identified and digitized using pre-event satellite imagery of March 3, 2017. Aerial photographs were captured from two separate drone surveys of the landslide area, the first immediately after the event, and a second about a week later to collect high-resolution aerial imagery of the entire affected region. A high-resolution digital terrain model was generated within a 50 meters (m) buffer either side of the landslide. This provided the spatial baseline for assessing damages, losses, and needs. Field surveys were conducted by trained local volunteers to assess the impacts of the disaster, including building attributes and household assets. Survey findings were supplemented by the 2015 Sierra Leone Housing and Population Census, the property tax data base from Freetown City Council, and the 2011 Sierra Leone Integrated Household Survey. Refer to Annex 8.1 for more details on damage assessment methodology.

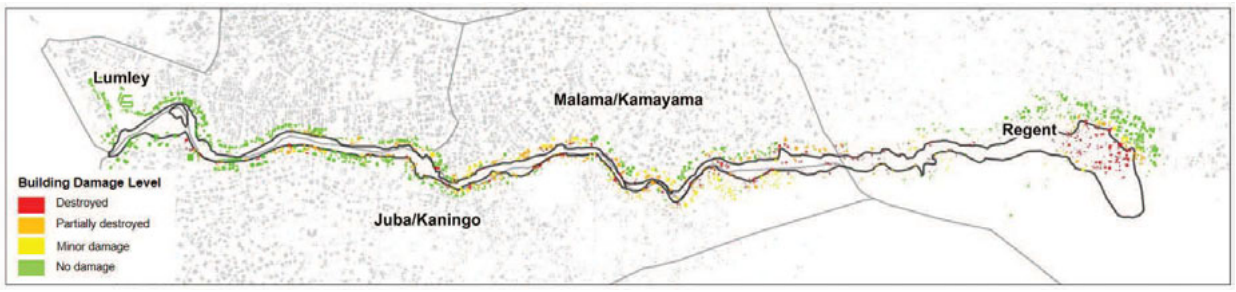
4.1.3 Effects of the Disaster

The most devastating impact of the landslide was experienced in Regent (Western Area Rural), but the impacts of the flooding due to the landslide were harsh downstream in Western Area Urban. The landslide that began from Sugar Loaf Mountain in Regent became a debris flow along a flooded valley, which caused massive flooding along the river channel from the mountain traversing through Western Area Urban. The floods with accompanying debris affected buildings and households in the Kamayama/Malama Juba/Kaningo and Lumley neighborhoods along the river channel (Figure 15).

Another flood occurred the same day in Western Area Urban in the neighborhoods of Dwarzak and Culvert. No buildings were damaged by this flood. However, given the typology of construction in this area, coupled with their location on low-lying land at the mouth of the river, multiple families shared these modest "shacks."

A total of 901 buildings (residential, mixed-use, public, and commercial) covering 116,766 square meters were affected by the landslide and floods, from Sugar Loaf Mountain to Lumley Creek. Of these, 769 buildings were residential, 27 were commercial buildings, while the remaining were mixed use, apart from a church and an orphanage. 349 buildings of about 34,178 square meters were destroyed; 263 buildings of about 38,384 square meters were moderately

FIGURE 15: Affected Buildings and Households in Kamayama/Malama Juba/Kaningo and Lumley Neighborhoods



Source: World Bank, Arup, INTEGEMS (2017).

TABLE 3: Estimated Damages and Losses in Real Estate (Housing) Sector

Wards	Building Damage	Household Asset Damage	Other Internal Asset-Cash Savings	Total Damage	Total Damage
	USD Million				SSL Billion
Regent	4.19	1.23	0.06	**5.48**	**41.10**
Malama/Kamayama	2.76	1.32	0.08	**4.16**	**31.20**
Juba, Kaningo	2.14	1.12	0.25	**3.51**	**26.33**
Lumley	0.56	0.12	0.004	**0.68**	**5.13**
Dwazark and Culvert	—	0.31	—	**0.31**	**2.33**
Total	**9.65**	**4.10**	**0.39**	**14.14**	**106.08**

Type of Loss	Estimated Losses USD Million	Estimated Losses SSL Billion
Temporary Shelter	1.95	0.26
Rental Income Losses	4.135	0.55
Demolition and Construction Debris Removal	3.3	0.44
Total Estimated Losses	**9.38**	**1.25**

Note: For the losses estimation, rental income losses were calculated using a proxy from 2015 Sierra Leone Housing and Population Census and field survey findings, which provided an average annual rent for a property in Western Area Rural and Western Urban and an approximate number of rental properties in the affected area. Other losses included the cost of temporary shelter (excluding basic services) and the cost of demolishing moderate damaged buildings in the river channel, demolishing remaining structural elements of destroyed buildings, and removal of construction debris. International Organization for Migration (IOM) estimates to set up a temporary shelter (without services) per household for three months (USD 2,600), based on their similar experience in Democratic Republic of Congo experience, was used as a baseline to estimate losses for around 100 households currently living in camps (based on 30 August 201—ONS update). The average cost of demolishing a single and multi-story building as well as the cost of removing the construction debris was acquired through discussions with a few local contractors and real estate experts.

Source: World Bank Assessment Team (2017).

damaged; and the remaining 289 buildings suffered minor damages. Table 3 enumerates these damages and losses, and estimates them by taking into account replacement costs of similar construction. From the floods in Dwarzak and Culvert the same day, no buildings were damaged. However, household assets and savings were lost in 669 buildings (Figure 16).

The cumulative estimate of both damages and losses in Western Area Rural and Urban due to the two events is USD 15.43 million. Damage alone from both events is USD 14.18 million. Losses incurred from both events is estimated to be USD 1.25 million.[13]

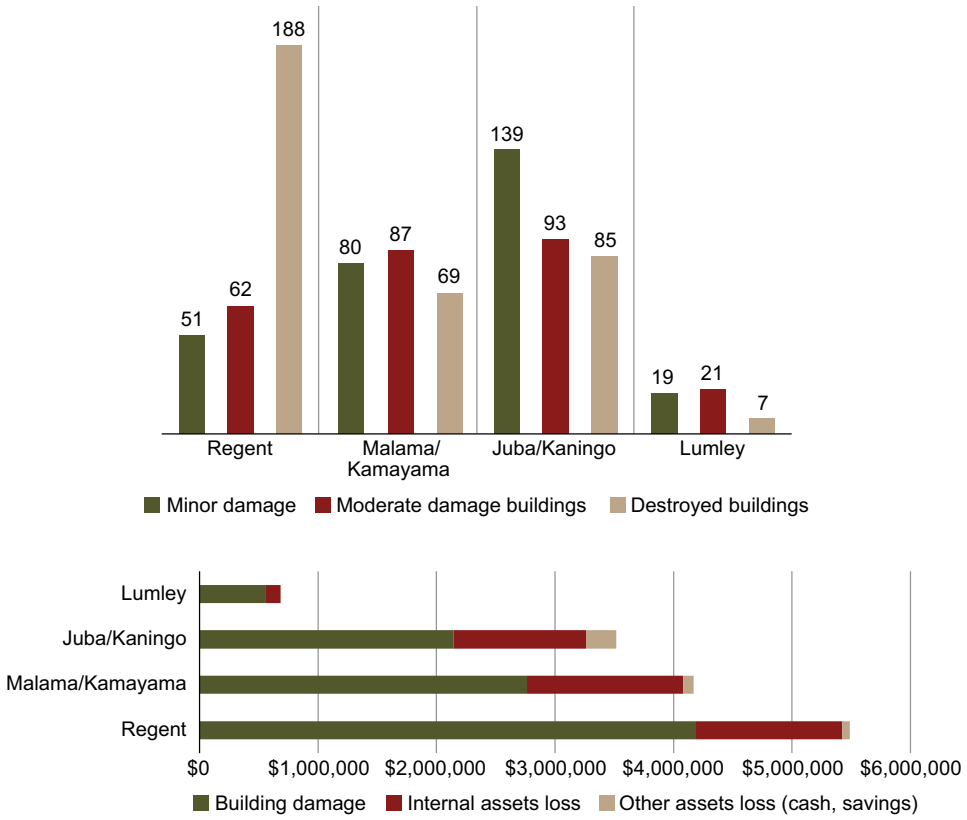
This latter figure includes estimated loss from rents for owners, rent to be borne by displaced families, costs of provision of temporary shelter for three months, the costs of demolition of damaged buildings, and the cost of removal of construction debris. (Table 3).

4.1.4 Resilient Recovery Needs

The overall recovery needs in the short, medium, and longer term are estimated to be USD 13.29 million. Of this, the short-term recovery over the next three months that is targeted to provide urgent relief is estimated to be USD 2.00 million. Given that the

[13] There may be additional losses due to the loss of documents that would support land tenure, sales or purchases, and leases. However, these could not be estimated and have been excluded.

FIGURE 16: Level of Damages and Cost of Damages by Ward from Regent to Lumley



Source: World Bank, Arup, INTEGEMS (2017).

TABLE 4: Estimated Needs for the Real Estate Sector (USD million)

Short-Term/Immediate Recovery (0–3 months)—2 Million USD/15 Billion SLL
• Provision of temporary shelter; transitional assistance to permanent housing solutions such as Mile6; demolition of moderately damaged unsafe buildings; and destroyed buildings; and removal of debris.
Medium-Term/Full Recovery Phase (4–12 months)—2.3 Million USD/17.25 Billion SLL
• Planning and execution for retrofitting moderately damaged buildings that are structurally sound and situated in what are deemed habitable areas (i.e., non-high risk zones); explore options to include relocation and/ or additional rental housing in the existing structurally sound building stock in safe locations—for example, a subsidy from government to add more floors, retrofitting the owner-occupied moderately damaged buildings provided on a condition that owner will rent a floor (or rooms) to affected households for a year or so; demarcate high and medium hazard zones on the ground to raise awareness; preserve flood plains created by floods and encourage their use for urban agriculture; develop resilient recovery framework for housing and urba planning based on final multi-disaster risk assessment; and develop site-specific local mitigation measures including importantly, soft measures.
Long-Term/Resilient Reconstruction (1–3 years)—9 Million USD/67.50 Billion SLL*
• Resettle unsafe areas according with comprehensive spatial strategy that would be developed based on multi-risk assessment and risk maps (this strategy has been considered for financing purposes under the DRM chapter along with zoning codes); develop resilient building codes with an enforcement mechanism, capacity building in both private and public sectors to enforce and implement stringent process to acquire land and construction permits; devolve responsibility to spearhead the development of a strategy for integrated real estate development that includes affordable housing completely to local city council; enhance land tenure through functioning land cadaster and registry; establish a functioning public land inventory; review and validate property tax database and land value maps for the Western Area Urban and Western Area Rural; leverage private financing to innovate and increase the affordable and safe rental housing market.

**9* million USD/67.50 billion SLL is calculated based on an assumption that the Government of Sierra Leone would focus on the poor households in the affected area for providing safer housing solutions. The cost of construction for a low-cost house was considered to be approximately USD 6,250 as provided by local contractors, real estate agents, and field interviews.

monsoons are expected to continue till mid- to end-October 2017, this figure could change should there be additional natural hazard events. Medium-term early recovery over the next 3–12 months for the poor households from the affected population is estimated to be USD 2.3 million. Longer-term estimates for resilient recovery over one to three years, for the poor households from the affected population, is estimated to be USD 9 million (Table 4).

Housing represents a major share of real estate, household wealth, and building reconstruction needs. However, any housing strategy in Freetown must be part of a larger city-wide spatial development strategy so that multiple urban development challenges are addressed in a comprehensive manner. Without such an approach, Freetown's development will remain institutionally fragmented, adversely impacting the ability of the city to both grow in a sustainable manner as well as respond effectively to shocks such as the recent disaster.

Any city-wide spatial strategy must consider densification of existing pockets of land that is safe to develop for multiuse purposes. The tools for land redevelopment will require innovation to adapt international knowledge to the local context; this could be different in different locations of the city. Such tools could include innovative voluntary and market driven mechanisms for addressing land swaps from risk areas to safe areas, targeted rental support for affected households, possible integration of rent-to-own options for housing in mixed use developments, and developing financing models for interventions that could attract private finance.

4.2 Transport

4.2.1 Sector Context

About 90 percent of all goods and passengers are transported via Sierra Leone's road network. The classified network size is more than 11 thousand kilometers (km), comprising 2,237 km of primary roads, 1,764 km of secondary roads, and 4,152 km of tertiary roads; the length of the urban road network is estimated at 3,093 km.

The road system in Freetown suffers from three major deficiencies: inefficient and inadequate network, poor design and construction, and no effective maintenance. First, the network itself is inefficient, with no proper planning in the hierarchy of roads and poor connectivity; relatively few roads provide cross-town connectivity, and capacity on some roads is inadequate for existing traffic volumes, while other roads have excess capacity. Second, most roads are poorly engineered or poorly constructed by the communities. Thirdly, there is no effective road and drainage maintenance; except for recently constructed and rehabilitated roads, most roads and drainage in the city are in very poor condition, resulting in reduced traffic speeds, damage to vehicles and in some cases danger to road users, and urban flooding due to blocked drains.

The institutional arrangements for the delivery of infrastructure and services are complex and inadequate, with several agencies having responsibility for various aspects of urban transport, inconsistent objectives, and priorities, overlapping mandates while some functions are not specifically allocated to any one agency.

The provision and maintenance of road infrastructure is in the domain of Central and Local Government and is therefore a public asset. The Ministry of Works, Housing, and Infrastructure is responsible for policy formulation, coordination, and monitoring with Sierra Leone Roads Authority and local authorities as road asset managers.

Some of the challenges before the disaster were as follows:

- The transport system's institutions, assets, and knowledge are not effective and have no central or local plan;
- No inventory of road and bridge features available, and therefore no classification of affected roads and structure in the National Road System;
- Structures and roads have not been properly designed and engineered and were poorly constructed by the communities;
- No effective road drainage system; and
- No effective routine maintenance before the disaster.

4.2.2 Methodology

Inspection of the affected transport system was conducted, which involved the institutions, physical assets, and knowledge of the people managing the system. The primary impact was upon the bridge asset connectivity. The affected bridges were located along the main flood corridor and other areas affected by the storm. The physical inspection identified defects on existing bridges that may have occurred because of the flooding/storm and proposed recovery measures for a functional review of this section of the transport network that could enable planning of more functional solutions and (re-)design with more resilient options for recovery. The visual inspection mainly focused on the following:

- Identification of damaged road infrastructures which require emergency works for temporary repairs with available funding;
- Data collection including span and width of structures for the development of repair mechanisms with cost estimation to reinstate the structural integrity of all defective/collapsed bridges on build back better principles (BBB);
- Visual assessment of condition where the structures exist.

The affected roads were mainly feeder roads that were not within the classified national road system; therefore no data was available with the road agency. The assessment of the impact of the disaster on the road infrastructure within the affected communities was carried out through visual inspection and assessment of the damage to the road infrastructure. During the assessment, the location of proposed new road structures, including culverts and bridges, was also identified and mapped out to improve on the overall performance of the network. The quantities of the proposed intervention were computed and unit rates applied to produce estimates of the cost of recovery and restoration works.

4.2.3 Effects of the Disaster

Connectivity and accessibility to various communities (Regent, Motormeh, Pentagon, Kamayama, and Kaningo) were lost because of collapsed bridges and damaged access roads. Eight bridges connecting Kamayama community and Kalingo were identified, including two road bridges and six pedestrian bridges. Two road bridges along the Regent–Charlotte water course affected by the storm were also identified. The damage on road infrastructure was quite extensive. Of the 10.5 km inspected, about 6 km were identified as damaged and will require full restoration (Table 5).

Damage Estimates

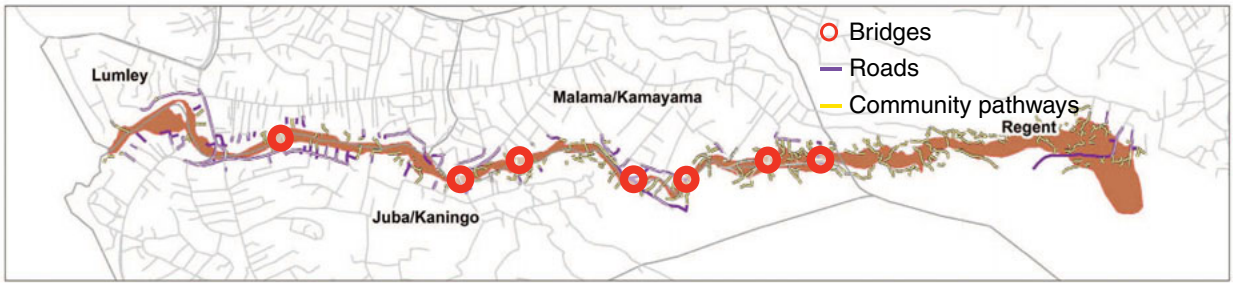
TABLE 5: Estimated Damages and Losses in the Transport Sector

	Roads		Bridges		Total	
Community	SLL Billion	USD Million	SLL Billion	USD Million	SLL Billion	USD Million
Kaningo	0.33	0.04	0.74	0.10	1.08	0.14
Kamayama	0.60	0.08	0.49	0.06	1.08	0.14
Regent	0.30	0.04	2.84	0.38	3.14	0.42
Culvert/Kroo Bay	—	—	2.05	0.27	2.05	0.27
Grand Total	**1.23**	**0.16**	**6.12**	**0.81**	**7.35**	**0.98**

Source: Assessment Team (2017).

FIGURE 17: Affected Roads, Bridges and Pathways by the Regent-Lumley Landslide

Collapsed bridge at Kaningo (Sheriff Drive)



Source: World Bank, UNOPS, Arup and SLRA (2017).

Loss Analysis

In addition to the damages caused by the event, economic losses were caused by connectivity losses, especially related to the bridges that were destroyed. This will result in higher transport costs for people to move around the city and may in some cases mean people not being able to afford to access employment or markets. However, due to a lack of information, in terms of traffic count on the roads, even before the disaster, calculating increased transport costs and associated impacts on productivity could not be done in the limited time and resources available.

4.2.4 Resilient Recovery Needs

The short-term recovery objective will be to restore connectivity and accessibility within and between the affected communities. Modular bailey bridges are being discussed by the government as a quick recovery option that can be deployed fast. United Nations Office for Operations Services (UNOPS) is supporting the government to assess the recovery needs and integrate appropriate bridge designs that are raised and allow for high flood waters to pass underneath. The bailey bridge option also allows for easy maintenance and repair that would enhance build back better principles.

Roads need to be reviewed, repaired, and reconstructed to better withstand future flooding. In addition, drainage infrastructure needs to be integrated into the road network system. The drainage infrastructure within the landfill sites also requires rehabilitation and upgrading to reduce flood risks in the future. Associated maintenance of the transport and drainage infrastructure will help to reduce flood risk and enhance the resilience of the road network (Table 6).

In the long term, institutional strengthening is needed to enhance the transport asset management system and to have an effective approach to managing and maintaining the transport infrastructure network. In addition, clearer roles and responsibilities need to be assigned, alongside appropriate budgets to manage this.

TABLE 6: Short-, Medium-, and Long-Term Resilient Recovery Needs in the Transport Sector

Intervention Area	Cost	
	SLL Billion	USD Million
Short-Term (0–3 months) Response and Relief Efforts	**6.26**	**0.84**
Replacement of previous crossings as listed in the damage assessment table	1.79	0.24
Construction of relief culverts on embankment at Charlotte Bridge approach	0.99	0.13
Remedial maintenance of Regent Village Bridge	0.71	0.10
General maintenance including: drainage clearing, construction of metal grill/wooden crossings along feeder roads of Regent, Charlotte, Kaningo, Kamayama, Juba area	1.42	0.19
Desilting of landfill site culvert	1.35	0.18
Medium-Term (4–12 months) Early Recovery	**29.32**	**3.90**
Provision of Bailey Bridges linking the Kamayama-Kaningo-Juba communities	24.40	3.25
Construction/installation of culverts within Regent, Charlotte, Kaningo, Kamayama, Juba flooded areas	2.79	0.37
Rehabilitation of 0.5 km of urban arterial road destroyed by landslide and new bridge	0.90	0.12
Reconstruction of 5.5 km of feeder roads within Regent, Charlotte, Kaningo, Kamayama, Juba flooded area	1.23	0.16
Long-Term (1–3 years) Resilient Recovery and Reconstruction	**4.88**	**0.65**
Strengthened Road and Bridge Asset Management System	4.88	0.65
Total Needs	**40.46**	**5.39**

Source: Assessment Team (2017).

4.3 Electricity and Telecommunications

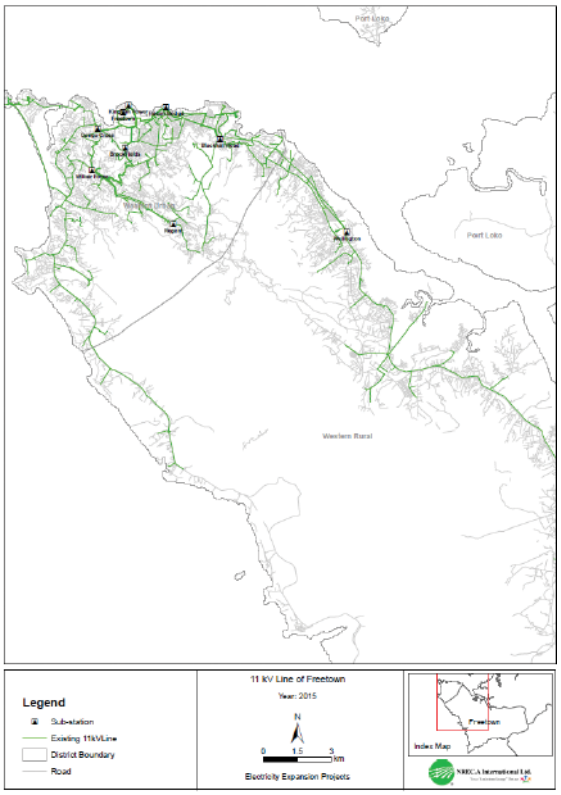
4.3.1 Sector Context

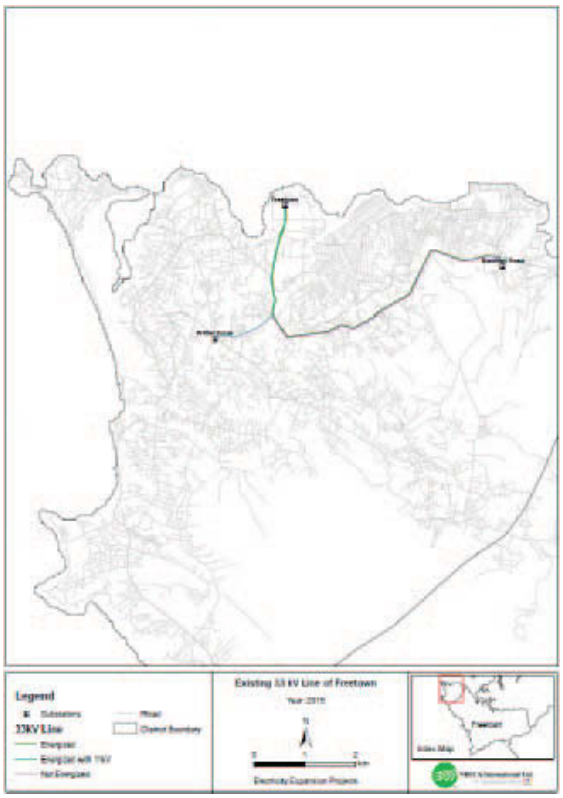
The electricity sector suffers from significant underinvestment, technical inefficiency, and lack of coverage. Average electrification is low at about 30 percent, and even if higher in Freetown (80 percent), installed capacity is low such that only about half of the demand in Freetown can be met by the Bumbuna power plant, even if it functions at maximum capacity. Although solar energy is on the rise, it plays only a negligible role.[14] And while hydropower produces 62 percent of electricity, its potential remains underutilized. The electricity network is over 50 years old and many of its distribution lines were destroyed during the war and have been poorly maintained since. The sector has suffered from low levels of financing and investments and rural areas have only 5 percent coverage. The lack of investment has led to high technical losses in transmission and distribution, high commercial losses caused by inefficacies in revenue collection, poor energy efficiency, and the inability to generate enough power to cover the demand. The sector reported an estimated 38 percent technical loss in 2016 and has one of the highest electricity tariffs in West Africa (Figure 18).

Sector reforms have led to the vertical unbundling of production and retail, and the creation of a regulator. In a bid to improve sector efficiency, the National Electricity Act was approved in 2011, starting the process for the unbundling of the previous power authority and creating the Electricity Distribution and Supply Authority (EDSA), the Electricity Generation and Transmission Company (EGTC) and the regulator, the Electricity and Water Regulatory Commission (EWRC). Policy formulation and sector oversight remains with the Ministry of Energy. EDSA commenced statutory operations as the sole off-taker of generated power on January 1, 2015, purchasing power from EGTC and independent power producers. EGTC owns and operates the Bumbuna hydropower plant and the transmission line to Freetown.

[14] Sierra Leone decided to invest in renewable energy. In its recent energy policy, the Government of Sierra Leone is actively considering renewable energy sources, especially solar and hydro-electric to cover the energy deficit and protect the environment, National Energy Policy, 2009.

FIGURE 18: 33KV and 11KV Power Lines in Western Area





Source: Provided by EGTC, 2016.

Although the telecommunication sector (comprising radio, television, fixed and mobile telephony, and internet) is playing an important part in the lives of Sierra Leoneans, network interruptions associated with the recent disaster has been limited. About 72 percent of people in the country are reportedly listening to the radio daily, and mobile telephones have become important platforms for the transfer of funds to areas where the financial sector is not present, messaging to the hard-to reach areas, and general use in business and education. Yet, physical network dependent on services like landline phone and internet play only a marginal role, with the penetration of the latter being only 4 percent, explaining the limited disruption.[15] Therefore, the remaining discussion in this section will focus on the damage and impact in the power sector.

[15] A number of telecom operators were interviewed and all stated that the effect of the landslide on their operational infrastructure was minimal and repairs had been undertaken. Their overwhelming view was that as service providers, there was little or no business interruption.

4.3.2 Methodology

In the absence of geographic maps of EDSA's customers, EDSA was unable to provide detailed information on the number of customers affected or their location. Subsequently, information on affected areas was obtained by EDSA via on-site inspections. Primary data were collected through structured interviews with all key stakeholders in the sector. This provided real time information on the effect of the landslide/flooding on the electricity sector and on EDSA's activities. Supporting information has been provided directly by ESDA, including estimated costs.

4.3.3 Effects of the Disaster

During the landslide and flooding disaster, there were power outages across the city, including the main hospitals at Hill Station, Wilberforce, and Connaught. These have backup generators and the effect of the power outage on their patients was minimal. Schools were on holiday and did not need

power. Sierra Leone has no trains or trams so the power outages did not affect the transportation network. The power stations owned by EGTC and the 33 kV transmission power line owned by ESDA were not affected, but there was damage to transformers, low voltage poles, switchgear, and conductors—all of which are required to supply electricity to their customers in the area. Moreover, the 11 kV line linking Lumley and Juba was damaged, as was the PWD substation. EDSA reported 372 households affected from Mountain Cut, PWD, Malamah, Kaningo, and Regent. The distribution lines have not yet been restored; therefore, these properties are still without power. These households had meters that were irrecoverably damaged and would need to be replaced prior to power being restored (Figure 19 and Figure 20).

Since electricity power networks require a constant balance between the supply and varying demand of electricity, EGTC was quick in evacuating its maximum allowable power output from the Bumbuna power station. During the incident, EDSA received several distressed calls from people in affected communities worried about the power supply and the potential risk of electrical incidents. EDSA responded by reducing the evacuation and power supply to 21 MW at that point to safeguard people and their equipment.

Damage Assessment. EDSA undertook an assessment of the damage after the event to restore temporary power supply as quickly as possible. Lost and damaged material or equipment that has been purchased and replaced by EDSA is listed in Table 7.

FIGURE 19: Fallen High Tension Pole Back of Lumley and Juba Bridge

Source: Picture provided by EDSA staff member, August 2017.

FIGURE 20: Reduction in Power Evacuation/Supply to Communities

Source: EDSA staff, August 2017.

Loss Assessment. Temporary shelter is being provided to victims who have been rendered homeless by the

TABLE 7: Extent of Damage to EDSA's Infrastructure

Area	Physical Infrastructure	Overall Effect/Power Quality
Regent	1 transformer at the Guma Pumping Station Low voltage poles, conductors, damaged accessories	Customers without power for 48 hours in the immediate area of the landslide
Kaningo	1 transformer at Momoh Drive Low voltage poles, conductors, damaged accessories	Customers without power for 24 hours in the area of flooding
Kamayama	1 transformer at the Malama Extension Low voltage poles, conductors, damaged accessories	Customers without power for 24 hours in the area of flooding
Lumley—Juba	All 21 transformers in Goderich Low voltage poles, conductors, damaged accessories	Customers without power for 12 to 24 hours in the area of flooding
PWD Pademba Road Substation	Switchgear (RMU), low voltage panel, transformer	The areas of Pademba Road, Sumaila Town, George Brook, Dundas Street, Campbell Street all without power for 48 hours

Source: Assessment Team (2017).

landslide and floods, and in that context EDSA has started providing electrification to one of the temporary camps. Electrification work has been completed at the Old Skool compound in Hill Station. Solar lighting is being provided at the other temporary shelters. The government is looking to provide permanent housing for displaced households at a previously identified site at Mile 6. This development is being led by the Ministry of Works Housing and Infrastructure and entails the construction of 52 one- and two-bedroom self-contained units. EDSA is waiting for the detailed design of the area but has provided estimated costs based on the electrification of a typical 2-bedroom self-contained house.

Other losses include the replacement cost of the electricity meters, which is not a direct cost to EDSA, as customers need to pay for the meters. A single-phase meter costs SLL 705,500 and a three-phase meter costs SLL 1,350,000. It is assumed that of the 372 households affected and reported by EDSA, 10 percent were on 3-phase and 90 percent on single-phase meters.

The tables below show preliminary damages and losses to EDSA in the different affected communities and by type of damage/loss. Kaningo was worst affected as most of the poles, aerial bundled cables, and overhead power lines were swept away by the flooding. EDSA has provided an estimated cost of the electrification of a self-contained two-bedroom house at SLL 256,308,000 plus an additional 20 percent for cabling and other accessories. The final cost will depend on the final design of the community (Table 8 and Table 9).

4.3.4 Resilient Recovery Needs

Recovery Needs: The importance of energy and electricity cannot be underestimated in the recovery efforts following the disaster. EDSA and the Ministry of Energy are working with the ONS Shelter Pillar to provide electricity to the temporary camps and the permanent locations where houses are being built for the affected families and individuals. The three temporary camps and premises are all short-term solutions and have varying degrees of electricity

TABLE 8: Damages[1] of EDSA's Infrastructure Based on Geographical Spread

Area of Distribution Lines Affected	Damage	
	SLL Million	USD
Regent	39	5,263
Kamayama	131	17,430
Kaningo	291	38,893
Juba/Lumley	13	1,780
PWD Substation	827	110,250
Total	**1,030**	**173,616**

Note: 1/excluding meter replacement
2/assuming a combination of 1- and 2-bedroom units with provision for a perimeter fence.
Source: Assessment Team (2017).

TABLE 9: Damages and Losses by Type of Impact

Type of Impact	Loss	
	SLL Billion	USD
Provision of electricity to temporary shelter	0.15	20,416
Permanent shelter	0.31	41,009
Meter replacement	0.29	38,172
Total	**0.75**	**99,597**

Source: Assessment Team (2017).

provision. The Old Skool compound at Hill Station has been inspected and all the necessary undertaken to ensure power could be provided while in operation. Solar lighting has been provided in the short term to the temporary sites at Juba Barracks or the Kamayama School. To support those who have lost homes, 52 houses are being constructed at Mile 6, 300 m from the 2015 relocated flood victims. This additional community at Mile 6 will require electricity from the grid power (there is no connectivity at this stage) and will include solar street lighting to provide safe communities for those who have already suffered horrific trauma and are trying to rebuild their lives. An estimate for the electrification of 52 standard two-bedroom houses has been produced but will require further review when the final site layout and building design has been completed. EDSA is in the process of undertaking a survey to confirm the costs of installing electrification and solar lighting facilities in these areas.

Building Resilience—Future Flood Risk Mitigation Measures: With the expansion of Freetown and population growth, EDSA is considering the following to provide a lasting solution to its perennial flooding problems, especially in its bid to provide services to customers in disaster/flood prone areas:

1. Rehabilitate/replace affected equipment/material.
2. Diversify or relocate power lines in built-up areas.
3. Ensure that all MV/LV network poles are erected with concrete basements for firm support.
4. Construct elevated plinths for transformers, switchgears, and distribution panels in areas susceptible to flooding.
5. Convert overhead lines to underground cables.
6. Convert bare conductors to insulated conductors.

In the Telecoms sector, capacity needs to be built for disaster management communications and telecommunication equipment (Table 10).

1. Satellite phones will enable ongoing communication in areas where the local 3- and 4-G networks are unable to reach.
2. Call Detail Record provides information about activities on mobile communication networks and can be used to provide information on aggregated human mobility, by estimating dynamic trajectories and spatial-temporal distribution of people. This information can give the authorities a better and quantitative understanding of population flow patterns over time and at specific events. In Sweden, Call Detail Record was used to direct emergency aid by analyzing mobile phone records covering the time when people are fleeing natural disasters.

TABLE 10: Communications and Telecommunication Needs

Needs Description	SLL Billion	USD Million
Short Term (0–3 months)	1.46	0.19
Replacement of damaged equipment	1.305	0.17
Provision of electricity to temporary shelter	0.15	0.02
Medium Term (4–12 months)	.31	0.04
Electrification of houses at the new community at Mile 6	0.31	0.04
Long Term (1–3 years)	4.95	0.66
Construct elevated plinths	0.15	0.02
Convert base conductors	4.80	0.64
Total	**18.46**	**0.90**

Source: Assessment Team (2017).

4.4 Water and Sanitation

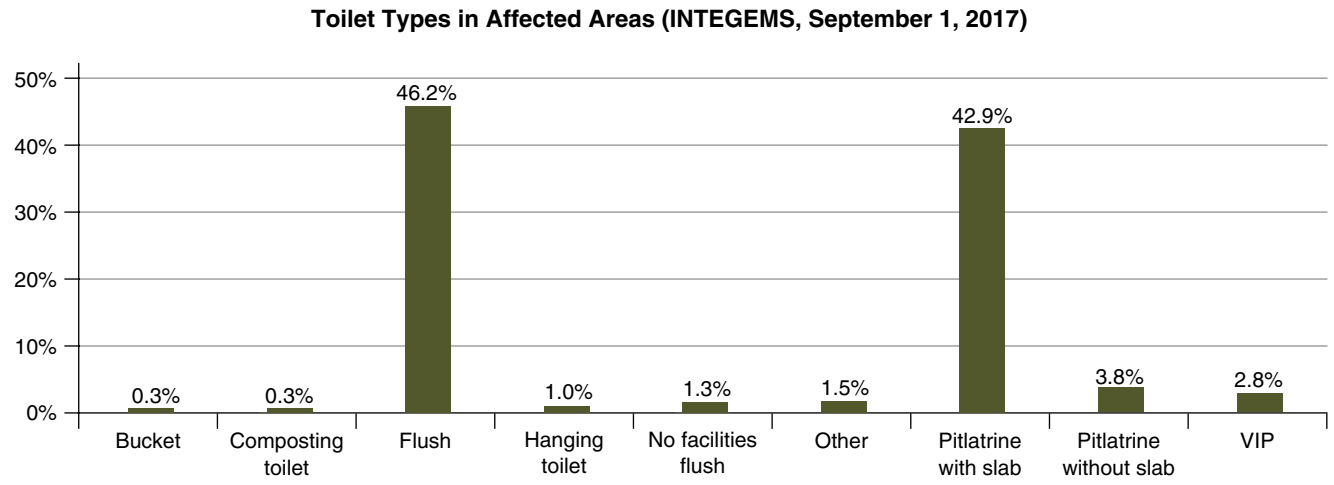
4.4.1 Sector Context

Improved water coverage in Freetown. According to the WHO Joint Monitoring Program of urban areas of Sierra Leone had up to 85 percent coverage in improved water sources, with 11 percent having piped water on premises and 74 percent having public standpipes or protected wells. Only 9 percent are listed as unimproved, while 6 percent are listed to be using surface water as their source of drinking water.[16] This estimates that 74 percent of the population relies on point sources, such as protected hand-dug wells which are considered unsuitable for dense urban environments, where water points are very close to on-site sanitation facilities. Further, there has been very little investment in Freetown's utility (Guma Valley Water Company) since the war, despite the drastic population increases putting stress on the city's services in this post-war period.

Improved sanitation coverage in Freetown. Sierra Leone has seen limited to no progress on their MDG targets for sanitation and open defecation has increased in urban areas to 8% since 1990.[17] WHO's Joint Monitoring Program estimates improved

[16] WHO (2015).
[17] WHO (2015).

FIGURE 21: Toliet Types in Affected Areas



Source: Assessment Team (2017).

sanitation[18] coverage at 23% in urban areas in Sierra Leone.

On the other hand, per data collection during the DaLA in the affected areas, 46.2% have access to flush toilets and 42.9% to pit latrines, while 3.1% don't have access to any facilities reporting they use the bushes, a bucket or other options (Figure 21).

Safe disposal and treatment of fecal sludge and waste water is another challenge for sanitation in Freetown. The sewer system is limited to approximately sixty properties in the Central Business District (CBD). Approximate 1 million people in the city produce 1,650 cubic meters of fecal sludge per day, and only approximately 38 cubic meters is collected by trucks and brought to the designated disposal site, King Tom.[19] A large quantity of waste does not even reach the dumpsite, in part due to the difficulty of collection from some of Freetown's steeper slopes, discharging into open drains and directly into water ways. This poor management of fecal sludge directly impacts on human health, due to the possibility of contaminating groundwater supplies and the risk generated by unsafe disposal. This risk to human health was evidenced during the 2012 cholera outbreak which resulted in 20,000 deaths across 12 districts nationwide.[20]

4.4.2 Methodology

Primary and secondary data collection method. The assessment team consulted a variety of agencies on the ground to gain a qualitative overview of damages, losses and needs. These agencies included Guma Valley Water Company, Freetown City Council, UNICEF, the WASH Consortium, and the NGO GOAL.

For the quantitative analysis, data sources for the baseline prior to the disaster include the WHO Joint Monitoring Program in 2015, Statistics Sierra Leone, IFC International 2013 survey, Water Point Mapping data from the Freetown City Council and the Water and Sanitation Program, Fixing Freetown Report, 2015. For post-disaster damage assessment, the assessment uses immediate post-disaster mobile phone survey data from the United Nations Children's Fund, primary data collected by INTEGEMS Survey team and

[18] "Improved sanitation" as classified by the Joint Monitoring Program of the World Health Organization includes composting toilets, flush toilets to a piped sewer system, septic tanks, pit latrines with slabs and Ventilated Improved Pit latrines. The facilities must not be shared to be classified as improved. For more information see WASH Post 2015 Proposed Indicators for drinking water, sanitation and hygiene http://www.susana.org/_resources/documents/default/3-2331-7-1444132829.pdf

[19] FCC Fecal Sludge Management Unit, Interview, September 1, 2017.

[20] WSP, 2015.

mapping work by the firm ARUP on behalf of the World Bank.

Data interpretation and analysis. Calculations of costings are based on figures sent by the ONS on number of people and households affected, tabulations of survey data from INTEGEMS to get coverage rates, and GVWC data on the number of connections in the affected area.

Limitations of the methodology. The assessment was carried out in the immediate weeks following the disaster. It is therefore restricted by some non-finalized figures in the assessment as some aspects of the situation on the ground continue to be diagnosed at the time of writing. Furthermore, some of the financial estimates are not including longer term development needs, such as those for sanitation, though they remain an important issue for consideration.

4.4.3 Effects of the Disaster

To date, there are 10 areas identified by the Ministry of Health as being impacted, not just by the landslides but by the flooding which continued over subsequent days and weeks.[21] For the water and sanitation sector the flooding continues to pose a heightened risk of waterborne diseases in flood-affected areas.

In the water sector, multiple sources reported that a large fraction of the affected population was reliant on dug wells, and though 34 percent were protected dug wells, unprotected sources to include surface water, unprotected wells, and springs made up to 29 percent of the supply for the area for drinking water. Due to the severity of the flooding however, even the sealed wells are likely to have been contaminated.[22] Meanwhile, despite 13 percent of those interviewed reporting piped water to their premises as a main source of drinking water, the utility GVWC reported that there were only 28 household connections in the affected area[23] and thus we can deduct from this and qualitative information available that a large portion of those reporting piped coverage were likely to have been illegal or "unofficial" connections (Figure 22 and Figure 23). The presence of these illegal connections tapping the mains increases the risk of contamination of even the piped water system.

The levels of contamination of the water in several dug wells, both protected and unprotected has been measured by UNICEF and the WASH consortium. UNICEF samples revealed levels of fecal coliforms, particularly from community wells as "Too Numerous to Count,"(TNTC) in the majority of cases, meaning extremely vulnerable to waterborne diseases such as cholera and diarrhea. Furthermore, of over 2,000 people who responded to a recent mobile phone survey in affected areas, 72 percent reported their water source had been damaged by recent landslide and flooding (Figure 24 and Figure 25)

Regarding damages to utility infrastructure, the utility has stated that there was a crack in the reservoir at Babadorie because of the landslides and flooding of the treatment facility. This flooding resulted in the need to shut off supplies to some connected households. Flooding also affected the treatment plant at Charlotte. Many other problems pre-date the landslides and flooding of August 14 and thus are covered more in the needs section of this document for addressing longer term resilience of the network. Total damages in water are estimated at USD 0.47 million.

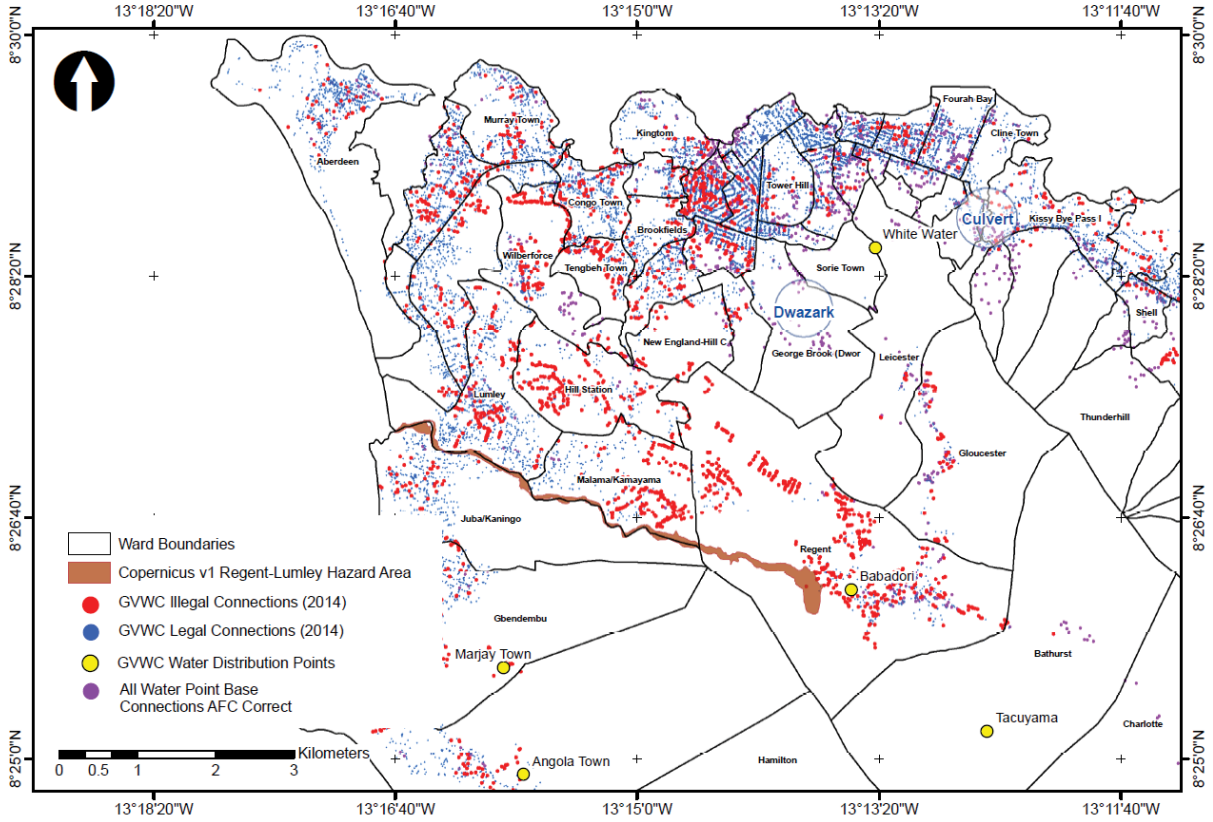
Damage assessment in sanitation. As the existing infrastructure in sanitation mainly consisted of a combination of flush toilets (46 percent) and pit latrines (43 percent), the main damage that has come about is from the houses in the affected area where these latrines would overflow or seep into the water supply. A survey conducted in the affected area found that 41 percent of flush latrines and 51 percent of pit latrines with slabs (the two main categories) were now

[21] Freetown City Council Fecal Sludge Management Unit interview, September 1, 2017.

[22] INTEGEMS (September 1, 2017).

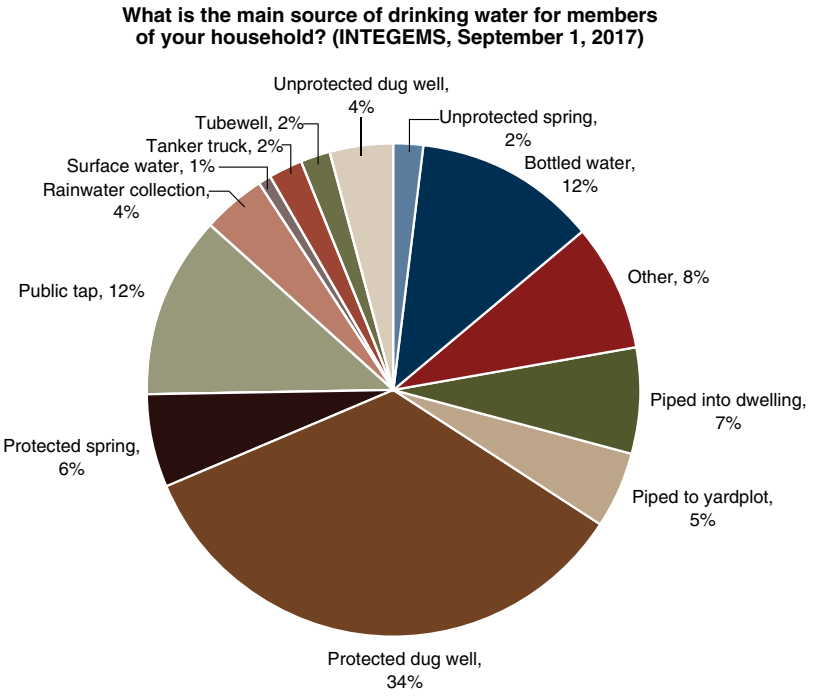
[23] Though GVWA reported only 28 household connections at "ground zero," 737 connections also were indirectly affected by the flooding and cut-off of supply.

FIGURE 22: Legal and Illegal Connections in Western Urban Area



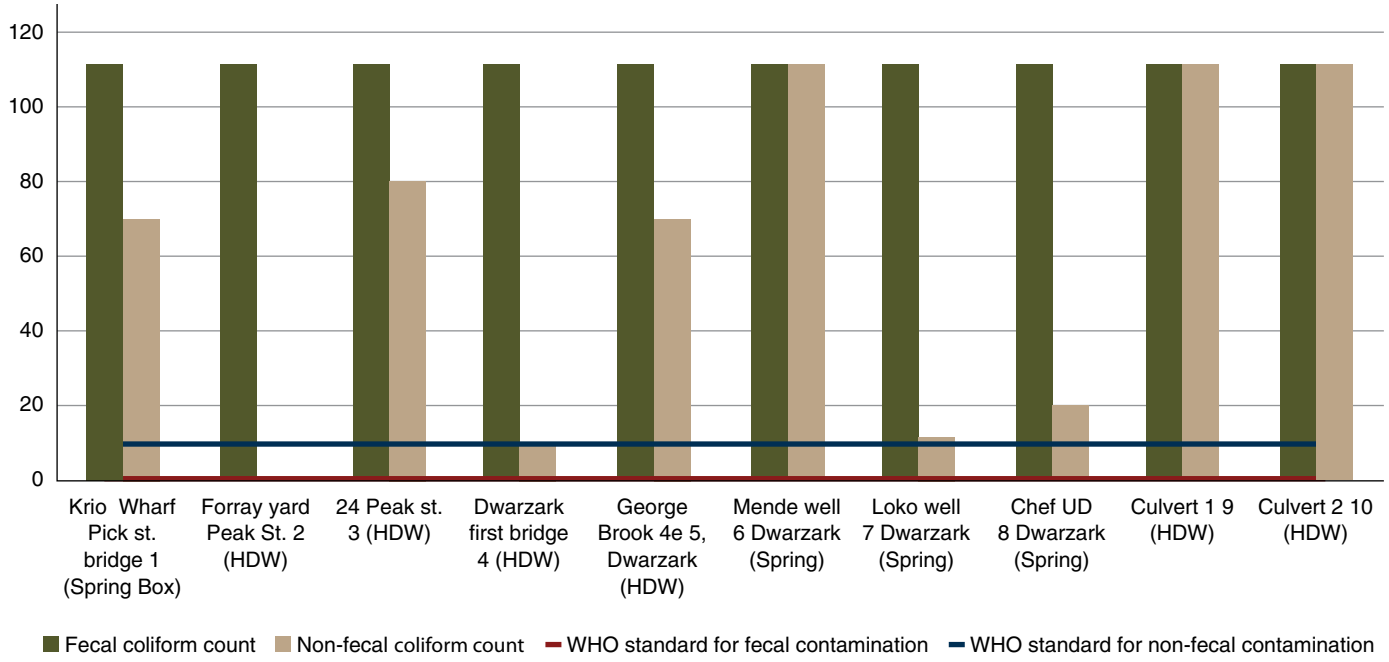
Source: World Bank, Arup, GVWC 2017.

FIGURE 23: Main Sources of Household Drinking Water



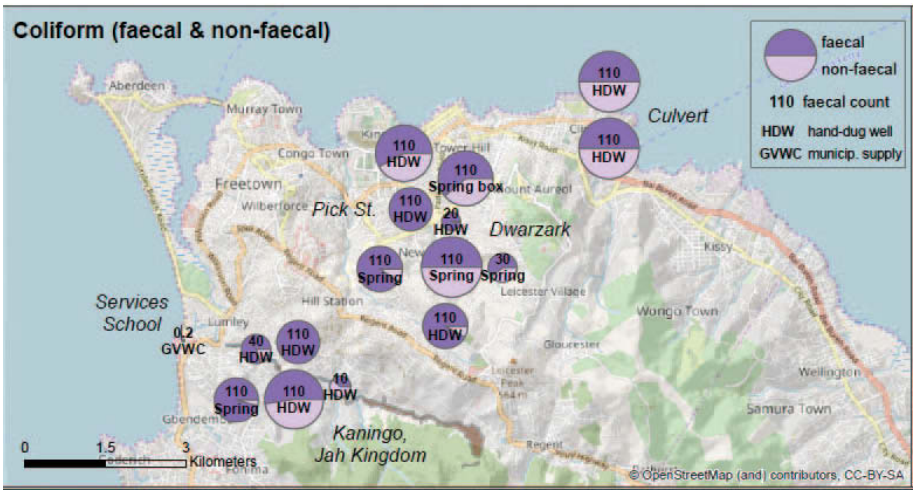
Source: World Bank, Arup, INTEGEMS 2017.

FIGURE 24: Quality Tests in Water Sources across the Affected Areas



Source: UNICEF (2017).

FIGURE 25: Water-Quality Tests Revealed High Levels of Fecal Contamination across Affected Areas, Particularly Hand-Dug Wells



Source: UNICEF Map Action (2017).

not functioning after the disaster. This adds to the risk of cholera outbreaks due to unsanitary material being deposited in flooded households as well as the content of latrines seeping into drinking water supplies in these densely populated areas. Beyond the household, due to the overall lack of a sewerage network in the city and the lack of a fecal sludge management facility, there was little in the way of infrastructural damage to be incurred. Total damages in sanitation are estimated at USD 0.29 million (Table 11).

Loss Analysis. In the water sector, losses come from the need to provide emergency supplies such as trucked water, emergency kiosk installation, and bottled water

TABLE 11: Summary of WASH Damages and Losses (USD millions)

	Damages		Losses		Total Damages and Losses	
	SLL Billion	USD Million	SLL Billion	USD Million	SLL Billion	USD Million
Water	3.51	0.47	6.63	0.88	10.14	1.35
Sanitation	2.16	0.29	0		2.16	0.29
Total	**5.67**	**0.76**	**6.63**	**0.88**	**12.30**	**1.64**

Source: Assessment Team (2017).

to relief camps, as well as minor immediate repairs to piped infrastructure. Losses in the water sector are estimated at USD 0.88 million.

For sanitation, very little of the pre-existing Fecal Sludge Management (FSM) industry is formally recognized and thus losses are not quantified here. The FSM team at the Freetown City Council reports 15 groups who manually empty pits and use locally fabricated machines; the machines come from seven small and medium enterprises averaging five employees each; but only three of these enterprises are registered formally. A regulatory component is still sorely lacking but the FSM Unit, established in the FCC in 2016, has worked to strengthen private sector entities in the collection, transport, and disposal of waste to the King Tom site.

4.4.4. Resilient Recovery Needs

Short-term needs (0–3 months). In the immediate aftermath of the disaster, relief agencies such as the WASH Consortium and UNICEF are paying GVWC to provide safe and clean water via tanker truck delivery to the camps. Other temporary water sources include bottled water and the provision of water treatment tablets such as Aquatabs or water from kiosks and bladders. In the two camps for the affected populations, temporary latrine installations have been erected to cater to affected families. Each latrine block has six toilets and four showers. In terms of piped service, GVWC needs to replace generators and pumps, clearing the Weir of boulders in Charlotte and repair temporarily existing "spaghetti pipes" connections with the view to building a formal tertiary distribution network in the medium to long term. Addressing these short-term activities estimated cost is around USD 1.3 million.

Medium-term needs (4–12 months). The response of the WASH sector will have to be coordinated with the housing pillar regrading decisions to relocate high risk areas or densify low risk areas. Nonetheless, a cost-effective medium-term solution for water needs is the installation of 2–3 boreholes with associated storage tanks and distribution network through standpipes, to replace hand dug wells and box springs.[24] Other critical activities are water quality monitoring, installation of a pondliner in the Babadorie treatment works, and rehabilitation of the Charlotte water system which was affected by flooding. The GVWC should also gradually cut down on non-revenue water and illegal connections to enhance financially sustainability and expand their coverage through a formal household connection program.

Meanwhile for sanitation, different costing options can be developed involving the private sector to ensure that affordable and improved household latrines are built for the affected populations. Household latrine facilities will need replacing, in some cases upgrading, while in extremely densely populated communities shared facilities will be necessary. A combination of private sector approaches and government subsidies can be employed to address the needs of poorer households unable to afford their own facilities. Simultaneously, to address the problem of fecal sludge management, more stringent regulation combined with incentivization arrangements should be applied to ensure the trucking of waste to the central dumpsite at King Tom. Emergency interventions to

[24] Each borehole and network can provide for up to 2,500 people a greatly increased capacity from hand-dug wells that can provide for only up to 250 people. Furthermore, boreholes are more likely to be able to provide a reliable source of safe and clean water as they are protected from contamination due to their depth and construction.

TABLE 12: Summary of WASH Short-, Medium-, and Long-Term Needs

	Needs							
	Short-Term (0–3 months)		Medium-Term (4–12 months)		Long-Term (1–3 years)		Total	
Sector	SLL Billion	USD Million	SLL Billion	USD Million	SLL Billion	USD Million	SLL Billion	USD Million
Water	8.80	1.17	23.25	3.10	45.61	6.08	77.65	10.35
Sanitation	1.18	0.15	5.25	0.70	0.00		6.43	0.86
Total	**9.98**	**1.33**	**28.50**	**3.80**	**45.61**	**6.08**	**84.08**	**11.21**

Source: Assessment Team (2017).

restore functionality of the dumpsite should begin, including erecting a boundary to stop households encroaching on the dump itself. The estimated cost of these medium-term investments for water and sanitation is approximately USD 3.8 million.

Long-term needs (1–3 years)

Freetown's WASH infrastructure is in serious need of investment as has been described in the sector context. As part of a long-term plan a master plan for WASH is needed, since the city has been struggling to cope with a population three times what it was built to serve and aging of infrastructure with no replacement since 1960s. More resilient structures should be built to ensure that drinking water shortages do not recur in the case of further flooding. Further, on the water production sites, additional repairs/improvements on the Babadorie storage tank including on the Charlotte system would be supported. Basic long term needs are estimated to be a minimum of USD 6 million dollars for water. Sanitation needs require a more detailed analysis and long term solutions therefore they have not been assessed (Table 12).

So far, DFID is supporting the GVWC treatment plant, including the rehabilitation of the transmission pipe. AfDB, in conjunction with Netherlands Enterprise Agency, is making significant commitments to the Freetown water supply and sanitation improvements. These efforts should be built on in long term investments.

4.5 Health

4.5.1 Sector Context

Although per capita spending on health is relatively high, the country's health indicators are still among the worst in the world. In Sierra Leone, communicable diseases contribute to 65 percent of the total disease burden, though noncommunicable diseases (29 percent) and injuries (6 percent) are on the rise. The leading causes of death are malaria, lower respiratory infections, cardiovascular disease, and diarrheal disease.[25] The country has one of the highest Maternal Mortality Ratios (MMR) in the world with 1,360 maternal deaths per 100,000 live births.[26] About 47 percent of maternal mortality was among teenagers and one-fourth of maternal deaths are due to unsafe abortions among adolescents. Other health, nutrition, and demographic indicators include: (i) high total fertility (4.9) with low contraceptive use (16 percent) and high unmet family planning needs for currently married women (25 percent) which is even higher for the age group 15–19 (30.7 percent);[27] (ii) 57 percent of households are food insecure and only 15 percent have access to basic sanitation. Such a situation is in contrast with the relatively high per capita spending on health and the relatively moderate coverage of some key health and nutritional interventions. Efficiency and quality of the services provided are of serious

[25] Institute for Health Metrics and Evaluation, Global Burden of Disease (http://healthdata.org/sierra-leone).

[26] WHO (2016).

[27] SLDHS (2013).

concerns;[28] and (iii) lack of crucial supplies including drugs and safe blood for transfusions and infrastructures that lead to inadequately equipped health facilities and increase probability of transmission of disease including HIV and hepatitis. The Ebola Virus Disease Outbreak in 2014 and 2015 further exacerbated health in the country, particularly for the most vulnerable—women and children

The health system lacks critical foundational structures for its development, including: (i) over-reliance on out-of-pocket payments and external sources of funding;[29] (ii) severe human resource constraints such as very low numbers (less than 10 percent of the total health care workforce are medical doctors and professionals [state-registered nurses and above]), maldistribution (up to 60 percent of healthcare workers are in the bigger cities and providing care to 40 percent of the population), and poor-remuneration (almost 50 percent of health care workers are "volunteers"); (iii) lack of crucial supplies including drugs and safe blood for transfusions and infrastructures that leads to inadequately equipped health facilities; (iv) poor infrastructure that leads to inadequately equipped health facilities; (v) inadequate surveillance and emergency preparedness capacity;[30] and (vi) a weak governance and regulatory system that has, among other issues, resulted in a relative large number of health facilities,[31] insufficient health financing, and finally a weak health management information system.

Although there are many facilities, they lack medical professionals and equipment and infrastructure services. There are 122 public and private health facilities with a total number of 8,966 staff in Western Area, both Urban and Rural. The 2017 Service Availability Readiness Assessment showed that a significant number of these health facilities had been facing service availability challenges. For instance, more than 60 percent of health facilities had no laboratory technicians, about half of facilities had no proper disinfection equipment, and one-fourth of the facilities have no electricity or water access.

4.5.2 Methodology

The assessment team comprises experts on health financing, service delivery, gender, public health, nutrition; and civil engineers from UN Children's Education Fund, UN Population Fund, and UN Operational social protection services, World Health Organization, UNAIDS and World Bank.

The assessment covered seven wards in the Western Area that were identified by the government as directly affected.[32] Information was obtained from Service Availability Readiness Assessment (SARA), self-reporting from health facilities, and field visits to the affected areas. Meetings were held with key stakeholders, including government officials, members of technical working groups under the *Health and Burial Pillar*, health workers in the field, representative from development partners, as well as professionals from technical agencies such as U.S. Centers for Disease Control, China Centers for Disease Control, Medicine San Frontier, and E-Health Africa, among others. Best practices and lessons learnt from the disasters in Haiti, Bangladesh, Malawi, and Nepal were reviewed to inform the design of the response strategy and activities recommended in this report. Besides, other relevant documents, such as *the Cholera Emergency Response Plan 2017*, the MoHS's Disease-Surveillance Updates have been reviewed.

The Assessment Team faced some challenges for a credible damage, loss, and needs assessment: (i) impossible to visit all 122 health facilities to verify the information received; (ii) difficult to measure the indirect/cumulative effects because the country is still in the rainy season, and new damages and losses may happen before the rainy season ends; and (iii) health sector challenges by chronic issues such as shortage

[28] Sun, Ahn, Lievens, and Zeng. (2017).

[29] WHO (2013).

[30] WHO (2016).

[31] WHO (2016).

[32] To estimate the impact of the disaster on people living with HIV (PLHIV), UNAIDS in collaboration with National AIDS Secretariat, National AIDS Control Programme, UNICEF and Network of People living with HIV conducted a rapid assessment using the PLHIV support groups living in all the affected locations.

of trained health workers and supplies. The need to Building Back Better health facilities is enormous. The number of health facilities per 10 thousand population is remarkably higher in the country, particularly in Freetown, in comparison to other countries with similar income levels.

4.5.3 Effects of the Disaster

The flood and landslides had a moderate impact on the health system and constrained the health system's capacity to deliver essential services. In the disaster-struck areas identified by the government, six health facilities were affected and need to be repaired or relocated.[33] The direct damage to the sector is estimated at USD 24,664 (SLL 0.18 million). The total loss is USD 4.67 million (SLL 35 billion). The total needs for building the Western Area health sector back better is estimated at USD 11.12 million. Thirty percent, or USD 3.4 million, is allocated to the national emergency medical services' operationalization, while short-term interventions will receive USD 5.8 million (75 percent). Bilateral, multilateral, and philanthropic donors have committed in-cash and in-kind resources to the emergency response to date. The total commitment from the five largest donors to date (U.K. Department for International Development, US CDC, USAID, China Center for Disease Control and Prevention, Global Alliance Vaccination Initiative, and United Nations Population Fund) is USD 5.0 million, with the majority dedicated to short-term support. This leaves a funding gap of USD 6.1 million (17.3 percent of short-term, 40.3 percent of medium-term, and 42.4 percent of a long-term nature).

Damage Analysis. The total estimated value damaged is USD 24,664. In the identified affected areas, three health facilities were flooded, and the remaining three health facilities experienced roof leakages that resulted in damages. Roof leakage and associated damage is widespread in other parts of Western Area. The damage includes: (i) damages to infrastructure such as flooding of pit latrines and septic tanks, incinerator, and doors; (ii) damaged furniture such as benches, chairs and desks; (iii) damaged medical equipment; (iv) tainted medicines; and (v) destroyed patients' records, archives, and documents (Table 13). For infrastructure, a discount rate of 80 percent was applied to arrive at their current values. For other items, no discount rate was applied.

Loss Analysis. The estimated loss for the sector is about USD 4,667,466 which takes two major forms. First, the loss of health workers. Secondly, loss caused by by-gone expenditures for response to the disaster.

[33] In Western Area Urban and Rural, an additional 16 facilities suffered from roof leakage. Additionally, 78 people living with HIV (PLHIV) and their family members perished whilst 110 people living with HIV lost their drug supplies. The supplies have however been restored by national authorities, UNAIDS and the network of PLHIV. These damages and losses have, however, not been included in this rapid assessment estimations.

TABLE 13: Estimated Damages in the Heath Sector

Health Center: Partial Damage	Replacement Cost	
Partial Damage	**SLL Million**	**USD**
Toilet and water supply, leaking roof (concrete, low)	23.2	3,098
Damaged tables and benches (concrete, low)	12.4	1,650
Damaged incinerator (concrete, low)	6.7	890
Flooded delivery room, toilet, leaking roof (concrete, low)	9.2	1,230
Facility flooded, all reporting tools damaged, wall shelves in drug store damaged and washed away with some IV fluids, inside of building needs to be painted (concrete, low)	90.9	12,116
Flooded toilet, incinerator, medical equipment and furniture (concrete, low)	42.6	5,680
Total	185.0	**24,664**

Source: Assessment Team (2017).

TABLE 14: Estimated Losses in the Health Sector

Loss Component	Subtotal	
	SLL Billion	USD Million
Temporary health facilities	2.77	0.37
Temporary health care provision	3.61	0.48
Other possible costs (above normal budget allocations)	28.62	3.82
Total	**35.01**	**4.67**

Source: Assessment Team (2017).

For instance, opening and running temporary health clinics and monitoring disease outbreaks (Table 14).

The estimation comprises two components, namely the short-term loss (up to three months) and medium- and long-term loss (3–12 months and 12–36 months, respectively). The short-term loss is related to incremental spending on top of the ongoing investments in the health sector in Freetown for a period of three months, including:

- *Health services for internally displaced persons*: Seven health clinics have been or are going to be set up for these persons for three months; the cost centers for organizing these services include: (i) 50 health workers with a monthly allowance is USD 250 per capita; (ii) the daily running cost for a big clinic is USD 1,000 and for a small clinic is USD 500; and (iii) USD 10 per day per health worker for food.
- *Monitoring of morbidity and malnutrition increases*: The spending incurred will enable health facilities in Western Area to implement enhanced electronic Integrated Disease Surveillance and Reporting (e-IDSR) and active community-based surveillance for infectious disease outbreak detection. The cost centers used for estimation include training, transportation, allowance for surveillance officers and health workers, communication allowance, and laboratory and office supplies, etc. Further, health workers will be trained on early identification of severely malnourished children.
- *Public awareness campaigns*: Cost centers include training, air time, allowance, etc.
- *Control of possible outbreaks*: Estimated cost includes cholera vaccine purchase and vaccination campaign, water quality assessment at affected communities and affected health facilities, assessment of WASH in six health facilities in the affected areas, training on infection prevention and control, and supervision.
- *Vector control*: Estimated costs are based on costs for equipment such as sprayers, personal protection gear such as gloves, gum boots, transportation, training, and allowance.
- *Provision of Sexual and Reproductive Health-Family Planning (SRH-FP) services for women and girls*: Costs for services include provision of dignity, mama-baby kits; registration, screening, management, and linkage to referral for pregnant women as well as follow-up tracking, health promotion, support for the health and psycho-social management of gender based violence (GBV), Provision of HIV prevention combination services and referrals for HIV testing and treatment, and provision of SRH-FP supplies.
- *Medium- to long-term medical and psychological care:* Only cost for addressing mental health issues was estimated.

Costs for lost health workers, the medium- and long-term medical cost for the disabled, the initial set-up cost (e.g. tents, floor leveling and preparation, and WASH component) have not been included in the loss estimation. Should these costs be included, the loss to the sector would be much higher.

4.5.4 Resilient Recovery Needs

The total estimated needs for recovery and resilience building is USD 11.12 million. Of the total, USD 3.4 million or 30 percent will be for introduction of new emergency medical services. **The rest of the needs are USD 7.8 million, of which the short-term needs are USD 5.8 million** (Table 15).

TABLE 15: Estimated Needs in the Health Sector

Sector	Short-Term (0–3 months)		Medium-Term (4–12 months)		Long-Term (1–3 years)		Total	
	SLL Billion	USD Million	SLL Billion	USD Million	SLL Billion	USD Million	SLL Billion	USD Million
Health	43.82	5.84	18.75	2.50	20.85	2.78	83.39	11.12

Source: Assessment Team (2017).

The components identified are as follows:

In the short term/Immediate recovery (0–3 months)

1. Prevent, detect, and respond to infectious disease outbreaks and the potential increase in malnutrition rate.
2. Ensure quality essential health (RMNCAH, mental health) and nutrition services are provided to the affected populations (both at facilities and communities), in particular to women, girls, children, and vulnerable groups.
3. Ensure safe water and sanitation services to the population and at priority health facilities.

Medium term/Full recovery phase (4–12 months)

1. Renovate and equip affected health facilities.
2. Establish a cost-effective centralized medical waste management system through a public-private mechanism in Freetown.
3. Adopt a whole-of-society approach at all levels for health hazard assessment, health system preparedness, and response capacity building for future disasters.

Long term/Resilient reconstruction (1–3 years)

1. Relocate the facility flooded.
2. Ensure right-sitting and right-sizing of health facilities by Local Councils and health authorities being part of the health sector recovery and restructuring agenda.
3. Increase domestic resources toward long-term sustainable investments in the health systems to ensure essential services are available, accessible, affordable, and of good quality.

4.6 Education

4.6.1 Sector Context

The education system in Sierra Leone is organized into the following sub-sectors: Pre-primary, primary, secondary, trade and vocational education training (TVET); tertiary education; and non-formal education. In 2016, the Western Area had 1,849 schools with an enrollment of 431,692 students at the pre-primary (8 percent), primary (55 percent), and secondary level (37 percent). Education service delivery in Sierra Leone is by a mix of public and private agents, receiving varying levels of government assistance. In the Western Area, only 13 percent of schools are government owned; 27 percent are owned by religious institutions; 20 percent by communities, and 40 percent are owned by private proprietors. Public expenditure on education is relatively low, at 2.4 percent of GDP and 15.2 percent of total government expenditure in 2013. The share of current expenditure is very high (> 99 percent), of which around 75 percent is spent on salaries.

Since the war, enrollment expanded rapidly in Sierra Leone, especially in primary. In 2015, the primary gross enrollment ratio was 127.6 percent and the primary completion rate was 75.3 percent. Sierra Leone outperforms Liberia and Guinea on these indicators, though not on pre-primary and senior secondary enrollment ratios. Nevertheless, significant disparities exist based on location and poverty level. Gender disparities in access have been eliminated in primary but gradually deepen at the junior and senior secondary levels. Other significant challenges faced by the sector are high dropout rates (only 48 percent of students who start class 1 complete the primary cycle) and poor learning outcomes. These outcomes

are driven by many factors, including, insufficient and inadequate school infrastructure, limited availability of critical quality inputs, low quality of teachers and poor teacher management, inadequate management and accountability systems, and low public spending.

4.6.2 Methodology

Assessment of Damages to Assets: The assessment was based on following the steps:

1. *Identification of affected facilities:* MEST did an initial rapid assessment of 113 schools located in Regent, Kamayama, Kaningo, Dwarzark, Culvert, and others on the type of damage[34] to the schools.
2. *Estimating asset types and quantities:* The data on types of assets and associated quantities in affected facilities (e.g., number of furniture items, textbooks, latrines, classrooms) was obtained from the 2015 school census.
3. *Estimating unit costs:* Unit costs for various items were obtained from review of contracts, market scoping, and key informant interviews. In the case of assets since not all assets were in good condition before the disaster, baseline unit costs were adjusted based on its initial condition: (i) assets in good condition: 100 percent of unit cost; (ii) assets in need of repair: 75 percent of unit cost.
4. *Estimating the level of damage to assets:* The level of damage to assets was classified as: (i) full damage (i.e., the building was destroyed—only 1 school); (ii) high damage; (iii) moderate damage; and (iv) minor damage.
5. *Valuation of damaged assets:* The damage to assets is valued based on pre-disaster value of assets (as determined by the unit cost associated with the assets and its condition multiplied by average quantities of such assets per school) multiplied by the number of schools in a given asset damage category, and further adjusted by the "damage coefficient" associated with the asset damage category: (i) total damage (destroyed) is 100 percent of pre-disaster value of asset; (ii) high damage is 75 percent of pre-disaster value of asset; (iii) moderate damage is 35 percent of pre-disaster value of asset; and (iv) minor damage is 15 percent of pre-disaster value of asset. The overall value of damaged assets is obtained by aggregating the value of damaged assets in the four asset damage categories.

Loss Assessment: The assessment of losses is comprised of the following components: (i) cost of demolition, rubble removal, and/or cleaning in schools with building damages; (ii) cost of disinfection and replacement of furniture in the schools used as shelters; (iii) set up of makeshift schools in the three campsites; (iv) social mobilization to get children back in school; (v) increase in operational cost of schools absorbing affected students; (vi) increase in displaced households' financial burden (beyond what they can afford) to meet education needs of school going children; (vii) loss of revenue for schools from student deaths and permanent closures of schools; (viii) loss of teacher productivity from teacher deaths; and (ix) loss of income of unapproved teachers from permanently closed schools that cannot be absorbed.

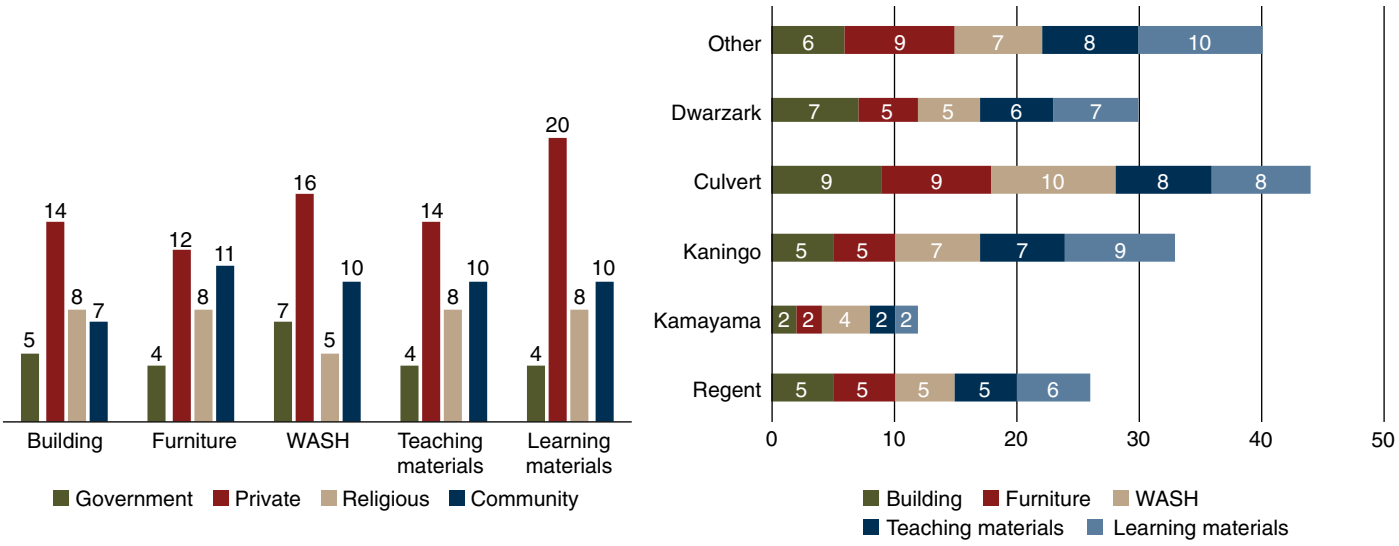
Some weaknesses of the methodology are: (i) noise in the school census data; (ii) the census data is from 2015; (iii) data gaps (e.g., number of teacher deaths, identification of schools to be closed, yet to be assessed schools); and (iv) damage valuation based on multiplying mean asset values per affected school (based on the full sample of schools where the given asset was damaged by the disaster) with number of damaged schools with a given level of damage.

4.6.3 Effects of the Disaster

The disaster affected 59 schools, (corresponding to 41 unique facilities), primarily in the Regent, Kamayama, Kaningo, Dwarzark, Culvert, and Juba communities. Based on the initial rapid assessment by the Ministry of Education, Science, and Technology (MEST), one school (1 facility) was fully destroyed, while 34 schools (23 facilities) incurred damage to the

[34] The types of damage considered were: (i) damage to building, (ii) damage to WASH, (iii) damage to furniture, (iv) damage to learning materials, and (v) damage to teaching materials.

FIGURE 26: Schools with Asset Damage by Ownership and by Damage Area



Source: Assessment Team (2017).

buildings, 38 schools (29 facilities) to WASH, 35 schools (24 facilities) to furniture, 36 schools (26 facilities) to teaching materials, and 42 schools (30 facilities) to learning materials. MEST is in the process of identifying schools which will be permanently closed. Six schools are being used as shelters for 172 displaced households further impacting the furniture (Figure 26).

Among the displaced, 3,455 students and displaced households face severe financial constraints to meet the education needs of school-going household members. Hundreds died or went missing in the wake of the disaster, including teachers and students. While the number of students who died is not known, 369 casualties and missing persons were reported as children of school-going age.

Damage Analysis. The value of damaged assets is estimated to be USD 522,219. In terms of value of damages per school, Regent was hit the hardest. In terms of asset categories, the highest damage was incurred to buildings (USD 291,110), followed by furniture [inclusive of the six schools used as shelters] (USD 126,001), WASH (USD 83,595), teaching and learning materials as well as equipment (USD 21,512).

Loss Analysis. Losses, the decrease of revenues due to lower/no production and increased costs to provide additional services in the immediate direct response to the disaster, were valued at USD 699,896. A key element of loss is the drastic decrease in ability of displaced households to meet the out-of-pocket expenditures in education (USD 242,689).[35] Other key losses relate to readying schools used as IDP shelters for school reopening (e.g., evacuation, disinfection, replacement of furniture) and loss of revenue to schools from student casualties and permanent school closures (USD 148,529).

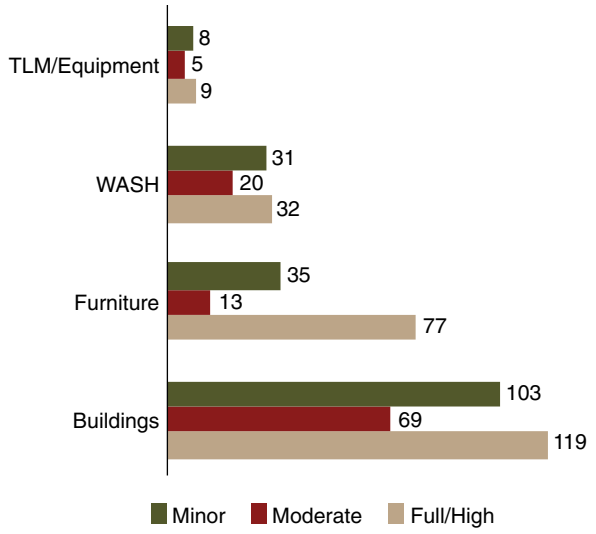
TABLE 16: Estimate of Asset Damage to Education Facilities in Affected Area

Disaster Area	Damages	
	SSL Billion	USD Million
Regent (highly affected)	1.17	0.16
Kamayama, Kaningo (moderately affected)	0.61	0.08
Culvert, Dwarzark, others (minor affects)	2.14	0.29
Total	**3.92**	**0.52**

Source: Assessment Team (2017).

[35] At the time of the verification, only 31 percent of displaced persons had returned to work. For the remaining, the biggest constraints to resume work were lost assets (54 percent), lost working tools (22 percent), and lost money (57 percent).

FIGURE 27: Loss Analysis in the Education Sector



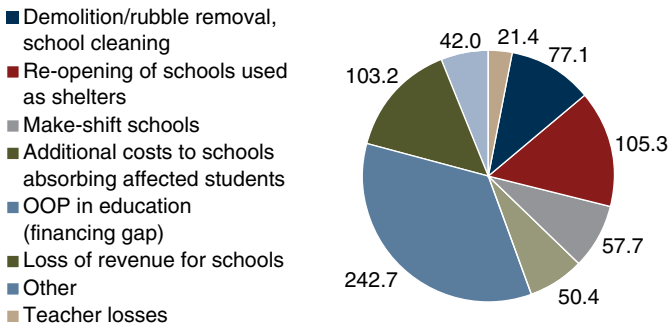
Source: Assessment Team (2017).

TABLE 17: Estimated Losses in the Education Sector by Affected Areas

Value by Disaster Areas	Loss	
	SSL Billion	USD Million
Regent (highly affected)	0.65	0.09
Kamayama, Kaningo (moderately affected)	0.78	0.10
Culvert, Dwarzark, others (minor affects)	1.91	0.25
Unclassified, unaffected	1.92	0.26
Total	**5.25**	**0.52**

Source: Assessment Team (2017).

FIGURE 28: Estimated Losses in the Education Sector by Type of Effects (USD thousands)



Source: Assessment Team (2017).

4.6.4 Resilient Recovery Needs

Short Term (0–3 months): The short-term needs are USD 956,691 and comprises of two key areas: (i) get affected schools ready for school reopening (including the six schools used as shelters); this entails immediate repair and rehabilitation of damaged buildings, WASH facilities, and replacement of teaching and learning materials; and (ii) support timely return and absorption of displaced students and students whose schools were permanently closed; this includes identification of good quality schools to absorb affected students, social mobilization, school supplies for displaced students, psychosocial training of teachers, bursary and tuition support for displaced students, makeshift school at camps, and school feeding for affected students and/or schools.

Medium Term (4–12 months): The medium-term needs are USD 773,828. The interventions in this phase will deepen the support initiated in the short term to build resilience and sustain school participation of affected children, including: (i) relocation/ reconstruction of schools (in lieu of closed schools); (ii) upgrade of physical and learning environment in selected affected schools, including upgrade of critical school infrastructure where these were nonresilient, substandard or lacking, and supply of teaching and learning materials in line with minimum standards; and (iii) continue support for retention, attendance, and completion of the school year by displaced students, through continued teacher training, school feeding, and tuition support to displaced students for the remaining academic year.

Long Term (1–3 years): The long-term needs are estimated in USD 291,000. In the long run, efforts to upgrade physical and learning environments in schools to make them more resilient and meet minimum standards should be expanded to other affected schools. Capacities for emergency preparedness and response in the education sector need to be strengthened, in accordance with 2019–20 Education Sector Plan.[36]

[36] MEST is putting together an emergency response plan. Interventions and costs here are tentative and will be finalized later.

TABLE 18: Short, Medium, and Long Term Needs in the Education Sector

Needs Description	SLL Billion	USD Million
Short Term (0–3 months)		
Ensure readiness of affected schools to reopen on time	3.21	0.43
Support timely return and absorption of affected students in good quality schools	3.96	0.53
Medium Term (4–12 months)		
Upgrade physical and learning environment in affected schools to be safe, resilient and meet minimum standards/reconstruct schools	1.96	0.26
Incentivize attendance, retention and completion of displaced students	3.85	0.51
Long Term (1–3 years)		
Upgrade physical and learning environment in affected schools to be safe, resilient and meet minimum standards/reconstruct schools	1.28	0.17
Strengthen capacities in emergency preparedness and response	0.90	0.12
Total	**15.16**	**2.02**

Source: Assessment Team (2017).

4.7 Social Protection

4.7.1 Sector Context

The Government of Sierra Leone is implementing several social protection programs across various ministries, departments, and agencies, and many NGOs and the private sector are also active in the country. In Sierra Leone, social protection interventions include unconditional cash transfers for specific vulnerable groups such as extremely poor households and the aged, conditional cash transfers such as cash-for-works, cash-for-food, farm inputs subsidies, and psychosocial support for specific groups, among others. The government, with support from development partners, has established a basic safety net system that includes the building blocks for an efficient, coherent, and well-coordinated social protection system, as well as a national cash transfer for extremely poor households, the Sierra Leone Social Safety Nets Program (SSN). The systems developed include management information system, payments, targeting, grievance redress mechanism, targeting as well as coordination structures. The SSN is implemented by the National Commission for Social Action in collaboration with key partners including the National Social Protection Secretariat, the Ministry of Social Welfare and Gender Affairs (MSWGA), the Anti-Corruption Commission, Statistics Sierra Leone, and the National Registration Secretariat.

During the Ebola Virus Disease (EVD) Outbreak in 2015, the sector received funding and support from partners including the U.K. Department for International Development, the World Bank, Irish Aid, and U.S. Agency for International Development, among others. Nearly 60,000 households across the country were provided income support during the emergency and the recovery phases of the EVD. As part of the EVD response, systems, tools, and standardized implementation protocols were developed and used to respond effectively to the crisis. Although still nascent, to a certain extent, these systems and tools are also capable of responding to other emergencies, such as the recent flooding and landslides.

Poverty Overview of Affected Areas

The flagship SSN program relies on geospatial poverty maps to select the poorest communities to benefit from the program.[37] Based on these maps, Western Area Urban has the lowest extreme poverty incidence in the country. More specifically, absolute poverty incidence in Western Area Urban is 13 percent and extreme poverty

[37] These estimates are pre-Ebola, given there has been no household budget survey since the crisis.

TABLE 19: Poverty Overview in Western Urban and Affected Areas

	Absolute Poverty			Extreme Poverty		
	Area	%	Ranking within Western Urban	Area	%	Ranking within Western Urban
Affected	Western Urban	13%		Western Urban	4.2%	
No	Tasso Island	49%	1	Allen Town II	18.2%	1
No	Allen Town II	41%	2	Allen Town I	7.8%	2
No	Kissy Brook	30%	3	Kissy Brook	7.5%	3
No	Allen Town I	25%	4	Mount Aureol	6.6%	4
No	Thunderhill	22%	5	Tengbeh Town	6.4%	5
Yes	George Brook (Dwarzak)	21%	6	George Brook (Dwarzak)	5.9%	8
Yes	Malama/Kamayama	21%	7	Mountain Regent	5.3%	16
Yes	Juba/Kaningo	13%	23	Cline Town	3.8%	31
Yes	Mountain Regent	11%	35	Malama/Kamayama	3.0%	43
Yes	Cline Town	8%	59	Juba/Kaningo	2.1%	60

Source: Geospatial Poverty Maps for SSN (2014).

incidence is 4.2 percent. In addition, compared to other areas (sections) in Western Area Urban, most of the affected areas, except for Dwarzak and Kamayama, are not among the 10 poorest areas in the Western Area Urban. The following table shows the poverty figures for the affected areas prior to the flooding and landslides (Table 19).

The main SSN program is not currently operating in the Western Urban, although the National Social Protection Secretariat **is assessing the possibility of including vulnerable areas in Freetown as part of the current SSN program expansion using IMF funding.** However, the Rapid Ebola SSN Program, which provided cash transfers to poor, Ebola-affected households in the Ebola recovery period, did cover several localities in Western Urban. However, none of these overlap with the landslide and flood areas, indicating that most of these areas were better off prior to the occurrence of this natural disaster.

4.7.2 Effects of the Disaster

Estimated number affected. The Ministry of Social Welfare and Gender Affairs in collaboration with the NaCSA, World Food Programme, UNFPA and other development partners conducted a registration and verification exercise of affected households, resulting in a total of 1,908 households (as of September 5). These data indicate that some families lost breadwinners to the disaster, including 162 households (about 10 percent) who reported having lost the head of the household. The disaster also had an important impact on children, as 16 percent of affected people were 5 years old or younger, and 26 percent were between 6 and 14 years old. These impacts could have medium- to long-term effects on social protection if the country's vulnerable population increases because of this disaster; these figures are small relative to the overall poverty headcount rates, which cover over half of the population.

Social protection structures and housing damages and losses. Based on consultations and mapping analysis conducted as part of the DaLA, there is no indication of damage to structures specifically used for social protection (e.g., development centers, community centers, social protection desks). The disaster has left thousands of people homeless as houses were torn down and covered in the debris or completely washed away. A recent U-report poll (for further discussion of this poll, see section 5.3.2.) conducted as a collaboration between UNICEF and the World Bank indicates that, as expected, the most commonly reported impact was housing loss or damage. Survivors are being housed temporarily in public structures including school buildings, with many not able to return to their original homes. If not properly managed, there are risks including overcrowding and people living in squalid, inappropriate conditions, which could ultimately result in undesirable social and health outcomes. Women and girls face heightened vulnerabilities in temporary shelters, which can expose displaced persons to the risk of gender-based violence due to various factors, including close living quarters, the breakdown of family structures, and other protective mechanisms.

Loss of livelihoods: Some survivors lost access to income-generating opportunities, particularly through the loss of housing, breadwinners, assets, and liquid cash. According to the registration/verification exercise, more than half of adults in affected households reported to be petty traders or street vendors; 13 percent masons; 7 percent salaried employees; and 6 percent taxi or bike drivers. One of the main consequences of the disaster for affected households was the loss of livelihoods. More than two weeks after the event, only one out of three adult members in affected households had reported returning to their economic activity. The remainder had not returned because they lost assets, working tool, or money, while others reported they were hospitalized, traumatized, or were waiting for assistance.

Psychosocial and other impacts: Some of the dead are still unaccounted for while some corpses recovered were in terribly lamentable condition. The disaster has therefore left people, especially survivors, deeply shocked and traumatized. In terms of damages directly affecting the social protection sector. On the other hand, based on consultations and mapping analysis conducted as part of the DaLA, there is no indication of damage to structures specifically used for social protection (e.g., development centers, community centers, social protection desks).

TABLE 20: Estimate Losses for Social Protection Sector

Type of Impacts	Loss	
	SLL Billion	USD Million
Food and nonfood aid	13.82	1.92
Identification, registration, and validation of effected households	0.46	0.06
Emergency cash transfer for households out of camp. Based on verification exercise, this estimation assumes 72 percent of affected households take "out of camp" package, and it includes administrative costs (15 percent).	10.08	1.26
Emergency cash transfer + shelter for households inside camp. Assuming 28 percent of affected household take "in camp" package. Camp operation costs are based on estimates provided by International Organization for Migration (USD 2,600 per household).	11.59	1.61
Total	**35.96**	**4.85**

Source: Assessment Team (2017).

4.7.3 Resilient Recovery Needs

Short term (0–3 months): The government and partners are prioritizing two forms of support for affected households: (i) emergency cash transfers to help the affected households meet their immediate needs such as food, non-items, and shelter; and (ii) psychosocial support, both to support affected households in coping with the shock and to make the best immediate decisions related to the use of cash transfers. The cash transfer structure, with an initially higher amount tapering off, would also aim at incentivizing affected households to opt out of staying at camps and seek their own accommodation.[38]

Medium (4–12 months) to Long Term (1–3 years): The government, with support from partners, should take active steps to ensure the sustainability of the immediate response efforts as well as continue to build adaptable systems that increase the country's ability to rapidly and effectively respond to crises of this nature. Specific areas identified include:

1. *Further improve the ability of the national safety nets system to quickly scale up as part of an emergency response*. The country made substantial progress on this during the Ebola crisis, but further efforts are needed, including to adapt tools and systems to different vulnerabilities (e.g., urban areas, disaster risk management). This could include conducting a needs assessment, development or adaptation of the different systems (e.g., management information system, payments, targeting, grievance redress mechanism), as well as strengthening the capacity of implementing agencies on the use of these protocols, tools, and related technologies.
2. *Explore ways to mainstream the affected households into the national social safety net program*. This was successfully carried out for the Raped Ebola-Social Safety Net (SSN) beneficiaries following the Ebola crisis. In doing so, to maintain the program's credibility and transparency, there is a need to ensure the profiles of landslide- and flood-affected households are aligned with the SSN program, the program's targeting procedures are closely adhered to, and adequate, sustainable funding is secured.
3. *Continue to strengthen the capacity to address protection and psychosocial needs for vulnerable populations*.

A fourth possible area considered is the setup of a social protection disaster preparedness fund meant to cover relief, registration/verification, emergency cash transfers, and psychosocial support in case of future disasters such as this one. However, at this stage such a fund may not be the appropriate measure given: (i) the existing funding channeled toward the sector from both external and internal sources is insufficient to provide full coverage of the most vulnerable groups such as the extreme poor; (ii) institutional capacity in the social protection sector is still nascent; and (iii) leakage risks related to such funds are likely to be high.

[38] Under the leadership of the Psychosocial and Protection Pillar, Protection Desks have been established in affected communities and temporary camps to strengthen the referral pathway for cases of abuse. The Protection Desks are staffed with Family Support Unit Officers of the Sierra Leone Police and MSWGCA social workers. Efforts are under way to prevent and sensitize on issues of child protection and gender-based violence. Efforts are also under way to strengthen the documentation and reporting GBV cases for current and future programming.

TABLE 21: Recovery Needs in the Social Protection

Task SLL	SLL Billion	USD Million
Short Term (0–3 months)	21.50	2.87
Emergency cash transfer for households out of camp. Based on verification exercise this estimation assumes 72 percent of affected households take "out of camp" package. Includes administrative costs.	9.42	1.26
Emergency cash transfer plus shelter for households inside camp. Assuming 28 percent of affected housheold take "in camp" package. Camp operation costs are based on estimates provided by International Organization for Migration (USD 2,600 per household). Includes administrative costs.	12.07	1.61
Medium and long term (4–36 months)	27.74	3.70
SSN systems and needs assessment to improve scalability of SSN	0.38	0.05
Adapt targeting tools to different vulnerabilities	0.83	0.11
Provision of psychosocial support to affected households[1]	0.29	0.04
Short-term cash transfers to affected households	3.75	0.50
Mainstreaming affected households into SSN (for 3 years)	8.25	1.10
Adapting systems and development of operations manuals for implementation of cash transfers as emergency response	9.00	1.20
Capacity building	5.25	0.70
Total estimated cost	**49.24**	**6.57**

Note [1] Estimate is based on psychosocial support provided to Ebola affected families as part of the Rapid Ebola Response-SSN program, where the community mobilization and sessions were implemented by MSWGA. The estimated average cost per household is USD 19.
Source: Assessment Team (2017).

5

ECONOMIC EFFECTS AND IMPACT ON LIVELIHOODS

5.1 Macroeconomic Impact

5.1.1 Sector Context

Sierra Leone's economy grew at an average annual rate of 7.8 percent over the period 2003–2014 but contracted by 21.0 percent in 2015 due to the Ebola outbreak and the downturn in international iron ore prices. In 2016, the economy grew 6.1 percent, driven mainly by agriculture and services, but the exchange rate depreciated by 21 percent as the current account deficit increased to 16.6 percent from a decline in current transfers and lower than anticipated export receipts. Further, the fiscal deficit widened to 6.3 percent of GDP, up from 4.4 percent in 2015, because of lower revenue mobilization and expenditure overruns in capital expenditure and transfers of goods and services. Inflation increased to 17.4 percent as the monetary authority initially sought to support economic recovery in addition to the upward adjustment in fuel and utility prices by the government.

The economy's recovery from the twin shocks of Ebola and iron ore export collapse is expected to remain on track in 2017 with real GDP growth projected at 6 percent. During the first half of 2017, real economic activities were driven largely by the rebound in mining and continued recovery in agriculture and services. Total mineral production reached USD 310.3 million in the first half of 2017 compared to USD 304.5 million in the first half of 2016. Iron ore and rutile continue to account for the largest shares of mineral production. Activities in the agriculture and services are expected to remain strong in 2017, driven mainly by the inflows of foreign direct investments.

Despite many dead or missing workers, the impact of the landslide and flooding on economic growth has been negligible. The incident was localized in few communities and did not result in significant disruption in economic activities.

Inflationary pressure has persisted since the beginning of 2017. The year-on-year inflation (all items) increased monthly from 17.4 percent in December 2016 to 20.2 percent in March before declining for months in a row to 19.8 percent in April and later to 18.9 percent in May. It later increased to 19.1 percent in June. High food prices and the depreciation of the exchange rate have been the major driving force of inflation. The Bank of Sierra Leone (BSL) reacted to the increased inflation by adopting a tight monetary policy stance by raising the monetary policy rate by 100 basis points in June 2017, the second time it did so in six months.

5.1.2 Effects of the Disaster

With the increase supply of food relief items by donors in the aftermath of the August 14 landslide and flooding, food inflation is expected to subside and dampen overall inflation. This, coupled with the continuous tightening of monetary policy and commencement of the agricultural harvest season in September, are expected to drive inflation downward by the end of the year. Food distribution is a temporary solution; interventions should be tailored to the livelihood of the affected population to ensure their food security.

Fiscal policy remained constrained by lower revenue mobilization and the need to clear the large payment arrears accumulated in 2016 and new 2017 arrears. Domestic revenue mobilization amounted to SLL 1.6 trillion in the first half of 2017 compared to SLL 1.3 trillion in the first half of 2016. Income

and goods and services taxes account for the largest share of revenue collected in the first half of 2017 (SLL 941.0 billion), followed by customs and excise duties (SLL 495.3 billion) and nontax revenue (SLL 173.1 billion). Although domestic revenue grew by 23.1 percent in the first half of 2017, it only amounts to 44.8 percent of annual target.

Total expenditure stood at SLL 2.6 trillion (48.4 percent of annual budget) in the first half of 2017 compared to SLL 2.5 trillion in the first half of 2016. The overall expenditure comprises of recurrent expenditure (SLL 2.0 trillion) and capital expenditure (SLL 660.9 billion). The increase in total expenditure was mainly because of increased domestically financed capital expenditure as well as transfers of goods and services. Preliminary estimates indicate that the overall fiscal deficit (including grants) stood at 3.6 percent of GDP (SLL 1.0 trillion). The deficit was financed mainly by accumulation of arrears and increased borrowing from the domestic banking system. Total unpaid checks at the BSL as at end-June amounted to SLL 517.4 billion.

The government had limited fiscal space to respond to the August 14 landslide and flooding event as the domestic borrowing requirement had almost reached its limit (2.0 percent of GDP) while payment arrears to suppliers and contractors continued to accrue. Given the dire situation, the authorities have approached the IMF to request an Extended Credit Facility (ECF) Program. The government has also requested additional budget support of USD 20 million from the World Bank Group. Although the fiscal authorities had budgeted SLL 48 billion (USD 6.4 million) as a contingency fund to respond to unanticipated events, little of the fund was available when the disaster struck. In addition, the allocated contingency fund appears grossly insignificant to cope with a disaster of this magnitude. Government Ministries, Departments and Agencies (MDAs) have been diverting allocated funds for 2017 to respond to the August 14 disaster. The Office of National Security (ONS) including the military and the police as well as Ministries of Health, Energy, Education, and Water Resources have all been implementing extra-budgetary spending to respond to the disaster. The full effect of the fiscal impact is likely to be felt by the end of the third quarter of 2017 when MDAs are expected to request additional funding to implement earmarked programs.

Budget implementation, hampered by the disaster, could be exacerbated by the anticipated adverse impacts on revenue mobilization. The inflow of relief items into the country on the backdrop of the August 14 events is expected to lead to a sharp increase in duty waivers and exemptions (since most of the relief items will be treated as aid or donated items). Further, the high death count will impact revenue mobilization minimally. **Overall, the fiscal deficit is expected to widen by end of 2017 largely because of expenditure overruns in response to the disaster.**

The increase in donor-related imports for relief would worsen the trade balance. However, donor funding inflow in support of the government's recovery efforts would offset the adverse effect of the trade deficit on the current account. In addition, increased donor funding inflow would help the BSL to accumulate reserves and stabilize the exchange rate.

5.1.3 Resilient Recovery Needs

Medium term (4–12 months): It is important to earmark additional budgetary resources in the 2018 budget for MDAs, for the Ministries of Health, Water Resources, Energy, and of Works, Housing and Infrastructure and Education that were the most affected. The government should assess the fiscal implications of the disaster and the associated budgetary requirements. The adequacy of the disaster-related contingent liabilities should be assessed and disaster risk financing diagnostic conducted to explore potential financial protection instruments available. A disaster risk financing strategy should be developed, considering the use of risk retention and risk transfer instruments for disaster response. Finally, a comprehensive livelihood assessment is recommended to define the needs and identify the priorities to guide the recovery efforts.

5.2 Commerce and Productivity

5.2.1 Sector Context

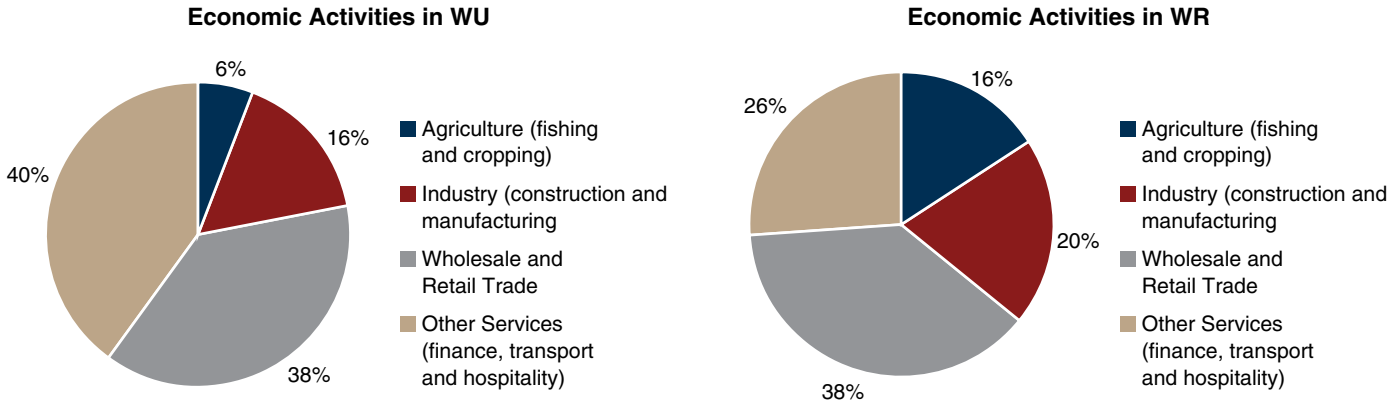
According the 2015 Population and Housing Census (PHC), the predominant economic activity in the Western Area Rural is wholesale and retail trade, with 38.0 percent of the working population engaged in the activity. Other services including finance, transport, and hospitality were second with 26.0 percent. Industry (mainly construction and manufacturing) and agriculture (mainly fishing and crop farming) employs 19.7 percent and 15.7 percent, respectively. Only 6.9 percent of the working population are engaged in crop farming while 6.4 percent are engaged in fishing, much lower compared to other rural areas in Sierra Leone where farming is the main occupation. The Comprehensive Food Security and Vulnerability Analysis[39] puts the share of households in farming at 5.6 percent and the most common income-generating activities in Western Area Rural as petty trading, providing a livelihood for 42.3 percent of households with more women (43.4 percent) engaged in this activity than men (14.3 percent). Petty trading is constrained by very low profit margins and high competition, because of the homogeneity of the products that are sold (generally the incomes of petty traders are not subject to tax).[40]

The Matormeh community in Regent where the landslide occurred could have slightly different characteristic than the rest of Western Rural. It was a new residential settlement (about ten years old) with mostly urban workers as residents. However, this difference is unlikely to be significant as Figure 29 shows similar occupation trends apart from agriculture. In the Western Urban Area, other services (finance, transport, and hospitality) and wholesale and retail trade are the dominant occupations, with 39.4 percent and 37.7 percent, respectively. This is followed by industry, mainly including construction and manufacturing. However, the share of livelihood in agriculture is much lower in the Western Urban Area. It is likely that affected persons in the Western Urban Area districts were mostly engaged in wholesale and retail/ petty trade as most of the communities had low income earners as residents (Figure 29).

5.2.2 Methodology

The value of loss to economic activities in the affected areas in the Western Area districts was assessed using the actual frequency of persons reported to be engaged in those activities during the 2015 census and adjusting it by the number of dead or missing workers. The total number of dead or missing workers was obtained by multiplying the

FIGURE 29: Composition of Economic Activities in Western Urban and Rural Area



Source: PHC (2015).

[39] CFSVA(2015).

[40] CFSVA (2015).

total number of dead or missing persons reported by ONS by the occupation rates in Western Area during 2015 census. The livelihood loss is then obtained by multiplying the number of dead or missing workers by the value added per worker in the various livelihood categories. In addition, the livelihood loss of affected persons alive was obtained by multiplying the number reported in a survey of affected persons by the value added by worker in each livelihood category. Livelihood loss is assessed here for a one-year period and should be interpreted as an economic shock. It does not pertain to a lifelong loss of earnings, which is being covered under the poverty section.

A survey was conducted to estimate the damage to commercial buildings. A proxy to calculate the value of assets inside a retail outlet or shop or pharmacy has been used, since no detailed data could be obtained. Therefore, commercial assets were computed as a multiple of the average value of residential assets. The average household asset value is USD 1,500. This means that the asset value per commercial building was assumed at USD 3,000.

5.2.3 Effects of the Disaster

Damage Assessment. A total of 27 commercial buildings were destroyed on August 14, comprising mostly retail outlets and shops. Their estimated value is reported in the Housing Section. Given an assumed asset value of USD 3,000 per building, the total value of commercial assets destroyed is put at USD 167,000 (Table 22).

Loss Analysis. Of the total number of dead or missing (1,141 as of September 5), it was estimated that this included 405 workers, comprising 288 workers in the Western Rural Area and 118 workers in the Western Urban Area. The services sector (mainly wholesale and retail/petty trade), recorded the largest number of dead or missing workers (277), comprising 186 workers in the Western Rural Area and 91 in the Western Urban Area. This is not surprising since wholesale and retail/petty trade was the largest occupation in the Western Rural Area. Industry (mainly construction and manufacturing) recorded 76 deaths, 56 in and 20 in the Western Rural and Urban Areas, respectively. Agriculture recorded 52 deaths, 45 in and 7 in the Western Rural and Urban Areas, respectively (Table 23).

The estimated total value of livelihood loss for dead or missing workers was USD 224,705. Western Rural Area (Martomeh Community in Regent) with the largest number of dead workers, recorded 71.4 percent of the total livelihood loss (USD 160,640) while Western Urban Area recorded 28.6 percent of losses (USD 63,602). In terms of the type of livelihood, services, mainly wholesale and retail/petty trade, bore the brunt of the total losses, USD 151,927 comprising USD 102,067 in Western Rural Area and USD 49,860 in for Western Urban Area. Agriculture, mainly crop farming and fishing, recorded a total livelihood loss of USD 41,927, comprising USD 36,153 for Western Rural Area and USD 5,774 in Western Urban Area. Industry (construction and manufacturing) was least affected, recording a total loss of USD 30,851, comprising USD 22,883 in Western Rural Area and USD 7,968 in Western Urban Area (Table 24).

A total of 2,310 displaced workers from the affected communities were surveyed to assess the livelihood loss because of not being able to go to work. The livelihood loss for displaced workers was estimated at USD 1.17 million. The biggest losses occurred in retail or petty trade (USD 454,814) and skilled labor (USD 128,285) (Table 25).

However, since the disaster event, 32 percent of the affected workers have returned to work, resulting in a net gain of USD 492,598. This puts the net livelihood loss of displaced workers at USD 680,000. The net livelihood loss could further decline to USD 358,000 if another 30 percent of the total of displaced workers are assumed to return to work in the next three months (Table 26).

TABLE 22: Value of Damage to Commercial Buildings

Type of Building	Damage	
	SLL Billion	USD Million
Commercial building assets damaged or destroyed	1.25	0.17

Source: Assessment Team (2017).

TABLE 23: Estimated Losses by Industry

	Western Area Urban	Western Area Rural	Total
	Number of Workers Dead or Missing		
Crop farming	2	20	22
Animal production	1	3	5
Forestry and hunting	1	4	5
Fishing and aquaculture	2	19	21
Agriculture Total	**7**	**45**	**52**
Mining and quarrying	2	11	13
Manufacturing	7	17	24
Electricity gas stream	3	5	7
Water supply and SWM	1	2	3
Construction	6	22	28
Industry Total	**20**	**56**	**76**
Wholesale & retail trade	44	109	154
Transport and storage	7	17	24
Accommodation and restaurant	4	5	10
ICT	1	1	3
Finance and insurance	2	1	3
Real estate	1	2	2
Professional scientific and technical activities	7	10	17
Administration & support service activities	3	4	7
Public administration	5	10	15
Education	3	6	10
Health	3	5	7
Art and recreation	1	2	4
Other services	5	6	12
Household activities	3	6	8
Extraterritorial	1	1	1
Services Total	**91**	**186**	**277**
Total	**118**	**288**	**405**

Source: Assessment Team (2017).

TABLE 24: Estimated Livelihood Losses for Dead or Missing Workers

Sector	Western Urban	Western Rural	Total
	USD		
Crop farming	1,943	15,845	17,788
Animal production	1,141	2,628	3,769
Forestry and hunting	1,051	2,893	3,944
Fishing and aquaculture	1,639	14,787	16,426
Agriculture Total	**5,774**	**36,153**	**41,927**
Mining and quarrying	927	4,458	5,385
Manufacturing	2,971	6,772	9,742
Electricity gas stream	1,075	1,843	2,918
Water supply and SWM	591	758	1,349
Construction	2,404	9,053	11,457
Industry Total	**7,968**	**22,883**	**30,851**
Wholesale & retail trade	24,394	60,008	84,402
Transport and storage	3,991	9,352	13,343
Accommodation and restaurant	2,421	3,009	5,430
ICT	783	716	1,499
Finance and insurance	892	768	1,660
Real estate	444	825	1,269
Professional scientific and technical activities	3,675	5,701	9,376
Administration & support service activities	1,664	2,210	3,875
Public administration	2,792	5,318	8,111
Education	1,732	3,525	5,257
Health	1,502	2,495	3,997
Art and recreation	802	1,168	1,970
Other services	3,012	3,425	6,436
Household activities	1,396	3,083	4,479
Extraterritorial	359	463	822
Services Total	**49,860**	**102,067**	**151,927**
Total	**63,602**	**160,640**	**224,705**

Source: Assessment Team (2017).

TABLE 25: Estimated Livelihood Losses from Affected Persons Survey

Sector	Total Loss USD
Street vendor, petty trader, credit seller	454,814
Skilled labor (carpenter, mason, plumber, painter, tailor, mechanic)	128,285
Other, not specified	124,958
Formal sector wage earners (teacher, nurse, policeman)	90,456
House wife	88,976
Okada, taxi, keke driver	60,304
Unemployed, not able to work, retired	-
Security guard/maid	36,921
Hairdresser, beautician, caterer, waiter, DJ	38,152
Stone breaker	9,496
Volunteer	8,595
Pastor, religious leader, traditional healer	7,384
Total (rounded to nearest 1,000)	**1,173,000**

Source: Assessment Team (2017).

TABLE 26: Estimated Productivity Losses Due to Death and Displacement

Losses	SLL Billion	USD Million
Productivity loss due to dead and missing people	2.20	0.29
Productivity loss due to displacement	2.68	0.36
Total	**4.88**	**0.65**

Source: Assessment Team (2017).

5.2.4 Resilient Recovery Needs

It is important to note that households have different vulnerabilities and the impact of livelihood loss is more pronounced for those households that were already vulnerable before the landslide (i.e., agriculture-dependent population and retailers/ petty traders). A small livelihoods support grant to help businesses re-start, especially if they have lost everything, could be a way forward. However, it is crucial that a comprehensive livelihood assessment be carried out to identify priority areas for support and building resilience. These needs have not been costed in this sector, to avoid double counting with social protection needs. However, there will likely be specific livelihood support needs that may not be fully captured under ongoing and planned social protection programs, as outlined below.

Immediate recovery (0–3 months): To define the needs and identify the priorities to guide the recovery efforts, a comprehensive livelihood assessment is recommended. Food distribution and temporary shelter should be immediate priorities.

Medium term/full recovery phase (4–12 months): The government should put in place a small livelihoods support grant to help people and business re-start, especially where they have lost everything.

Long term (1–3 years): Interventions should be tailored to the livelihoods of the affected population to ensure not only food security but their active participation in the labor force.

5.3 Poverty and Livelihood Impacts

5.3.1 Sector Context

Sierra Leone has seen substantial reductions in poverty since the end of the 10-year long civil war but remains a very poor country. The Western Area, particularly Freetown, is significantly less poor than the rest of the country. The incidence of poverty in 2015 stood at 45 percent for the country, but only between 15 (urban) and 18 (rural) percent in the Western Area.

The communities affected by the landslide and associated flooding are typical of the Western Urban Area overall. Despite its geographical location in the Western Rural Area district, Regent—the most affected area—has statistics more like Western Urban Area, to which it is adjacent (Table 27).[41]

[41] World Bank (2017).

TABLE 27: Selected Welfare Proxies

	Western Area Rural	Regent	Western Area Urban
		%	
Persons aged 10+ Literate	66	77	78
		%	
Use grid as main light source	13	35	67
With zinc/concrete roof	93	90	96
With piped water in house/compound	9	11	18
Using public tap	34	20	40
Owning house	51	42	34
With cement block walls	41	52	62

Note: Figures for Western Area Urban and Rural from "2015: Population and Housing Census: Summary of Final Results" (Statistics Sierra Leone); and for Regent from "Disaster Prone Areas Statistics" (Statistics Sierra Leone).
Source: Statistics Sierra Leone (2015).

5.3.2 Effects of the Disaster

Past floods have had a more significant impact on poor households in the Western Area. During the 2015 rainy season, there was intensive flooding in specific areas in Freetown and the Western Rural Area, and more widespread flooding in Pujehun and Bonthe Districts. In the 2015 Comprehensive Food Security and Vulnerability survey, data was collected on whether households had experienced various shocks over the past 12 months. In addition, data was collected on the ownership of various household durable goods and on food insecurity using a number of means. A comparison was made between the population in Western Area affected by floods in 2015 and those not affected. Overall, those affected had lower quality housing, fewer durable goods, and more food insecurity. The value of durable goods owned decreased by 23 percent and food insecurity increased 0.65 points (in a scale from 0 to 8) in those households that had experienced flooding. No significant differences were found in food consumption or nonfood expenditure (Table 28).

TABLE 28: Flooding and Household Welfare, Western Area

Indicator	2015 Floods	
	Not Affected	Affected
Index of housing quality	6.2	5.5
Index of asset ownership	7.1	3.8
Estimated value of durable goods (SLL)[a]	1,299	757
Food insecurity experience scale[b]	3.3	6.3
Food consumption score[c]	47.8	35.6

Note: a/Using current values of items given in 2011 SLIHS; values expressed in thousands of Leones in 2011 prices.
b/Higher values imply worse food insecurity.
c/Higher values imply a more consistent, varied diet.
Source: Calculations from 2015 Comprehensive Food Security and Vulnerability Analysis (World Food Program).

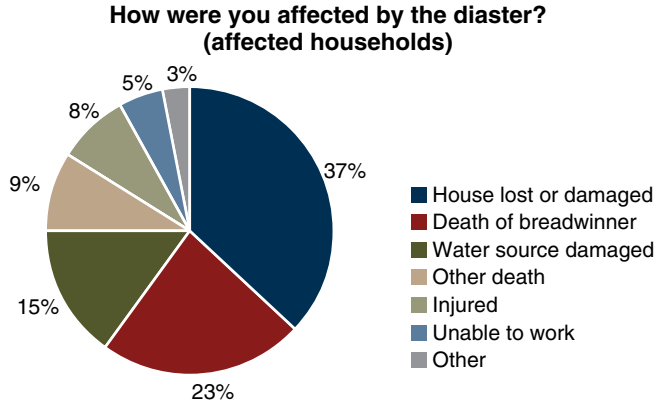
Interpretation of this cross-sectional analysis using the 2015 Comprehensive Food Security and Vulnerability Analysis requires several caveats. First, the areas affected by flooding may have been poorer to begin with. Within Freetown, however, the areas most affected by the 2015 floods were low-lying informal housing areas that were likely significantly poorer than other parts of Freetown before the floods. Although the dataset is quite large (over 30,000 households), the low incidence of these events leads to a fairly small sample size.

Poor households in Western Area are often more exposed to floods and likely more susceptible to suffer losses from such events. This stems from location factors as poor households are typically being pushed due to land ownership and market factors to marginal hazard-prone areas (i.e., steep land), but also housing materials and infrastructure are of poorer quality, and the production activities conducted by the majority are typically unsafe or less resilient to floods. In fact, while poverty rates remain well below the rest of the country, Freetown was the only area to experience a significant increase in poverty between 2003 and 2011, from 14 to 21 percent. The increase in poverty in Freetown was driven by in-migration, the slow creation

of well-paid jobs, and inflation. So, the correlations reported likely derive from both the fact that the poor live in areas that are less desirable due to the risk of flooding, and that flooding makes the households poorer than they would be otherwise.

Floods can bring death, injury, disruption of socio-economic activities, and damage or destruction to public infrastructure, private physical, and productive capital. In urban areas, livelihood damages are mainly reflected in housing. A recent U-report poll (Figure 30) conducted two weeks after the landslides in the Freetown area as a collaboration between UNICEF and the World Bank indicates that indeed the most commonly reported impact was housing loss or damage. Survivors are being housed temporarily in public structures, including school buildings, with many not able to return to their original homes.

FIGURE 30: Type of Affectation According to Household Poll



Source: U-Report Poll (2017).

According to the 2015 Population and Housing Census, only about a third of the households in the affected areas owned their own dwellings (the rest mostly rented from private individuals). Much of the loss of housing stock will therefore accrue to the households that owned these buildings, which may or may not reside in the affected areas, and are likely wealthier. Renting households may still be out of pocket if rent money was paid in advance. (It is not uncommon for rent to be paid annually in advance.)

Nonetheless, for many survivors, both rich and poor, housing constitutes a source of livelihood and not just welfare. The loss of housing itself and the productive assets and small business stocks in them will impact the ability of the household to earn a living going forward. Analysis of both the census data of the affected areas and the registration of affected persons shows that two of the most common livelihoods are small-scale traders and those working as carpenters/masons.

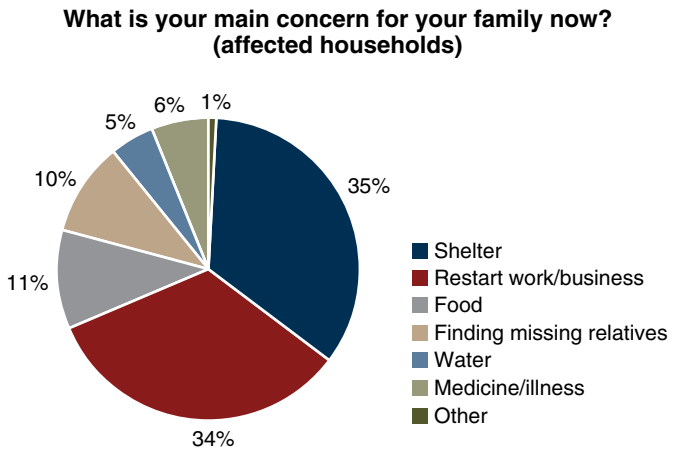
Small-scale traders often stock their goods at home. The classification employed by the DaLA report of destroyed, damaged buildings by residential, commercial, or mixed use may not fully account for those selling items out of their homes or those keeping stocks at home and selling from a market stall or on foot.[42] Those working as carpenters and masons may be either self-employed (producing furniture or building components in their own workshop) or they may work as casual laborers on construction sites. Casual laborers may own their own tools. In both cases, the loss of productive assets/stocks will affect the ability to earn a living in the longer term.

According to data from the registration of affected households, more than two weeks after the event, only one out of three adult members in affected households had reported returning to their economic activity. Over half of the respondents gave an economic reason for not returning to work; the most common reasons given were loss of money (most likely working capital for small-scale traders) and loss of assets. About a third of respondents had not returned due to being too traumatized or hospitalized. The U-report data (Figure 31) in fact indicates that returning to work is currently the highest priority for affected families after obtaining shelter. The U-report poll respondents also indicate help restarting businesses as the most helpful form of post-emergency support (31 percent) after support for relocation and rebuilding of homes (63 percent).

The disaster will have an ongoing impact on the welfare of households in other dimensions. Households that experienced extensive flooding will have lost

[42] The 2011 Sierra Leone Integrated Household Survey found a median value of USD 74 of unsold goods and products in small household enterprises involved in retail trade, although there was nothing to indicate where these stocks were kept.

FIGURE 31: Main Concern of Affected Households



Source: U-Report Poll (2017).

paperwork such as voter ID cards, birth certificates, driver's licenses, and educational qualifications. Replacing these may be expensive/time consuming/impossible, resulting in difficulties enrolling in school or finding employment.

The beginning of the school year is often a time of substantial cash outlay for poor households with children in school. The most common reason for school-age children not to be enrolled in school is financial constraints.[43] If affected households are particularly hard up in the weeks after the disaster, before schools open on September 11, children may not be able to start school on time, increasing the probability that they are never re-enrolled.

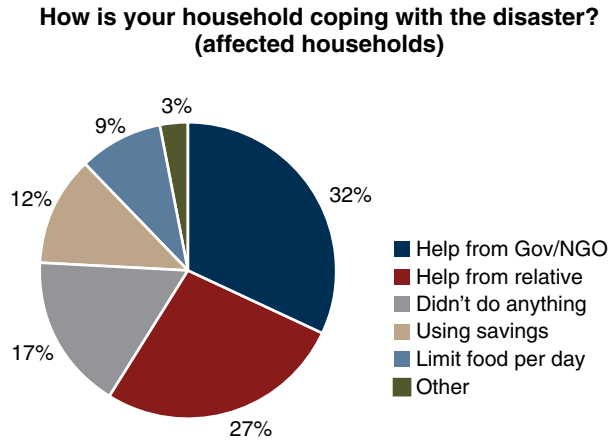
That the welfare of victims declines in the aftermath of a disaster is indisputable. However, the effect of disasters on household's poverty is not. **The floods' effects on poverty will depend on a number of factors.** The first is the *extent to which key households' assets were lost*. If an entire household was killed, their house and all their belongings destroyed, this is a human tragedy and a loss to the economy of Sierra Leone but does not result in a household that is impoverished by the disaster. The poverty impact will depend on the number of individuals surviving but having lost household members (particularly earning ones), housing, savings, and household and business assets.

[43] Note: See Education Profile for Sierra Leone, calculations from 2011 Sierra Leone Integrated Household Survey.

At the same time, the level of protection available against disasters will determine whether risk leads to short-term drops in income and consumption. People often ask for loans or receive cash and food from relatives and friends to limit the consequences of disasters. Empirical studies have documented these and many other mechanisms and their effectiveness; however, this protection is never more than partial. So, the residual risk can lead to increased poverty. If many other households within a community suffer the shock at the same time (as in the case of landslides and flooding), this is likely to magnify the impact of a particular shock on a household as informal community-based insurance and coping mechanisms are overwhelmed. Also to smooth consumption, households often cut back food consumption below adequate levels.

Large-scale government or donor-implemented support interventions can reduce the impact of floods by decreasing the need for ex-post, adverse coping mechanisms. Shocks that affect entire communities simultaneously are more difficult for households to cope with, as they overwhelm the informal networks on which households usually rely. Unfortunately, neither the 2015 Comprehensive Food Security and Vulnerability Analysis nor the 2011 Sierra Leone Integrated Household Survey captures information on household coping mechanisms in the face of floods or other shocks. Data captured via a phone poll of mobile phone subscribers in Freetown captured information on coping strategies in response to the floods. Figure 32 suggests that the most common coping strategy mentioned by affected households is

FIGURE 32: Main Household Coping Strategies



Source: U-Report Poll (2017).

"help from the government/NGOs" (32 percent). This high number is likely due to the high visibility of the disaster and the high-profile disaster response efforts. It is followed closely behind by "help from relatives" (27 percent) and then "didn't do anything."

Important challenges remain for government and donor assistance in the aftermath of the floods to become effective. Some studies have found that support is often too small and infrequent to play a major role;[44] may be ineffectively allocated due to errors in targeting;[45] and is unclear whether delivery should be in-kind, cash, or a mix of both.

Disasters often require a quick response; otherwise disaster impacts can become permanent. Notwithstanding, the bias in self-reporting, the same U-report shows that close to a third of those affected have not received any support two weeks after the poll. Clear and transparent rules for funding disaster relief are equally important to reach those in the most need; so when shelter provision, food aid, or cash transfers stop nobody is caught by surprise. Finally, once the most pressing needs have been addressed, support will probably need to shift toward longer term needs, such as home relocation or business reinsertion. Developing technical and administrative capacities around a safety net to accomplish a faster and more organized response will be needed. The social protection section of the DaLA report discuss some ways forward.

5.3.3 Resilient Recovery Needs

This analysis suggests considerations for recovery and resilience. First, many affected households need small grants to help them restart their businesses and to return to economic self-sufficiency as soon as possible. Rebuilding activities (or building activities) at relocation sites should prioritize hiring workers from affected households. The development of banking and insurance products suitable for poor households who are self-employed in commerce or other trades would greatly reduce the risk these households face from natural disasters as well as other shocks like theft. Any relocation efforts must take into consider the livelihood needs of the relocated people. It will be very difficult for them to resume the types of economic activities which they are used to in a remote location, far from the large economy of Freetown (Table 29 and Table 30).

TABLE 29: Industry of Employment by Ward (percentage of working adults by industry)

	Regent	Juba/ Kaningo	Malama/ Kamayama	Clinetown (Culvert)	George Brook/ Dwazark
Agriculture, Fishing	6	6	10	11	9
Mining and Quarrying	9	3	5	3	2
Manufacturing, Utilities	12	12	11	12	10
Construction	17	10	7	6	7
Trade	18	24	31	37	27
Transport, Storage	6	8	6	10	6
Hospitality	3	4	3	5	6
Finance, Real Estate, Professional, Admin.	9	10	10	3	8
Public Admin., Defense	3	3	3	2	2
Education, Health, Other Services	14	14	10	7	15

Source: Disaster Prone Areas Statistics (Statistics Sierra Leone). Calculations from 2015 Population and Housing Census.

[44] Gilligan, Hoddinott, and Taffesse (2008); Quisumbing (2005).

[45] Jayne, T. S., Strauss, J., Yamano, T., Molla, D. (2002). Targeting of food aid in rural Ethiopia: Chronic need or inertia? *Journal of Development Economics,* 68(2), 247–288.

TABLE 30: Occupation by Ward (percentage of adult household members)

	Regent	Juba	Kaningo	Kamayama	Culvert	Dwazark
Street Vendor/Petty Trader	43	48	42	45	72	49
Carpenter/Mason	19	11	16	23	4	18
Bike/Taxi Driver	5	6	4	4	8	8
Salaried	8	9	16	5	2	1

Note: Only selected occupations, columns do not sum to 100.
Source: Beneficiary list from verification exercise (September 5, 2017).

6

CROSS-CUTTING ISSUES

6.1 Environment

6.1.1 Sector Context

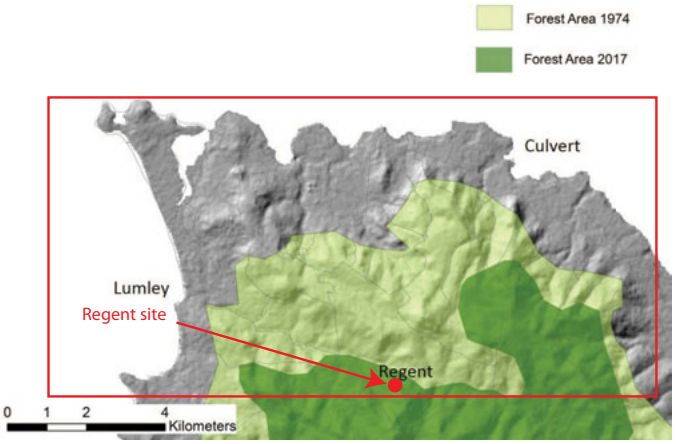
The Ministry of Agriculture, Forestry, and Food Security manages all forest reserves, agriculture, and food security issues. Within this ministry, the National Protected Area Authority (NPAA) is responsible for protected areas. NPAA oversees the reforestation in the Western Area Peninsula National Park and enforces its boundaries and conservation. The Ministry of Lands, Country Planning, and Environment allocates, surveys, and maps land; issues deeds and title registration; and confers ownership; land acquisition for all activities, including commercial purposes and residential housing, is obtained through this ministry. The Ministry of Works and Housing issues and enforces building permits.

Under the Office of the President, the Environmental Protection Agency oversees all environmental matters, including environmental impact assessments. The agency is financially autonomous. Its raises revenue through permits and implementation of environmental projects, and all internally generated funds are retained for its operations.

The Western Area Peninsula National Park (WAPNP) was created in 1911 to protect 20,000 hectares (as a legally gazette non-hunting) forest reserve. Today, the park covers about 18,300 hectares and most of its natural habitat remains intact. Almost 60 percent of the forest vegetation is estimated to be pristine. It is home to 80 percent of the country's terrestrial biodiversity, including migratory bird species, and hosts rare fauna (e.g., the Jenkin Duikers and chimpanzees). The park's highest peak is 971 meters above sea level, and it houses the Guma Valley and Congo Dams, which together provide water for the entire Freetown area.

Despite having a comparatively high carbon stock, the WAPNP has lost approx. 420 hectares[46] (0.08 percent of total cover) a year for the last decade. Urban sprawl and informal settlements settled in the forest until the government took action in 2011 and 2012 to protect its boundaries and status. The landslide event was concentrated in the northern end of the park. It destroyed, based on comparative satellite imagery over a 40-year period[47] (1974–2017), approximately 60 percent of the forest cover (Figure 33).

FIGURE 33: Forest Cover Loss in the Northern Section of WAPNP



Source: Arup (2017).

[46] Osterreichische Bundesforste AG (2017).

[47] ARUP modeling using satellite imagery post landslide in 2017.

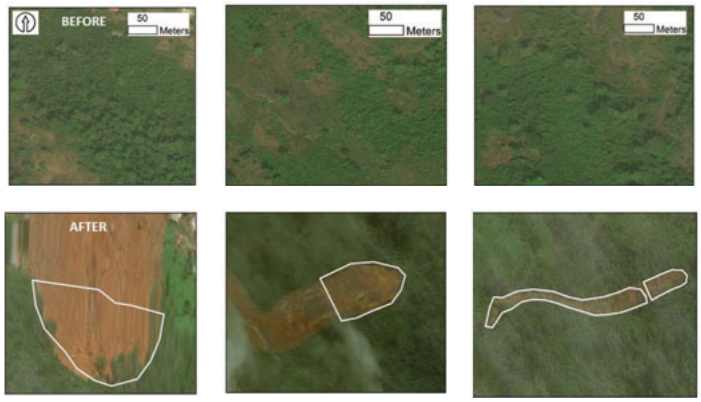
The mean average aboveground biomass density is estimated to provide a carbon sink of about 166 tons per hectare or 83 tons of carbon per hectare. Based on this, about 160,000 tons of carbon dioxide (CO_2) emissions are attributable to anthropogenic deforestation.

Figures 34 and 35 provide satellite imagery of the Regent area captured before (March 2017) and after (August 2017) the landslide event. The imagery shows four areas where landslides occurred: three are close to Sugarloaf settlements while the fourth location is in the Tacugama Chimpanzee Sanctuary (also in the WAPNP). In terms of ecology, the mapped areas were largely primary forests before the landslide and the surrounding areas in all four areas were experiencing deforestation (various stages shown in the pre-disaster images). In terms of land use, housing stock suffered the worst. Based on the damaged but still-standing homes, the structures are a mixture of high-end and poorly constructed houses.

6.1.2 Effects of the Disaster

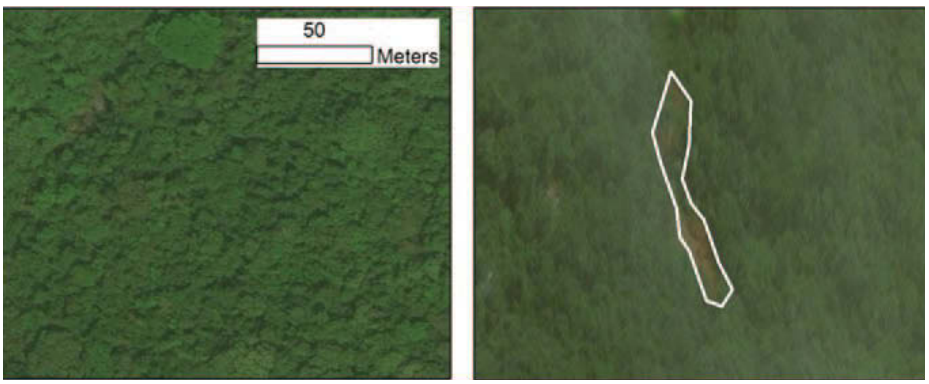
Deforestation of the WAPNP and rapid land conversion for residential purposes dominate discussions. The settlements within the surrounding catchment area can be clearly identified from the spatial maps; however, there are also areas of degraded shrub land which surround the closed and moderately dense high forest area. This assessment acknowledges the possibility of multiple causal factors for these degraded areas.

FIGURE 34: Outlined Areas of Landslide Indicating Areas of Primary Forest Destroyed



Source: Arup (2017).

FIGURE 35: Takugama Chimpanzee Sanctuary: Area of Primary Forest Lost Because of Landslide



Source: Arup (2017).

The assessed financial damages are largely associated with the landslide event, which resulted in the loss of forest cover. The damage assessment was based on the area of primary forest destroyed and not the entire WAPNP, because certain areas were already degraded.

Damage to the environment is estimated at SLL 55.8 million (USD 7,440), based on the potential carbon sink loss. The affected area is 4.38 hectares of upper Guinean Forest, with an estimated annual CO_2 sequestration potential of 333.09 mg of CO_2 per hectare. Estimating the economic value of the lost forest in terms of local or export timber markets was not possible because this depends on knowing the species type and size (age). The disaster precludes such knowledge (Table 31).

6.1.3 Resilient Recovery Needs

Reforestation: Deforestation of the Western Peninsula forest reserve contributed to the landslide. Observations around the landslide area indicate widespread human development and deforestation. To protect the watershed below, quickly carrying out reforestation is recommended.

Protect fragile ecosystems from further degradation: Protect and stabilize the environment against hazards. For example, by adopting preventative measures to further reduce the potential loss of topsoil from the affected areas.

Promote community participation in and co-benefits arising from WAPNP: Promote management practices that provide co-benefits to the communities settled on the fringes of the Western Peninsula National Park. This would provide a win–win for the forest reserve and for the poor: protecting the forest while avoiding forests-use confrontations.

Fostering institutional collaboration in Natural Resource Management: Strengthen institutions to map the city of Freetown and to enforce land conveyance and building permitting regulations—thus arrest continued deforestation. Clear lines of responsibility need to be established among the Ministry of

TABLE 31: Types of Damages for Environment Sector

	Damage		Loss	
Impact	SLL Million	USD 1,000	SLL Million	USD 1,000
Primary Forests			—	—
Carbon Capture	55.8	7.44	—	—
Total	**55.8**	**7.44**	—	—

Source: Assessment Team (2017).

TABLE 32: Cost Estimates and Gaps—Recovery and Resilience Needs for Environmental Sector

	SLL Billion	USD Million
Medium Term (4–12 months)		
Budget support to facilitate the functioning of the NPAA	2.63	0.35
Long Term (1–3 years)		
Redefinition of roles and responsibilities of all actors within the sector	3.75	0.50
Organize regular steering committee meetings to discuss challenges from each of the actors	3.75	0.50
Engagement frequently with other development partners working in natural resource management and environment	3.75	0.50
Total	**13.88**	**1.85**

Source: Assessment Team (2017).

Agriculture, Forestry, and Food Security; Ministry of Water, Housing, and Infrastructure; Ministry of Land, Country Planning, Environment; and Environmental Protection Agency. Governance is key to better managing the natural resources management and the fast urbanization of Freetown.

Medium Term (4–12 months): Implement the National Protected Area Authority Act 2016. The Act includes protective measures for the Western Area Peninsula National Park.

Long Term (1–3 years): Foster institutional collaboration in natural resource management.

6.2 Solid Waste Management

6.2.1 Sector Context

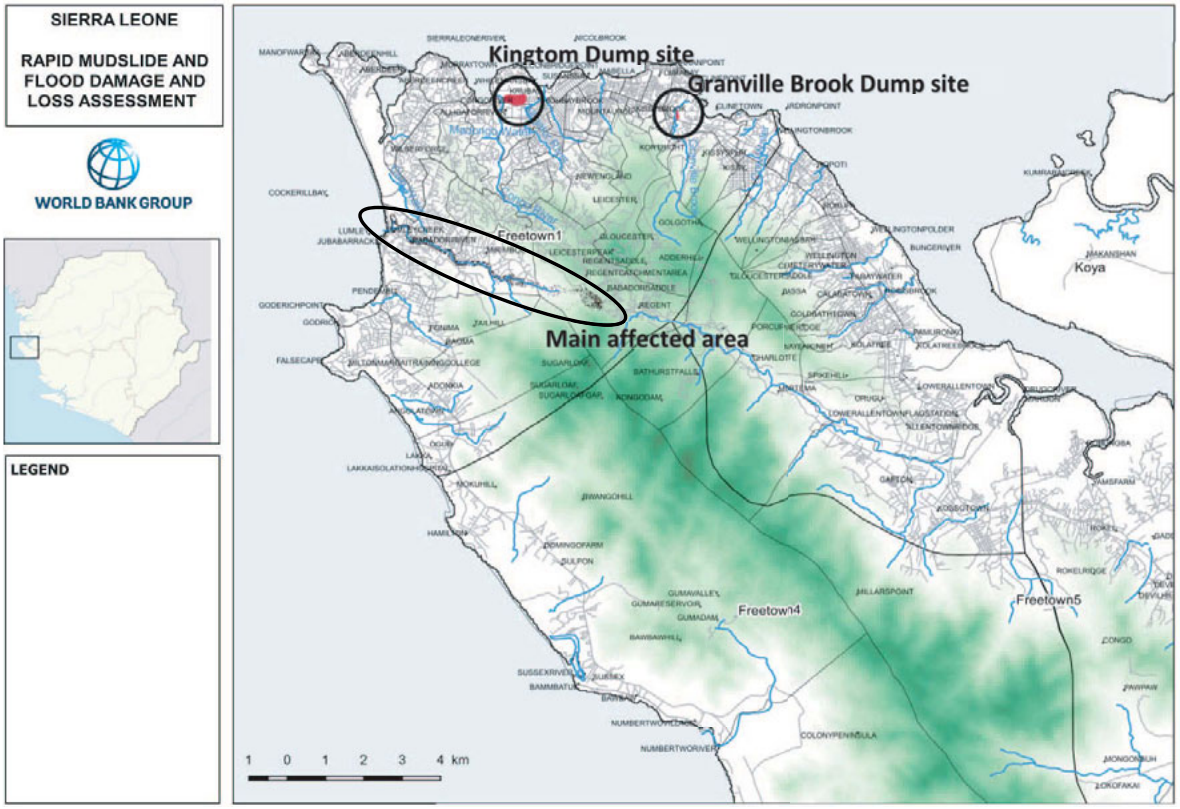
Municipal solid waste management is not a private good and has high negative externalities when not well managed. In a resource constrained, rapidly urbanizing, and partially decentralized context like Sierra Leone, developing a technically, financially, and managerially sustainable system for collection, transfer, and safe disposal needs to address the following: cost recovery, efficiency, public accountability, management, finance, economies of scale, legislation, institutions, and cost. The quality of solid waste services provided in a city is usually a good indicator of how the city is governed and managed. As stated elsewhere in this report, urban management is a significant challenge in Sierra Leone because of a fragmented jurisdictional and functional governance system. For example, the Ministry of Health and Sanitation is responsible for policy making in the solid waste sector. The control of waste management facilities, international agreements, and policy making for e-waste and hazardous waste lies with the Environmental Protection Agency. The actual contract to provide municipal solid waste services was awarded to a private company, signed by the Ministry of Local Government and Rural Development; and the Freetown City Council is responsible for the delivery of solid waste management services.

There are two dump sites, both posing very high risks to the dense residential communities where they are located—The partially fenced Granville Brook or "Bomeh" where the garbage piles are 10–15 meters high, and the King Tom site. Less than half of the 500–600 tons of solid waste (household, medical, hazardous, and toxic waste) generated in Freetown reaches these sites (Figure 36 and Figure 37).

FIGURE 36: Example of High Density Area Near Estuary at Granville Brook/Bomeh Dump Site Prior to Flooding

Source: Digital Globe (2017).

FIGURE 37: Location of Main Disposal Sites in Relation to Landslide Area



Source: World Bank (2017).

6.2.2 Effects of the Disaster

There are no transfer stations or engineering landfills in Freetown and therefore no damages to solid waste infrastructure. The Granville Brook/ Bomeh dump site in Culvert and the beach at Juba Barracks (the mouth of the Badadori River) experienced unusually high incidences of debris deposits. The flooding carried waste materials and items from homes along the Badadori River, into Lumley Creek, and onto the beach.

Pre- and post-disaster satellite imagery at Lumley Creek shows the flood-water submerged the Lumley foot bridge (white arrow in Figure 38). The redness of the creek's water also indicates large amounts of sediment. The panorama below, shows a view from East to West across the beach. Debris covers at least 1,260 cubic meters (shown by the red area in the satellite images).

Hydraulic stability, health and safety, and environmental risks were confirmed during the field visits.

- *Hydraulic risk*: Two culverts of corrugated metal piles 2.5 meters in diameter originally installed to enable the flow of water have, over time, collapsed with the weight of accumulated solid waste. They are destroyed.
- *Stability risk*: The waste slopes present a high risk and potential collapse. This would cause severe ponding upstream from the site and exacerbate the risk of continued flooding. A collapse would be dangerous for workers at the site and for residents in the dumpsite's vicinity.
- *Health and safety risk*: The leachate from the dumpsite gets released directly into the stream, which is widely used by residents for washing and crop watering, among others, posing an immediate health and safety hazard.
- *Environmental risk*: Waste is being dumped in the river bed, carried downstream, and washed out to sea, contaminating the coastal area.

FIGURE 38: Debris at Lumley Creek Resulting from Flooding and Debris Flow Related to Regent Landslide Disaster

Note: The yellow circle indicates the location of the panorama above, which shows a view from east to west across the beach. The white arrows indicate the Lumley footbridge, which is submerged in the post-disaster imagery. The aerial extent of the debris was mapped in GIS based on field observations in the Lumley Creek area.
Source: World Bank, Arup, Digital Globe (2017).

PHOTO 2: Estuary of Granville Brook

Source: EuropeAid, Urban Planning Project 2014.

6.2.3 Resilient Recovery Needs

The needs focus on: (i) eliminating the immediate risks to health and safety; (ii) recovering value from the waste and debris; and (iii) eliminating the waste (Table 33).

Short term (0–3 months):

Drainage cleaning and corrective measures: Collect and properly dispose the garbage currently blocking the gutters and access roads, making the roads and gutters accessible and as functional as before the disaster.

Debris removal and beach restoration: Remove the approximately 1,260 square meters of debris on the beach at Juba Barracks. A Cash-for-Work program would provide a win–win solution, employing affected community members who are living at the Juba Camp temporary shelter and restore the area.

Medium Term (4–12 months):

Closure and reclamation of Granville Brook dump: Undertake a study to inform on how to: (i) reduce stability risk; (ii) reclaim land for redevelopment; (iii) control odors and gas migration; (iv) reduce waste exposure to humans, wind, and vectors; and (v) control infiltration of rainwater/surface water to reduce leachate generation.

Communications, awareness raising, and community engagements: Prepare a communications strategy and promote good hygiene and waste disposal practices through communications outreach.

PHOTO 3: Granville Brook Running through Dump Site and Culvert Immediately Downstream of Dump Site

Source: Assessment Team (2017).

TABLE 33: Cost Estimates and Gaps—Resilient Recovery Needs for Solid Waste Management Sector

Resilient Recovery Needs	SLL Billion	USD Million
Short Term (0–3 months)		
Clear drainage and remove blockages from gutters	0.45	0.06
Clean up debris from the beach at Juba Barracks	0.30	0.04
Medium Term (4–12 months)		
Conduct a feasibility study on the closure and reclamation of Granville Brook dump	5.63	0.75
Engage in a communications, awareness, and community outreach campaign	1.06	0.14
Long Term (1–3 years)		
Develop sector development studies, legal instruments, contracts, and environmental and social safeguards	7.50	1.00
Total	**14.93**	**1.99**

Source: Assessment Team (2017).

Landfill: Carry out a study to identify potential sites for landfills.

Long Term (1–3 years):

Sector development plan: There is a need to address the institutional issues, which will be critical to addressing the more long-term development objectives. These include the roles of communities, and more broadly enhancing stakeholder engagement. The viability of the inclusion of thermal, biological, and mechanical treatment technologies to recycle commodity materials and to recover resources in the waste needs to be studied. This is both in relation to the potential market of demand for the treatment by-products, and after a thorough sector analysis with the following deliverables: (i) solid waste sector expertise for immediate and long-term sector planning and phased development, including a financing plan and fiscal impact minimization strategy; (ii) specialized solid waste sector legal technical assistance for outsourcing contracts and licensing, developing public–private partnerships, as well as

developing regulations; (iii) support for the negotiation of inclusive and binding agreements that address the needs of all parties in win–win arrangements; and (iv) addressing social and environmental safeguards.

6.3 Gender Considerations

Disasters affect women, men, girls, and boys differently. Identifying the different needs, capacities, and contributions of different groups is necessary to consider gender issues. The availability of Sex and Age-Disaggregated Data (SADD) is imperative to ensure vulnerable populations (including women, children, pregnant women, the elderly, and people with disabilities) and their specific needs and capacity can be identified. The Registration Pillar has ensured the availability of SADD since the acute phase of emergency and data have been validated through a verification process.

UNFPA reached 1,113 women and girls with dignity kits. UNAIDS and NGO partners also distributed dignity kits and psychosocial support in all affected areas since the onset of the emergency response. These interactions and analyses have informed the findings below.

6.3.1 Disaster Effects

Women staying in the camps have lost homes and family members, including husbands, parents, siblings, and their own children. Many women were not at home at the time of the landslide, because they had gotten up at around 4 A.M. or 5 A.M. to go to the market. When they returned home, they found that their loved ones and everything they owned was gone. The shock of this, and the enormity of the loss they experienced was evident. Their coping mechanisms, as a result, have been severely impacted.

In the immediate aftermath of the disaster, women who have surviving children have had to prioritize securing food and shelter. They have not had the safe space or time to process their own grief. Some women have reported that the sound of rain at night made them anxious and that they live in fear of a similar incident reoccurring. Others have been impacted by multiple traumas in the past, having previously lost other family members during the Ebola outbreak. These women would appear to be at risk of depression and anxiety disorders as well as posttraumatic severe disorder. Early intervention and appropriate psychosocial support could help to mitigate some of these risks.

Beyond food and shelter, women with surviving children of school age will require financial support to keep their children in school. Without the support of their husbands and extended family, women's access could be compromised.

Many women witnessed the mutilated bodies of their neighbors washed by their homes, and/or bore witness to their neighbors trapped and dying inside their homes. They spoke of the screaming, and being powerless to help. These women will need psycho-social support, despite not having lost property or loved ones themselves.

Furthermore, the psychological impact of not having been able to offer their loved ones a proper burial and funeral must be considered. This violation of deeply held religious and cultural norms is likely to be a further source of profound pain. Many women have reported that the bodies of their loved ones have not been recovered. This could create a reluctance to move away from unsafe areas going forward; unless some means of recovering and identifying the bodies of lost loved ones can be found, or another way to bring about a sense of closure that satisfies religious or cultural practices.

Much work will be required to understand the damages inflicted on individuals and communities. This may require creating support mechanisms and resource availability for many years.

The development of a gender policy would greatly enhance the effective implementation of the Sierra Leone Social Protection Policy of 2011. Similar to the 2015–16 Social Safety Net Program, a gender policy should prioritize women and other vulnerable populations in receiving basic social protection packages.

6.3.2 Recommendations

Equally weight the qualitative assessments and quantitative reporting and analysis. The psycho-

social impact of this disaster will require planning and effective response that considers multifaceted layers of trauma and gender dimensions.

Consider sanitation, cooking, and hygiene facilities in the positioning and strategic planning of shelter areas, particularly regarding gender-specific needs.

Communicate in signs and text to reach the widest audience. Label facilities using symbols and text, especially for shower facilities segregated by gender.

Link humanitarian efforts and recovery throughout the response, recovery, and sustainable development. Mainstreamed gender at all stages, ensuring women take part in the decision-making process and their perspectives inform ongoing and future assessments.[48]

PHOTO 4: Adama Yankubah Explaining How She Escaped on a Branch with Her Son (Pentagon)

Source: Photo-UN Women-Mary Hassan.

[48] For sector-specific recommendation and additional information, please refer to the UN Women Gender Alert: http://www.unwomen.org/en

6.4 Disaster Risk Management

6.4.1 Sector Context

Strengthening disaster risk management (DRM) will play a critical role in enabling an effective resilient recovery; Building Back Better reconstruction in turn will better resist and reduce the impacts of future shocks and stresses in Sierra Leone. A recurrent observation within this report, throughout all sectors, has been the complexities of institutional systems management that cause weaknesses in the overall resilience of these systems to shocks. To better manage risks in this multi-hazard environment, the government needs to simplify and strengthen institutional arrangements, in turn to improve the disaster risk knowledge, better implement risk reduction and preparedness, and improve the overall emergency response mechanisms. One of the primary recommendations of this report is to use and enhance the current DRM platform centrally to address this root problem. If core issues remain encapsulated within silo's, or a purely sectoral approach, any potential solutions or improvements will be so diluted by the institutional complexities to the point where they are not effective.

In all sectors, it has been evident that there is a key gap in technical capacities. Individually each sector has been lacking the ability to define, design and deliver, and maintain basic needs and services to the population. This is also reflected and amplified in the case of shocks and events such as occurred on August 14, 2017. In discussion with the government and partners this fact has been recognized and the government has been developing the concept of creating a central 'technical pillar' or Project Management Office (PMO) to assist with recovery. This report recommends that this concept is supported and developed as a crosscutting solution that could be housed, initially, within the DRM crosscutting sector.

A strongly focused and central technical capacity within the government will not provide all the solutions that will be required; however, such a capacity could effectively underpin and anchor much of the physical recovery planning, design, and

implementation of projects that will be required—without diluting and dividing the resources that will be needed between all 10 sectors. This concept would also enable a more cost-effective and consistent mechanism for central design, planning, and execution of a resilient recovery action plan.

These preliminary recommendations are provided as part of the recovery and reconstruction needs and the respective cost of the required activities to be considered as a basis for a more detailed recovery and reconstruction plan. Short-term needs are focused in the stabilization and reprofiling of the landslide-impacted areas. The estimated cost of the required activities has been estimated at approximately. USD 2.6 million. For the medium term, prioritizing indexing, design and planning to undertake priority works has been estimated at around USD 5.56 million, and for the long-term implementation of institutional and community capacity strengthening activities and mitigation works in USD 19.9 million (Table 34, page 85).

Disaster Risk Management Institutional arrangement:

- *As part of its post-war recovery effort, the Government of Sierra Leone reviewed its National Security Structure*, and enacted the National Security and Central Intelligence Act in 2002. Two years later, the Disaster Management Department was created within the Office of National Security. The DRM Department has currently 10 dedicated staff among the 185 ONS total staff. At the district level, a security representative is appointed in each of the 13 districts to cover both security and DRM. These district representatives directly report to the chairman council and ONS Director.
- *A National DRR Platform has been established to facilitate the coordination between the DRM stakeholders and to promote the integration of DRM into national development policies, plans, and strategies*. However, the DRR national platform lacks strong stakeholder commitment and ONS capacity to make it fully functional. At the district level, coordination is devolved to District Disaster Management Committees.
- *At the strategic level, the country has drafted a National Disaster Management Policy and National Disaster Preparedness and Response Plan*. However, these instruments are not fully operational and DRM has not been fully integrated in the development plans and strategic ministries, department, and agencies. One of the main reasons is that there is no legal framework to enable government agencies to mainstream disaster risk reduction into their development strategies, plans, and programs. In addition, local government councils do not have legal responsibility and budget allocation for Disaster Risk Reduction.
- *Disaster risk reduction is yet to be effectively institutionalized in Sierra Leone*. The ONS budget for disaster risk management is not adequately funded. Partners, donors, international financial institutions, and nongovernmental institutions fund most national activities. In general, development partners support preparedness and response, not disaster risk reduction.
- *The absorption capacity of the DRM structures should be considered.* Initially external support may be required to enable DRM structure to adapt and absorb to some potentially significant changes and a reinforced scope of activities/responsibilities as is recommended in this report. The new capacities generated within the recovery phases will need to be carefully managed and reviewed institutionally in regards to how they can be best captured for the long term.

6.4.2 Resilient Recovery Needs

Short Term Recovery (0–3 months): The government is transitioning from relief to the early recovery phase. In order to effectively manage the recovery planning and implementation process, the government should establish a central technical mechanism that includes a design cell for all sectors affected by the disaster. In this time frame, priority should also be given to the consolidation of all existing assessment data and information into a central repository to enable informed planning and prioritization of tasking.

Establishment of a central technical capacity: The immediate role will be to create a robust technical platform that will combine and consolidate all existing technical capacities within Sierra Leone into a functional and cohesive structure for the design, planning,

prioritisation and execution of a **Resilient Infrastructure Recovery Plan.**

- ***Consolidation of assessments and data:*** Create a central repository for all existing and future assessments and data for all sectors.
- ***Create a central infrastructure index:*** A central indexing system for all physical infrastructure assets and systems covering all sectors.
- ***Establish a central technical design and review process:*** In preparation for the next phase to establish a design and review process that will govern the planning and prioritization of investments and application of build back better principles across all sectors for the reconstruction phase.

Medium Term/Full recovery phase (4–12 months): The World Bank and Global Facility for Disaster Reduction and Recovery (GFDRR) are supporting the development of flooding, landslide, coastal erosion, and sea-level rise hazard and risk information for the cities of Freetown, Makeni, and Bo. The work is being financed under the Africa Caribbean Pacific–European Union (ACP–EU) National Disaster Risk Reduction Program. The outputs from this study are expected to be finalized by this calendar year 2017. This will form the baseline for risk and mitigation measures to inform urban policy and planning as well as urban development projects and investments.

- ***Mapping and Delineation of High Risk and No Build Zones:*** Using the GFDRR risk mapping outputs to start the demarcation of highest risk and no build zones to be integrated into the recovery planning for all sectors.
- ***Development of a Master Transport Plan for Freetown:*** To review and revise the transport functionality and connectivity needs that will enable informed decision making for reconstruction and reinforcement needs within the transport system. Bridging design and functionality reviews to prepare project options that ensure build back better principles are applied in reconstruction.
- ***Development of a Master Drainage Plan for Freetown:*** The Sierra Leone Road Authority has just completed a feasibility study for the Freetown Drainage Master Plan. In the coming months, the government is planning to prepare a Storm Water Drainage Master Plan for Freetown and detailed technical studies for priority drainage works. Works in the main affected slip area need to be prioritized, but also carefully informed by detailed risk analysis to ensure that new infrastructure (including housing, roads, bridges, health centers, and schools) are not rebuilt in high risk areas. Mapping and delineation of these high-risk areas need to be prioritized, along with proper enforcement of no-build zones.
- ***Slope Stabilization:*** The area immediately below the hill slope from which the landslide initiated has suffered total destruction and the topography has been altered. There is still potential for further volumes of marginally stable material to detach from the slope and slide down toward the totally damaged area, so the area is still considered unsafe. Stage plan development for slope trimming design, blasting, and re-profiling has been prepared by UNOPS/ARUP, to be completed and executed as priority works.

Long term (1–3 years): The August 14 landslide and flooding presents many lessons for future disasters, and has created government awareness of the need for prevention, preparedness, and community awareness. The following priority work streams are proposed, each of which is associated with a specific gap or need:

- ***Define and strengthen a DRM legal, institutional, and operational framework and tools, combined with the promotion of stronger stakeholder information, awareness, and involvement.*** Overall, the DRM Agency at ONS should develop a coherent, implementable, and costed National Action Plan for DRM aligned to the Sendai Framework for DRR 2015–30. This can include all institutional/governance capacity issues and DRM programs which must be accompanied with a strong coordination mechanism given the multi-sectoral nature of DRM. Also, Freetown City Council capacities in terms of risk knowledge, disaster prevention, and preparedness need to be built to strength urban communities' resilience against disasters.

- ***Better-management of flood- and landslide-prone risk areas for zones already urbanized and protection/prevention measures in the forest zones.*** A comprehensive plan to manage the risk prone areas including detailed zoning (high, medium, and low risk) with the respective risk reduction measures is needed. The relocation of populations living in the highest risk zones should be a priority as well as controlling urbanization in those areas while prioritizing environmental protection to avoid urbanization in those areas. Appropriate mitigation and densification measures for the other zones where risk reduction strategies can be applied through infrastructural and non-infrastructural measures.
- ***Establish a clear institutional arrangement and viable funding for the operation and implementation of the recovery process.*** Using and building from the capacities established within the central technical capacity, a central project management office (PMO) can be established for the design, implementation, and monitoring/quality assurance of recovery projects across all sectors. For the longer term the specific technical capacities that have been created and developed in the short and medium terms will need to be captured and harnessed institutionally so that they are integrated effectively into a national resilient infrastructure plan.
- ***Enhance hydrological, meteorological, and climate monitoring systems at the national level when developing more detailed hazard and risk maps.*** The ongoing multi-city hazard and risk assessment study will help identify and map the landslide and flood risk areas according to the level of risks at the city level. However, detailed studies to link risk zoning with the local urban configuration and possible mitigation measures will be needed as part of the risk prone areas management plan. The country should also consider strengthening the capacity in generating accurate climate, meteorological, and hydrological information to meet the needs in term of an Early Warning System and climate impacts prospective for future investments.
- ***Develop multi-risk early warning systems that are people centered.*** In particular, systems whose warnings are timely and understandable to those at risk, which take into account the hazards and risks, demographic, gender, cultural, and livelihood characteristics of the target audiences, including guidance on how to act upon warnings, and that support effective operations by disaster managers and other decision makers who should be part of the medium- and long-term measures under the recovery plan.
- ***Strengthen disaster preparedness and contingency planning.*** A Multi-Hazard National Emergency Plan for Disaster Response was prepared in 2006 and a specific Flood Preparedness Response Plan developed in 2016 for coordination and management of flood response through the country. That flood plan includes both a national- and a district-level Standard Operating and Procedure, which lists the key activities to be undertaken in a flood event. However, the government response to the Monday, August 14, 2017, flood and landslide event demonstrated the need for further capacity strengthening in this area. An assessment of the government's response mechanisms should be conducted to inform better coordination of future emergency situations. This should include the DRM agency, and all agencies related with emergency management. They should be trained, equipped, and fully operational to coordinate, monitor, and provide relevant guidance in case of emergency. Conducting regular simulation exercises of the Multi-Hazard Contingency Plans (MHCPs) should be also considered.
- ***Implement a community risk awareness strategy to help improve community resilience to future disasters.*** Sierra Leone has established disaster management committees in all 13 of its districts, as noted in the Disaster Management Department "Sierra Leone National Progress Report on the Implementation of the Hyogo Framework for Action (2009–11)."[49] In Freetown, 300 community-based volunteers have been trained, with the aim of helping to increase the local capacity to address emergencies. The reactivation of these Disaster Management Committees should be part of the government disaster reduction program to build the

[49] Mye Kamara (2012).

TABLE 34: Summary of Key Recovery (short term) and Reconstruction Needs (medium to long term) through Strengthened DRM Framework and Tools

Short Term (0–3 months)	Short-Term Costs SLL Billion	USD Million
Consolidation of assessments and data into a central repository	1.50	0.20
Create a central infrastructure Index System	1.50	0.20
Establish a central technical capacity and office	15.00	2.00
Establish a central technical design and review process	1.50	0.20
Sub-Total	**19.50**	**2.60**
Medium Term (4–12 months)	**Medium-Term Costs SLL Billion**	**USD Million**
Mapping and delineation of High Risk and No Build Zones	3.82	0.51
Development of a Master Transport Plan for Freetown	10.50	1.40
Development of a Master Drainage Plan for Freetown	10.50	1.40
Slope Stabilization	15.00	2.00
Project management, Insurance and Unallocated Costs	1.87	0.25
Sub-Total	**41.69**	**5.56**
Long Term (1–3 years)	**Long-Term Costs SLL Billion**	**USD Million**
Recovery management and institutional capacity strengthening	15.00	2.00
Enhance the legal and policy framework for DRM mainstreaming through other development sectors	1.88	0.25
Support the functioning of the National Disaster Risk Reduction platform	1.50	0.20
Design of mitigation works and resilient infrastructure systems	22.50	3.00
Developing urban infrastructure and mitigation measures in affected area	75.00	10.00
Implement a community risk awareness strategy to improve community resilience to future disasters	1.13	0.15
Design and make operational Early Warning Systems including the strengthening of the hydromet services (meteorological and hydrological departments)	24.75	3.30
Strengthen the capacity of national and local institutions in disaster preparedness and emergency management	7.50	1.00
Sub-Total	**149.25**	**19.90**
Grand Total	**210.4**	**28.06**

community proactivity in addressing risk reduction and mitigation. The implementation of the recovery strategy will need affected community's engagement and ownership.

- ***Strengthen financial preparedness in anticipation of future disasters.*** A disaster management fund was created in 2011 but is still only provisioned by donations from citizens and partners. A regular emergency fund would need to be created as part of the government's annual budget to provide full autonomy and flexibility to the DRM agency to lead the rescue in a timely manner. Other contingent financing options can also be considered as part of a broader risk layering approach.

7

LOOKING FORWARD: DISASTER RECOVERY AND RESILIENCE FRAMEWORK AND STRATEGY

The August 14, 2017 landslide and floods, will be remembered as one of the most tragic natural disasters in recent times in Sierra Leone, due to a very high death toll, and a severe impact on livelihoods and vulnerable communities jeopardizing sustainable development. The rapid needs assessment provides specific recommendations for the short, medium and long term including the stabilization and reprofiling of the landslide-impacted areas, design and implementation of mitigation measures in risk prone areas, emergency preparedness and response as well as early warning systems for natural disasters, preparation of a drainage and other master plans and studies for improving infrastructure and services in Freetown, strengthening the institutional capacity and coordination mechanisms.

USD 82 million is needed for recovery efforts: USD 16.72 million for urgent short-term relief (0–3 months), USD 23.82 million for early recovery over the medium term (3–12 months), and USD 41.86 million for long term resilient recovery (1–3 years). Due to the networked nature of infrastructure, interdependencies between different sectors and the multiple institutions in the urban system, isolating impacts of discrete single sector investments is not feasible. Given the limited fiscal capacity to respond as domestic borrowing has peaked with 2.0 percent of GDP, financial and technical support of development partners to Freetown will be essential for recovery.

The opportunity for increasing resilience and embracing an urban renovation process in the Western Area.

The recent event underscores the critical need for a paradigm shift needed to enhance resilience to climate change and disasters, from a reactive development approach to one which prioritizes the prevention of risk. A preventive approach would require the development of policies and an enabling legislative framework and procedures for action by different institutions endorsed by representative stakeholders: central government, local government, private sector and civil society organizations that interface with the communities. The National Disaster Management Policy and National Disaster Preparedness and Response Plan are to be strengthened and operationalized into the development plans and operations of government entities, both central and local.

Ongoing risk multi-hazard assessments supported by the Global Facility for Disaster Reduction and Recovery at the World Bank will provide the necessary technical underpinnings to inform improvements in current practices to mitigate, reduce or avoid high risks. Risk maps will provide a basis for territorial dimensions of resilience, as the new decision-making structures that will be needed for the implementation of territorial development at the local level. These local structures will need the capacity to develop and apply risk management tools that integrate risk reduction for land management and real estate development, to reduce unacceptably high levels of vulnerability generated from inadequate land use, water management, fecal sludge management, solid waste management, as well as inappropriate building practices.

Planning and urban design tools that should inform the recovery process and will need to be differentiated by location of hazards and site specific characteristics of neighborhoods including physical, social and economic attributes of places and people which defines vulnerability. Such territorial planning tools would be needed to achieve the policy goals of reducing the constant generation of unacceptably high levels of vulnerability due to multiple factors: land use, infrastructure design and inappropriate building practices to name a few. Significant consultations with state and non-state actors would be needed to develop strategies for achieving those goals for both recovery and for building long term resilience. Strategies would need to be politically and economically feasible to be implementable.

The starting point would be classification and demarcation of locations with levels of high, medium and low hazard risks, followed by feasibility studies and appropriate, regulations, and procedures that mandate management of risks a priority especially in critical locations. Technical and socio-economic studies will define the levels of risk, people's needs and examine the different recovery and renovation options, followed by feasibility studies and technical specifications and associated costs for each of the interventions. For instance, to address high hazard areas: there may be a need to establish no-build zones prioritizing environmental protection to avoid future urbanization; there may be a need to establish locations from which public and private assets require relocation within a defined time; there may be a need for mitigation and densification measures for zones where risk reduction strategies can be applied. It is very important to plan the necessary actions to ensure that the investments will be well-maintained. Ultimately, decisions on optimum land-use practice, including the provision of norms and required building and operational standards at neighborhood levels may need to be promulgated.

Toward developing a people-centered and inclusive recovery strategy for the Western Area

A recovery strategy needs to emerge through a credible multi-level consultative process that is led by an advocacy council or deliberative body that is inclusive. Inclusiveness is essential to keep such a body insulated from political cycles and changes in government. It would include representation from national government and local government, private sector, professionals and their organizations, media, academia, and non-government organizations that interface with the communities. The future of Freetown will depend on collaborative and transparent problem solving to achieve the most optimal outcomes for its citizens which can only be achieved through transparent negotiation and tradeoffs between different interventions for recovery, including their prioritization and financing. The attributes of a recovery strategy would include a combination of measures to address risk reduction/ prevention and control, including importantly, for strengthening livelihoods; it would be developed in a bottom-up participatory manner with informed contributions by affected communities within the broader territorial development constraints that exist in Freetown

For the consultative process to be "informed" and meaningful, there would be the need for establishing a data bank that builds from the ward level up to the city or district, and a system that distills this through appropriate communication tools. Socio-economic mapping by wards should be conducted aiming of inclusive participation that acknowledges the diversity of actors and does not view the communities as comprised of homogenous interests. The aim of participation is empowerment, capacity building to unable communities to be equal partners in the identification, analysis, treatment, monitoring, and evaluation of their problems and risks, but importantly so they can contribute as partners with a stake in reduce their vulnerability. Enhanced disaster preparedness can save lives and livelihoods. Preparedness projects, contingency planning and early warning systems, should complement risk mitigation and community approaches. Other potential activities would likely include: multi-level communication campaigns to raise awareness; catalyzing coalitions and networks for consensus building and decision making through ongoing facilitation, etc. Provided with risk information, such coalitions would be able to prioritize and contribute to the implementation and maintenance of basic projects, for example, drainage in a ward prone to flooding.

The Recovery Implementation faces multiple challenges: financial and technical support of development partners to Freetown will be essential.

Implementing comprehensive urban recovery and regeneration interventions in Freetown will be intricate. Such interventions require the design and development of financial models, participation processes, legislative frameworks for mixed use development particularly for rental housing models as the majority in Freetown are renters: For example, housing cooperatives may need to be developed to ensure social *inclusion* and collective action; rent to own options may need to be developed; negotiations between potential investors may need to be facilitated to arrive at quantities of built-up areas that make locations financially viable, including for the integration and delivery of public goods and services to meet the basic needs and preferences of the population; social protection and cash transfers mechanisms may need to be adapted by location to reach poor people facing increasing disaster risk. The scope will be to better manage the shock and help to solve housing/shelter, improve livelihood and avoid long-term implications in the form of negative human development impacts and lower future income streams, and thus poverty traps.

The overarching message from international experience is "governments should permit land and housing markets to work, supplementing them with targeted interventions when necessary."[50] The Dikmen Valley Housing and Environmental Development Project, the first example of regeneration in Turkey to respond to risks and the largest in scale involved about 10,000 households to bring about urban transformation. It provides a good example that can be adapted to the needs of Freetown. An example of employment-generating risk reduction schemes to mitigate flood damage have been promoted in Liberia by Mercy Corps, with 26 percent of newly created employment specifically for women.[51] The Guardians of the Slopes project in Manizales, Colombia, promoted by the local government, created employment and income opportunities for numerous formerly unemployed women.[52] Activities normally involve cash-for-work schemes centred on debris clearance and recycling, drain clearance, social awareness activities, small stability works, installation of logistical facilities and operation of temporary shelters. Other activities could be also implemented like urban agriculture, support to small scale businesses, improved storage facilities, new commercial arrangements for sales, micro credit and micro insurance schemes, water and food security projects, and natural resource management schemes.

The institutional arrangements for the delivery of infrastructure and services in Freetown are intricate. Several agencies have the responsibility for various aspects of the same sector, inconsistent objectives and priorities, overlapping mandates while some functions are not specifically allocated to any one agency. There are consequently, no effective infrastructure asset management inventories and therefore no systems to monitor and prioritize, re-construction, repair and maintenance of infrastructure works. Any asset registry needs to have a detailed inventory of critical infrastructure assets, including location, typology, status, and maintenance needs to inform annual budgetary needs for operations and maintenance, an important and cost-effective approach to disaster risk management. A geospatially enabled system would allow the overlap of multiple information layers, such as hazard maps to demonstrate which infrastructure is most at risk, to develop risk management strategies.

International experience highlights that well-performing institutions with strong support from city residents are better able to respond to disaster risk reduction and recovery. Institutions transcend specific entities, and fostering good institutions means letting evolve a messy array of overlapping entities (the media, neighborhood associations, engineering groups) that may not all have lofty motives but nevertheless allow divergent views to percolate into the public consciousness. Encouraging a diverse set or organizations that facilitate collective action by large groups of citizens will allow them to press more effectively for the spread of information, the availability

[50] World Bank and United Nations (2010).

[51] Andrews et al. (2011).

[52] Alcaldía de Manizales y de la Corporación Autónoma Regional-CORPOCALDAS (2003).

of prevention measures and alternatives, and their cost effectiveness.[53]

Financing options could include public resources, development partners support, community and household savings, and investment by financiers (for real estate or infrastructure development) that may become available to Freetown. Financing will likely be a direct consequence of the institutional frameworks developed for Recovery. As highlighted in the background paper on the land tenure system[54] an option for accessing lands already occupied is to not to ask occupiers to divest themselves of the asset, but to reach an agreement through negotiation with all parties having an interest in the land, whereby the Freetown City Council is able to partner with them to improve and develop the occupied area so that it is better utilized and which will bring about both an economic and social benefits—the advantage is that the cost of relocation does not arise. The institution for promoting hazard risk management through urban regeneration in Freetown will need powers to make, change and enforce plans and regulations including regulations regarding the use of local physical space and local economic development; authority to administer and manage local government finances and manage local procurement; engage in their own local human resource management and make local employment decisions; and to flexibly administer and deliver local government services. The relative strength or weakness of these institutional attributes will determine Freetown's future—its ability to be able to deliver public goods and services that meet the basic needs and preferences of the broad spectrum of its population's affordability, in safe locations.

[53] World Bank and United Nations (2010).

[54] The European Union supported Urban Planning Project, 2014.

8

ANNEXES

8.1 Methodology for Damage Assessment of Real Estate Sector

This assessment covers affected areas in Freetown, Western Area Urban (Malama/Kamayama, Juba/Kaningo, Lumley, Dwarzak and Culvert) and Western Area Rural (Regent). Malama/Kamayama, Juba/Kaningo, Lumley and Regent were affected by the landslide and associated flooding on 14/08/2017 (referred to as the Regent Landslide). Dwarzak and Culvert were affected by separate flooding events on 14/08/2017, unassociated with the Regent Landslide. The assessment of the buildings uses different methods to estimate the damages due to the nature of the two events as describe in the Chapter 2—where the landslide was a major high-intensity event but urban flooding is a recurring annual event in the city.

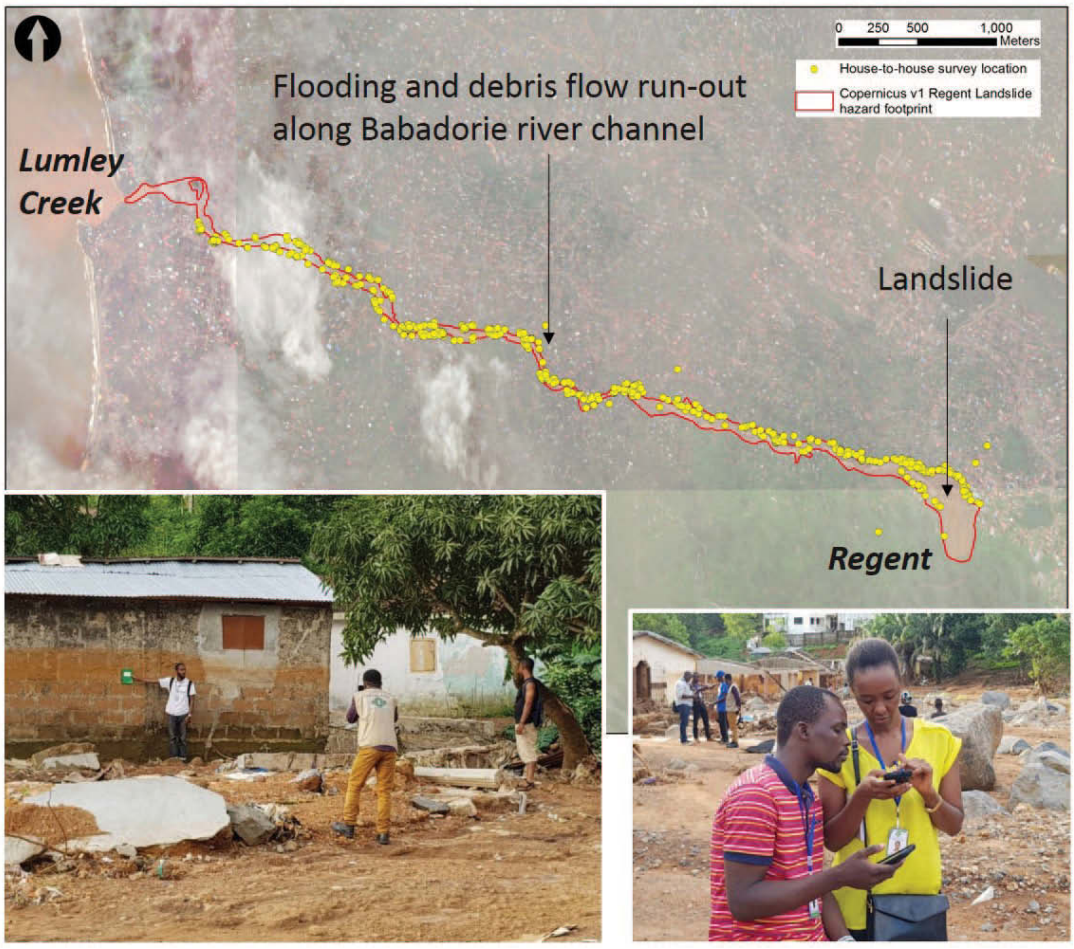
PHOTO 5: Drone Mapping of Affected Area Conducted by EDA

Source: EDA, 2017.

Primary and secondary data collection methods included:

- Immediately following the flooding and landslides of 14/08/2017, numerous international agencies produced post-disaster maps and released both pre- and post-event satellite imagery to allow a coordinated and informed response to the disaster. These sources of information and data have been reviewed and compiled as part of this DaLA and are specifically cited where used.
- The location of pre-event buildings in the area of the Regent Landslide was identified and digitized using pre-event satellite imagery provided by DigitalGlobe (DigitalGlobe © 2017), dated 03/03/2017. In total 2,116 buildings were identified within a 50m buffer either side of the Regent Landslide. DigitalGlobe (DigitalGlobe © 2017) also released post-event satellite imagery dated 15/08/2017.
- Aerial photographs were captured from a drone survey carried out by the local company TrackYourBuild Ltd. (TYB) in the area of the Regent Landslide, immediately following the event. This effort was coordinated by UNOPS.
- A drone survey of the Regent Landslide area was commissioned by the World Bank on 28th August to collect high-resolution aerial imagery over the full extent of the affected region. This survey was conducted by Edward Davies & Associates, Ltd. (EDA) a local engineering consultancy. EDA also carried out post-processing of the aerial drone images to generate a high-resolution digital terrain model (DTM) of the Regent Landslide and channel through to Lumley.
- Field surveys were conducted by the DaLA team to establish the impacts of the Regent Landslide and the flooding in Dwarzak and Culvert.

PHOTO 6: Household Surveys Conducted by INTEGEMS in Affected Areas



Source: INTEGEMS, Arup (2017).

- Three days of systematic house-to-house surveys were undertaken by teams of up to 12 local volunteers in the region of the Regent Landslide. The volunteers were trained and coordinated by INTEGEMS (Integrated Geo-information and Environmental Management Services). A total of 514 responses were received from affected the affected population and used to inform the DaLA.
- The 2015 Sierra Leone Census Population and Housing census results, FCC property tax database by wards acquired from their valuation department, Sierra Leone Integrated Household survey 2011 were also used to inform the understanding of characteristic housing attributes e.g. structural typology, internal assets etc. to supplement the house-to-house surveys.

8.1.1 Data Interpretation and Analysis Method

The assessment methodology for the buildings sector uses two different methods of damage assessment to reflect the differing nature of the Regent Landslide and the flooding in Dwazark and Culvert.

Building identification

- Where available, building usage (residential, mixed-use or commercial) was identified for specific buildings within the GIS format buildings dataset using the house-to-house surveys.

- Generally, the location of critical facilities (healthcare, educational, public and religious buildings) could not be specifically identified within the GIS format buildings dataset (beyond the ward level). Losses associated with healthcare and educational facilities were assessed by alternative methodologies and are not accounted for in this section of the report
- The estimated proportion of commercial facilities in each ward was identified but were removed from the hosing real estate section and included in industry and commerce section.
- Two public buildings and one religious building were identified by the house-to-house surveys.

Building damage assessment

- Initial estimates of building-specific damage level (minor damage 0–20 percent; moderate damage 20–50 percent; destroyed 50–100 percent) were made using the GIS format buildings digitized in the area surrounding the Regent Landslide, post-event DigitalGlobe (DigitalGlobe © 2017) satellite imagery and initial drone imagery captured by TYB. Additional information on building typology (informal, masonry, reinforced masonry, other) and size was also estimated from the remotely sensed data.
- These interpreted levels of damage and building characteristics were then verified or corrected using information collected by the house-to-house surveys. Not all buildings within the GIS format buildings dataset were inspected by the house-to-house surveys, and in the absence of building-specific damage assessment from the house-to-house surveys, the interpreted level of damage and building typology was taken from the initial estimates from remotely sensed data.
- Building replacement value was determined using USD per square meter values estimated from: [1] existing estimates of replacement value compiled as part of the ongoing *Sierra Leone Multi-City Hazard and Risk Assessment*; and [2] interviews with local contractors.
- The damage associated with buildings subject to minor damage was estimated as 20 percent of the building rebuild value. The damage associated with moderately damaged buildings was estimated as 50 percent of the rebuild value. The damage associated with destroyed buildings was estimated to be 100 percent of the rebuild value.

Asset damages assessment

- The value and level of damage to household assets was determined from house-to-house surveys if available (i.e. if a specific survey could be attributed to a specific building from the GIS format buildings dataset).
- If unavailable building specific house-to-house survey information was not available, the value of household assets was estimated based on consultations with local suppliers. The frequency of assets per household was estimated from the 2015 Census.
- If building specific information was unavailable about the level of damage to household assets, it was assumed that the damage to household assets was the same as the level of damage to the building.
- If the value of household assets was estimated to be less than 10 percent of the value of the building, the value of the household assets was raised to 10 percent of the value of the building (to account for additional possessions which would not be accounted for in either the census or house-to-house surveys).
- The damage associated with assets subject to minor damage was estimated as 20 percent of the assets value. The damage associated with moderate damage assets was estimated as 50 percent of the assets value. The damage associated with destroyed assets was estimated to be 100 percent of the assets value.
- During the house-to-house surveys it was identified that some households stored savings in the form of cash in their homes. If available, these other assets were recorded on a building specific basis and assigned 100 percent damage if the assets were moderately damaged or destroyed.
- Where building-specific information was unavailable about the value of other assets, the average for the ward was assigned to each building within each ward and subject to 100 percent damage if the assets were moderately damaged or destroyed.

- Building and associated asset damages were aggregated to the ward level for presentation of results.

Flooding in Culvert and Dwazark

- Because of the extent of devastation caused by the Regent Landslide disaster, the limited number of trained field survey volunteers available in the short time frame, and because of reports of social unrest in the areas of Culvert and Dwazark, site-specific surveys were not conducted in these regions. Observations of the structural damages at Culvert and Dwazark were made from comparisons of the high-resolution pre- and post-flooding satellite imagery, and from the high-resolution aerial photos captured by the TYB drone surveys.
- These remote observations were complemented with field site visits and photographs captured by the DaLA team to inform the range of typical building typologies affected by the flooding, as described above.
- The Household asset costs were estimated based on consultations with local suppliers.
- The frequency of assets owned by each household in each region was informed using the ward-specific Sierra Leone Population and Housing Census, 2015
- The asset damages for Culvert and Dwazark have been calculated assuming that the total number of households affected by flooding in these areas, as reported by the ONS, lost 50 percent of their assets.

8.1.2 Limitations of the Methodology

The following assumptions apply to the methodologies used to estimate building damage following the Regent Landslide and flooding in Dwazark and Culvert:

- Simplified building typologies were used to allow rapid identification and classification of the building stock by the field teams and using satellite imagery.
- Rebuilding costs are approximate only based on the simplified building typologies used for the satellite imagery interpretation and door-do-door surveys.
- For the Regent Landslide assessment, the total number of affected buildings was directly identified using satellite imagery. The use (i.e. residential, mixed-use or commercial) of over 350 buildings (of 900 affected) was directly identified by the house-to-house surveys. The usage of the remaining affected buildings was estimated based on the distribution of buildings of different usage per ward, as determined from the house-to-house surveys. The distribution of the total damages (USD 14 million) and number of affected buildings (900) among the sub-sectors of residential, commercial, mixed-use buildings is therefore a statistically representative approximation only.
- The damages estimates for Culvert and Dwazark includes only the assumed total damage of assets to the affected Households, since it was not possible to obtain reliable field-survey data regarding the extent of structural damage to buildings in these regions.

8.2 List of People Met During DaLA Mission

Name	Organization
Ning Xiao	China CDC
Klaere Heyden	GIZ Office Freetown
Loti Chingoma	GOAL
Daniel Kamara	Kroo Bay CHC
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Abu Fofanah	MoHS
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SAS Sheku Kargbo	MoHS
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Santigie Sesay	MoHS
Foday Dafae	MoHS
Alie Wurie	MoHS
Kwame Oneil	MoHS
Sarah Tawali	MoHS
Ansumana Sillah	MoHS
Doris Bah	MoHS
Jatu Abdulai	MoHS
Saidu Conton Sesay	OCOS
Sarah Hersey	US CDC
Regan Hartman	US CDC
Fillippo Pongelli	WFP
Gbemi Brainerd	AfDB
Grace Campbell	Arup
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Sara Hersey	CDC
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Gbessay Momoh	FAO
Prince Kamara	FAO
Gbessay Momoh	FAO
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Prince Kamara	FAO
Gbessay Momoh	FAO
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Sulaiman Kaikai	Freetown City Council
Sulaiman Zainu Parker	Freetown City Council
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Nyan Zikeh	Freetown WASH consortium (Oxfam)
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Maada S. Kpenge	GUMA water utility
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Abdul Karim Koroma	ONS
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Nabie A. Kamara	ONS
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Mrs Memumat Jalloh	SLRA
Mr Bembu	SLRA
John B. Kamara	SLRA
Akindele Beckley	SLRA
James Faya	SLRA
Edmond Norrie	Track Your Build
Marbey Sartie	UN Women
Leif Jonsson	UNDAC
Steven Goddfinch	UNDP
Tanzila Sankoh	UNDP
Steven Goldfinch	UNDP
Sam Doe	UNDP
Betty Alpha	UNFPA
Donald Elhassein	UNFPA
Doudou Sulayman Mbye	UNHABITAT
Rogier van den berg	UNHABITAT
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Dr. Robert Moikowa	UNICEF
Patrick Aokoth	UNICEF
Pablo de Pascual	UNICEF
Sylvia Lee	UNICEF
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Ian Gough	UNOPS
David Mc Whirter	UNOPS
Ioannis Papageorgiou	UNOPS
David McWhirter	UNOPS
Ian Gough	UNOPS
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Maria Busquets	USAID
Swati Sachdeva	WB
Sophie Charlotte Emi Ayling	WB
Samantha Zaldivar	WB
Trudy Morgan	WB
Robert Reid	WB
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Anita Takura	WB
Abu Kargbo	WB
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Mariama Kai Fornah	WB
Sheik A. Y. Sesay	WB
Ivo Imparato	WB
Mamadou Ndione	WB
Elad Shenteld	WB
Kemoh Mansaray	WB
Mohamed Rashid Bah	WB
Mariama Khai Fornah	WB
Elizabeth Foster	WBG
Ballah Musa Kandeh	WFP
Will Hopkins	WFP
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Filippo Pongelli	WFP
Brian Christopher ROSS	WFP
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Name	Organization
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Amy Clancy	HIV Manager UNICEF
Kajali Paintal	Nutrition Manager UNICEF
Victor Sule	Immunization Specialist UNICEF
Riad Mahmud	SRH Technical Specialist UNFPA
Kim Dickson	Representative UNFPA
Chris Oyeyipo	FP-SRH, Technical Specialist, UNFPA

Name	Organization
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Susumu Takahashi	UNOPS
Ing Alhaji Timbo	EDSA
Mr Unisa Samura	EDSA
Mr Milton Gegbai	EDSA
Mr Alex Nikolic	EDSA
Mr Charles Ibrahim	EDSA
Mr James Rogers	EDSA
Ing Dennis Garvie	EGTC
Ing Sinneh Kamara	EGTC
Mr Victor Findlay	NATCOM
Ms Gaelle Kerlan	Orange/Airtel
Mr Shadi Al Gerjawi	Africell
Ing Michael Kargbo	EWRC
Ing Kelcise Sesay	EWRC


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