
URBAN FLOODING IN JIDDARI POLO, MAIDUGURI METROPOLIS, NIGERIA: AN ASSESSMENT OF FLOOD FREQUENCY, DRAINAGE CONDITIONS, AND RESIDENTS' PERCEPTIONS

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Abstract

Urban flooding has become a persistent environmental challenge in many Nigerian cities due to rapid urbanization, inadequate drainage infrastructure, poor waste management, and increasing rainfall intensity. This study assessed urban flooding in Jiddari Polo, Maiduguri Metropolis, Nigeria, with emphasis on flood frequency, drainage conditions, and residents' perceptions. A survey research design was adopted using both primary and secondary data. Primary data were collected through structured questionnaires, interviews, field observations, and photographs. A total of 221 respondents, representing 5% of the study population, were selected using simple random sampling. Data were analyzed using descriptive statistics, including frequencies and percentages. The findings revealed that 55% of respondents experienced flooding almost every year, indicating that flooding is a recurrent environmental problem in the area. Furthermore, 65% rated the drainage systems as being in poor condition, while 45% identified indiscriminate waste disposal into drainage channels as the major cause of drainage failure. Flooding was found to have significant socio-economic impacts, with damage to residential buildings (35%) emerging as the most severe consequence, followed by health-related problems (25%). Half of the respondents (50%) perceived poor drainage infrastructure as the principal cause of flooding, ahead of heavy rainfall and poor urban planning. The study concludes that ineffective drainage systems and poor environmental sanitation are the major drivers of recurrent flooding in Jiddari Polo. It recommends the rehabilitation and expansion of drainage infrastructure, regular desilting and maintenance of drainage channels, enforcement of urban planning regulations, improved waste management practices, and the adoption of integrated flood risk management strategies to enhance urban resilience.

Keywords: Urban flooding; Drainage conditions; Residents' perception; Flood frequency

1.0 INTRODUCTION

Urban flooding has become one of the most frequent and destructive environmental hazards affecting cities worldwide, particularly in developing countries where rapid urbanization often outpaces infrastructure development. According to Echendu (2023), urban flooding is the temporary inundation of normally dry land within urban areas when rainfall exceeds the capacity of drainage systems or natural waterways to convey runoff. The increasing occurrence of urban flooding has been linked to climate change, population growth, land-use changes, poor urban planning, and inadequate drainage facilities. In many African cities, including those in Nigeria, recurrent flooding has become a major challenge with significant socio-economic and environmental consequences (Echendu, 2023). Poor waste disposal practices and blocked drainage channels further aggravate flood incidents by reducing the efficiency of stormwater drainage systems.

Nigeria has experienced a growing number of flood disasters in recent years, with urban centres being particularly vulnerable. Flood events have caused loss of lives, destruction of property, displacement of residents, and disruption of economic activities. The severity of these impacts has increased due to the expansion of settlements into flood-prone areas and inadequate maintenance of drainage infrastructure. Studies have emphasized that effective urban flood management requires an understanding of flood frequency, drainage conditions, and the perceptions of residents regarding flood risks and mitigation measures (Umar et al., 2025; Echendu, 2023). Such information is essential for developing sustainable flood management strategies and enhancing community resilience.

Maiduguri Metropolis, the capital of Borno State in northeastern Nigeria, has experienced recurrent flooding over the years. The city lies within the River Ngadda floodplain and is characterized by low-lying terrain that makes many neighbourhoods susceptible to flood hazards (Umar et al., 2025). Recent flood events, particularly the devastating 2024 flood, highlighted the vulnerability of the metropolis to extreme rainfall and inadequate urban infrastructure. Reports indicate that delayed drainage maintenance, rapid urban expansion, and increasing rainfall intensity have contributed significantly to flood occurrences within the city (Umar et al., 2025). Similarly, flood mapping studies in Maiduguri have identified low-lying areas and sections with poor drainage as highly vulnerable to inundation during heavy rainfall events (Adeshina et al., 2025).

Jiddari Polo, one of the rapidly growing residential areas within Maiduguri Metropolis, has experienced repeated flooding incidents that affect livelihoods, mobility, and property. Despite these recurring events, there is limited empirical information on the frequency of flooding, the condition of drainage systems, and residents' perceptions of flood causes and impacts in the area. Therefore, this study assesses urban flooding in Jiddari Polo by examining flood frequency, evaluating drainage conditions, and analyzing residents' perceptions. The findings are expected to provide valuable information for urban planners, environmental managers, and policymakers in designing effective flood mitigation and adaptation measures for sustainable urban development.

2.0 CONCEPTUAL REVIEW

2.1 CLIMATE CHANGE

According to Kingsley et al. (2025), climate change is defined as a long-term alteration in climate patterns, often characterized by persistent shifts in temperature and precipitation.

These shifts are primarily driven by human-induced factors like deforestation and urbanization, as well as natural phenomena such as volcanic activity and changes in solar radiation (Fredricks et al. 2025). Climate change exacerbates urban flooding by increasing the frequency and intensity of extreme rainfall events, which generate large volumes of surface runoff that often exceed the capacity of urban drainage systems. Rising temperatures also alter precipitation patterns, making cities more vulnerable to flash floods, particularly where drainage infrastructure is inadequate and urbanization has reduced natural infiltration surfaces (IPCC, 2023).

2.2 LITERATURE REVIEW

Flooding is among the most devastating environmental hazards affecting human populations globally. It occurs when water inundates land areas that are normally dry as a result of excessive rainfall, river overflow, storm surges, or failure of drainage systems. In recent years, the frequency and intensity of flooding have increased due to climate change, rapid urbanization, and unsustainable land-use practices (IPCC, 2023). Flood events often result in loss of lives, destruction of infrastructure, environmental degradation, displacement of populations, and disruption of socio-economic activities. According to Ayanlade and Radeny (2020), climate variability and increasing extreme weather events have heightened flood risks across many African cities, making flood management a critical environmental concern.

Urban flooding is a specific form of flooding that occurs in built-up areas when stormwater runoff exceeds the capacity of drainage systems and natural waterways. Unlike riverine flooding, urban flooding is strongly associated with human activities such as uncontrolled urban expansion, poor land-use planning, and inadequate drainage infrastructure. Douglas (2021) observed that rapid urbanization increases the extent of impervious surfaces such as roads, pavements, and buildings, thereby reducing infiltration and increasing surface runoff. Consequently, urban areas become more susceptible to flooding during heavy rainfall events.

Climate change has further exacerbated urban flooding by increasing the occurrence of intense precipitation events. The Intergovernmental Panel on Climate Change (IPCC, 2023) reported that global warming is altering rainfall patterns, leading to more frequent and severe rainfall events capable of overwhelming urban drainage systems. Similarly, Green et al. (2024) noted that climate-induced changes in precipitation, combined with urban development pressures, have increased flood hazards in many cities around the world. These conditions are particularly severe in developing countries where urban infrastructure is often inadequate to cope with extreme weather events.

The condition of drainage systems plays a significant role in determining the severity of urban flooding. Effective drainage networks facilitate the rapid removal of stormwater and reduce flood risk. However, blocked, poorly maintained, or undersized drainage channels often contribute to water accumulation and inundation. Abass et al. (2022) found that inadequate drainage infrastructure and poor environmental sanitation significantly increase flood vulnerability in Nigerian urban centres. Similarly, Bayón et al. (2023) observed that debris and waste materials transported during rainfall events frequently obstruct drainage channels, reducing their efficiency and worsening flood conditions.

Recent studies have emphasized the importance of understanding flood frequency and community perceptions in flood management. Flood frequency provides insight into the recurrence and magnitude of flood events, while residents' perceptions help explain local experiences, preparedness levels, and adaptation strategies. Dano et al. (2020) argued that

community perceptions are essential for developing effective and sustainable flood mitigation measures. In Maiduguri Metropolis, recurrent flooding has become a growing concern due to increasing urbanization and inadequate drainage infrastructure. Umar et al. (2025) reported that the 2024 flood event exposed significant weaknesses in urban resilience and flood preparedness within the city. Likewise, Adeshina et al. (2025) identified several low-lying neighbourhoods in Maiduguri as highly vulnerable to flooding due to poor drainage conditions and topographic characteristics.

Although previous studies have examined flood vulnerability and spatial flood risk in Maiduguri Metropolis, there is limited empirical evidence on residents' perceptions of flood frequency and drainage conditions in Jiddari Polo, creating a need for a community-based assessment of urban flooding in the area. Therefore, assessing flood frequency, drainage conditions, and residents' perceptions is crucial for developing effective flood management strategies in Jiddari Polo and similar urban communities.

3.0 METHODOLOGY

3.1 Study Area

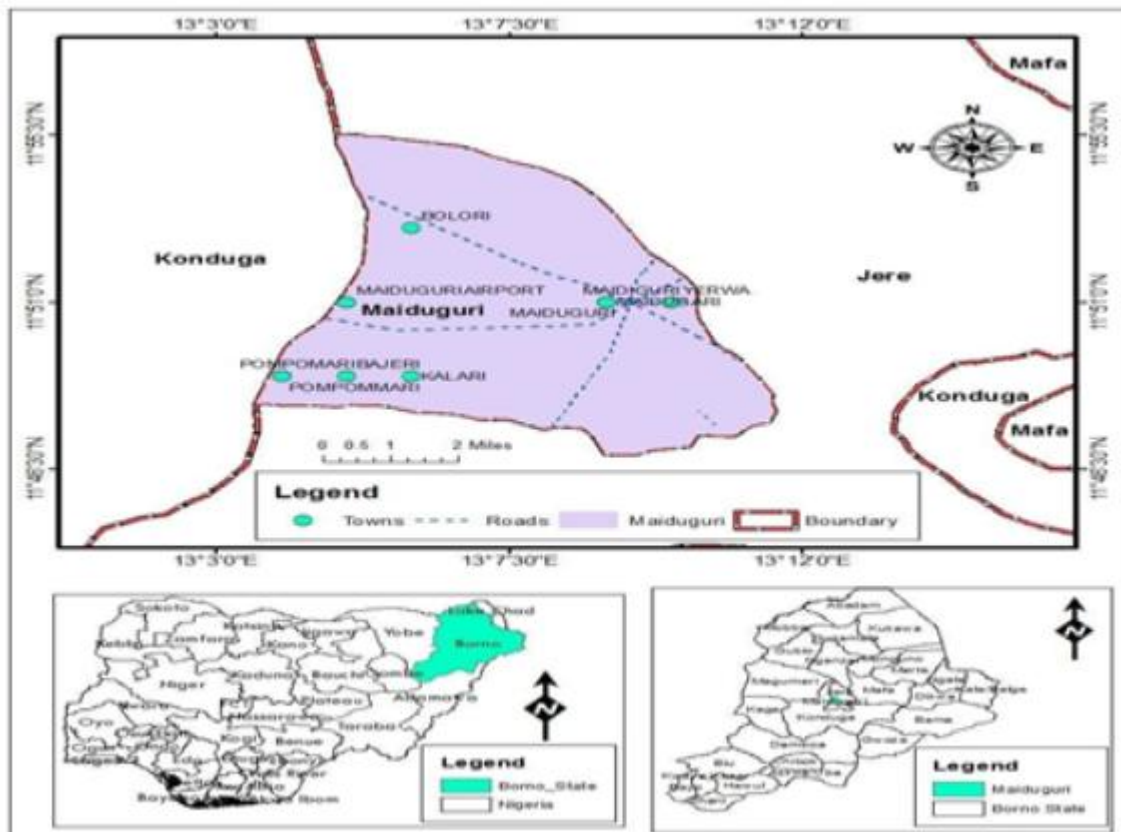


Figure 1: Map of the study area

Maiduguri Metropolis is located in northeastern Nigeria between latitudes 11°04'N–11°44'N and longitudes 13°04'E–13°44'E, covering about 543 km². It extends across Maiduguri Metropolitan Council (MMC), Jere, Konduga, and parts of Mafa Local Government Areas. The city developed from a British military outpost established in 1907 and has grown into the largest urban center in northeastern Nigeria (Idriss et al., 2021). The area consists mainly of flat to gently undulating plains formed on Chad Basin sediments, with elevations ranging

from 300–600 meters above sea level. It is drained by the Ngadda River and its tributaries. Maiduguri lies within the Sudan Savannah vegetation zone and possesses diverse soil types suitable for agriculture. The climate is characterized by low annual rainfall (about 650 mm), high temperatures, and high evaporation rates. Four distinct seasons occur: rainy season (June–September), harvest season (September–November), harmattan season (December–February), and hot season (March–May). Temperatures may exceed 40°C during the hot season (Idriss et al., 2021). The population of Maiduguri was estimated at 1.775 million in 2006 and projected to reach about 2.72 million in 2011. Residents are mainly engaged in agriculture, livestock rearing, trading, food processing, and local crafts. The study specifically focused on Jiddari Polo ward, with a population of 4,420 people.

3.2 Data Collection

Both primary and secondary data sources were utilized. Primary data were obtained through interviews, structured questionnaires, direct observations, and photographs. Secondary data were gathered from government reports, NGO publications, United Nations reports, textbooks, journals, newspapers, websites, and other relevant materials.

3.3 Data Analysis

The study employed a survey research design to investigate flooding and drainage problems in Jiddari Polo. Data collected included information on flood frequency and intensity, drainage conditions, impacts of poor drainage systems, and residents' perceptions of flooding. A sample size of 221 respondents, representing 5% of the study population, was selected using simple random sampling. Data collected were analyzed using descriptive statistical techniques such as frequency tables, percentages, and charts.

4.0 RESULTS AND DISCUSSIONS

4.1 Socio-Demographic Characteristics of Respondents

Table 1 present the socio-demographic characteristics of respondents. Findings indicate that 60% of the respondents were male, while 40% were female, suggesting that more males participated in the survey than females. This reflect the availability of male household heads during data collection or the socio-cultural setting of the study area. Regarding age, the majority (40%) were between 31 and 45 years, followed by 35% aged 18–30 years, while 25% were 46 years and above. This implies that most respondents were economically active adults with sufficient experience and knowledge of flooding in Jiddari Polo. In terms of occupation, 45% were traders, 30% were civil servants, and 25% engaged in other occupations, indicating that flooding has implications for both commercial and formal sector activities. Furthermore, 50% of respondents had resided in the area for 5–10 years, while 30% had lived there for more than 10 years. This suggests that most respondents had lived in the area long enough to provide reliable information on flood occurrence and drainage conditions.

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	60	60.0
	Female	40	40.0
Age Group	18–30	35	35.0
	31–45	40	40.0
	46 and above	25	25.0
Occupation	Civil servant	30	30.0
	Trader	45	45.0
	Others	25	25.0
Length of Residence	<5 years	20	20.0
	5–10 years	50	50.0
	>10 years	30	30.0

Source: Field Survey, 2026

4.2 Frequency of Flood Occurrence

Table 2 present the frequency of flood occurrence in the study area. The results show that 55% of respondents perceived flooding as very frequent, occurring almost every year, while 30% considered it occasional and 15% regarded it as rare. These findings indicate that flooding is a recurrent environmental challenge in Jiddari Polo. The high proportion of respondents reporting annual flooding suggests that the area is highly vulnerable to seasonal flood events, likely due to inadequate drainage infrastructure and increasing rainfall intensity.

Response Category	Frequency (n)	Percentage (%)
Very frequent (yearly)	55	55.0
Occasional	30	30.0
Rare	15	15.0
Total	100	100

Source: Field Survey, 2026

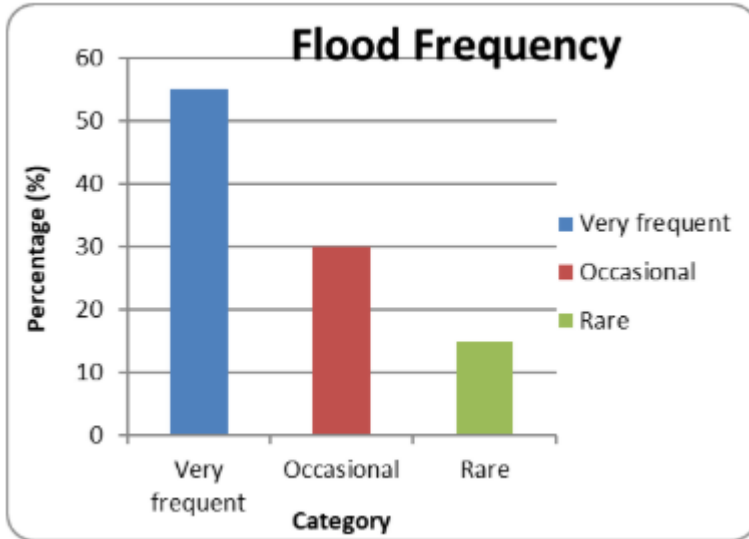


Figure 2: Histogram showing flood frequency

4.3 Condition of Drainage Systems

Table 3 present the condition of drainage system in the study area. The findings reveal that 65% of respondents rated the drainage systems as poor, 25% considered them fair, while only 10% rated them as good. This indicates widespread dissatisfaction with the condition of drainage infrastructure in the study area. Poor drainage conditions reduce the efficient discharge of stormwater, resulting in water accumulation during heavy rainfall and increasing the likelihood of urban flooding.

Drainage Condition	Frequency (n)	Percentage (%)
Good	10	10.0
Fair	25	25.0
Poor	65	65.0
Total	100	100

Source: Field Survey, 2026

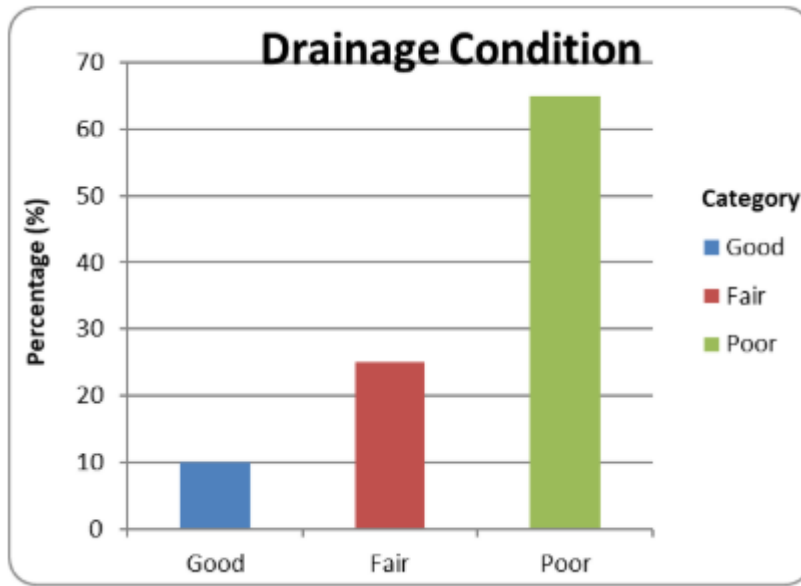


Figure 3: Chart showing the drainage condition in the study area

4.4 Causes of Drainage Failure

Table 4 present the causes of drainage failure in the study area. The results indicate that 45% of respondents identified waste disposal into drainage channels as the major cause of drainage failure. Additionally, 25% attributed the problem to lack of maintenance, 20% to poor construction or design, and 10% to urbanization. These findings suggest that human activities contribute more significantly to drainage failure than natural factors. Improper waste disposal blocks drainage channels, restricting the flow of stormwater and increasing flood risk during rainfall events.

Cause	Frequency (n)	Percentage (%)
Waste disposal in drains	45	45.0
Poor construction/design	20	20.0
Lack of maintenance	25	25.0
Urbanization	10	10.0
Total	100	100

Source: Field Survey, 2026

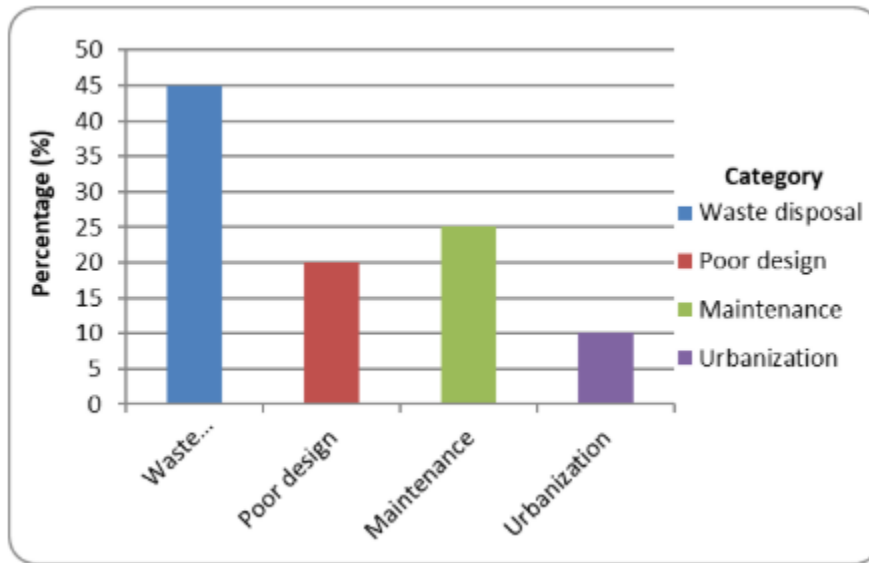


Figure 4: Chart showing cause of drainage failure

4.5 Impacts of Flooding on Residents

Table 5 presents the impacts of flooding on residents in the study area. The findings show that 35% of respondents identified damage to houses as the most significant impact of flooding. This was followed by health issues (25%), while road damage (20%) and disruption of movement (20%) were also reported. These results indicate that flooding affects residents socially, economically, and physically. Damage to residential buildings imposes financial burdens on households, while health problems may arise from exposure to contaminated floodwaters. Flood-related road damage and movement disruptions also interfere with daily activities and access to essential services.

Impact	Frequency (n)	Percentage (%)
Damage to houses	35	35.0
Road damage	20	20.0
Health issues	25	25.0
Disruption of movement	20	20.0
Total	100	100

Source: Field Survey, 2026

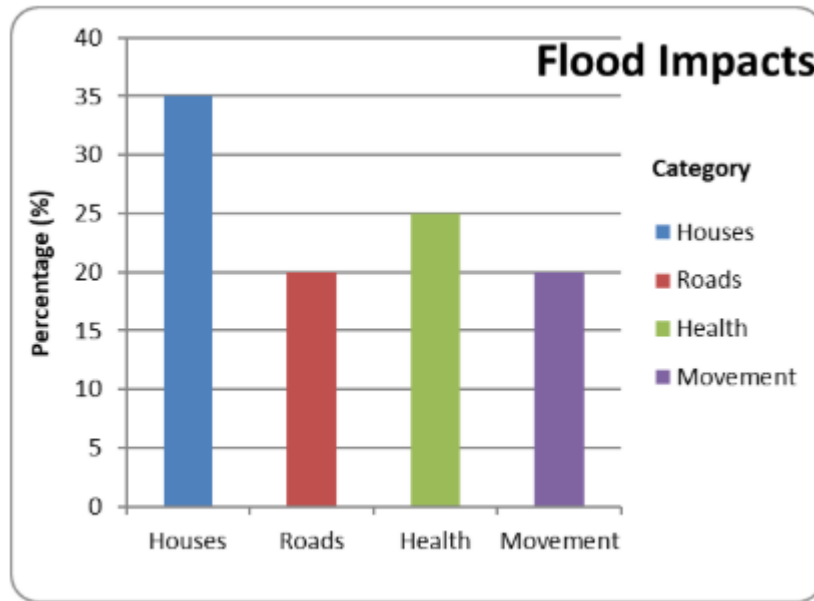


Figure 5: Chart showing the impact of flooding in the study area

Table 6: Residents' Perception of Main Cause of Flooding

Table 6 presents the perception of respondents on the main causes of flooding in the study area. The results indicate that 50% of respondents perceived poor drainage as the principal cause of flooding in Jiddari Polo. Meanwhile, 20% attributed flooding to heavy rainfall, another 20% to waste disposal in drainage channels, and 10% to poor urban planning. These findings suggest that residents believe flooding in the area is largely a consequence of inadequate drainage infrastructure rather than rainfall alone. This perception underscores the need for improved drainage construction, regular maintenance, effective waste management, and better urban planning to reduce flood occurrences.

Perceived Cause	Frequency (n)	Percentage (%)
Poor drainage	50	50.0
Heavy rainfall	20	20.0
Waste disposal	20	20.0
Poor planning	10	10.0
Total	100	100

Source: Field Survey, 2026

Conclusions

This study looks at urban flooding in Jiddari Polo metropolis. It assessed the frequency, drainage conditions, and resident's perception of flood in the area. The study found that in Jiddari Polo, flooding is a frequent occurrence with more than half of the respondents experiencing floods annually. The majority of residents perceive the drainage systems as being in poor condition. Also, waste disposal into drainage channels is the leading cause of

drainage failure. Flooding primarily damages residential buildings, while also affecting health, roads, and mobility. Residents consider poor drainage to be the major cause of flooding, highlighting the importance of improving drainage infrastructure, routine maintenance, and environmental sanitation. To mitigate against this reoccurring challenge of flooding in Jiddari Polo and other areas prone to flooding in urban centres, the following recommendations are highly important:

The government should reconstruct undersized or damaged drainage channels and extend them to areas without adequate drainage infrastructure.

The government and environmental authorities in Maiduguri and in urban center in different states should ensure strict compliance to monthly environmental sanitation exercises, neighbourhood monitoring, and public education on flood preparedness. Also, the state authority should establish a regular programme for desilting drains removing refuse before and during the rainy season.

Urban planning should be enforced to ensure that buildings are not constructed on drainage paths, floodplains, and drainage setbacks.

The Borno State Government and other states as well should adopt a comprehensive flood management strategy that combines improved drainage infrastructure, early warning systems, flood hazard mapping, land-use planning, and climate resilient urban development.

Lastly, regular flood risk assessments using remote sensing and GIS should guide infrastructural investment and emergency preparedness, particularly in flood-prone areas such as Jiddari Polo and low-lying parts of Maiduguri.

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