# BARRIERS TO FLOOD MITIGATION AMONG HOUSEHOLDS IN ST. MARY, JAMAICA

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**Abstract**

This paper explores factors that impede the implementation of flood mitigation measures by householders in two flood prone communities in St. Mary Jamaica. It reveals that floods impact households in numerous ways, and unearth strategies employed by householders to lessen the negative effects of floods. This paper reports that householders draw on various resources to facilitate their process of implementing flood mitigation measures; however, the implementation of additional resistance and resilience measures is made difficult by a combination of barriers including information and financial barriers.

Key words: Flood Mitigation, Resistance Measures, Resilience Measures, Barriers

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## List of Acronyms

NWA – National Works Agency
ODPEM – Office of Disaster Preparedness and Emergency Management
SDC - Social Development Commission
WRA – Water Resources Authority

# CHAPTER ONE (1) - BACKGROUND

Early flood risk management projects were designed and implemented by government agencies and focused on large-scale structural solutions (e.g. dams and levees) (Bubeck et al. 2012; Bichard and Kazmierczak, 2012; Laska 1986); this strategy evolved over the years to include non-structural, regulatory measures (Laska, 1986); it is important to note that these approaches to flood risk management excluded householders from the process to a great extent (Bubeck, 2012; Laska, 1986) and achieved limited success (Laska, 1986). However, it is now widely acknowledged that flood risk cannot be totally eliminated by public flood mitigation solutions (Osberghaus, 2014 ;Birkholz, 2014; Lopez-Marrero and Yarnal, 2010; Wilby and Rod Keenan, 2012; Paul and Routray, 2010; Wisner et al., 2004), hence, recent efforts in flood risk management in some countries also seek to address the role of citizens in implementing flood mitigation measures (Birkholz et al., 2014; Bubeck et al, 2012; Bubeck et al, 2012B; Bichard and Kazmierczak, 2012).

Although It is now widely acknowledged that citizens have an integral role to play in flood risk management (Osberghaus, 2012; Bubeck et al., 2012; Bichard and Kazmierczak, 2012; Harris, 2012; Lamond and Proverbs, 2009); numerous studies have indicated that residents of flood prone communities often fail to implement flood mitigation measures (e.g., Bichards and Kazmierczak; Harvatt et al. 2010;). Lamond and Proverbs (2009) conducted a literature review of empirical studies and argued that any programme aimed at encouraging home owners to implement flood protection measures must overcome barriers which may be informational, emotional and financial.

Other barriers according to Lamond and Proverbs (2009) depend on local circumstances, financial and regulatory regimes.

This paper explores the local circumstances in Jamaica which impede flood mitigation among households, drawing on insights from Port Maria and Annotto Bay. More specifically, this paper focuses on the flood impacts and mitigation measures as well as factors that promote and hinder the implementation of flood mitigation measures among households. It is true that numerous studies have been conducted on flood mitigation at the household level (Few 2003), however, some researchers call for more studies on the subject to enhance understanding and aid in decision making (Bubeck et al., 2012; Few. 2003)

Port Maria and Annotto Bay are flood-prone – coastal towns, which have experienced flooding on many occasions. It has been reported that these communities are without appropriate public mitigation measures; hence, experts have recommended the implementation of same in these communities. For example, Mandal and Maharaj (2013, p.166) points out that Port Maria "…lacks proper flood control measures" whilst recommending that "the river channel [Port Maria River/Outram river] needs to be widened by dredging and the existing drainage system of the area needs to be improved to clear clogged drains" (Mandal and Maharaj, 2013, p. 170). With regards to Flood Mitigation in Annotto Bay, the Office of Disaster Preparedness and Emergency Management – ODPEM (2013) points out that various public mitigation measures (e.g.

Dikes, Detention Ponds) are recommended by the National Works Agency (NWA) for implementation in the community.

Based on the foregoing, measures implemented at the household level could be the only flood protection for some residents of Port Maria and Annotto Bay. It is therefore important to investigate the strategies employed by residents to lessen the negative effects of floods, as well as to explore the factors that influence the implementation of flood protection measures at the household level in these communities.

## *AIM*

This study is aimed at finding out the barriers to the implementation of flood protection measures among households in Port Maria and Annotto Bay, Jamaica. More specifically, this research focuses on the factors that make it difficult for householders to lessen the effects of floods through the implementation of resilience and resistance measures. It should be noted that resistance measures also referred to as dry proofing (Lamond and Proverb, 2009) are designed to keep water out of the property/building, and may be temporary measures (Bichard and Kazmiercak, 2012), in which case they are implement just before a flood (e.g. the implementation door barriers); or permanent measures such as raising floors and the use of waterproof doors (Bowker, 2002 cited in Bichard and Kazmiercak, 2012).

Resilience measures on the other hand are referred to as wet proofing (Lamond and Proverb, 2012) and are aimed at reducing damages to the dwelling, “including the interior and furnishing, thereby facilitating the quickest possible recovery (Pitt 2008, cited in Bichard and Kazmiercak, 2012).

It is true that the implementation of resistance and resilience measures are only two of the many ways that residents of flood prone areas to cope with floods; the various types of coping strategies will be discussed later.

## *OBJECTIVES*

The objectives of this study are:

- To investigate the ways in which floods affect households in Port Maria and Annotto Bay.
- To identify the strategies employed by residents of Port Maria and Annotto Bay to lessen the negative effects of flooding.
- To investigate the rationale behind the mitigation strategies employed by residents of Port Maria and Annotto Bay.
- To assess the effectiveness of flood mitigation measures employed by residents of Port Maria and Annotto Bay.
- To investigate the factors that foster the implementation of Flood Mitigation measures among households in Port Maria and Annotto Bay.
- To investigate the factors that hinder the implementation of Flood Mitigation measures among households in Port Maria and Annotto Bay.

## *Structure of Thesis*

The overall structure of this study takes the form of five (5) chapters, including this introductory chapter. The paper proceeds as follows: Chapter two (2) explores the literature which speaks to topics relating to the aims and objectives of this paper and provides an explanation of key words used in this study. The third chapter is concerned with the methodology used for this study and also gives an overview of the study area. Findings and analysis are presented in Chapter four. The final chapter provides a synopsis of findings and identifies areas for further research.

# CHAPTER TWO (2) - LITERATURE REVIEW

The purpose of this chapter is to review the literature which speaks to flood impacts and mitigation strategies among households, as well as to investigate current understandings of the factors that influence householders' mitigation behaviour. It begins by exploring the general socio-economic and environmental effects of flooding.

## Flood Impacts

Floods produce both positive and negative effects (Braun and ABheuer, 2011;Few, 2003; Pelling 1999;Wisner et al., 2004); however, it can be argued that floods are renowned for their negative effects. Wisner et al (2004, p.176) point out that "although we understand all too well the damage floods do, we have not, until recently, understood very well the beneficial aspects of flooding;" moreover Wisner et al., (2004, p.176) argue that it is the collapse of confidence in public mitigation measures that fostered an increased interest in the 'living with floods' approach, which goes beyond the negative consequences of flooding to recognize the positive effects of this natural hazard. It should be noted that the positive effects of floods are varied and many, and include (but not limited to) the maintenance of diversity in flora and fauna which support livelihoods that depend on these resources (Wisner et al. 2004).

### Positive effects of flood on households

The work of Pelling (1999) provides examples of the positive effects of floods to individuals and institutions. Pelling (2009) noted that flooding may provide financial

gains for some entities and individuals through contracts obtained to provide services aimed at lessening the effects of floods (e.g. contracts to clean drains, raise yards, etc.). Additionally, the work of authors such as Wisner et al., (2004) and Few (2003) reveals that in some regions (e.g. in Bangladesh) different terms are used to differentiate between beneficial floods and destructive floods.

### Negative effects of floods

As mentioned previously the negative effects of floods are well known, as floods often produce extensive destruction to life and property – which varies from catastrophic floods that drown people and live stock - to less severe floods which hinder access to services and business activities and which may increase health risks (Wisner et al. 2004; Few 2003). Residents of flood prone communities may have to face these situations on many occasions over long periods of time; residents may implement various strategies to lessen the negative effects of floods. Strategies which may be employed by flood-plain residents to tackle the negative effects of floods are discussed below.

## *Strategies to Cope with Floods*

As was mentioned in the previous chapter, property level flood protection is only one of many approaches to cope with floods (Mavhura et al., 2013; Islam et al., 2012; Paul and Routray, 2010; Wisner et al., 2004; few, 2003). Before providing greater detail regarding the features of property level flood protection, it is necessary to look at coping strategies

in general. Wisner et al. (2004, p.100) defines coping as “the manner in which people act within the limits of existing resources and range of expectations to achieve various ends.” It should be noted that strategies to cope with floods may be applied before, during, or after the event (Wisner et al., 2004; few, 2003) and operate at different levels from the individual level (e.g. household) and community level to institutional levels (e.g. city-wide or beyond) (Jabeen et al 2011). Coping strategies are also categorized as structural or non-structural (Mavhura et al. 2013; Islam et al., 2012; Aboagye, 2012;Paul and Routray, 2010; Few, 2003 ) as well as indigenous (traditional) or modern (Mavhura et al. 2013 Paul and Routray, 2010;).

Coping strategies are further categorized under different headings (which will be discussed later) and are explored in different schools of thought. The following section discusses the approaches to understand ‘coping strategies’ in the fields of disaster risk reduction and climate change adaption, two schools of thought that explore similar ideas using different terms (Jabeen et al, 2010).

Various researchers have indicated that households can reduce their vulnerability to floods through the implementation of “coping and adaptive strategies” Linnekamp et al (2011, p.448). These researchers are often linked to the fields of disaster risk reduction and climate change adaptation. Jabeen et al. (2010) points out that there is a growing integration of these two fields, as there is greater understanding that alleviating socio-economic vulnerability to natural hazards or the impacts of climate change reflects similar schools of thought. As stated by Jabeen et al. (2010, p.416) “the two fields use

subtly different language to describe similar activities;" for example 'coping capacity' (as defined in the field of disaster) and 'adaptive capacity' (as defined in the climate change field) (Jabeen et al., 2010).

Several authors also presented information regarding the types of coping strategies (e.g. Mavhura et al. 2013; Islam et al., 2012; Jabeen et al., 2011; Paul and Routray, 2010; Wisner et al. 2004; Few, 2003;) . Wisner et al. (2004) differentiated between preventative and impact minimization coping strategies (also referred to as 'mitigation') and suggested that the decision to avoid living on flood plains is a preventative coping strategy. In contrast to preventative strategies, impact minimizing strategies are aimed at reducing loss and facilitate recovery. Unlike Wisner et al. (2004) who linked the term 'preventative strategy' to decision to avoid living in flood prone areas; authors such as Islam et al. (2012) and Paul and Routray (2009) use the term 'preventative strategies' on a temporal basis - to refer to actions applied before the event, whilst using the term 'mitigative strategy' (or 'corrective strategy' (Islam et al 2012)) to refer to actions taken during and after flood events.

In general, research on coping strategies reveals that coping techniques include (but are not limited to): 1. Modification to the physical and built environment (e.g. the implementation of property level flood protection measures, which involves making changes within /outside of the house) (Jabeen et al. 2011); 2. Building up stores of food, water and saleable assets (Mavhura et al., 2013; Jabeen et al, 2011; Wisner et al. 2004). 3. Diversifying production and Income Sources (Jabeen et al, 2011; Paul and

Routray, 2010; Wisner et al. 2004); 4. Development of social support network (Jabeen et al, 2011; Wisner et al. 2004).

It is important to note that, this paper is mainly concerned with coping strategies that are linked to modification of the physical and built environment at the household level and will explore both 'traditional' and 'modern' strategies that are implemented before, during and after floods, to lessen the negative effects of this natural hazard. The following section looks at property level flood protection in greater detail.

This research focuses on strategies employed by flood-plain residents to keep water out of their home and to protect the interior and furnishing of the house. These strategies are often referred to as flood proofing/property level flood protection measures and are further categorized as resilience or resistance measures (Kazmierczak and Bichard 2010), however, other terms are also used in the literature to describe these strategies. For example, terms including (but are not limited to) "mitigation measures" (e.g. Poussin et al, 2014) and "adaptive measures" (e.g. Kellens, et al. 2013) are used to refer to similar activities and are sometimes further categorized based on temporal features (based on the stages of the hazard cycle) or on the strategy being structural or non-structural.

According to Kellens, (et al. 2013, p.38) "people can adapt to floods by taking various adaptive measures, such as raising one's home above the highest flood level, by placing sand bags, or by taking out flood insurance." Associated with adaptive

measures are: (1) mitigation measures which are implemented before the event (e.g raising home above expected water level), (2) Preparedness Measures which are implemented just before or during a flood (e.g. the use of sand bags and moving furniture to higher floor) and (3) Recovery Measures (e.g. Flood insurance) (Kellens et al. 2013).

It is therefore true that strategies aimed at keeping water out of homes and to protect the interior and contents of home are referred to in the literature using different terms, however, for this paper these strategies will be referred to as property level protection measures, however, other terms such as private mitigation measures/flood mitigation measures will be used to describe these activities. The following section explores these measures in more detail.

As discussed above property level flood protection involves Flood proofing of homes and is concerned with the implementation of resistance (dry proofing) or resilience (wet proofing) measures (Lamond and Proverb, 2009). Resistance measures are designed to keep water of a property; while the resilience approach is to allow water into the dwelling whilst implementing measures to facilitate quick recovery after a flood event (Dhonau and Lamond, 2012). Most accounts suggest that flood proofing of homes can be beneficial for flood plain residents; however, these measures may be ineffective and unsuitable in some cases (Lamond and Proverb, 2009).

According to Dhonau and Lamond (2012) resistance measures are suitable in flood events that involves quick run off time, with low velocity; moreover, Dhonau and Lamond (2012) point out that resistant intervention are more suitable where the depths of floods do not exceed a metre, as above the mentioned depth, there is some risk to the structural integrity of the building. Dhonau and Lamond (2012) also acknowledged difficulties in keeping water from entering the property which relates to water entering buildings in many different ways, as well as the fact that water can seep through building materials. As stated by Lamond and Proverbs (2009, p.63) “some floods will cause structural damage and sweep away the best designed homes, ” however it is also true that where resistance measures are not successful, they may assist by providing householders extra time to evacuate the premises and to protect contents from flood waters (Dhanau and Lamond, 2012).

Resistant and resilient buildings are also seen to produce a dual advantage of costing less on average to restore after a flood as well as taking less time to restore (Dhonau and Lamond, 2012; Lamond and Proverb, 2009), hence it is suggested that the implementation of resistance and resilience measures enables flood victims to return quickly to their homes and reduce their stress and expenses (Dhonau and Lamond, 2012; Lamond and Proverb, 2009). However, it is also acknowledged that resistant and resilient buildings are not always cost-effective solutions and that planning for evacuation to emergency shelters may be a better approach in some cases. Indeed, as stated by Lamond and Proverb, 2009 “resistant and resilient building are not a panacea for all ills.” Therefore, it is of vital importance that governments and planners determine

the most suitable approach to deal with flood hazards (Lamond and Proverb, 2009); however, as stated earlier, a shift can be observed in flood risk management in some countries (e.g. UK and Germany), from a state-centred-approach towards one where citizens are expected to implement property level flood protection measures (Osberguhaus; 2014; Dhonau and Lamond, 2012; Bichard and Kazmierczak; 2012; Bubeck et al., 2012; Lamond and Proverb, 2009).

This research explores householders approach to flood proofing their homes (or the lack there off) in a country where citizens [for the most part] are not being encouraged to implement flood protection measures. Using examples from communities that "…lacks proper flood control measures" (Mandal and Maharaj (2013, p.166) and where recommendations are being made for the implementation of public mitigation measures, this study also explores barriers to the implementation of flood protection measures among households. The following section explores the literature which speaks to factors that influence the implementation of flood protection measures at the household level.

## *Factors that influence flood mitigation among households*

A number of researchers have explored factors that may influence the implementation of flood protection measures among householders; these factors as presented in the literature are varied and many, however, information regarding same is not presented in a straightforward manner (Birkholz et al., 2014; Bubeck et al. 2012; Bichard and Kazmierczak (2012;).

In reviewing factors that may influence flood mitigation behaviour, Bubeck et al. (2012 p. 1482) state that “these factors are currently not clear due to the complexity of the existing literature on this topic;” moreover, Bubeck et al. (2012) suggested that prior to their work such review was not available for flood risk in the literature, and pointed out that their work “aims to identify the most important factors, thereby reducing the existing complexity in the current literature” (Bubeck et al. 2012, p.1488). Similarly Bichard and Kazmierczak (2012, p.637) point out that the literature on the subject provide some level of understanding, however, “the information is scattered among many sources.” It is important to note that factors explored by researchers include (but are not limited to), perceptions of risk, perceptions on the role of government, experience with flooding, knowledge of flood hazard, knowledge of solutions and access to resources; these and some of the other factors that are presented in the literature are discussed below.

**Perceptions of Risk**

Much of the current literature on factors that may influence private flood mitigation measures pays particular attention to perceptions of risk; this was pointed out by a number of authors (e.g. Bubeck et al. (2012); Kellens et al. 2013). For example, whilst acknowledging that there is a growing body of literature which investigates the factors that influence householders’ flood mitigation behaviour, Bubeck et al. (2012, p.1482) suggests that among these factors, “flood risk perceptions have been the most dominant.” Flood risk perception is regarded as a complex research field which is in its infancy stage; moreover research on the subject is based on various theories (among others - Psychometric Paradigm and Protection Motivation Theory (PTM)) and

methodologies (Kellens et al. 2013). The literature also suggests that most studies on flood risk perceptions have been conducted in Europe; however, a number of studies have also been conducted in North America and Asia as well (Kellens et al., 2013).

It is important to note that information contained in review articles on the subject suggest that results are mixed, as some researchers have found a positive relationship between risk perceptions and householders' mitigation behaviour; while findings from other studies reveal the opposite. Interestingly, these reviews present different findings regarding the number of research reporting positive or negative relationships. For example the work of Bubeck et al. (2012) which reviews empirical evidence from seven countries indicate that findings from most of the reviewed studies shows no or only a weak relationship between the two variables; on the other hand, based on a review of studies that were also carried out in regions mentioned above, Osberghaus (2014, p. 4.) point out that "almost all cited sources finds a positive and significant correlation in their sample between flood risk perception and the uptake of mitigation measures".

Perceptions of risk according to Bubeck et al. (2012) are deemed to provide valuable insights for risk management as well as risk communication strategies, a notion which emanates from the expected positive relationship between individuals' flood risk perceptions and their willingness to implement mitigation measures; however, while it is true that householders' need to be aware of, and perceive, a certain risk in order to react to it, the foregoing suggest that high perceptions may not result in improved mitigation behaviour (Bubeck et al. 2012). Weak relationships between flood risk

perceptions and the implementation of mitigation measures according to Bubeck et al. (2012) may be explained based on Protection Motivation Theory (PTM) as well as methodological issues associated with cross-sectional surveys.

## EXPERIENCE

It should be noted that perception of risk is often linked to residents' experience of floods (Kellens, 2013;Lamond and Proverb, 2009) moreover, experience with flooding is deemed to be central to the implementation of flood mitigation measures, however temporal aspect is critical to the implementation process ((Bubeck et al., 2012, Lamond and Proverb, 2009). Authors such as Kellens (2013) and Bichard and Kazmierczak (2012) point out that empirical evidence indicate that, generally, individuals who have experienced flooding perceived their risk from flood as high and are more likely to implement protection measures.

It is therefore not surprising that most studies that assess the relationship between experience with flooding and mitigation behaviour reported a positive one – a situation that is applicable to the natural hazards in general (Bubeck et al., 2012). However, recent literature suggests that central to the implementation of mitigation measures is the severity of the negative effects experienced and not the experience with flooding per se; moreover, as previously stated timing is also a fundamental factor in this regard, as the literature suggests that the influence of experience can diminish in a relatively short time after a flood event (Kellins et al. 2013; Bubeck et al, 2012, Lamond and Proverbs, 2009). According to Burn (1999 cited in Kellins et al 2013, p.43) "prior experience with

flood events appear to be most useful when it is recent and relevant to the current event”

**Perception on the Role of Government**

Some researchers (e.g. Bichards and Kazmierczak, 2012; Harvatt et al., 2010;) have also Investigated how perceived responsibility affects flood mitigation behaviour among householders; these studies have indicated that some householders’ express the notion that the state is responsible to implement measures to protect their homes from the effects of floods (Harvatt et al., 2010), while others believe that responsibility should be shared between the government and citizens (Bichards and Kazmierczak, 2012).

For example, a study conducted in Scotland by Werritty et al. (2007, cited in Bichards and Kazmierczak, 2011, p.638) revealed that “less than a quarter of respondents accepted individual responsibility for flood protection, and attributing responsibility to local or central government was the main reason not to undertake any major measures to protect their properties.” Unlike the findings in the work of Werritty et al (2007), studies conducted by Bichard and kazmierczak (2011) found that responsibility was seen as shared between government and householders.

**Other Factors**

Some researchers also explore the influence of socio-economic and geographic factors (e.g. age, gender, income, land tenure, proximity of property to river, etc.) on flood mitigation (Poussin, et al. 2014; Bubeck et al., 2012;). Reviews conducted by various

authors (e.g.Poussin, et al. 2014; Bubeck et al., 2012) suggest that results are mixed with regards to the influence of socio-economic and geographic factors on householders' mitigation behaviour.

## *Barriers to Implementation*

Lamond and Proverbs (2009) link the lack of implementation to barriers that hinder the process. Lamond and Proverbs (2009) conducted a literature review and identified stages that a flood plain resident must go through, in order to implement mitigation measures. These stages according to Lamond and Proverbs (2009, p.64) fall into the category of 'desire to act' and 'ability to act'.

Lamond and Proverbs (2009) postulate that the desire to act depends on: awareness of the flood risk, the perception that action is required based on the risk, and the resident owing the problem instead of expecting other stakeholders to address same. Once the desire to act is achieved, the flood plain resident must have the ability to act which is dependent on that person being knowledgeable about solutions to the problem, that person must also have the necessary resources to implement the required solution; moreover, the resident must believe that the solution will be beneficial (Lamond and proverbs, 2009). According to Lamond and Proverbs (2009, p.64) "Barriers that stand in the way of any of these stages can upset the process of installation of mitigation measures."

In the work of Lamond and Proverbs (2009) barriers to implementation of mitigation measures are divided into four categories, namely: financial, informational, emotional and timing constraints. This paper explores the barriers to implementation of flood mitigation measures based on local circumstances in Jamaica.

This chapter reveals that as a natural hazard, flooding is not a phenomenon of only negative consequences (Wisner, 2004; Few, 2003); in order to lessen the negative effects of floods householders may implement various strategies at each stages of the disaster management cycle; however, a combination of complex factors may influence householders' mitigation behaviour. This research seeks to provide insight into the impacts of floods as well as strategies employed at the household level in St. Mary Jamaica to lessen the negative effects of floods; moreover this research, explores the factors that influence flood mitigation behaviours among households in the mentioned locality. Features of the study sites, as well as the methodology employed in this study are discussed in the flowing section.

# CHAPTER THREE (3) – STUDY SITES AND METHODOLOGY

This study was conducted in the communities of Port Maria and Annotto Bay in St. Mary, Jamaica W.I. Both Communities are located on the northeast coast of Jamaica (see appendix – A and B) and are susceptible to various natural hazards with riverine floods being the most recurring; the communities are also susceptible to flooding from storm surges (ODPEM, 2013; Town Planning Department, 1981). These communities are traversed by rivers - with Annotto Bay having four (4) major rivers - Annotto, Pencar, Motherford and Crooked Rivers (ODPEM, 2013); while Port Maria has two (2) major rivers - Outram River/Port Maria River and Paggee River (NWA, 2013; Town Planning Department, 1981).

## *History of flooding the study areas*

Floods in Port Maria and Annotto Bay are triggered by rainfall events and tropical cyclones, (ODPEM, 2013; Mandal and Maharaj, 2013). According to the Office of Disaster Preparedness and Emergency Management (2013), the community of Annotto Bay experienced 35 major riverine Floods during the period 1901 – 2009; the last major flood according to ODPEM (2013) was associated with a tropical storm in 2001. APPENDIX C shows the areal extent of the 2001 flood in Annotto Bay as presented in the work of the ODPEM (2013). This flood event affected approximately 593 households located in districts including Cane Lane, Fort George Road, Dump and Cargill Lane) (ODPEM, 2013).

No historic data was found regarding the number of floods in Port Maria over the period mentioned above (1901-2009), however, Mandal and Maharaj (2013) points out that reports from local news paper dating back to 1924 indicate that Port Maria has experienced several severe floods.

Over the past ten years, Port Maria has been impacted by two (2) major floods (NWA, 2013). The first of the two (2) floods took place in November of 2006, which was associated with a rainfall event (Mandal and Maharaj, 2013; NWA, 2013), the other major flood occurred in November of 2012; this event is deemed by many to be the worst flooding in the history of the community (NWA, 2013). It should be noted that the November 2012 flood was also triggered by a rainfall event; APPENDIX – D shows areas affected by the November 2012 flood in Port Maria. Affected areas included Paggee, [Part of] Frontier and Port Maria Proper (Based on SDC (2009) categorization of districts within Port Maria). Other districts within Port Maria that are not located in the flood plain are Cox Street, Trinity Land, Wentworth and Albion Mountain. The NWA (2013, p.2) points out that the incidence of flooding in Port Maria has increased since 2006, A situation “which catapult [Port Maria] into national attention”

## *Population of Study Areas*

The 2011 population census indicates that the population of Port Maria and Annotto Bay is approximately 7463 and 6017 respectively (STATIN, 2012). The number of households recorded in the 2011 census for Port Maria and Annotto Bay were 2741 and 1961 respectively (STATIN, 2012). As stated in chapter one (1), this study focuses

on households in the flood-plain of both communities. The ODPEM (2013) pointed out that as it relates to exposure to the natural hazards of riverine floods, earthquakes and storm surges in Annotto Bay, the largest proportion of people (2708) are exposed to riverine flooding. No data was found regarding the number of people/households that are vulnerable to flooding in Port Maria.

## *Rational for Study Sites*

Annotto Bay and Port Maria were selected for this study based on their history of flooding as well as their demographic features; however, consideration was also given to the fact that Port Maria (as the Parish Capital) and Annotto Bay (a major urban centre) are dominant administrative and service centres in St. Mary.

# METHODOLOGY

This section explains the research method employed to achieve the objectives outlined in Chapter one (1). For this study, primary and secondary data collection methods were used to collect both qualitative and quantitative data.

## *Secondary data collection*

The use of secondary data was integral to the completion of this research. In an effort to anchor the study in the body of external material, information was obtained from various books and journals. Information pertinent to the study was also obtained from a number of organizations (both governmental and non-governmental); for example flood Hazard Maps were obtained from the Office of Disaster Preparedness and Emergency Management (ODPEM), Water Resources Authority (WRA) (Governmental Organizations), while community profiles was obtained from the Social Development Commission (Governmental Organization) and the Annotto Bay Community Development and Environment Benevolent Society (Non-Governmental Organization).

## *Primary data collection*

During the period July – August 2014, primary data were obtained through semi-structured interviews with householders; interviews were also conducted with other stakeholders (Including personnel from Community Based Organization and Agency

representatives). Moreover, observation also provided valuable insight into features within the study areas.

**Semi-Structured interviews with householders**

Forty (40) semi-structured interviews were conducted with householders who reside in the flood-plains of Port Maria and Annotto Bay (20 interviews in each community). Residents of the study areas were contacted at their homes where interviews were conducted with the head of the household or an adult member of the household. Interviews encompassed both open and closed ended questions; however, questions were mostly open ended. Interviews have been used in other studies which investigated householders' flood mitigation behaviour (e.g. Lopez-Marrero, 2010; Linnekamp et al., 2011)

The first part of the interview sought information on households' experience (or the lack there of) with floods and general awareness of flood hazard and mitigation activities, as well as information on effects of flooding on the household.

The second part of the interview focused on the resistance measures and resilience measures respectively and the rational for action (or inaction). This part of the interview also encompassed questions regarding the effectiveness of the strategies employed based on the judgment of the participants. Moreover, in this part of the interview, participants were also asked about the factors that help in implementing mitigation

strategies. The third part of the interview focused on householders' perceptions regarding flood risk.

The fourth and final section of the interview sought information regarding householders' general life in the community; in the final section closed ended questions were employed to capture some of the household resources.

Households in the communities were identified through Flood Hazards Maps, and based on discussions with residents of the community. Households were randomly selected for participation in this study.

### Observation

Additional information on flood mitigation strategies was garnered through observation of building designs, public infrastructure and the general layout of the study sites. To acquire greater insights on phenomenon observed, the researcher engaged further with stakeholders (householders, agency representatives) which allowed for better understanding of facts and situations as they exist in the study areas.

## *Data Analysis*

Data obtained from interviews were examined and separated into various themes. Additionally, secondary data was used to support the main findings of this research.

## *Ethical Considerations*

Prior to commencing fieldwork, approval was obtained from the University of Leeds; hence due consideration was given to risk assessment. For this research informed consent and confidentiality was of vital importance; hence, all participation in this study was voluntary; participants were informed about the objectives of the study and were given the opportunity to ask the researcher questions about the study; moreover, participants were informed that they could discontinue the interview at anytime. Anonymity was assured as the names of participants were not recorded. Fundamentally, no pressure was exerted on the participants.

## *Limitations*

This study could have been more effective if surveys were conducted with a greater proportion of households, as well as if more key informants (e.g. Engineers) were interviewed. Despite these limitations, this study has the capacity to produce useful information.

# CHAPTER FOUR (4) - FINDINGS AND ANALYSIS

This section provides empirical data to achieve the research aim and objectives; it begins by providing information on participants' experiences with floods. Discussions regarding flood impacts in the communities, mitigation strategies and their effectiveness. Factors that foster and hinder flood mitigation among householders are also discussed.

## *Flood Experience*

The Majority of participants (97% or 39 participants) have experienced flooding over the past 10 years (see table 1). Most participants in both communities have indicated that their household experienced flooding 2 – 4 times during the above mentioned period. Table 1 also shows that all participants in Port Maria had experienced flooding; this was not the case for Annotto Bay, as one participant (5% of participants) in that locality did not have any experience with flooding; this participant was however aware that their home was located in a flood risk area.

**Table 1 Flood experience over the past ten (10) years, in percentages (N=40)**

| Study Site | Once | 2-4 | 5 or more | No Experience | *Number of times not specified | Total |
|---|---|---|---|---|---|---|
| Port Maria | | 75 | 20 | | 5 | 100 |
| Annotto Bay | 10 | 65 | 5 | 5 | 15 | 100 |
| Total | 5 | 70 | 13 | 3 | 10 | 100 |

Interestingly, some participants expressed that they had experienced flooding "many times" over the past 10 years and were unable to specify the number of times; therefore a participant form Annotto Bay said *"My household experienced flooding many time*

*over the past 10 years…we experience flooding every time it rains… if it rains 50 times our home is flooded 50 times"*. A participant from Port Maria also mentioned experiencing "many floods", whilst making a distinction between "dangerous floods" and "minor floods"; as this participant puts it *"My household experienced 3 dangerous floods and many minor floods… dangerous floods have greater magnitude of water".* As was discussed in the literature review not all floods are deemed to be destructive floods. Perhaps some participant made reference to "major floods" in answering the question relating to the number of times they experienced flooding over the past 10 years.

Although the literature regarding the conditions necessary for the implementation of flood protection measures indicate that flood experience may or may not have an influence on mitigation measures. Based on the work of Lamond and Proverb (2009) it can be argued that one of the stages necessary for the "desire to act" is in place among all participants.

Although most participants have experienced flooding over the past ten years; as discussed in the literature review, based on many factors, floods may impact households in different ways. Findings regarding the effects of flooding as reported by participants in this study, as well as findings based on information garnered from secondary sources are discussed below.

## *Flood impacts*

Participants were asked about the impacts of flooding on their households. It should be noted that 8 % percent (or three (3)) of the participants reported that they have not been impacted by floods over the past 10 years, a situation that will be discussed in greater detail later. It should be noted that participants in this study who have not experienced flooding or who have experienced flooding but in which case flood waters did not enter the dwelling, expressed that floods have "no effects" on their household. As a participant from Port Maria Puts It "*I have experienced flooding, but it had no effect… no water came into the house"*. A participant from Annotto Bay with a similar experience said "*the house at the front has problems with floods our part of the yard was elevated, so flood doesn't have any impact on us… We have problems with breeze [Hurricanes] not floods*". A participant from Annotto Bay who had not experienced flooding said "We never experience flood so it doesn't have any effect on us."

As discussed in the Literature Review floods may produce both positive and negative effects (Few, 2003); however, it is not surprising that the majority of participants (93 %) described negative effects of flooding. Only two (2) participant (5% of participants) reported effects of floods that they deemed to be positive.

### Negative effects

The negative effects of floods expressed by the participants are varied and many. Table 2 shows that damage to furniture and appliances was the most reported negative effect

of flooding on households in the study areas. A significant proportion of participants also reported damage to clothing as a negative effect of flooding.

**Table 2: Negative Effects of flooding on households by area in percentages (N=40)**

| Study Site | Damage to Building | Damage to Furniture and Appliances | Damage to Clothing | Damage to Books and Documents | Stress | Health Problems | Loss of Crops and Animals | Loss of Groceries |
|---|---|---|---|---|---|---|---|---|
| Port Maria | 5 | 70 | 55 | 20 | 10 | 10 | | 5 |
| Annotto Bay | 10 | 60 | 35 | 5 | | 5 | 10 | |
| Total | 8 | 65 | 45 | 13 | 5 | 8 | 5 | 3 |

In response to question regarding the negative effects of floods on the household, an interviewee from Port Maria said "*floods affects me negatively, my table glass was broken during the last flood, the flood damaged my mattress, clothes and books…Only my life I do not lose as yet.*" In answering the question relating the effect of flood on the household, a participant from Annotto Bay said: "*Washing Machine damaged; Furniture damaged; stove damaged… and no form of compensation."* Although this participant expressed that no form of compensation was received for damages to furniture and appliances, as will be discussed later, some participants indicated that their household received financial assistance from the state, however, while one participant expressed that "*The only good [from floods] is that I got $3000.00 from the government…",* compensation from the state was largely not reported to be an effect of flooding (whether positive or negative). It is also important to note that none of the participants expressed that their house was covered by flood insurance; hence, grants from the

state might be the only financial assistance/compensation that some households would have received.

As it relates to the effects of floods on the structure of buildings, only two (2) participants indicated that floods caused damage to the structure of their house. A closer look at the data revealed that damage to the floor of the building was reported. In referring to the negative effects of flood a participant from Port Maria reported that "*The flood burst the floor of my house"…* In explaining how flood impacted her house negatively, a female interviewee from Annotto Bay said: *"We don't have any floor from the flood during [hurricane] Sandy."*

Other responses regarding the negative effects of floods on the participants' households include the following:

*"Flood destroy everything, and cause me to have high blood pressure and stress…" (Participant from Port Maria)*

*"…The dirty water gave me an infection in one of my toes and it still doesn't get better" (Participant from Port Maria)*

*"I lost all livestock… all of my fowls and goats" (Participant from Annotto Bay)*

An effect of flood that could be classified as negative which was not reported by participants in this study is "loss of school time" as the November 2012 flood caused the Port Maria Primary school to be closed for approximately two (2) months. Loss of school time is a negative effect of flooding that was reported in studies conducted elsewhere (e.g. Linnekamp et al., 2011).

## Positive Effects

Participants were also asked about positive effect of flooding on their household. It was not surprising that the majority of participants indicated that flooding does not produce any positive effect; as one participant puts it: *"There is nothing positive about floods"* It is however, important to note that the only 5% percent (or 2) of the participants reported positive effects relating to obtaining work to clean business places after flood and monetary assistance from the state. Below are comments from these participants.

*"After the last flooding, I was employed by operators of supermarkets in the town to clean mud from their establishments."* (Participant from Port Maria)

*"The only good is that I got $3000.00 from the government*…" (Participant from Port Maria)

It is important to note that other household indicated government funds in the sum of JA$30,000 / JA$60,000 as a source to that assist in their recovery process, however, only one participant identified grant from government as a positive effect of flooding.

The following section explores the strategies employed by households to keep water out of their home and to protect the interior of their home from flood waters.

## *Resistance Measures*

A minority of seven (7) participants (18%) indicated that they implemented strategies to keep water out of the dwelling/reduce the amount of water that enter the dwelling. Table 3 shows that 10% (or 4) of the participants in Annotto Bay Indicated that they dug drains to channel water to the river (Crooked River), while 8% (or 3) of the participants stated that sand bags were used in an effort to keep water from entering their houses.

Additionally, a participant from Annotto Bay indicated the elevating (dumping) the yard as a strategy used to keep water out of the home.

**Table 3: Strategies employed by participants aimed at keeping water out of the home, in percentages (n=40)**

| Study Site | Sand Bag | Dump Yard | Drain | Total |
|---|---|---|---|---|
| Port Maria | 10 | | | 100 |
| Annotto Bay | 5 | 5 | 20 | 100 |
| Total | 8 | 3 | 10 | 100 |

## Resistance Measures – Rationale for Implementation

Two themes emerged for the rationale behind the strategies implemented to keep water from entering the home: (1) "Knowledge of Strategy" and (2) belief that the strategy will work". For example, a participant from Port Maria said *"I use sand bags because it is the only thing I know that can keep the water out"*. Talking about the reason for elevating the yard, a participant from Annotto Bay said *"The land was swampy so we had to dump it up before we build the house, dumping up the land is the best way to ensure that the house is not flooded."* In discussing the reason for the implementation of a drain a participant said*"…that is the strategy I know*…" Based on the work of Lamond and Proverbs (2009) these seven (7) participants (18%) would have successfully gone through the stages covered under "Desire to act" and "Ability to act" in implementing the abovementioned measures.

## Resistance Measures - Effectiveness of strategies

Participants were asked to rate the effectiveness of these strategies, based on a scale of 1 – 5; where 5 is very effective and 1 is not effective, the participant who elevated the

land [before building the house] indicated that the strategy was very effective (level of effectiveness = 5), as *"flood waters never enter her house over the years*." The use of drains was viewed by participants to be effective to some extent; it was revealed that participants believed that drains were effective during floods with low intensity. As these participants put it:

*"I give this strategy a 3, because sometimes the drain overflows..."*

*"I give it a 5, because it helps to keep the water out, but, when we have constant rain, you cannot stop water, you just have to make the water come in and ensure that you protect your things"*

Interestingly all participants who used sand bags as a measure to keep water out of their home expressed that this strategy was not effective (level of effectiveness =1 or 2); participants who used sand bags during flood events suggested that this measure was not effective as it did not stop water from entering the house. Below are responses regarding the effectiveness of sand-bags:

*"I have to give it 2 because it cannot really stop the water from coming in….". (Participant from Annotto Bay)*

*"I give this strategy a 2… I don't think I am going to bother using sand bag again because it cannot keep water out of the house" (Participant from Port Maria)*

## Resistance Measures: Factors that aid implementation

Residents utilized various resources to implement the mentioned resistance measures. Natural resources, financial resources and human resources were integral in the implementation of these strategies. Participants who identified the use of strategies to keep water out of their house discussed their household's ability to implement the strategy without outside help or the ability to pay others for assistance. Below are some

of the responses regarding the factors that enabled participants to implement the mentioned resistance measures:

"W*e have sand that was left over when we completed this house…we don't need help from others to do this"… (Participant from Port Maria)*

*"The beach is only a stone throw away so I collect my sand in my bag…"*

*"…I would pay a young man to dig the drain for us" (Participant from Annotto Bay)*

## Strategies Observed

It was observed that in general, most houses were not constructed in a manner that would keep water out of the home during a flood with a depth of more than 2 feet. In Port Maria it was observed that structures in their early stage of construction have floors that are significantly higher than other structures in the community (See Figure 1). Based on discussions with owners of these buildings, it was revealed that these structures are being built with higher floors due to recent experiences with flooding of depth up to 5 feet. One of the developments observed involved a house that will be constructed on stilts – a strategy that has been used successfully elsewhere ( e.g Puerto Rico and Guyana) (Lopez-Merrero, 2010; Linnekamp, et al, 2011)

**Figure 1: Observation made on house that is being built with an elevated floor as a resistant measure**

(Source: Researcher's picture, August, 2014.)

**Figure 2: Observation made on site for proposed house to be built on stilts as a resistant measure**

(Source: Researcher's picture, August, 2014.)

## Resistance Measures - Factors that hinder implementation

The majority of participants (83% or 33 participants) expressed that their household does not implement resilience measures in preparation for floods or during floods. The main reasons expressed by participants regarding the lack of action to implement resistance measure are: (1) they cannot do anything to keep water out of their homes or (2) they are unaware of strategies that could be used in this regard. Comments regarding the reasons for not implementing any measures to keep water out of the home or to reduce the amount of water that enter the home include:

*"We can't stop it, we know that we must get our blocks quickly to hoist what we are able to hoist" Participant from Annotto Bay*

*"There is no way to keep water out of anyone's house, even if you build the house high water is still going to come in…not even sand bag can stop it" Participant from Port Maria*

Participants were asked if they could think about ways in which their household could prevent flood waters from entering the dwelling or to reduce the amount of water that entered the dwelling. Some participants (13 participants) who had not implemented resistance measures indicated they could not identify any resistance strategy. Although it is true that resistance measures may not be appropriate or effective in all cases, it could be argued that participants' inability to identify resistance strategies could be linked to information barriers. It is also true that Information regarding flood proofing of homes is available on the website of the Office of Disaster Preparedness and Emergency Management (ODPEM); however, residents may not be aware of same. As stated in the Literature Review, having knowledge of strategies does not automatically translate into implementation (Lamond and Proverbs, 2009), a situation that is discusses below.

Twenty (20) participants who had not implement any measures to keep water out of their home identified resistance measures such as the use of sand bags (7 participants), raising the floor of the house (6 participants), water proof door (1 participant), water proof gate (1 participant), boundary wall (2 participants), and elevated land (2 participant) as strategies that could help to keep water out of the home, however, various reasons were given for lack of implementation.

Participants who identified sand bags expressed that this strategy would be ineffective in keeping water out of the home for a combination of reasons including the design of their home which would allow water to enter through the floors. Barriers to the implementation of the other strategies include financial constraints, land ownership issues and possible negative effects of alteration on neighbouring properties.

Participants were generally prepared to protect some of their household items from flood damage; these strategies are explored in the following section.

## *Resilience Measures - Lack of implementation of Strategies*

The majority of participants (93% or 37 participants) indicated that flood waters have entered their dwelling over the past ten years. As mentioned earlier, one (1) of the participants (3%) did not have any experience with floods; it is not surprising that this participant as well as two (2) other participants who had experienced flooding without

water entering the home indicated that they did not implement any measures before or during floods to protect their belongings. The rational for not implementing any measures is based on the belief that flood water will not enter the home; hence there is no need to make any preparation for floods. As one participant puts it *"I know that water will not come in, I am only afraid of the breeze."* The lack of implementation of flood protection measures for these participants seems to be based low perceptions of risk which may be linked to their experience with floods.

Of the 37 of participant (93%) who indicated that water entered their home over the past 10 years, one participants indicated that no measure was implemented to protect the interior of the home and contents; the reason for inaction was due to the participant not being at home during the two times that flood waters entered the dwelling. As this participant puts it *"I was not at home during [the flood that was associated with tropical storm] Sandy and the flood after that, so I did not get the chance to do anything to protect my things"* the above comment is a reflection of the types of strategies employed by participants in the study areas. As will be discussed below, protection measures implemented by participants in this study are usually implemented during or just before flood events.

## *Resilience Measures – Strategies Implemented*

In order to protect items from flood waters, the majority of participants elevated valuable items from floor level by various means, however, the use of concrete blocks was the

most dominant strategy mentioned by participants; 88% (or 35) of the participants employed this strategy (see table 4).

**Table 4: Strategies to protect items inside of the dwelling in percentages (N=40)**

| Study Site | Elevate items using concrete blocks and/or furniture | Made furniture in preparation for future floods | Tied Items in the roof | Pack items in the ceiling | Place belongings in plastic bags | Total |
|---|---|---|---|---|---|---|
| Port Maria | 85 | 5 | 15 | 10 | 30 | 100 |
| Annotto Bay | 90 | | | | 15 | 100 |
| Total | 88 | 3 | 8 | 5 | 23 | 100 |

The use of concrete blocks to elevate furniture and appliances is usually implemented shortly before or during flood events; this is a temporary strategy for most households. Only one participant indicated the furniture remained on concrete blocks in order to lessen the hassle in the future. In general, participants mostly used a combination of elevating items using concrete blocks and placing household items on beds and dining tables. However, In addition to elevating belongings from floor level using blocks, one participant made pieces of furniture in preparation for future floods (See Figures 3 & 5). As shown in Table 4 above, other strategies employed by participants during or just before a flood include: placing belongings in plastic bags (9 participants); using ropes to tie household items (e.g. Mattress) to the roof ( 3 participants from Port Maria) (see figure 4); placing items in the ceiling ( 2 participants from Port Maria ).

**Figure 3 Refrigerator elevated in preparation for future floods***

**Figure 3 (A) Furniture constructed in a manner that would allow the householder to elevate household items on it during floods***

**Figure 5: Furniture constructed to protect household items in future floods***

**Figure 4: Rope to be used to elevate items (e.g. mattress) during floods*.**

*Source: Researcher's picture – July, 2014

## *Resilience Measures - Effectiveness*

In general, participant s in both communities expressed that their strategies were effective; the mean value for each strategy in both community is four (4). As it relates to the participant who mentioned that items were made to reduce damage in future, it was stated that although there has been no flood since implementation of these strategy, a five (5) could be applied. This interviewee said *"Things won't be damaged in another flood, unless the water covers the house… so I am going to give it a 5"*

Below are some of the comments regarding the effectiveness of elevating items:

*"… As long as the blocks are high I am all right" (Participant from Port Maria)*

*Re: Placing bed on concrete blocks "... During all of the floods I was able to sleep on my bed" (Participant from Port Maria)*

*"It is the blocks that caused my thing not to get wet so I have to give it five out of five. The things that got wet are those that weren't place on blocks" (Participants from Annotto Bay)*

*"After the rain stopped falling and the water receded, the place was full of silt, only things that were not elevated got damaged. (Participant from Annotto Bay)*

## Resilience Measures – Factors that help in implementation

21 participants explained that they received concrete blocks and/or assistance from neighbours in elevating household items. On the other hand 15 participants discussed that no outside assistance was needed to implement strategies to protect their

belongings from flood waters as they always have blocks at home, and that no outside assistance was required as there were enough family members to perform the task.

## Resilience Measures - Factors hindering implementation

Participants were asked if they could identify other strategies that could protect the interior of their home from flood waters. Only 3 participants (8%) identified other resilience measures; these participants suggested having a two storey building but suggested that they would not be able to implement same due to restrictions from building regulations and financial challenges.

## Willingness to Implement other Strategies

There are a number of features of houses in the study areas that make them resilient to floods; these features were not necessarily implemented in preparation for floods or with the aim of reducing flood damage, but are in place based on traditional ways of building and based on the personal preference of householders. For example, most houses in the study areas have concrete floors instead of board floors; some houses also have electronic fixtures above the usual height of flood waters (see figure 6); where these features are not in place, if implemented, they could aid in reducing damage from floods. Residents were asked if they would consider implementing additional measures that could assist in reducing flood damage e.g. elevating electronic fixtures and replacing timber floors with concrete floors. Although having an elevated floor may not be effective in all floods, residents were also asked if they would consider raising the floor of their houses.

**Figure 6: electronic fixtures above the usual height of flood waters**

(Source: Researcher's picture, July, 2014)

## Replacing wood flooring with concrete floor

The minority of 35% (or 14) of the participants in this study reported that their house have timber floors (Table 5), however, one participant indicated that strategy to replace board floor with concrete floor would not be considered owing to the fact that the land that the household occupy is squatted.

**Table 5: Type of floor by area in percentages (n=40)**

| | Concrete | Timber | Total |
|---|---|---|---|
| Port Maria | 55 | 45 | 100 |
| Annotto Bay | 75 | 25 | 100 |
| Total | 65 | 35 | 100 |

## Raising electronic fixtures

45 % (or 18) of households reported that electronic fixtures were already above the expected height of flood waters, however, these participants explained that this strategy was not implemented in preparation for floods, but based on their personal preference; further investigation reveals that regulations may have also played a role. The remaining 55% (or 22 participants) indicated that they would consider raising electronic fixtures.

Participants were generally willing to consider implementing the additional strategies above. However, as stated previously, the implementation of other strategies including raising the floors of houses and having a two storey building as identified by some participants may be hindered by financial barriers and legal barriers (Land ownership issues and building regulation restrictions).

## Role of Householders and Government

The majority of participants (90%) either Strongly Agree or Agree that householders have a responsibility to protect their homes from flooding (Table 6). The minority of participants (10%) who indicated that households are not responsible for protecting their home expressed that they are unable to protect their home from flooding, hence they cannot be responsible.

**Table 6 responses to question "householders have a responsibility to protect their home from flooding"**

This question was adapted from the work of Kazmierczak and Bichards (2010)

| Study Area | Strongly Agree | Agree | Neither | Disagree | Strongly Disagree | Total |
|---|---|---|---|---|---|---|
| Port Maria | 55 | 35 | | 10 | | 100 |
| Annotto Bay | 5 | 85 | | 10 | | 100 |
| Total | 30 | 60 | | 10 | | 100 |

The majority of Participants (53%) either disagreed or strongly disagreed that "It is the government's responsibility to protect their home from flooding" (see table 7). A closer look at the explanations given reveal that although participants gave different responses on the role of government; they generally share similar opinions explaining that householders should protect things that are within the boundaries of their homes, while the government should deal with drainage issues.

**Table 7 – Responses to question "It is the government's responsibility to protect your home from flooding" in percentages**

This question was adapted from the work of Kazmierczak and Bichards (2010)

| Study Area | Strongly Agree | Agree | Neither | Disagree | Strongly Disagree | "It Depends" | "Not in every way" | Total |
|---|---|---|---|---|---|---|---|---|
| Port Maria | 35 | 15 | 5 | 35 | 5 | | 5 | 100 |
| Annotto Bay | 10 | 15 | 5 | 60 | 5 | 5 | | 100 |
| Total | 23 | 15 | 5 | 48 | 5 | 3 | 3 | 100 |

As it relates to the role of government in protecting homes from flooding, one participant from Port Maria did not choose from the list of options but opted to add the option "Not in every way" whilst explaining that the government's responsibility is to "clean the drains." A participant from Annotto Bay also did not choose from the options but answered by saying "it depends," this participant went on to explain that if the

householder purchase a property from the government, it is the government's responsibility to implement proper drainage systems; however, the government would not have any responsibility to protect the household from flooding if they choose to live on the river bank, a situation that is a reality in some areas in Jamaica.

As it relates to the role that government should play in protecting home from flooding, only one participant did not provide an explanation that reflects that government should be responsible for dealing with drainage issues; this participant blamed the government for the effects of flooding on households and pointed out that government should not collect taxes from people in flood prone areas, but instead, should provide opportunities for people to live in areas that are not vulnerable to flooding; this participant went on to explain that grants in the sum of $30,000.00 / $60,000.00 issued after floods that are associated with hurricanes would not be necessary and could be used to assist with building homes in less vulnerable areas or to provide employment.

In general participants take responsibility for protecting their home from flooding; however that situation could change if the state proposes that additional flood protection measures be implemented by householders. Perceptions of risk regarding flooding is also relatively high among participants in this study (see table 8); as the majority of participants expressed that there is a high chance or very high chance that their homes will be flooded in the next twelve (12) months; this is also a situation that could change due to factors such as less floods over time and the implementation of both private and public flood protection measures.

**Table 8: Participants responses regarding the chances that their homes will be flooded in the next 12 months, in percentages (N=40)**

| Study Area | Very High | High | Low | Very Low | Don't Know | Total |
|---|---|---|---|---|---|---|
| Port Maria | 40 | 10 | 10 | | 40 | 100 |
| Annotto Bay | 15 | 45 | | 5 | 35 | 100 |
| Total | 28 | 28 | 5 | 3 | 38 | 40 |

This chapter has provided insights into the ways in which flooding impacts households in Port Maria and Annotto Bay; it also reveals that the implementation of mitigation measures in the mentioned localities is largely dependent on household members being at home during flood events, as most participants employ temporary strategies that are implemented during or just before floods; however, participants expressed that the strategies implemented are highly effective. Residents draw on numerous resources during the implementation process; however, a combination of factors also hinder the implementation of protection measures especially resistance measures.

# CHAPTER 5 – CONCLUSION

Flooding is relative frequent in the Port Maria and Annotto Bay, this natural hazard impacts households in numerous ways, however, it may be argued that the negative effects outweigh the positive effects. Residents of the study areas faces numerous constraints in implementing flood protection measures (particularly resistance measures), residents are mostly aware of sand-bags as a resistance measure; however, this strategy is deemed to be ineffective. The elevation of homes – another resistance measure is made difficult by financial barriers, land tenure issues and design features of some homes which restrict householders' ability to make changes to their homes to lessen the negative effects of floods.

Perhaps the implementation of resistant measures is not the best strategy for the communities as implementation of same may not be cost effective and effective in all cases. It can be argued that residents are prepared to allow water into the dwelling whilst they implement measures to protect their valuable items within the house. Resilience strategies employed by householders may be described as "traditional", yet effective in making their homes resilient to floods, however, householders must be at home during flood events for these strategies to be implemented, moreover adequate warning is integral for the successful implementation of resilience measures in the communities.

In preparing for future floods some households are implementing both resistance and resilience measures based on their experience with floods (e.g. making furniture to protect belongings and making new buildings with elevated floors). These strategies are being implemented on the householders' own initiative and perhaps, may be adopted by other householders in the future.

The relatively high frequency of floods in both communities caused householders to be fully aware of the risks that they face from floods. For the most part, householders take responsibility for protecting things within the boundaries of their home and see the government as being responsible for the implementation of measures to improve the efficacy of drainage systems in the communities to reduce flood damage to households.

Further research is needed to find out what additional measures may be appropriate for the study areas (or specific sites within the areas) based on local circumstances; as well as the willingness and ability of householders to implement additional measures. As mentioned by Lamond and Proverbs (2009) research into strategies that may be appropriate for a particular locality may be tedious, however, this could be a venture that could reduce damage from floods in these localities and may also be reproduced/modified in other communities with similar socio-economic and environmental conditions.

Further research is also needed into the strategies employed by other stakeholders including (but not limited to) business operators, institutions (e,g. schools) and farmers

to lessen the negative effects of floods, as well as the factors that hinder (or may hinder) their willingness and ability to implement measure to lessen the negative effects of floods.

Residents of Port Maria and Annotto Bay face various barriers in implementing mitigation measures. Some residents are unable to make informed decisions as they are not aware of approaches and the procedure for contacting experts e.g. engineers in their implementation process. However, where knowledge is in place residents are restricted by socio-economic, housing design, legal and resource based challenges to implement mitigation measures.

Indeed, measures implemented by private households may lessen flood damage to a great extent; however, these strategies may be more effective if integrated with the traditional approaches to flood defence (construction of dams, levees, etc.); moreover, other mechanisms including evacuation and relocation may be necessary in some instances.

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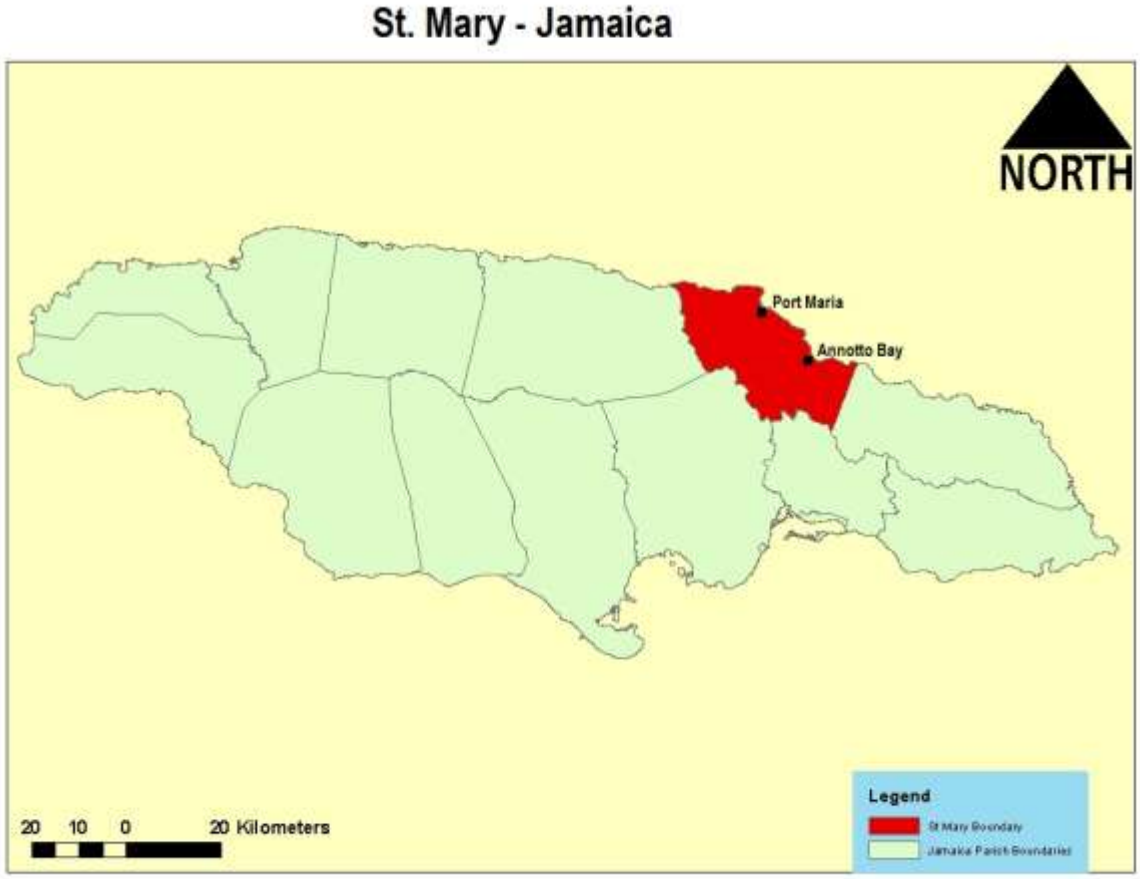
# Appendices

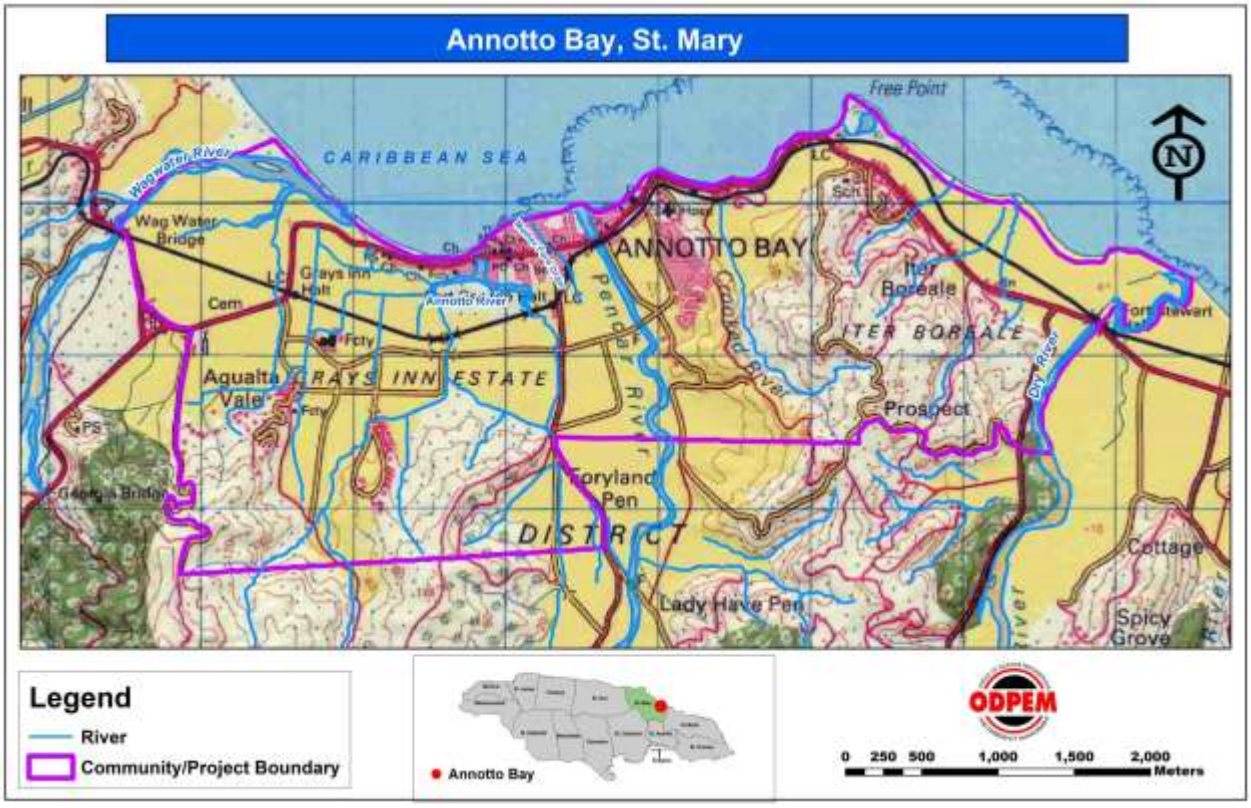
## APPENDIX – A



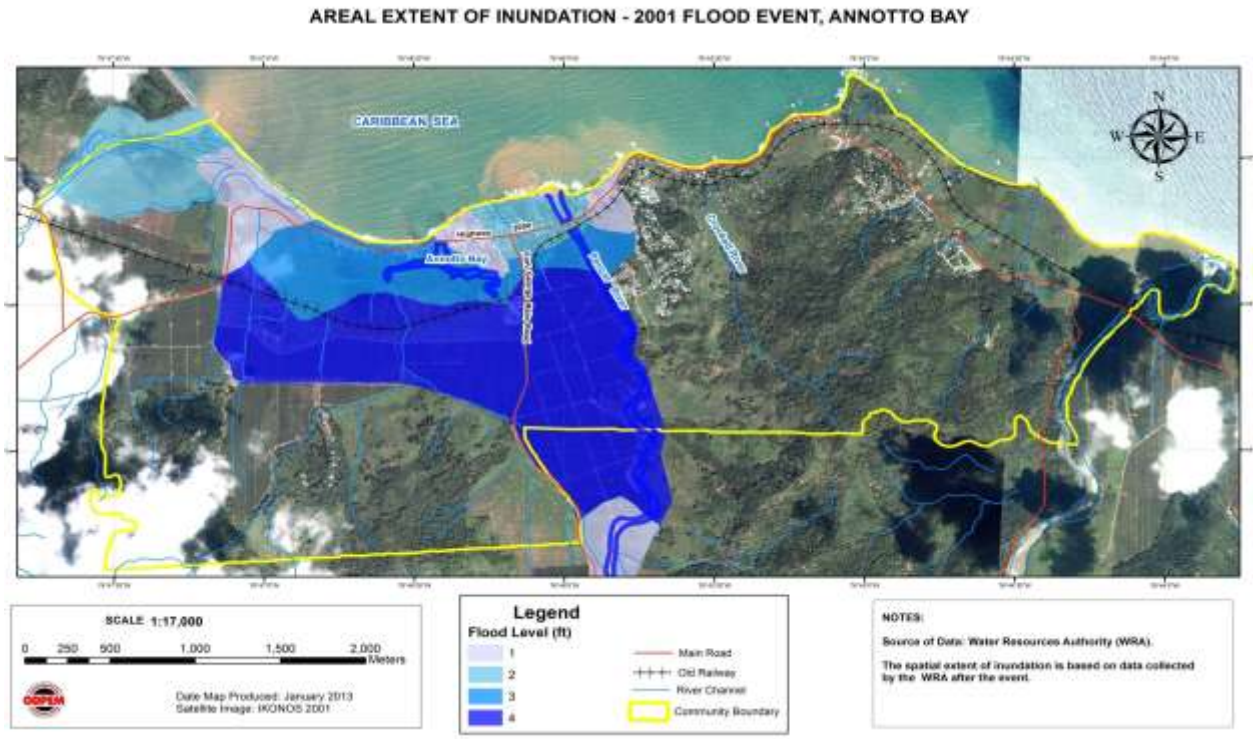
## APPENDIX - B

**Port Maria in its Local Context** (Source: NWA, 2013)


**Annotto Bay in Its Local Context** (Source: ODPEM, 2013)



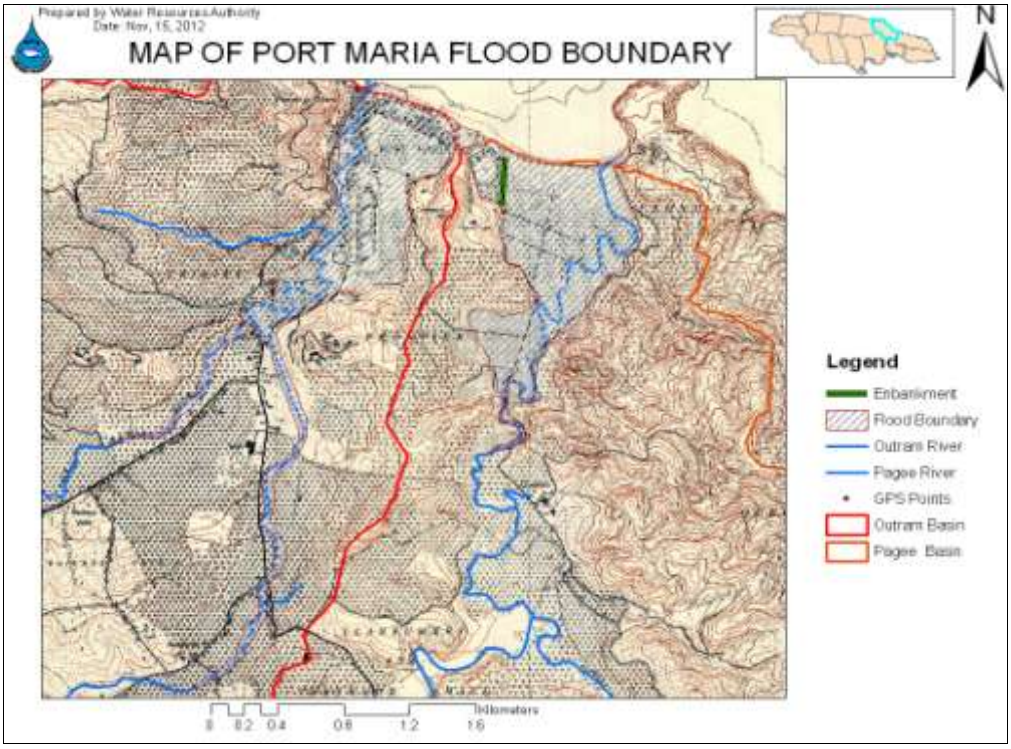
# APPENDIX - C




*Source: ODPEM, 2013*

## APPENDIX - D

Source: WRA, 2012




**Pictures of the November 2012 Flooding** (Source WRA, 2012)

# APPENDIX - E

Annotto Bay _____ Port Maria _____ Date _____

# Interview

*Interview to be conducted with head of household or an adult member of the household*

Good day Sir/Miss. My name is Sean Hylton; I am a student of the University of Leeds. Today I am conducting interviews as part of a student research project. This study is aimed at finding out the ways in which flooding affects households in this community as well as the strategies employed by households to lessen the effects of floods. All information will be kept private; your name will not be recorded and I would appreciate your participation.

1. **How long have you been living in this house? _____**

2. **Have your household experienced flooding while living in this house?**
   Yes [ ]
   No [ ] If no, are you aware that this community is vulnerable to flooding? Yes [ ]
   No [ ] ***Go to Q. 5***

3. **How many times has your household experienced flooding over the past ten (10) years? ___. When was the last time you experience a flood? _____**

4. **How does flooding impact/affect your household (Both Negatively and Positively)**
   Impact on: Livelihood / Employment /income - Education - Health - Housing condition - Other

_____
***Negative:***
_____

***Positive:*** *e.g. employment after floods; relief items etc.*

- **How would you describe the level of damage done to things that are inside of your house (e.g. furniture, appliances, other valuable items) over the past ten (10) years?**

Very High [ ] High [ ] Low [ ] Very Low [ ] Don't Know [ ] no damage [ ]

- **Why do you describe it that way?**

- **What do you think is the reason for that level of damage to things that are inside of your house over the years?**
- **How were you able to replace damaged items?**

Personal Funds [ ] Family Members [ ] Government [ ] Other [ ] please specify _____.

5. **In your opinion, what is/are the cause(s) of flooding in this community?**

6. **What do you think are the best ways to reduce flood damage (to households) in this community?**

*Please give reasons for your answer*:

7. **How does this household get information about possible floods? / How do you know when the community is about to flood?**

**<u>Strategies aimed at keeping water out of the Dwelling</u>**

8. **In preparing for floods or during a flood; did your household implement any measure(s) to keep water out of your home or to reduce the amount of water that enter your home?**

Yes [ ] No [ ] Why not _____ (***<u>Go to Q.14</u>***).

9. **What are the measures that you implemented to keep flood waters out of your home or to reduce the amount of water that enter your home? (Before a Flood, During a Flood, and in Preparing for future floods)**

| | Is this a permanent or temporary measure? |
|---|---|
| Strategy 1 | Permanent [ ]<br><br>Temporary [ ] |
| Strategy 2 | Permanent [ ]<br><br>Temporary [ ] |

10. **Why did you use/implement these strategies?**

11. **On a scale of 1 – 5, where five (5) is very effective and one (1) is not effective, how would you rate the effectiveness of this/ these strategies?**

| Strategy | Rating | Why do you give this strategy that rating |
|---|---|---|
| **1.** | | |
| **2.** | | |

12. **How did your household acquire the resources to implement these strategies? / How was your household able to implement these strategies?**

13. **Did your household receive any outside assistance / any other outside assistance (e.g from friends, relatives, CBOs, Government etc.) to implement:**

| Strategy # | If Yes….. | If No, How/Why were you able to implement this strategy? |
|---|---|---|
| **1.** yes[ ] No [ ] | **If Yes-** From whom and what type of assistance.<br><br>Would your household be able to implement this strategy without outside assistance?<br>Yes [ ] No [ ] | |
| **2.** yes[ ] No [ ] | **If Yes-** From whom and what type of assistance.<br><br>Would your household be able to implement this strategy without outside assistance?<br>Yes [ ] No [ ] | |

14. **Can you think of other ways in which your household could prevent flood waters from entering your home or to reduce the amount of water that enter your home?**

15. **Why haven't you implemented those strategies? / What made it difficult for your household to implement those strategies?**

## Protecting items that are in the dwelling

***16. Have flood waters ever entered this house over the past 10 years?***
*Yes [ ] No [ ] Why Not _____*
*(Go to Q.19).*

***17. How many times have flood waters entered the dwelling over the past 10 years?*** ____

18. **How does water normally enter the dwelling when there is a flood?**

**19. In preparing for a flood or during a flood; did you implement any measure(s) to protect your belongings/assets/valuable items that are inside of your house?**

Yes [ ]
No [ ] Why not _____. GO TO Q.25)

**20. What are the measures that you implemented to protect things that are inside of your house from flood waters?**

| | Is this a permanent or temporary measure? |
|---|---|
| Strategy 1 | Permanent [ ] Temporary [ ] |
| Strategy 2 | Permanent [ ] Temporary [ ] |
| Strategy 3 | Permanent [ ] Temporary [ ] |

**21. Why did you use/implement these strategies:**

**22. On a scale of 1 – 5, where five (5) is very effective and one (1) is not effective, how would you rate the effectiveness of this/ these strategies?**

| Strategy | Rating | Why do you give this strategy that rating |
|---|---|---|
| **a.** | | |
| **b.** | | |

23. **How did your household acquire the resources to implement these strategies? / How was your household able to implement these strategies?**

Strategy 1. Strategy 2. Strategy 3.

24. **Did your household receive any outside assistance / any other outside assistance to implement these strategies? e.g. from friends, relatives, CBOs, NGOs, Government etc.)**

| **Strategy** | **If Yes….** | **If No, How/Why were you able to implement this strategy** |
|---|---|---|
| **a.** yes[ ] No [ ] | **If Yes-** From whom and what type of assistance.<br><br>Would your household be able to implement this strategy without outside assistance?<br>Yes [ ] No [ ] | |
| **b.** yes[ ] No [ ] | **If Yes-** From whom and what type of assistance.<br><br>Would your household be able to implement this strategy without outside assistance?<br>Yes [ ] No [ ] | |
| **c.** yes[ ] No [ ] | **If Yes-** From whom and what type of assistance.<br><br>Would your household be able to implement this strategy without outside assistance?<br>Yes [ ] No [ ] | |

25. **Can you think of other ways in which your household could protect your belongings and valuable items that are inside of the house?**

26. **Why haven't you implemented those strategies:**

27. **These strategies may also be used to protect a house from flood damage…:**

| Strategy | Would you consider implementing this strategy?<br><br>*(If already implemented go to the next strategy).* | ***If No.. Why Not*** |
|---|---|---|
| Raise the floor | Yes [ ] No [ ]<br><br>Don't Know [ ]<br><br>Already implemented [ ] | |
| Replace timber floor with Ceramic tile over concrete [*For House with timber floor or house that had timber floor in the past* ] | Yes [ ] No [ ]<br><br>Don't Know [ ]<br><br>Already implemented [ ]<br>[ ] | |
| Raise electronic fixtures | Yes [ ] No [ ]<br><br>Don't Know [ ]<br><br>Already implemented [ ] | |
| Use water resistant Furniture (e.g. plastic chairs and tables) | Yes [ ] No [ ]<br><br>Don't Know [ ]<br>Already implemented [ ] | |

**28. How much money would you be willing and able to spend to make changes to your home to lessen the effects of floods?**

_____.

**29. Is your house covered by flood insurance?** Yes [ ] No [ ]

**<u>Perceptions</u>**

**30. What are the chances that your home will be flooded in the next 12 months?**

Very High [ ] High [ ] Low [ ] Very Low [ ] Don't Know [ ] no response [ ]

*Please give reasons for your answer*

_____.

31. **What are the chances that valuable items in side of your house will be damaged by flood water in the next 12 months?**
    Very High [ ] High [ ] Low [ ] Very Low [ ] Don't Know [ ] no response [ ]

    *Please give reasons for your answer:*

    **Are you worried about floods? (For yourself/for others)**

    Yes [ ] why?
    _____

    No [ ] why not?
    _____

32.

- **Householders have a responsibility to protect their homes from flooding?**
  Strongly agree [ ] Agree [ ] Neither [ ] Disagree [ ] strong disagree [ ]

- **It is the Government's responsible to protect your home from flooding?**
  Strongly agree [ ] Agree [ ] Neither [ ] Disagree [ ] Strongly disagree [ ]

**Please give reasons for your answer**
_____.

## OTHER INFORMATION REGARDING LIFE IN THE COMMUNITY

33. **Do you like when the community is flooded?**
    Yes [ ] No [ ]

*Please give reasons for your answer:*
_____.

34. **Do you like living in this community**
    Yes [ ] No [ ]

*Please give reasons for your answer:*
_____.

35. **What are your reasons for living in this community?**
    _____.

36. **If given the opportunity to relocate to another community in Jamaica that is less/not vulnerable to flooding, would you leave?**
    Yes [ ] No [ ] *Please give reasons your answer? If No to Q. 36 What would make you leave this community?* _____.

37. **Is there anything that we have not covered about flooding in this community that you would like to say?**

**HOUSEHOLD RESOURCES**

38. **What is the tenure of your dwelling? Is it…**
Owned [ ] Squatted/captured [ ] Rented [ ] Leased [ ] Rent Free [ ] Prefer not to say [ ] Other _____

39. **What is the tenure of the land?**
Owned [ ] Squatted/captured [ ] Rented [ ] Leased [ ] Rent Free [ ] Prefer not to say [ ] Other _____

**If owned, what do you have as proof that you own this land?**

_____
_____.

40. **What the main type of material used in constructing the external walls of this house?**
Concrete block and steal [ ] Stone [ ] Timber [ ] Brick [ ] Timber and Concrete [ ] Not Stated [ ] Other _____

41. **What is the main type of material used to construct the roof?**
Concrete [ ] Tile [ ] Shingle [ ] Metal sheeting [ ] Prefer not to say [ ] Not Stated [ ] Other

42. **What is the main type of material used to construct the floor?**
Timber [ ] Concrete [ ] Other Please specify
_____.

43. **How many people live in this house? _____**

44. **How many household members have been employed during the past 12 months? _____**

45. **Your annual household income (In JA$)?**

Less than 110,000 [ ] 110,001 – 500,000 [ ] 500,001 – 1,000,000 [ ] 1,000,001 – 2,500,000 [ ] More than 2,500,000 [ ]
Prefer not to say [ ]

**Age:** 18- 24 [ ] 25 – 34 [ ] 35 – 44 [ ] 45 – 59 [ ] 60 and over [ ]

**Gender:** Male [ ] Female [ ]

**Thank you for your participation.**

**Is there anything that you would like to ask me about this research?**

To make observation on the following: *Size and condition of building *Height of building