THE DEPARTMENT OF RURAL AND COMMUNITY DEVELOPMENT,

FACULTY OF DEVELOPMENT STUDIES

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WATER SPILLAGE EFFECTS ON RESIDENTS OF WEIJA, ACCRA

BY

GLORIA ASARE

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A Dissertation Submitted to The Department of Rural and Community Development of the Faculty of Development Studies, Presbyterian University College, Ghana in Partial Fulfilment of the Requirements for The Award of Master of Arts Degree in International Development Studies

BY

GLORIA ASARE

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DECLARATION

Candidate's Declaration

I hereby declare that this dissertation is the result of my own original research and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Signature……...….Date…….....

Name: ……..……

Supervisor's Declaration

I hereby declare that the preparation and presentation of the dissertation were supervised in accordance with the guidelines on supervision of dissertation laid down by the Presbyterian University College, Ghana.

Supervisor's Signature ..... Date……..…...

Name: …….....

ABSTRACT

The study examined how the people of Weija are affected by perennial flooding and its effects on their livelihoods as well as their coping mechanisms. The study employed both quantitative and qualitative research approaches to collect primary data using multi-stage sampling technique to select 120 flood victims for the study. The data was analysed using Statistical Package for the Social Sciences (SPSS) and Microsoft Excel software. The results revealed that anthropogenic activities including farming, construction of new settlements by property developers served as the main contributory factor to siltation leading to reduction of volume capacity of the dam. The local institutions are unable to enforce building permits regulations due to land tenure arrangements which allows the traditional authorities and families to sell land to property developers. Informal settlement in the waterways has further increased the magnitude of the floods and its impact on lives and properties. Due to their vulnerability, they often succumb to the external shocks which affect their ability to rebuild their productive assets which further plunge them into perpetual poverty. The flood has caused undetermined infrastructure damage as well as loss of human lives. Thus, the support of the National Disaster Management Organisation (NADMO) was found to be deficient and there is a need for effective response to the dangers of disasters by building individual and community resilience. In conclusion, it is important to note that floods cannot be completely eradicated in the Weija community, but it can be controlled to safe levels ensuring human security. The need to find long lasting solution should be the priority not only for Government but for all stakeholders to join forces to remove all barriers that mitigate against building community resilience by enforcing various land use regulations.

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To all the respondents who took time off their busy schedules to answer the questionnaires for this project work to be completed, I am grateful to you.

May God richly bless you all.

DEDICATION

I dedicate this work to my lovely husband, Isaac, and my children, Emmanuel, Michael, and Joel.

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LIST OF ABBREVIATIONS

GSS	Ghana Statistical Service
DFID	Department for International Development
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization
GLSS	Ghana Living Standard Survey
GSMA	Ga South Municipal Assembly
GWCL	Ghana Water Company Limited
IFRC	International Federation of Red Cross
IPCC	Intergovernmental Panel for Climate Change
MoFA	Ministry of Food and Agriculture
NADMO	National Disaster Management Organization
NGOs	Non-Governmental Organizations
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OECD	Organisation for Economic Co-operation and Development
SPSS	Statistical Package for the Social Sciences
UN	United Nations
UNDRR	United Nations Office for Disaster Risk Reduction
UNHCR	United Nations High Commissioner for Refugees
WWF	World Wildlife International

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

One of the greatest global problems facing the world in the 21st century is climate change and has attracted utmost attention globally. Billions of dollars have been devoted to addressing its catastrophic effects and identify sustainable and innovative solution to overcome the climate change crisis. According to International Federation of Red Cross (IFRC), the most vulnerable people in developing countries would face the brunt of extreme weather events (IFRC, 2020). Similar research findings by United Nations High Commissioner for Refugees (UNHCR) shows that climate is changing at unprecedented rate making it difficult to scientifically forecast constituting a major worry to the leaders and policy makers across the World (UNHCR, 2020).

There are also multiple projections regarding future trends in climate change, which suggest rise in the scale of destruction and thus the future forecasting of the climate change can be irreversible and extreme (Kovats *et.al*, 2001). According to the Intergovernmental Panel on Climate Change (IPPC) 2007 Report, climate change is "a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer)" (IPCC, 2007). And globally, millions have already started suffering from disaster as a result of climate change forcing millions to leave their homes in search of new beginning (UNHCR, 2020). According to Ritchie and Roser (2020), droughts and floods are the most fatal disaster events. Douben (2006) describes flood is the most destructive natural

hazards causing extensive damage to the environment, and devastation to human settlements.

Studies show that over 250 million people around the world are affected by flooding each year, losing their homes and livelihoods and in some cases their lives (Asian, 2002; OECD, 2016). Globally, floods cause more than $40 billion in damage yearly (OECD, 2016). In the United States of America, average loss is about $8 billion a year. In 2007, more than 55,000 properties were flooded in Britain while half a million people were left without safe water and electricity (Environment Agency, 2007). It has been argued that developed nations may be able to predict the likely incidents of heavy rain, storms, tornados and hurricanes but may not have the needed resources to curb the possible impacts on human life and property. The case is even worse for developing nations whose level of preparedness to manage any natural disaster like floods is badly lacking (de Ville *et al*., 2006).

In Asia, Pakistan is one of the most affected countries and its population is highly vulnerable to climate change, as 60% of its population live below the poverty line (Akhtar, 2011). The rapid change in the climate has enormous environmental, social, and economic threat to Pakistan. Due to the increasing changes in the climate, Pakistan experienced a devastating flash flood in July and August 2010, which inflicted severe damage to the provinces of Khyber Pakhtunkhwa, Sindh, Baluchistan and Punjab (Akhtar, 2011). In Africa, millions are affected by the flood. In Malawi, about a million people suffered from devastating floods, which claimed lives while an estimated 1.85 million people in Mozambique were impacted negatively by floods in 2019 (OCHA, 2019). Residents of flooded areas were cut off from the national grid and unable

to access safe drinking water. This invariably led to outbreaks of waterborne diseases like typhoid and cholera. Furthermore, agricultural crops were destroyed and undetermined loss of household assets and community infrastructure as well as loss of human lives.

Floods, thus, affect development efforts in many sectors including agriculture, sanitation, environment, and education, which could undermine and erode all the economic gains and heighten inequalities. It must be noted that the effect of extreme flooding is dramatic, not only at the individual household level, but also in the country as a whole (Doocy *et al*., 2013). To this end, the 2030 Agenda for Sustainable Development acknowledges the need to reduce the risk of disasters and recommends the need to reduce exposure and vulnerability of the poor to disasters, and building resilient infrastructure (United Nations, 2020). It has been argued that flooding stands out from other types of disasters because it is feasible to prevent flooding by using flood prevention measures such as moving away from rivers and other water bodies. However, many do not evacuate their homes because they do not have alternative places to move to (Okaka & Odhiambo, 2019). Thus, people continue to live and work in areas threatened by flood damage making floods part of the lives of several communities in the world (Action Aid, 2006).

And in Ghana, one of the communities that have been affected by persistent floods is Weija in the Greater Accra Region. According to World Bank (2019), about $3.2 billion worth of economic assets are currently at risk of flooding in the Greater Accra Region including Weija. The perennial flood is caused by the combination and intersection of many factors. However, spillage of the Weija dam has been isolated as the main cause, which has resulted in loss

of lives and millions of dollars of properties over the years (IFRC, 2018). In recent times, spillage conundrum has been exacerbated by excessive rainfall due to the impact of climate change. The excessive amounts of water are spilled downstream to protect the dam from eventual collapse which could be more catastrophic. The spillage of the dam is occasioned by Ghana Water Company, which over the years, has inflicted considerable destruction to farmlands in the farming communities. The spillage poses substantial social and welfare problems over extended periods of time including economic stress associated with re-building as people try to recover their lives, property, and relationships (IFRC, 2018).

The Intergovernmental Panel on Climate Change (IPCC) predicts "heavy precipitation events, which are very likely to increase in frequency, will augment flood risk" Tarmizi, (2020). According to Action Aid (2005), climate change phenomenon has resulted in increase in rainfall amount leading to floods, particularly in coastal and low-lying areas fuelling the constant spillage of water downstream. However, the surge of disasters caused by floods in recent times according to FAO (2008), is the drastic reduction of the reliability on predictability in rainfall patterns, which affects the timely preparedness and response to flood warnings. Thus, this has made flooding the most common global hazard causing phenomenal loss of properties and livelihoods and poses substantial social and welfare problems that may continue over extended periods of time (Fiasorgbor *et al*., 2018). There is, therefore, the need to reduce the risk of natural disasters by setting up institutions and enacting regulations and policies to safeguard lives and property when natural disasters occur.

The National Disaster Management Organization is the government agency that is responsible for the management of disasters as well as other emergencies in Ghana. The board operates under Ghana's Ministry of Interior, backed by an act of Parliament of Ghana (Act 927) 1996 to manage disasters and emergencies. The National Disaster Management Organization (NADMO) is called to action in times of such disasters (Fiasorgbor *et al.*, 2018). Their main mandate is to cushion the effects of displacements and to help affected people to recover from disasters. There are a number of Non-Governmental Organizations which also provide support to the displaced people to enable them recover and build resilience.

1.2 Problem Statement

Floods have become one of the leading causes of natural disasters affecting many developed and developing countries. In Ghana, many households are affected annually causing recurrent losses of material goods, and endangered human lives. One of the areas noted for flooding is Weija in the Greater Accra region. The flood in Weija is as a result of spillage of water from the Weija dam to the downstream communities who live along the banks of the Densu river. Constructed in more than 40 years ago, Weija dam is built on the Densu river which supports the main water treatment plant for the Greater Accra Region. The dam is operated by the Ghana Water Company supplying about 80% of the portable water for the city of Accra and its environs. Due to current increase in the rainfall volume and anthropogenic activities causing siltation, the dam is unable to contain the water fed from the River Densu. In order to prevent eventual collapse of the dam as a result of large water volumes, spillage of water has become prerequisite to forestall any catastrophic impact on thousands of

residents in the area. Analyses of time-series rainfall data and hazard mapping showed that during periods of torrential rainfall, the dam is overwhelmed with storm water hence exposing the Weija township located downstream to flood hazards (Owusu-Ansah *et al.*, 2018).

There are about 500,000 inhabitants within Weija with 57% peasant farmers who farm along the spill way of the dam due to the fertility of the soil. The affected communities are Glefe, Bortianor, Weija Away, Oblogo, Tetegu, Pambros Salt, Old Barrier and Ada Kokpe. The water spillage threatened their livelihoods, which causes displacement as well as devastating impacts on infrastructure, crops, health, education, environment as well as damage to property with millions of dollars spent on reconstruction and recovery efforts. Due to the locations of these towns, the population are at risk and would continue to experience frequent devastating flood events in coming years. With the significant loss of property and lives, many people still live in these areas (IFRC, 2018).

Many authors (Asiedu, 2020; Abeka *et al.*, 2020; Tengan & Aigbavboa, 2016; Ahadzie & Proverbs, 2011; Asumadu *et al*., 2015) in recent times have focused on causes of floods in the Greater Accra region and how to address the challenges of floods using exploratory literature review methodology. They, however, failed to identify the effects of the floods on the people living in Accra particularly those in Weija. Moreover, their research relied only on secondary sources of data. Drawing on a comprehensive literature review, Mensah and Ahadzie (2020) also studied the causes, impacts and coping strategy of floods in Ghana. Their study revealed that destruction of productive and social infrastructures are the main effects of the floods. The main coping strategy has

been relocation of people to new areas. Again, the authors relied heavily on secondary data source using published articles. With the above limitations, the current attempts to fill the gaps by employing both primary data and published articles focusing on the effects of water spillage on the people of Weija town, who have been experiencing perennial floods. It also looked at both causes, and coping strategies employed by the people living in Weija.

1.3 Research Questions

1. What are the effects of flooding on the people of Weija?
2. What measures do the residents put in place in anticipation of the flood?
3. What are the strategies put in place in dealing with the flood situation?

1.4 Main Objective

To examine how the people of Weija are affected by perennial flooding and its impact on their livelihoods. An attempt was made to understand the coping mechanisms of the people in the aftermath of a flood and level of preparedness before a flood occurs.

1.4.1 Specific Objectives

1. To assess the effects of flooding on the people of Weija
2. To assess the level of preparedness in anticipation of a flood.
3. To examine the strategies put in place in dealing with the flood situation.

1.5 Definition of key Concepts

According to United Nations Office for Disaster Risk Reduction (UNDRR), **Hazards/Disasters** are potentially damaging physical events, which may cause loss of life, injury, or property damage. Each hazard is characterized by its location, intensity, frequency, and probability (UNDRR, 2017).

Vulnerability "is a set of conditions resulting from physical, social, economic, and environmental factors that increase the susceptibility of a community to the effects of hazards" (UNDRR, 2017).

Risk is the probability of harmful consequences or economic losses resulting from the interactions between natural or human-induced hazards and vulnerable or capable conditions (UNDRR, 2017).

Flooding is defined as the overflowing of water from sources such as rivers, reservoirs and ponds caused by prolonged seasonal rains, typhoon rains, and encroachment of seawater on land or during tidal surges, the speed of flooding can be slow or fast and depending on the frequency, seasonality, or flood outline (Ingle Smith, 1999). In the context of this study, the flooding is as a result of spillage of the Weija dam. Weija dam is fed by River Densu. The rising water levels of the river also affect the water level in the dam which invariably caused the water to be spilled downstream eroding vegetation and human settlements. Thus, the flooding is due to failures of damming structure to hold volume of water fed by the Densu river which affects the livelihoods of thousands of people.

Spillage is defined as the release of excess water from water storage compartment units or drainage facilities such as dams that have reached their maximum storage capacity, in order to prevent damages as a result of excess water pressure. Spillage often comes at the expense of surrounding communities as large volumes of spilled water are known to cause severe flooding (UNDRR, 2017).

1.6 Delimitation of Concepts

To access the impacts of flooding on the people of Weija, the research focused on key areas particularly, the causes of floods, preparedness in anticipation of floods and the coping mechanisms when a flood occurs. These served as a guide to obtain relevant information as to the plight of the people during the challenging situations of the people after a flood.

1.7 Organization of the Study

Chapter one gives an introduction about the research. Chapter two comprises information on the work of other people in relation to flooding. Chapter three outlines the research methods employed for data collection and data analysis. Chapter four gives an in-depth analysis of the data and discussions of the results while Chapter five focuses on conclusions and recommendations.

1.8 Limitation of the Study

The subject of flooding brings about grief because of their previous losses to flood. Some residents may decline to talk on this issue because of recent demolition exercise by the Government to prevent people from building close to the dam. Due to time constraints and the outbreak of the COVID-19 pandemic, the researcher was unable to organize more focus group discussions to collect qualitative data on the impact of the flood on the livelihood of the communities in Weija. However, since the population were homogenous, a few personal in-depth interviews organized gave substantial information that helped the researcher to objectively assess the impact of the flood on the livelihood of Weija town.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter examines how the people of Weija are affected by perennial flooding and its impact on their livelihoods. It further expands the concept of floods and looks at the spillage induced floods in the world and zero in on the experiences in Africa and in Ghana in particular. Also, this chapter seeks to understand the coping mechanisms of the people in the aftermath of a flood and level of preparedness prior to the flood. This chapter further delves into the conceptual framework of floods and its effects on the people of Weija.

2.2 The Concept of Flood

Flooding has become a major problem in many parts of the world due to its social, economic, and environmental impacts (Mensah & Ahadzie, 2020), spreading their damaging effects over a quite larger number of days or weeks (Bunn *et al*., 2002). According to the United Nations (2020), flooding is "a general and temporary condition of partial or complete inundation of normally dry land areas from overflow of inland or tidal waters from the unusual and rapid accumulation or runoff of surface waters from any source". A study conducted by the World Wildlife International (WWF) indicated that many incidences of flooding are exacerbated by spillage of dams (WWF, 2001). Spillage is the only option to save a dam from eventual collapse when the dam is unable to contain excess water in an event of a heavy rainfall. In the context of this study, the flood is induced by frequent spillage by Ghana Water Company Limited. It must be noted that other factors such as human activities have contributed to the

reduction of the volume capacity of the dam mainly due to siltation. The chapter reviews published articles on causes of floods, effects, and mitigation measures.

2.3 Spillage Induced Floods

The construction of dams has become one of the means of generating electricity, provide portable drinking water for cities, and for irrigation to ensure all year food production to meet the needs of the growing population. According to the World Wildlife International (WWF), however, many catastrophic floods were induced spillage (WWF, 2001). World Wildlife International has chronicled spillage induced floods in many parts of the world:

In September 2000, more than 1,000 people lost their lives in West Bengal in Western India as a result of the emergency releases from several dams, creating water surges into four rivers: the Damodar, Barakar, Mayurakshi and Ajoy. The spillage washed away a million homes damaged property worth more than £40 million. Many parts in Nigeria along the Niger river were flooded in September 1999. The floods were initially attributed to the heavy rains. However, it was later realized that the spillage from Kainji, Shiroro and Jebba dams caused catastrophic floods, which over 80,000 people were displaced as well as 100, 000 hectares of crops destroyed. At least 39 people lost their lives as a result. A report released by the United Nations showed that the operators of three large dams were forced to open sluice gates to protect the dams from collapse (WWF, 2001). In October 1999, a hundred died and thousands were left homeless in floods in the Mexican state of Hidalgo. A significant cause is water released from the La Esperanza dam, which floods two rivers.

And in Ghana, at least 48 people die during floods in Northern Ghana after engineers in neighbouring Burkina Faso open spillways to relieve water pressure on the Bagre dam submerging forty villages completely in September 1999. In the Greater Accra region, the Accra Metropolis has been experiencing harsh long-term flooding over the years which has cost significant harm to lives and properties. Each rainy season, the metropolis experience rain fed floods that lead to the damage of property, loss of lives and a slowdown of economic activity (Rao *et al*, 2011). Weija is one of the towns that experience perennial floods due to the spillage of the Weija dam. A study by Kuma *et al* (2008) revealed that precipitation within the Weija dam's catchment area has decreased by 0.93%. Thus, the amount of rains could not have been the cause of the frequent spillage. The cause is due to the reduction of the overall volume capacity of the dam. This is largely attributable to the anthropogenic activities in the areas around the dam (Kuma *et al*., 2008).

Undoubtedly, the frequencies of these events and the number of people affected have increased progressively as a result of anthropogenic activities such as deforestation, overgrazing and urbanization (Bankoff, 2003). One of the contributory factors accounting for the spillage is the land use and management around the catchment area of the dam (Afeku, 2005). Human activities such as estate development, agricultural and dumping of refuse in gutters and drains have resulted in the siltation of the dam. Some developers have either built along and/or across watercourses resulting in flooding (Adabor, 2012; Andjeilovic, 2001).

2.4 Effects of Spillage Induced Floods

In general, flooding can cause devastating damage to both social and economic infrastructures. Calculating the damages of such an event can be a tedious task because the cost of a natural disaster is ultimately linked to several factors, and more importantly varies by type of disaster. According to Bunn *et al*. (2002), these factors include the "magnitude and duration, the structure of the local economy, the geographical area affected, the population base and the time of day it occurred". In the densely populated areas, the disasters normally cause considerable damage to properties and untold suffering to human lives (Bunn, *et al*., 2002). According to Kliesen (1994), most areas in the United States of America are susceptible to flood disaster. For example, flooding in the St. Louis area resulted in the Mississippi river staying above flood stage for a record of 79 days' flood stage in the area occurs at 30 feet. In Bosnia, the Government statistics shows that more than one million people, or a quarter of the population, have been affected by flooding and landslides, comparing the destruction to that of the country's war in the 1990s. Asia is struck by 70% of all floods in the world and the average annual cost of floods over the past decade is approximately 15 billion dollars. Economic losses and impacts have remained high and constitute a large developmental burden. It has been suggested that strategies should be put in place to cope with the financial burden from hazardous events (National Research Council, 1999).

In the Netherlands, a large coastal flood was the worst natural disaster that hit the country. The physical health effects that occurred during and after the flooding included: mortality mostly from flash floods, injuries such as sprains/strains, lacerations, infectious diseases, poisoning carbon monoxide,

hypothermia, respiratory diseases (Jonkman *et al*., 2003). Until recently, the costliest year for floods in Australia was 1974, when floods affecting New South Wales, Victoria and Queensland resulted in a total cost of $2.9 billion (Hossain *et al*., (2017). The Queensland Government estimates costs for the 2011 floods exceeded this figure for Queensland alone; with the damage to local government infrastructure estimated at $2 billion, and the total damage to public infrastructure across the state at between $5 and $6 billion (Kingsford, 2000). The floods indeed did not only affect communal infrastructure but also the emotional behaviour of many flood victims. The emotional cost of flooding was long lived. Follow-up studies found that about one-quarter still could not recover from the emotional trauma of the event (Emergency Management Australia, 2002). Factors that contributed to the non-recovery included the severity of the flooding, the degree of the resulting financial hardship, age, and socio-economic status. Elderly people on low incomes whose houses were flooded were the most ill- affected (Flood Management in Australia, 1998).

In Ghana, the problem of flooding phenomenon is common. It is estimated that more than 4 million people have been affected by flood in the past 50 years resulting in economic damage of over 780 million dollars (Tasantab *et al.*, 2018). This has obviously reverse gains made in addressing inequalities and eradicating poverty as the poor and the vulnerable communities bear the brunt of flood disasters. Unlike Accra and Kumasi, most floods in the Northern region are triggered by spillage from the Bagre dam in the Burkina Faso. The spillage of the Bagre dam in Burkina Faso during the raining season has become annual ritual affecting the livelihoods of the downstream communities along the Volta river in the Northern region of Ghana (Tasantab *et al.*, 2018). A study by Musah

et al., (2013) showed that recurrent floods in Tolon-Kumbungu in the Northern region of Ghana mainly caused by the opening of the Bagre Dam in Burkina Faso. According to the authors, farmlands in the District are destroyed every year washing away soil nutrients as well.

Thus, floods can lead to upsurge of food prices and further deepen the vulnerability of the poor households who are mostly affected. Soil nutrients are washed away through erosion leading to low capacity of the soil to support plant growth. As indicated earlier, the washing away of the topsoil around the riverbanks as a result of farming activities could lead siltation and invariably the carrying capacity of the dam. This could also affect the quality of the downstream water, loss of aquatic habitat, leading to lower fish production and loss of wetlands (Bunn *et al*, 2002). Damage to critical facilities such as health is not promptly repaired. Experience shows that damaged to infrastructure recover at a slower pace. For example, as a result of the floods that affected many communities in 2007 in Weija, renovation of several key infrastructures such as schools, clinics and bridges still remained unrepaired particularly for community owned or community operated rural systems (Hamidazada *et al*., 2019).

Effects of floods could be indirect such as loss of output and reductions in economic activities and leisure time. Also, common mental disorders, such as anxiety and depression are likely to affect certain subgroups of the population, such as those on low incomes the psychological effects may continue for months or even years after the flood events (Asian, 2002). It has been found that flood disasters can be especially traumatic for children, women, aged who tend to be vulnerable (Hamidazada *et al*., 2019). Sometimes, there is a need to relocate people when home and/or community have been destroyed, which affect their

daily activities including children's education. As indicated elsewhere in this thesis, the Weija flooding is also caused by the spillage of the Weija dam destroying homes and farmers' produce. The floods expose communities to health risks, food shortages and mental stress and thus there is a need to find sustainable solution to the problem with support from the Government (Tasantab *et al*., 2018). This is because Kundzewicz *et al*., (2002) observed that even though the 21st century is predicted to be an era of water scarcity, flood losses worldwide will continue to go up to tens of billions of US dollars in material damage and thousands of fatalities per year. The situation could be worse in Weija due to the nearness of the dam to the community and the possibility of spillage every year.

2.5 Flood Mitigation and Management

The overarching aim of flood mitigation strategy is to reduce to minimum the level of loss of lives and properties as flood risks cannot be avoided completely and thus there is a need to manage them (Nasiri, *et al*., 2016). Faisal *et al*. (1999) identified two main approaches for flood mitigation: structural and non-structural approaches. According to the same authors, structural measures consist of infrastructure development such as dams or river dike that modifies the river flow costing of storing, diverting and confinement of floods. Non-structural measures include educating, reporting, warning, and forecasting, assessing measures, emergency services, land use planning, flood insurance, enforcing building codes, health and social measures, and public participation (Faisal *et al*., 1999; Nasiri, *et al*., 2016). According to Samuels (2006), flood risk management involves pre- and post-flood activities involving various professionals including hydrologists, hydraulic engineers, economists, social

scientists, ecologists, and planners to conduct flood risk assessment in order to gauge its impact on the vulnerable. Tingsanchali (2012) has identified the main steps of risk management as: Flood planning mitigation measures (preparedness-before disaster); Response measures (during disaster); and Recovery (after flood risk management process).

In another vein, Ali (2013) has categorised flood risk management process into the pre-flood and post-flood activities:

The Pre-flood activities include:

- Distinguish vulnerable areas.
- Disaster planning to find discharge paths, public service, and infrastructure supplies for emergency actions.
- Construction of flood related infrastructure (physical structure and forecasting system)
- Land-use planning and preventing unsuitable development in the flood plains.
- Awareness among the people exposed to flood.

The post-flood activities:

- Injuries relief
- Reconstruction of damaged places
- Recovery of the environment and the economic
- Review of the flood management measures to advance the planning for future hazards and disaster.

According to Wisner (2001, cited in Norris *et al*., 2007), the process of mitigation in developing countries often failed to address the "root causes of disaster vulnerability, namely, the social, economic and political marginality of

the population and environmental degradation". Literature also suggests that social processes particularly the political processes can exclude the most vulnerable groups of receiving the needed support (Voss, 2008). From the literature reviewed so far, natural hazards are not likely to decrease in the foreseeable future. Though geological events may occur independently of any human control, available data suggest that mankind play a role in global climate. Technological hazards may also increase rapidly as a result of the unregulated development of industries in most countries. A sustained effort is needed to minimize risk, both by reducing vulnerability through prevention and mitigation and by developing early warning systems to allow people to put adequate measures in place. There is no doubt that global climate change has increased the frequency of extreme precipitation events and may cause many more floods (Zhang *et al*., 2014).

2.6 Conceptual Framework

According to Mandych, (2011), floods can be classified based on the factors and conditions of their generation. According to the same author, river floods constitute one main category of floods and inundations of shores of lakes and seas on the other hand. The third category identified is a large-scale flood caused by human activity. Spillage induced floods falls under this category. In recent years, there has been increase in incidence of floods due to spillage of dams. Though most are built with the promise that they will reduce flooding downstream, many have had the reverse effect. This is most marked during times of heavy rains, when reservoirs become swollen (WWF, 2001). It must be noted that human activities along the riverbanks over the years have contributed considerably to reduction of the volume capacity of the dam causing the need to

spill excess water to save the eventual collapse of the dam (WWF, 2001). From the literature review, the effects of the spillage induced floods are viewed through the lens of livelihood framework. Livelihood comprises the capabilities, assets and activities required for means of living (DFID, 1999). According to Chambers and Conway (1992), a livelihood is sustainable if it can cope with and recover from stress and shocks, maintain, or enhance its capabilities and assets, and provide livelihood opportunities for the next generation. It is based on the premise that people become vulnerable when floods occur leaving them no resources to recover. Flood disasters have deleterious effects on economic activities of the individuals. It also leads to cascading failures of critical infrastructure which invariably affect the delivery of social and health services.

With these effects, individuals and institutions have developed mechanisms to cope with and mitigate the effects of the disaster as well as building resilience. Coping mechanism in terms of flooding is defined as an involuntary response to a disaster or unanticipated failure in major sources of survival'' (Ellis, 1998, p. 13). 'Thus, a household coping mechanism is a way of solving the problems within the availability of its resources. Coping mechanisms is primarily developed to protect and regain from losses or damages from the effect of the flood hazard (Ellis, 1998, p. 13). In order to mitigate against the effects of the floods, it is important to look at the enabling environment provided by institutions and polices in which these resources/assets are utilized to achieve livelihood outcomes. Thus, the study looks at the role and responsibilities of the National Disaster Management Organisation (NADMO) in the management of disasters in Ghana. Specifically, it looks at role played by NADMO and various institutions in providing support to these communities to

ameliorate their plight and build their resilience. Building the capacity of communities to be resilient would sustain and improve their livelihood opportunities in the face of perennial floods. This approach gives a broader framework for analysing the complexities of development in Weija community.

Conceptual framework of dam spillage

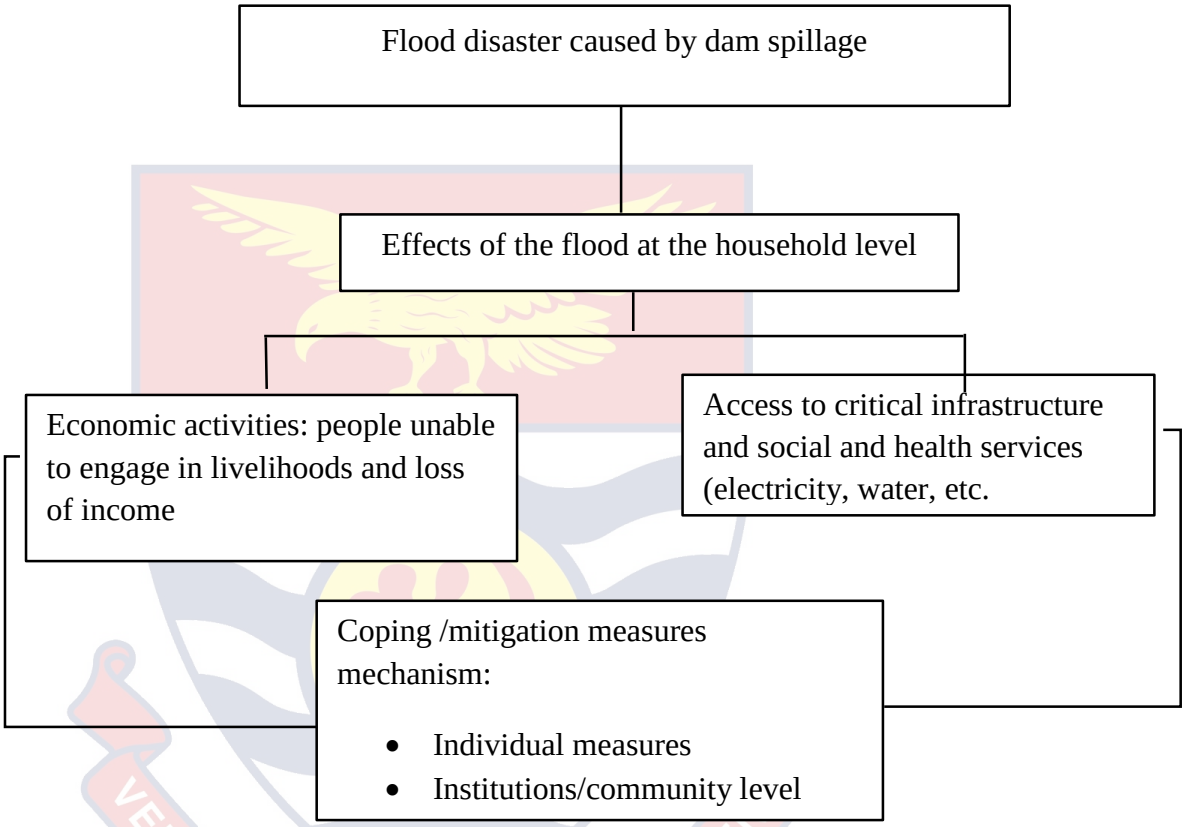

Figure 1: Conceptual Framework

Source: Author's Construct (2020)

In conclusion, the Chapter has delved into causes and effects of floods on the livelihood of people and showed that the poor bear the brunt of flood disaster. It also provided evidence in the literature that the flood disaster would continue to grow as a result of climate change and that there is a need to put mitigating measures to protect lives and properties. This would help the world achieve the Sustainable Development Goals by tackling the root causes of inequalities by building the resilience and helping the poor and the vulnerable to recover from flood disasters. The study thus employed the livelihood framework

to uncover the effects of floods at the household level. The next chapter would delve into the background of the study area and presents research methods to study the impact of floods on the livelihood of communities living in Weija.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter discusses and presents an overview of the methodology and strategies developed and adopted in the research. It describes the methods and processes necessary to carry out the study. It further provides research methods employed in the attainment of the research objectives. Furthermore, the issues of the research design, sampling techniques and size, data collection methods and tools used for analysis are discussed. Additionally, it looks at the various ethical issues to ensure that respondents were not exposed to unnecessary stress or manipulation or personal risk.

3.2 Study Area and Climate

The field work was conducted in Weija in the Ga South Municipal of the Greater Accra Region (see Figure 2). The Weija town was selected because it has been experiencing perennial floods over the years. According to the 2010 Population and Housing Census, it has a population of about 411,377 inhabitants (GSS, 2010). Weija has become one of the commercial towns in the Municipal due to the construction of the ultra-modern shopping centre, the West Hills mall. Communities such as Tetegu, Oblogo, Pambros Salt, Lower McCarthy Hill, Weija, Bojo Beach and Ada Kokpe have been inundated, while others, including Glefe and Opetekwei, are also seriously affected (Arhinful, 2020). Weija is within the coastal savannah and experiences a mean annual rainfall of 846 mm with mean daily temperature of 26^{o}C (GSS, 2019). Weija experiences heavy rains from mid-April to mid-September every year and causes the community to flood. Flooding become severe when the dam is spilled submerging farmlands,

washing away farm produce as well as affecting domestic animals and sometimes human lives and personal properties. The residents over the years have refused to adhere to several warnings to evacuate the area, since they are located on a water course and in areas that serve as buffer.

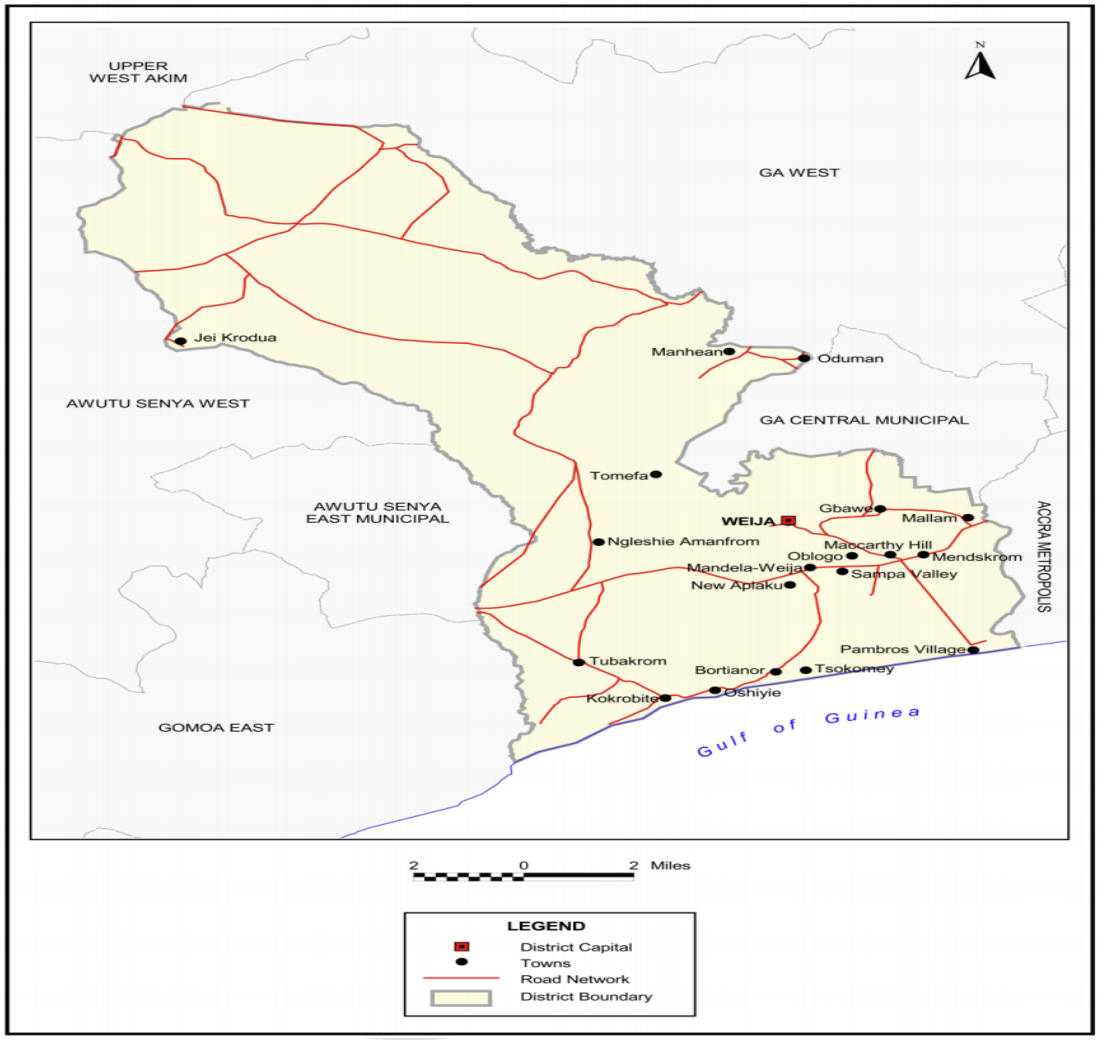

Figure 2: Shows Map of Weija in the Ga South Municipal Assembly

Source: Ghana Statistical Service (2019).

3.3 Research Design

The study employed mixed method approach in collecting primary data. These are qualitative and quantitative approaches. The proponent of the quantitative approaches argued that quantitative data tends to be rigorous, credible, and scientific while the qualitative proponents counter this by arguing that their data is sensitive, nuanced, detailed, and contextual. Both approaches are not only complementary but are often two sides of the same coin (Trochim, 2000). To this end, this study employed both approaches to benefit from the advantages of sample surveys and statistical methods (quantification, representativeness, and attribution) and the advantages of the qualitative approach. The study used personal interviews/conversation to gain deeper understanding and explored people's thoughts and feelings to obtain detailed information about the effects of the flood on their livelihoods. This served as additional source of information to corroborate the findings generated by the survey (Trochim, 2000).

3.4 Target Population

The targeted population of this research was Weija town within the following suburbs: Weija Away, Ashbread, Mandela, Riverside, New Weija, and SCC. The people in these suburbs are within the flood prone parts of Weija town. This enabled the researcher to obtain relevant information pertaining to the vulnerability, and the coping mechanisms of the affected persons.

3.5 Type and Sources of Data

Primary data was used to obtain relevant information pertaining to this research. Primary data was obtained from the researcher's field activity. This was based on personal observation and conversation with people affected, and

the use of questionnaires. Secondary data from published journals were used to complement the data collected through survey.

3.6 Sampling Design

3.6.1 Sampling Procedure and Sample Size

The researcher employed two-stage sampling technique to select respondents for the study. First, the suburbs experiencing the brunt of the flood from the water spillage were listed and selected using simple random sampling. Due to the population size of each suburb and the magnitude of the flood impact, the suburbs were stratified into two main groups according to the population size and extent of the flood. These are the high risk and the low risk affected areas. The high risk affected, and highly populated area was Weija Away suburb while the low risk/low population density areas were Ashbread, Mandela, New Mandela, New Weija, Riverside, and SCC suburbs. The researcher assigned sample size for each stratum. A total of 97 sample size was drawn from Weija Away (high populated and high risk) while 23 was drawn from the other suburbs (low risk less densely populated areas).

The number of houses in each stratum was estimated with support from the local authorities. The first house was chosen randomly and then visited the subsequent house based on the frequency of the houses that needed to be sampled. In a house with more than one household, a simple random sampling (using the lottery method) was employed to select a household for interview. In all, 120 sample size was drawn from the six suburbs. Since the population within the flood prone areas are homogenous, a sample size of 120 was considered adequate to draw meaningful conclusion.

3.6.2 Data Collection Instruments

Semi-structured questionnaire and face-to-face interview was used as instruments for the collection of data on the assessment of the effects of floods. Questionnaires focused on the flood victims and how they managed on their own to cope with the disaster or how the help they received alleviated their suffering. The questionnaire focused on the following thematic areas: Demography; Opinion of respondents on the causes of floods; Level of preparedness in anticipation of a flood Impact of flooding on the people of Weija; and Coping mechanisms of the people when a flood occurs.

The study planned using Focus Group Discussions as an additional tool to explore additional information related to the effects of floods in Weija. However, due to the COVID-19 pandemic, the researcher could not employ the Focus Group Discussion tool. Nevertheless, personal interview was used to further gather additional information that the questionnaire failed to capture particularly on how the people cope with floods.

3.6.3 Pretesting of Instrument

Ten (10) flood victims were selected for the pretesting of the questionnaire. This afforded the opportunity to rectify likely challenges that resulted from some of the questions. The questions were rectified and realigned to enable the respondents understand them better.

3.7 Ethical issues

Research into the issue of post-floods effects on people requires the researcher to think carefully about the ethics of research, about actions of the Research Assistants and the survey team. One of the basic tenets is that respondents/subjects should have their privacy protected through the practice of

informed consent. Furthermore, respondents should not be exposed to unnecessary stress or manipulation or personal risk. The researcher is also responsible for preserving the confidentiality of any information that could identify the subjects. In conducting this study, the researcher anticipated the emotional and psychological trauma that could be triggered by certain questions particularly on post-floods effects, which are normally negative. To this end, respondents were asked if they were comfortable to talk about their post-flood experiences. Those who were willing to share their experiences were included in this study. Again, the team was cautious of their research activities not to cause people to believe that their participation in this research would lead to financial reward and that the research was purely academic exercise. The beneficiaries were assured of the confidentiality of the information received.

3.8 Data Analysis

As stated earlier, mixed method was used to collect primary data. The questionnaire was used for collecting quantitative data and this was supported with in-depth interview at the household level. The questionnaires were checked for consistency and completeness. Open-ended questions were categorised and coded for easy entry into Microsoft Excel. The data was then exported to Statistical Package for the Social Sciences (SPSS) for analysis. The data were analysed at various levels: descriptive as well as bivariate levels. The data was presented using Tables and Graphs. In order to address the objectives of the research, the data were analysed based on the objectives of the study as follows:

Objective One

The objective was to access the impact of flooding on the people of Weija. The data collected were categorical data measuring the impact of the

floods on their properties. Frequency Tables were generated, and attempt was made to establish relationship between the impact of the flood and the socio-demographic background. Additional data were collected through in-depth interviews capturing the impact on their economic activities, disruption of social and health services.

Objective Two

This objective accessed the level of preparedness in anticipation of a flood and early warning systems available at the community level. The key questions were categorical in nature. Thus, frequency tables were generated, and further analysis was performed to identify association between the variables and the level of preparedness and the socio-demographic background of the respondents.

Objective Two

This objective looked at the strategies put in place in dealing with the flood situation. This was analysed based on the individual ability to put measures in place to deal with the flood situation and the institutional arrangements and support systems to help people in recovery and building resilience. The data were open-ended and categorical data while some were multiple responses in nature. As stated earlier, the open-ended questions were coded based on the key themes emerged from listing all the responses.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

The purpose of this study was to examine the effects of perennial flood on the livelihoods of people in Weija. Additionally, the study identified the level of preparedness prior to the flood and post flood coping mechanisms of the people affected by floods in Weija. This Chapter presents and discusses the field data collected in September 2020 in Weija on the subject under research. It looks at the socio-demographic background, level of preparedness, effect of the flood and the coping/adaptation mechanisms employed by the people during the duration of flood. It must be stated that an attempt was made to compare results based on the population and extent of floods in Weija town as identified in the sampling procedure. The analysis, however, revealed no significant differences in these two categorizations and this attempt was rather made to compare the results based on gender.

4.2 Socio-demographic Background

This section looks at the socio-demographic background of the people affected by floods in Weija. It looks at gender, age, educational level, religious affiliation, and marital status of the respondents. These variables provided basis for understanding the vulnerability context within which the flood occurs. Attempt was made to use gender lens to understand how women and children are disadvantaged when natural disaster occurs.

4.2.1 Sex of the Respondents

The field data analysis revealed that 78% of the respondents were women while men represented 22% as indicated in Figure 3.

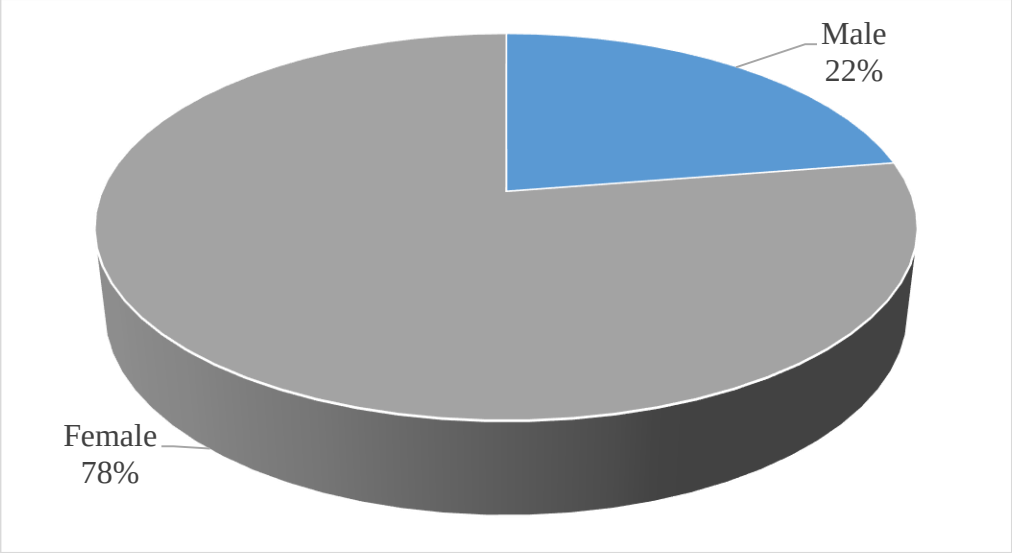

Figure 3: Sex of the Respondents

Source: Field Survey (2020)

However, the 2010 Population and Housing Census Analytical Report for Ga South Municipal paints a different picture. The data shows females represent 51.1% while the male population accounts for 48.9% (GSS, 2014). This shows that women are disproportionately affected by the flood in Weija. This corroborates with the findings by Hamidazada *et. al.*, (2019) which revealed that in most world's natural disasters, more females are impacted than males.

4.2.2 Age Distribution of the Respondents

The study revealed that most (98%) of the respondents were within the economically active age bracket (20-59 years) as shown in Table 1.

Table 1: Age Distribution of the Respondents

Age Group	Frequency	Percent
20-29	17	14.2
30-39	39	32.5
40-49	45	37.5
50-59	17	14.2
60-69	2	1.7
Total	120	100

Source: Field Survey (2020)

The findings of the study are in consonance with the Population and Housing Census Analytical Report for Ga South Municipal, which shows a steady decline in dependency ratio in Ghana (GSS, 2014) implying that the number of persons in the active age group is increasing compared to those in the dependent group. This shows that the number of people affected by the floods were mostly those in economic active group.

4.2.3 Educational level of Respondents

The study revealed that 70.8% have had education while 29.2% have had no formal education as indicated in Figure 4. It was revealed that majority (37.5%) of the respondents had completed Junior High School while 20% had completed Secondary school education.

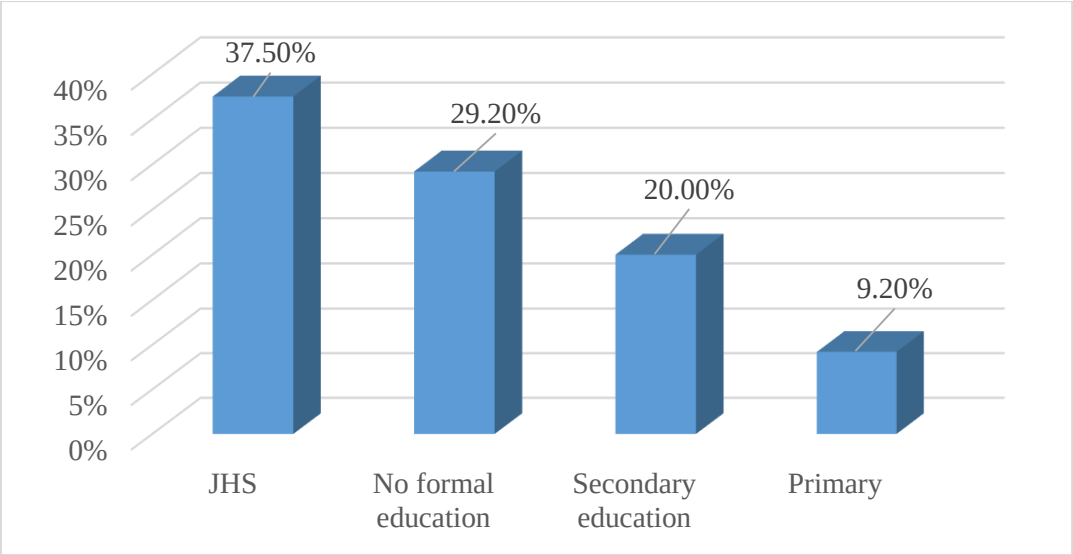

Figure 4: Educational Attainment of the Respondents

Source: Field Survey (2020)

Education plays a vital role in equipping individuals with knowledge and skills to adapt to their environment and contribute to the overall socio-economic development of the country. In Ga South Municipal, 14.5% have had only up to primary education, 20.8% have had basic education while 13.4% had completed SSS/SHS, and one-tenth (10.0%) completed. In general, the people living in the flood prone areas in Weija had lower educational level than the data presented by the Ghana Statistical Service in the Population and Housing Census Analytical Report for Ga South Municipal (GSS, 2014) as none of the respondents in this current research have had post-secondary education.

4.2.4 Religious Affiliation of the Respondents

From the study, it was realised that Weija community is predominately Christian constituting 89% of the respondents while 10% were affiliated to the Islamic religion. Other religion constituted 1.0% (see Figure 5).

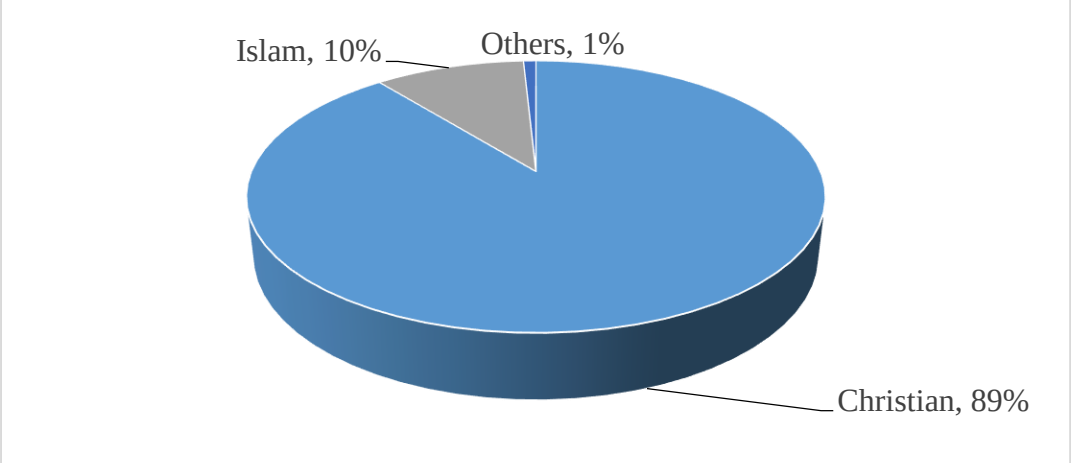

Figure 5: Religious Affiliation of the Respondent

Source: Field Survey (2020)

According to Ghana Statistical Service (2014), 84.6% of the population are considered Christians. Islam constitutes 8.8% while other religions constitute 1.0%. Traditional religion account for 3.5 while other religions constitute 0.2%.

4.2.5 Occupation of the Respondents

The data revealed that most (95%) of the respondents were employed within the informal sector while 5% were employed in the formal sector (see Table 2). About 61% were traders while 17% were artisans. Additionally, 17% were into farming/fishing. Further analysis revealed that proportion of women who were into trading were more than that of men. The occupation of the respondents shows that their income levels were relatively low.

Table 2: Occupation and Gender of the Respondents

Occupation	Female	Male	Total
Trader	69.89%	29.63%	60.83%
Artisan	16.13%	18.52%	16.67%
Farmer	5.38%	22.22%	9.17%
Fisherman	5.38%	18.52%	8.33%
Others	3.23%	11.11%	5.00%
Total	100.00%	100.00%	100.00%

Source: Field Survey (2020)

4.2.6 Marital Status and Number of Children

The data shows that most (57%) of the respondents were married, 28% were single, 9% were divorced while 6% lost their spouse. The maximum number of children per household was 11 while the minimum was 0 with an average of 2.53. It was realized that respondents who were divorced had the highest number of children as shown in Figure 6.

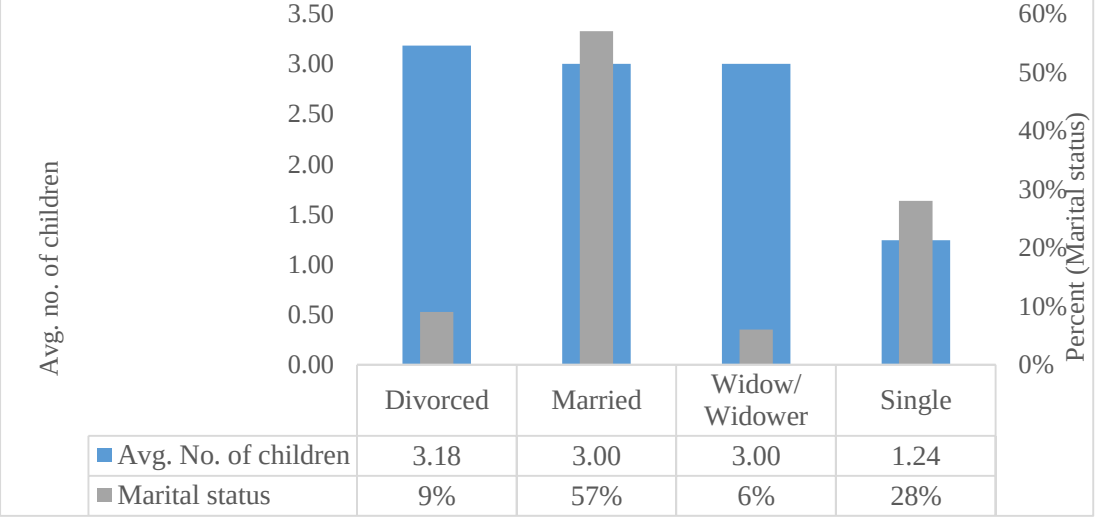

Figure 6: Marital Status and the Number of Children

Source: Field Survey (2020)

Children in these flood prone areas are susceptible to water borne infections and malaria. Their education could be compromised. Thus, there is a

need for the Department of Social Welfare to regularly visit these flood prone areas in order to design psychosocial support programmes aim at addressing physical and mental wellbeing of the children in the flood prone areas.

4.3 Causes of Flood in Weija

From the data collected, it was revealed that 81% of the respondents believed that the cause of flood is due to the Weija dam spillage as shown in Figure 7. The data further shows that 14% opined that the flood is as a result of heavy rains while 5% indicated that it is an act of God.

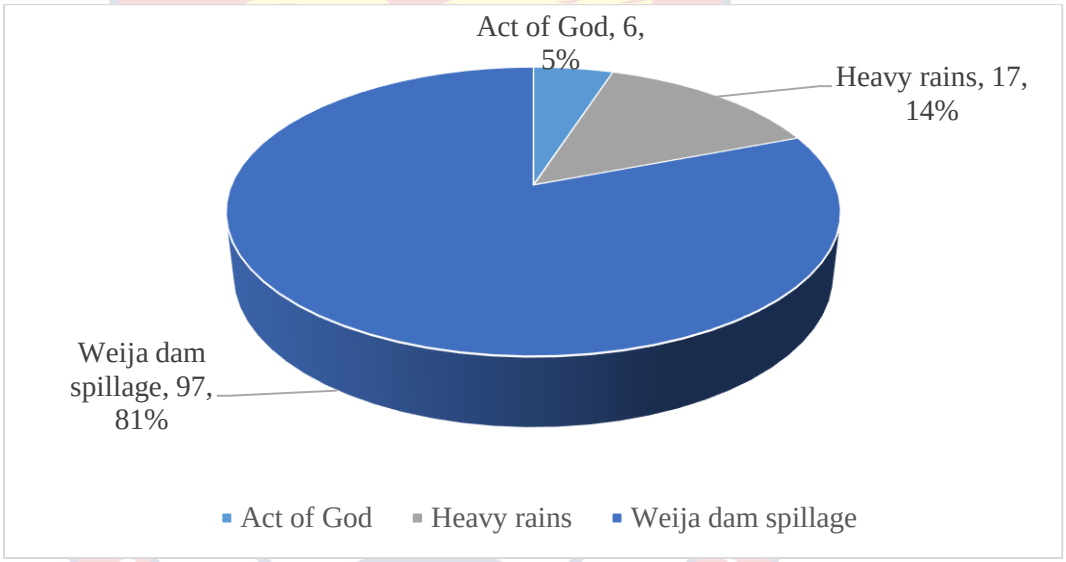

Figure 7: Causes of Flooding

Source: Field Survey (2020)

The anthropogenic activities constitute the main contributory factor to the flood magnitude for any level of precipitation causing considerable damage to properties and loss of lives of flood prone areas in the Weija community (Kundzewicz, 2013).

According to Kuma *et al* (2008), precipitation within the Weija dam's catchment area has decreased by 0.93%. There is, however, a reduction of the volume capacity of the dam due to anthropogenic activities causing siltation of the dam.

This undoubtedly contributed to the frequency of spillage causing damage to property and loss of human lives and human suffering. Thus, the main factors responsible for the floods beside the occasional spillage of the dam are: socio-economic changes due to population growth and economic development in flood-prone areas as well as land-use change and changing perceptions of risk; and increase in the frequency of heavy precipitation as a result of climate change (Kundzewicz, 2013).

According to Schmuck and Hanna (2000), those who are more religious, among Muslims and Christians, have a fatalistic behaviour when they experience hazardous situations as they believe that these disastrous are only befalling with knowledge of god. However, the study shows that only 5% believed that the perennial flooding is an act of God.

4.3.1 Duration of Flood Caused by Spillage

As indicated in Table 3, majority (75%) of the respondents indicated that the flood normally lasts between one to two weeks. The remaining 25% indicated it could last for more than two weeks. While floodwater takes time to dry out, there could be overflow of human excrement from latrines, which runs into the street and possible into homes and drinking water sources. This may lead to outbreaks of cholera and diarrheal diseases. According to the Ga South Municipal Assembly Environmental Health Department, floodwater may also contain E. coli and heavy metals and other infectious organisms, including intestinal bacteria such as salmonella and agents of typhoid and paratyphoid. Stagnant floodwater could also serve as breeding grounds for mosquitoes causing malaria. The duration of the flood also affects economic activities and impede access to other services such as health, education, electricity etc.

Governments and Non-Governmental Organizations (NGOs) continue to provide support to the victims to enable them cope and recover from the flood.

Table 3: Perceived Flood Duration

Duration of Flood	Frequency	Percent
One week	41	34.2
Two weeks	49	40.8
Three weeks	19	15.8
Four weeks	9	7.5
Others	2	1.7
Total	120	100

Source: Field Survey (2020)

The section discusses the three main objectives:

a) Assessment of the impact of flooding on the people of Weija

b) Assessment level of preparedness in anticipation of a flood

c) Examines the coping mechanisms of the people when a flood occurs.

4.4 Impact of Flooding on the People of Weija

Floods have deleterious social and economic consequences to communities and individuals. Although the local authorities have issued stern warning and continue to destroy unauthorized settlements especially around waterways and wetlands, new structures continue to spring up every day. The immediate impacts of flooding include loss of human life, damage to property, destruction of crops, loss of livestock, and deterioration of health conditions owing to waterborne diseases. The analysis of the effects of the flood on the people of Weija was done within the livelihood framework. People eke out their living in the context of vulnerability. Within this context, the people living in the flood prone areas of Weija have various assets that allow them to achieve

livelihood outcomes. Achievement of the livelihood outcomes such as health, education is derived from the social and institutional environment. Lack of access to these assets (social, physical, financial, human, and natural assets) would increase their vulnerability. Flood disaster as a result of the spillage of the dam constitutes external risk factors which the people within the flood prone are subjected to. It is, therefore, important to understand the vulnerability context within which the flood affected people pursue their livelihoods.

4.4.1 Vulnerability Context

The livelihood framework identified the risks factors within which the population pursue their livelihoods and thus achieve the overall livelihood outcomes. The perennial flood within the Weija town has been identified as one of the main natural risk factors that act as a threat to their livelihoods. According to UN Women Watch, women and children were disproportionally affected by the impact of the floods. The results of the study showed that 77.5% of the respondents were women. Also, the study area accommodates people with low educational attainment, and this has direct relationship with their income levels. The highest educational attainment of most of the respondents was Junior High School.

Most of the respondents lived in informal settlements and worked in the informal sector (artisans and traders), which affect their earnings and thus their ability to relocate to a better residential area. It is believed that rural urban migration accounts for the springing up of informal settlements in the urban areas. According to Kundzewicz (2013), the hope of overcoming poverty drives poor people to migrate to informal settlements, which have previously been left uninhabited on purpose because effective flood protection cannot be assured.

When the respondents were asked about the group, they considered vulnerable, the data showed that 73% of the respondents said women and children were the most vulnerable group when flood occurs (see Figure 8). This is because women take the social/traditional role of taking care of children and would always want to protect their children. Moreover, the challenge of providing potable water for cooking as a productive role of women puts them at risk more as they would have to walk longer distances to find such for the welfare of their families.

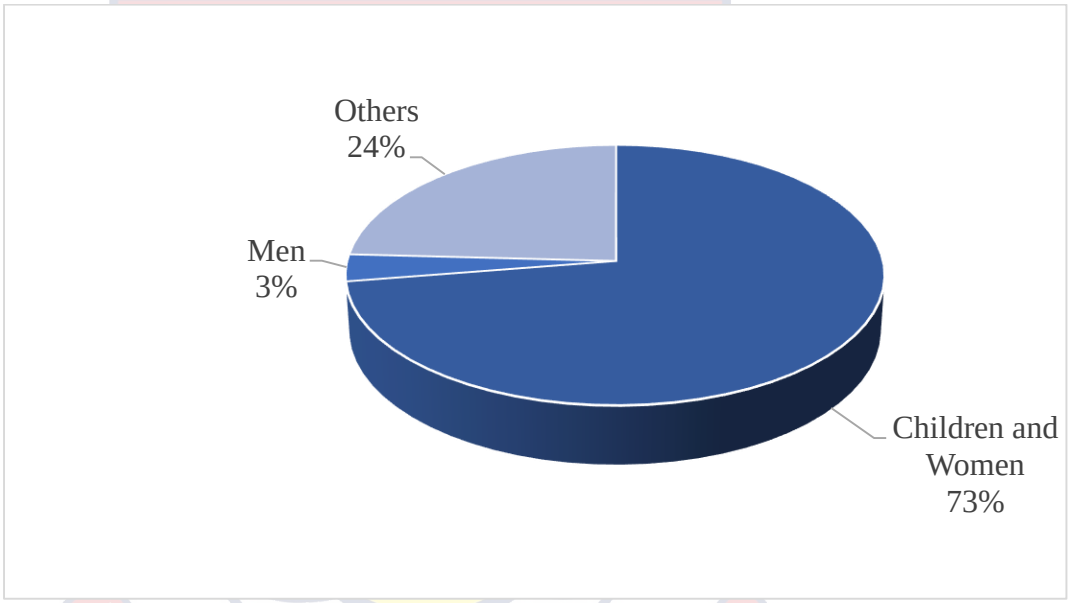

Figure 8: Vulnerable Groups Affected by the Flood

Source: Field Survey (2020)

4.4.2 Effects of the Flood on Economic Activities

As indicated earlier, more than 90% working in the informal sector as traders and artisans with less than 10% working in the formal sector. It was realised that the agricultural activities have dwindled due to the pressure on the land for new settlements which has further blocked waterways. Farmers' crops are submerged during the floods. The in-depth interview revealed that Artisans and traders are unable to continue their work during the duration of the floods which could continue up to four weeks. Women traders and artisans who

constitute 90% and earn daily wage are mostly affected. The in-depth interview also revealed that due to poor road network in the communities, roads and bridges are often damaged, which disrupts economic activities within the duration of the flood. Similarly, the direct effect on production assets, be it in agriculture or industry, inhibit activity and lead to loss of livelihoods. The spill over effects of the loss of livelihoods can be felt in business and commercial activities even in adjacent non-flooded areas.

4.4.3 Human Lives and Property

The devastating perennial floods in the Municipality often result in loss of life and damages to personal property and undetermined value of critical public infrastructure. The research revealed that 10% of the respondents reported loss of relatives through the flood (see Figure 9).

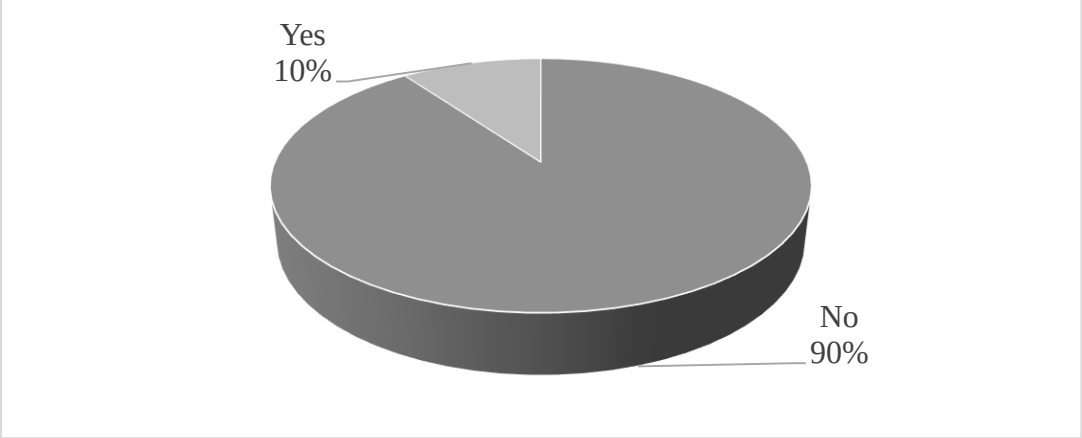

Figure 9: Respondents Who Reported Loss of Relatives through the Flood

Source: Field Survey (2020)

Some of the residents in the affected community the researcher talked to showed that the flood has caused damage to infrastructure including access to essential services such as access to clean and safe water, electricity, transport, communication, education and health care services. In addition to the loss of

public infrastructure, the study revealed that personal properties of 58% of the respondents were damaged through flood. These included house and household items such as mattress, television, livestock fridge, farm produce, cell phone and room furniture as indicated in Table 4.

Table 4: Loss of Properties by the flood (Multiple Response)

Type of Property	Number	Percent
Mattress	33	28%
Television	28	23%
House	21	18%
Domestic animals	17	14%
Fridge	9	8%
Farms	8	7%
Food	7	6%
Cell phone	2	2%
Furniture	1	1%

Source: Field Survey (2020)

4.4.4 Education and Health

Natural disasters affect children's education reducing learning hours considerably which invariably lead to poor academic performance. Personal interview conducted revealed that children are sometimes unable to go to school not only due to collapse of school building but due to ill health. Parents thus face multiple crisis; taking care of their children and at the same time trying to recover from the disaster. This could have long term effects on the children's education and health (Alderman, Hoddinott, & Kinsey, 2006). From the personal interview with some of the households, the loss of property and the need to recover from the disaster affect investment of children's education as expenditures are more focused on recovery needs.

The impact of flood on health of the victims cannot be over emphasized. Victims are traumatized which leaves a long-term health implication. Health

effects observed during the research included infections and outbreak of cholera and typhoid. According to Songsore (2017), the health conditions suffered by the poor could be attributed to disaster risk such as flood. Using flood disaster events from 2014 to 2015, he observed that the outbreak of cholera in many parts of Accra including Weija was as a result of floods. During the personal interviews at the household level, it was revealed that communities affected by the flood experienced disruptions of services such as safe drinking water which increases health risk through water contamination. The loss of loved ones can generate deep impacts, especially on children. Displacement from one's home, loss of property and livelihoods and disruption of economic and social activities can cause continuing stress. The stress of overcoming these losses can be overwhelming and produce lasting psychological impacts.

4.5 Level of Preparedness in Anticipation of a Flood

Flood forecasts, warnings and responses are critical components of modern flood preparedness systems. Early warning and forecast could be categorized under non-structural flood protection measures aimed at saving lives and reducing material losses and human suffering (Kundzewicz, 2013). Beside the spillage of the dam, Weija community experiences flash floods. Thus, the topographical nature of Weija community, the time lag between an intense precipitation and the resulting river flood peak is very short making it too late for a useful flood forecast (Kundzewicz, 2013). Nigg (1995) articulates clearly the two basic functions of any warning systems must fulfil: assessment (from the moment that a specific hazard is detected to the point when a risk message is developed for the threatened locality); and dissemination (issuing and transmitting the warning message to a target audience).

Although the warning system is not well developed to assess the risks levels of the Weija community, the dissemination of information of any spillage by the Ghana Water Company is through the FM radio. According Gadzekpo (2005), FM radio has been the most-used reception platform, with 82% of the population receiving radio via over 96 FM stations across the country. It was not surprising that 55% of the respondents said they relied on FM radio stations for information on impending Weija dam spillage as indicated in Table 5. Over 30 % of the respondents received information from the National Disaster Management Organization (NADMO) while 15% of the respondents relied on community leaders, assemblyman, and personal interactions for information regarding impending dam spillage. It was realised that more men than women had access to information from community leaders while women relied mainly on radio stations.

Table 5 Sources of Spillage Information to Respondents

	Male		Female		All	
	Freq	Percent	Freq	Percent	Freq	Percent
NADMO	9	33.3%	28	30.1%	37	30.1%
Assemblyman	0	0.0%	4	4.3%	4	4.3%
Community leaders	4	14.8%	5	5.4%	9	5.4%
Others	0	0.0%	5	5.4%	5	5.4%
Radio news	14	51.9%	51	54.8%	65	54.8%
Total	27	100.0%	93	100.0%	120	100.0%

Source: Field Survey (2020)

4.6 Mitigation and Coping Mechanism of the Residents of Weija

The study examined the strategies put in place in dealing with the flood situation by the households who are affected by the flood in Weija town. The

spillage induced flooding in the town has become an annual ritual. Hence, many households have developed mitigation and coping mechanisms to deal with the situation.

4.6.1 Flood Mitigation and Management

The development of early warning systems would help reduce damage caused by the flood disaster by analysing and predicting the risks. It also reduces the vulnerability of people by improving preparedness, enabling flood-prone communities to better adapt and respond. A study by the World Bank predicts increase in frequency and severity of floods in Ghana due to climate change (World Bank, 2011). Thus, there is a need to identify innovative ways and strategies to control and manage flood risk in Ghana particularly in the study area.

The National Disaster Management Organization (NADMO) has zoned and identified the area as flood prone zone. However, during the in-depth interview discussions with some of the household affected by the flood, it was found that construction of flood related infrastructure has not been implemented. Land-use planning and preventing unsuitable development in the flood plains is yet to be implemented as more and more lands are being sold to private developers for the construction of new settlements. The study revealed that 82% of the respondents have been informed by NADMO through the media the need to relocate and move to safer place. However, these warnings have gone unheeded.

NADMO and other Non-Governmental Organizations have been supplying relief items to the household affected by the flood to reduce human suffering. It was revealed during the in-depth interview that the Municipal

Assembly normally reconstruct damage places after the flood. However, long-term solutions have not been instituted to curtail the level of damage and human suffering caused by the floods on annual basis. This corroborates the assertion by Wisner (2001, cited in Norris *et al*., 2007) that the process of mitigation in developing countries often failed to address the "root causes of disaster vulnerability, namely, the social, economic and political marginality of the population and environmental degradation".

From the perspective of the respondents, most (88% of respondents) believed that the spillage can be curtailed if the Weija dam is desilted to increase the dam's capacity (see Figure 10). This view corroborates with a study by Kuma *et al.,* (2008), which shows that there is reduction of the total volume of the dam as a result of siltation caused by farming activities and construction of new settlements. About 9% were of the view that people should move to higher grounds while about 3% recommended the need for farmers to stop farming along the banks of the dam.

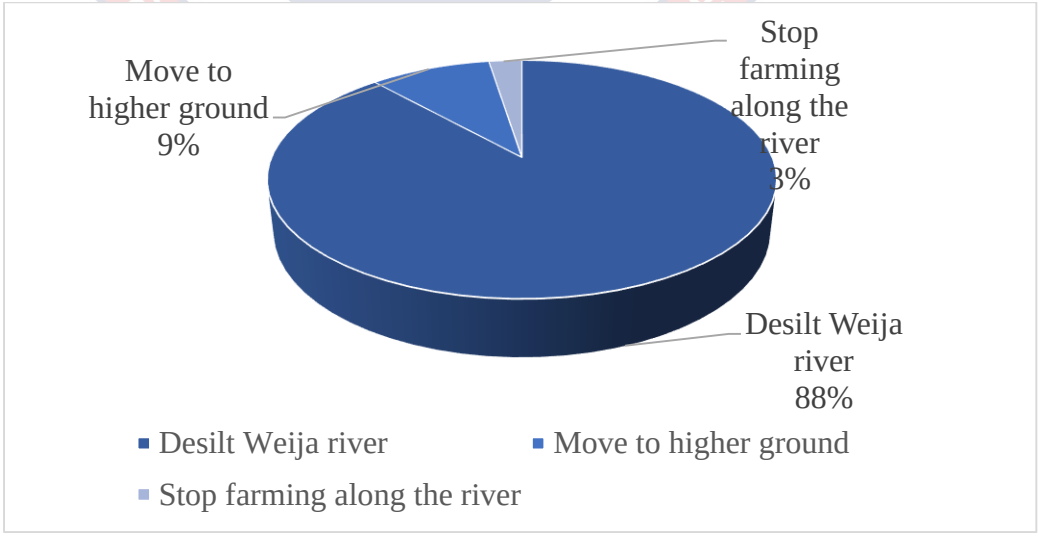

Figure 10: Perception of how to Manage Floods in Weija by Respondents

Source: Field Survey (2020)

According to most of the respondents (80%) installation of early warning systems would be one of the best ways to inform residents of the spillage managing the spillage while 10% believed that early sensitization of the flood could help reduce the effects of the flood caused by the spillage. Others (10%) believed that developing alternate coping mechanisms would help build resilience and adapt to the environment (see Table 6).

Table 6: Management of Weija Dam Spillage

Management of the spillage	Frequency	Percent
Alternative coping mechanism	12	10
Early flood sensitization	12	10
Early warning systems	96	80
Total	120	100

Source: Field Survey (2020)

Many households have resorted to structural mitigating measures by elevating their structures with stones and sandbags, and strengthening walls, constructing drains and pumping water out during flooding events (Attipoe, 2015). The findings of the study corroborate with the study by Owusu-Ansah *et al*., (2018) on the coping strategies by households affected by flood in the Weija town. However, these measures have not been able to save the situation leading to loss of property by the households. To this end, they resort to their social and family networks.

4.6.2 Coping Mechanisms of the Residents

The study showed the family support systems and social networks cushion the affected people to better cope and recover from the flood's impact.

About 88% of the respondents relied on family and friends when there is incidence of floods (see Figure 11). Additionally, some respondents mentioned that churches, Non-Governmental Organizations (NGOs) and government organizations extended support to enable them to cope and recover from the impact of the flood.

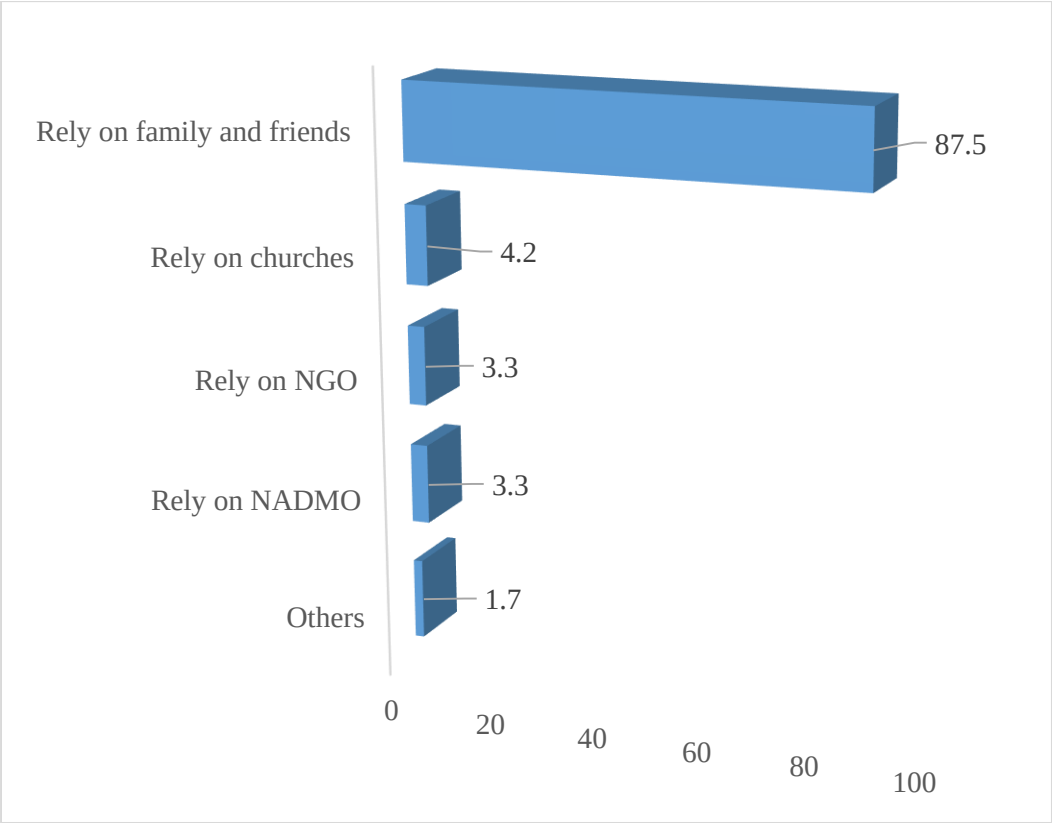

Figure 11: Post Flood Coping Mechanisms

Source: Field Survey (2020)

Further analysis shows few (24.17%) of the respondents acknowledged receipt of support from the National Disaster Management Organization (NADMO), churches, and Non-Governmental Organizations (NGOs). In responding to the devastating floods, the Government of Ghana through the National Disaster Management Organisation (NADMO) provides relief assistance to the most affected people including immediate food supplies, drinking water, and other life-saving items to reduce the deleterious impact on the vulnerable segments of the population. The supports were life jacket, food items including rice and oil, mosquito nets, mattresses, television as indicated in Figure 12.

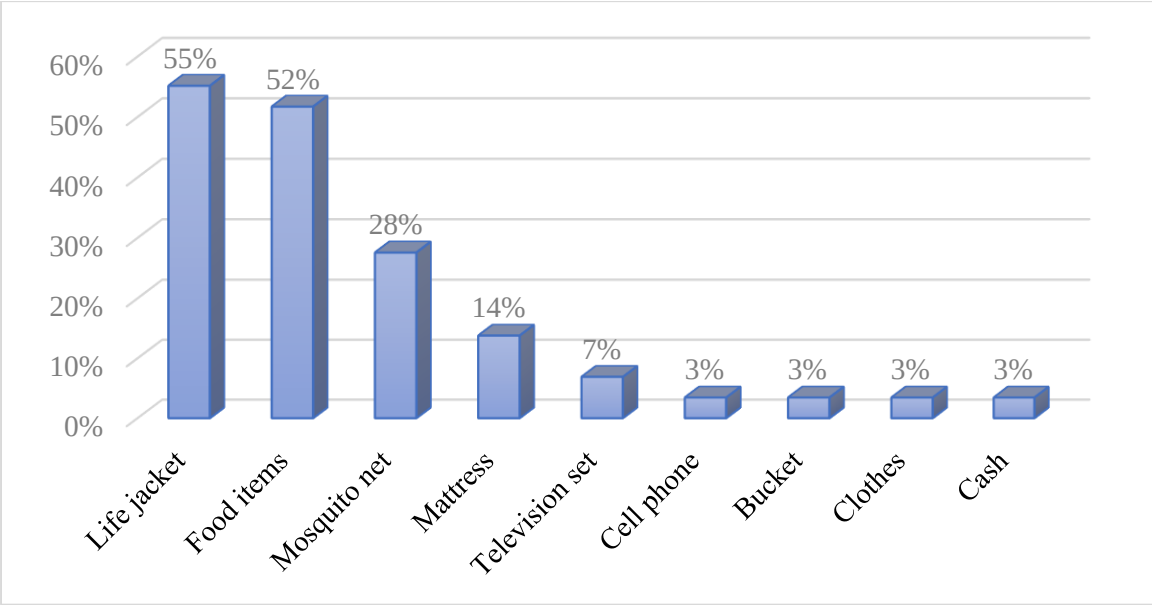

Figure 12: Material Support received from Institutions (Multiple Response)

Source: Field Survey (2020)

The study shows that 81% of the respondents said the National Disaster Management Organisation (NADMO) represents the main institution that provides support to the people affected by floods in the town (see Figure 13). The rest were media, religious organizations, and Ghana Water Company. They have been providing services to the communities allowing them to anticipate and prepare ahead of time. However, more than 70% of the respondents believed that the services are not effective.

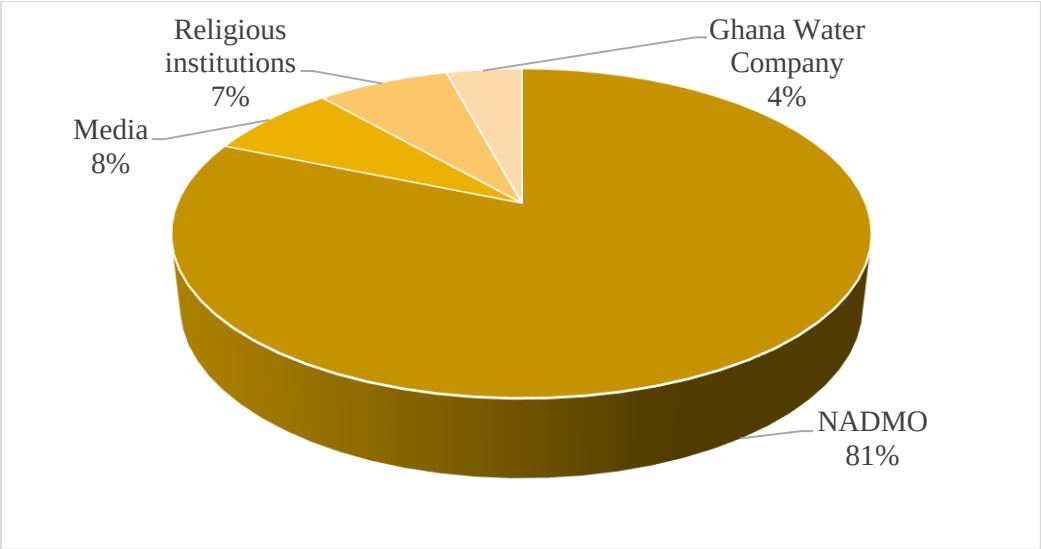

Figure 13: Institutions Providing Post-Flood Support Services

Source: Field Survey (2020)

Personal conversation with some of the people indicated that those affected by the floods were looking for permanent solution to the flood problem. It is, therefore, important to identify preventive rather than corrective measures to effectively mitigate flood disasters in these vulnerable communities. However, they were not ready to bear the consequences of demolition of structures obstructing the flow of the water. The study also looked at the level of preparedness at the individual level. The study shows that the preparedness at the individual level was abysmally poor and there is overreliance of public systems especially National Disaster Management Organisation (NADMO) to provide post-flood support and help them to recover from the flood disaster. The annual ritual support system would rather perpetuate dependency rather than building individual and community resilience.

The chapter discussed the findings of the study looking at the socio-economic background of the respondents and how they are affected by the floods as well as their coping mechanism. The socio-economic background of the respondents

shows that there would be a need for Government to develop more permanent solution that would enhance community resilience rather than handing over handouts making the people more dependent on humanitarian aid.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The study focused on the effects of spillage induced flood on the people of Weija in the Ga South Municipality of the Greater Accra Region of Ghana. The annual occurrence of floods and its effects on the livelihood of the people of Weija has brought to the fore the need to build resilient community to reduce human suffering.

The study employed mixed methods of quantitative and qualitative research approaches to collect primary data using multi-stage sampling technique to select 120 flood victims for the study. The data was analysed using Statistical Package for the Social Sciences (SPSS) and Microsoft Excel software. The data analysis revealed that informal settlements in the waterways have further increase the magnitude of the floods affecting human lives and properties. The flood prone areas are mostly informal settlements occupied by 90% of people working in the informal sector with relatively low level of education. Their attempts to escape poverty and seek opportunities in the urban areas has forced people to migrate to settle in areas that pose risk to human life. Due to their vulnerability, they often succumb to the external shocks which further affect their ability to build on their productive assets and further plunge them into perpetual poverty.

The main cause of the flood is due to anthropogenic activities causing siltation of the dam which has affected the original dam volume. The local institutions are unable to enforce building permits regulations and ensure safety of residents due to land tenure system which allows the traditional authorities

and families to sell land to property developers. With the construction of West Hill ultra-modern shopping mall, the area continues to attract new settlements, and this would further put pressure on the already fragile ecosystem. The flood has caused damage to infrastructure as well as loss of human lives. The livelihoods of the people are affected including their ability to earn income to support their families. Their ability to achieve their livelihood outcomes are compromised as their children's education and health status of the entire household are affected during the flood period. Women and children bear the brunt of post flood impact. Children would have to stay home up to 4 weeks affecting their learning.

The family and social networks provide safety nets for the vulnerable in these flood prone areas to cope and recover from the effects of the devasting flood. The Government and Non-Governmental organizations play active role in responding to the immediate needs of the flood victims through the provision of relief items such as lifejacket, mosquito nets and other household items. However, long term recovery measures have not been provided leading to the annual flood occurrence in the community. The support of the National Disaster Management Organisation (NADMO) was found to be deficient and the need for effective response to the dangers of disasters by building individual and community resilience.

1. What are the effects of flooding on the people of Weija?
2. What measures do the residents put in place in anticipation of the flood?
3. What are the strategies put in place in dealing with the flood situation?

5.2 Conclusions and Recommendations

Human induced activities, urbanization, and climate change act together to increase the magnitude of floods and its impact on the vulnerable. And it has contributed significantly to the reduction of the overall volume of the dam and thus any heavy rains would cause the operators of the dam to open the spillways in order to save the dam from total collapse.

The spillage induced flood has had deleterious effects on social services and infrastructures that support economic activities in the town. It has had negative effects on the heath as well as children's education. Children's education is hampered whenever the floods occur. Most people living in the flood affected communities work in the informal sector and rely on daily wage. Thus, the floods affected their livelihood. This affects the overall local economy within the Municipality. The loss of relatives of household members has left a deep emotional and psychological scar in the minds of some of the respondents. The high cost of relief items distributed annually to the affected people may adversely impact investment in infrastructure and other development activities in the area and in certain cases may cripple the local economy as recurrent flooding in the Weija may discourage long-term investments by the government and private sector as well.

The households affected by the floods relied on information from NADMO and the media to prepare towards any flood incidence. There are no efficient early warning systems in place to predict rainfall amount that could cause the dam to be spilled of excess water. To this end, the people have put in place coping mechanisms to allow them to manage the floods situation. These include erecting structures to prevent water from entering their homes. However,

these structural measures have not achieved the desired impact. Thus, they relied on their families and social networks to run to a safe place when they anticipate heavy rainfall.

The measures put in place to curtail the floods are ephemeral in nature which do not address the root cause of the floods. These measures include provision of life jackets, food, and other non-food items to the affected households. From the foregoing, the study recommends the following:

- The Municipal Assembly should form collaborative partnership with the Traditional leaders who are the custodians of the land to zone the lands and develop land use planning strategy to safeguard the environment and improve human security in Weija and its environs.
- Additionally, the Ghana Water Company should protect the dam through regular maintenance (desilting) and monitoring to curb unauthorised human activities around the dam.
- Since the impact on the flood disproportionally affect women and children, the Department of Social Welfare should take interest in the children affected by the flood by providing psychosocial support to help in their mental and emotional wellbeing and recovery.
- The National Disaster Management Organisation should install modern weather forecasting technologies as an early warning system to predict more accurate rains that could cause the authorities to spill the excess water. While the pressure is mounting on the local authorities to enforce the land use regulations, it is important for those living in these areas to take personal initiatives themselves to reduce their flood risks.

- Future studies should involve multi-disciplinary research team to identify both social and economic impacts of the flood on both personal and public properties and to come out with medium to long term strategy to reduce the impact of the flood on the Weija community.

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APPENDIX A

QUESTIONNAIRE

PRESBYTERIAN UNIVERSITY COLLEGE, GHANA

FACULTY OF DEVELOPMENT STUDIES

This survey is to gather information to determine the impact of Flooding on livelihood of the people of Weija in the Ga South Municipality of the Greater Accra Region of Ghana. It forms part of the conditions for the award of a Masters' degree the researcher is pursuing. All information gathered would be used solely for academic purpose and the confidentiality and anonymity of respondents are assured.

A. BIO-DATA

1. Sex: Male ( ), Female ( )

2. Age of respondent a) 20-29 b) 30-39 c) 40-49 d) 50-59 e) 60-69

3. MARITAL STATUS: a) Single ( ), b) Married ( ) c) divorce ( ) d) widow/widower ( )

4. Educational level… a) No formal education b) primary c) JHS d) SHS/Vocational/Technical e) others (specify)
……

5. Religious background? a) Christian b) Muslim c) Traditional d) others
……..…

6. How many children do you have? a) 1 b) 2 c) 3 d) 4 e) more than 5 (specify)
…… …….

7. Economic activity? A) Trader b) farmer c) teacher d) hairdresser e) seamstress, other (specify)
……..

B. OPINION OF RESPONDENTS ON THE CAUSES OF FLOODS.

8. Identify the cause of flooding in Weija? a) Heavy rains b) Weija dam spillage

c) Acts of God d) others (specify)

……..……..

9. How do you predict flood occurrence? a) Radio news b) Announcement from NADMO c) From community leaders d) From assemblyman e) others (specify)....

10. Duration of flooding a) One-week b) Two weeks c) Three weeks d) Four weeks e) Others (specify)

……..……

11. What time of the year is your community prone to floods? a) March-April

b) May-June c) July-August d) Sept-Oct e) others (specify)

……

12. How do you think the frequency of floods can be reduced? a) Desilt the Weija river b) Stop farming along the White Volta c) Move to higher grounds

d) Stop the Weija dam spillage e) others (Specify)

……....

13. How do you think floods can be managed effectively in your community? a)

Early warning system b) early flood sensitization c) alternative coping mechanisms d) Others (specify)

…….

C. LEVEL OF PREPAREDNESS IN ANTICIPATION OF A FLOOD.

14. Are there any early warning systems in your community on flood? a) Yes ( )

b) No ( ) c) Sometimes ( )

15. Is NADMO effective when floods occur? a) Yes ( ) b) No ( )

16. Are these measures effective? a) YES ( ) b) No ( )

D. IMPACT OF FLOODING ON THE PEOPLE OF WEIJA

17. Have you witnessed any flood in this community before? a) Yes ( ) b) No ( )

18. Who are the most vulnerable? a) Women b) Children c) Women and Children d) Men e) others (specify)
……

19. Have you lost any relative or loved one before? a) Yes ( ) b) No ( )

20. Have you lost any property during floods? a) Yes b) No ( )

21. Have your farm produce been washed away by floods before? a) Yes ( ) b) No ( )

22. What kind of property were washed away? a) Domestic animals b) Food c) House d) Farms destroyed (e) Others (Specify)
……..…

E. COPING MECHANISMS OF THE PEOPLE WHEN A FLOOD OCCURS

23. What do you do to protect yourself and family when floods occur? a) Rely on NADMO b) Rely on NGOs c) Rely on family and friends (d) Churches e) others (specify)
……..…

24. What support did you receive from any of these institutions? (Name the institution and the items received)……

25. How did these items support you to cope with the disaster situation?

APPENDIX B

QUALITATIVE DATA COLLECTION TOOL

Water Spillage Effects on Residents of Weija, Accra

October 2020

Checklist for Interacting with heads of Households affected by the flood.

Identifiers	
Date of interview	
Interviewer's Name	
Name of Respondent	
Gender	Male/Female
Community	
What are the causes of the flood in your community?	
What are the effects of the flood on: Livelihood	
Children education	
Health	
Community infrastructure	
What have you been doing to reduce the effects of the flood on your household?	

What are the measures put in place by the Municipal Assembly in this community to reduce the impact of the flood?	