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PROBLEMS OF FLOOD IN HOOGHLY DISTRICT OF WEST BENGAL: A GEOGRAPHICAL INVESTIGATION

Project Work on Disaster Management for the Partial Fulfilment of 6th Semester Honours Degree in Geography

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1. Introduction

A flood is a natural disaster that occurs when an area is submerged or inundated with water, typically due to heavy rainfall, melting snow or ice, or the overflow of rivers, lakes, or oceans. Floods can be localized, affecting a small area such as a neighbourhood or a town, or they can be widespread, affecting large regions or even entire countries. Floods can have devastating effects on both human populations and the environment. They can cause loss of life, damage to buildings and infrastructure, displacement of people, disruption of essential services such as water supply and electricity, and contamination of water sources. Floodwaters can also erode soil, destroy crops, and harm or displace wildlife. The flood statistic of India reveals that the nature of flood in India becomes more severe, unpredictable, and frequent than earlier. In 2018, the country has faced total damage of about 960 billion INR (₹), which cumulatively becomes about 4700 billion INR since 1953 (CWC, 2019). In the last 66 years (1953 – 2018), the average annual flood affected area of India is 7.14 million hectares (m ha) where about 33 million populations have been affected every year (CWC, 2019). In 1980, Rashtriya Barh Ayog (RBA) had estimated that the total flood prone area of the country was about 40 m ha, which has been raised by 49.815 m ha after revised by the Working Group on Flood Management set up by the Planning Commission during 12th Five-Year Plan (2012 – 2017) through the available information furnished by the State Governments (cwc.gov.in/fm-projects).

West Bengal, a part of Bengal Delta, has a long-recorded history of flood (**Table 1**). At present 42.55%of total area of the State is susceptible to flood.The highest affected area as recorded in 1978 is about 30,607 sq. km and in 2000, it is about 23,971 sq. km. A noticeable spatial variation among the district of West Bengal has been observed in the flood prone map (**Figure 1**). The map also shows a significant area of the Hooghly district is under flood prone.

Table 1: Flood history of West Bengal (Source: (Source: IWB-GoWB, 2021)

HISTORICAL RECORD OF FLOOD IN WEST BENGAL		
Flood affected Area (in Sq. Km.)	**Years during which Flood occurred (1960 to 2021)**	**Total Number of Years**
Below 500	1985, 1989, 1992, 1994, 1997, 2001, 2002, 2005, 2006, 2010, 2012, 2013, 2014, 2016, 2018 & 2019	16
Between 500 – 2,000	1962, 1963, 1964, 1965, 1966, 1972, 1975, 1996, 2003, 2004, 2011, 2015 & 2020	13
2,000 – 5,000	1960, 1961, 1967, 1969, 1970, 1974, 1976, 1980, 1981, 1982, 1998, 2009, 2017 & 2021	14
5,000 – 10,000	1973, 1977, 1991, 1993, 1995, 2007 & 2008	7
10,000 – 15,000	1968, 1979, 1983, 1990 & 1999	5
15,000 – 20,000	1971, 1986, 1987 & 1988	4
Above 20,000	1978, 1984 & 2000	3

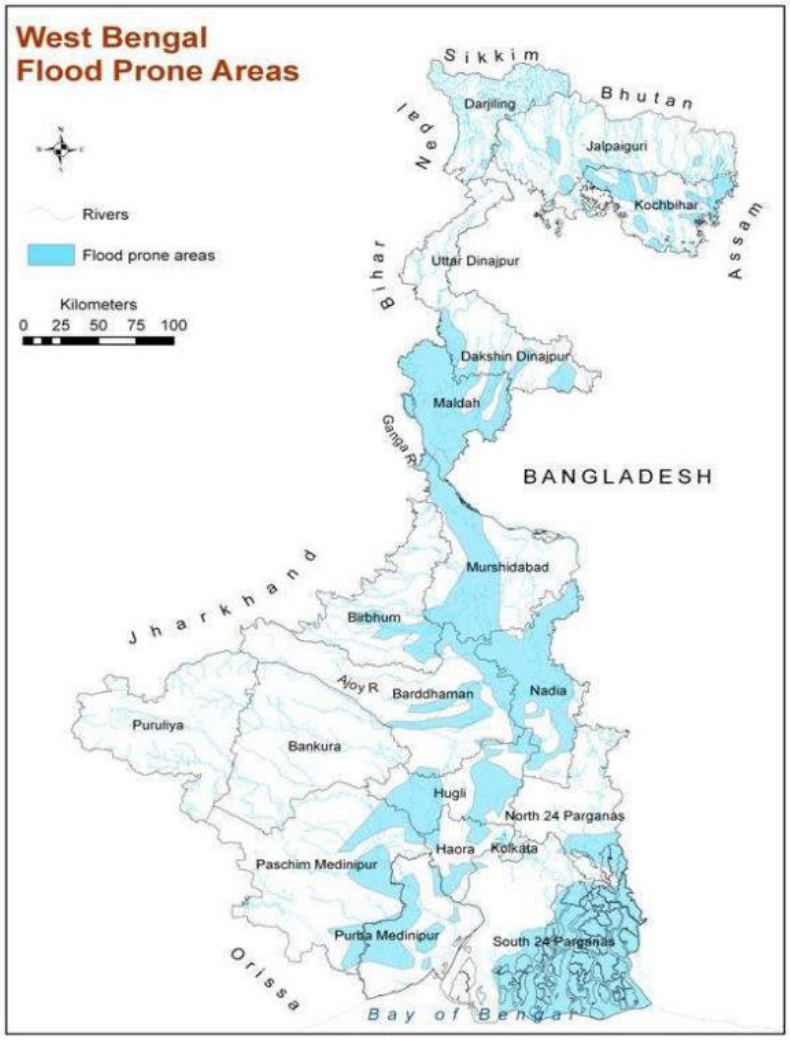

Figure 1: Flood prone area of the West Bengal (Source: IWB-GoWB, 2019)

2. Major Types, Factor, and Impact of Flood

There are several major types of floods that can occur in different environments and under various circumstances. Here are some of the main types:

a. **River Floods**: River floods occur when the water level in a river exceeds its capacity and spills over its banks. They can be caused by heavy rainfall, snowmelt, or a combination of both. River floods often affect large areas and can last for several days or even weeks.
b. **Flash Floods**: Flash floods are rapid and localized floods that occur within a short period, usually within a few hours or even minutes. They are typically caused by intense rainfall over a small area, often in mountainous or urban regions. Flash floods can be particularly dangerous due to their sudden onset and swift-moving water.
c. **Coastal Floods**: Coastal floods occur when oceanic or sea water inundates coastal areas. They are often associated with storms, storm surges, or high tides. Coastal floods can cause significant damage to coastal communities, erode beaches, and lead to saltwater intrusion into freshwater sources.
d. **Urban or Pluvial Floods**: Urban or pluvial floods happen in urban areas when the drainage system becomes overwhelmed by heavy rainfall, leading to water accumulation on streets, roads, and low-lying areas. These floods are typically localized and can cause infrastructure damage, traffic disruptions, and basement flooding.
e. **Dam or Levee Failure**: Flooding can occur when a dam or levee fails to hold back water. This can happen due to structural issues, excessive inflow of water, or overtopping caused by intense rainfall. Dam or levee failures can result in catastrophic flooding downstream of the compromised structure.
f. **Ice or Snowmelt Floods**: In colder regions, floods can be caused by the rapid melting of snow or ice. As the accumulated snow or ice melts, it can overwhelm rivers and cause them to overflow. Ice jams, where ice accumulates and obstructs the flow of water, can also lead to localized flooding.

Floods can be caused by a variety of factors, both natural and human-induced. Here are some major causes of floods:

a. **Heavy Rainfall**: Intense or prolonged periods of heavy rainfall can quickly raise the water levels in rivers, streams, and other bodies of water, exceeding their capacity and causing flooding. This can occur during severe thunderstorms, tropical storms, hurricanes, or monsoon seasons.
b. **Snowmelt**: During warmer seasons, the melting of accumulated snow and ice can contribute to increased water runoff. If the melting occurs rapidly or if there is a combination of melting snow and heavy rainfall, it can overwhelm rivers and lead to flooding.

c. **Dam or Levee Failure:** Failure of dams or levees can result in sudden and significant flooding. Structural issues, improper maintenance, or extreme inflow of water can cause dams or levees to breach or collapse, releasing large volumes of water downstream.
d. **Coastal Storms and Storm Surges**: Powerful storms, such as hurricanes or cyclones, can bring intense winds and storm surges. Storm surges occur when strong winds and low atmospheric pressure push seawater onto coastal areas, causing coastal flooding.
e. **Rapid Urbanization and Poor Drainage**: In urban areas, extensive pavement and buildings can reduce the natural absorption of water into the ground. Poorly designed or inadequate drainage systems can result in water accumulation on streets, leading to urban or pluvial flooding.
f. **Deforestation and Land Use Changes**: Removal of forests and vegetation, particularly in hilly or mountainous regions, can increase runoff and erosion. Without the natural barriers and water absorption provided by vegetation, water flows more rapidly into rivers and streams, increasing the risk of flooding.
g. **Climate Change**: Climate change can contribute to more frequent and intense rainfall events, sea-level rise, and changes in weather patterns, all of which can increase the likelihood and severity of floods in certain regions.
h. **River Channel Modification**: Alterations to river channels, such as straightening or narrowing them for navigation or agricultural purposes, can impact the flow of water. These modifications can increase the risk of flooding by causing water to flow more rapidly downstream and reducing the river's capacity to hold water.

Floods in India have significant impacts on various aspects of society, economy, and the environment. Here are some of the major impacts of floods in India and West Bengal:

a. **Loss of Life and Displacement**: Flooding often results in the loss of human lives. People may be trapped or swept away by fast-moving water or suffer injuries due to collapsing infrastructure. Additionally, floods can force people to evacuate their homes and communities, leading to temporary or long-term displacement.
b. **Infrastructure Damage**: Floods caused extensive damage to infrastructure such as roads, bridges, buildings, and utilities. Floodwaters can erode and weaken foundations, leading to structural failures. Damage to infrastructure disrupts transportation, communication, and access to essential services, affecting daily life and economic activities.
c. **Agricultural Losses**: India's agriculture sector heavily depends on monsoon rains, but excessive rainfall and floods can have adverse effects. Floodwaters can submerge farmlands, leading to crop losses and soil erosion. Livestock and fisheries can also be affected, causing economic hardships for farmers and impacting food security.

d. **Economic Impact**: Floods have a significant economic impact on affected regions. The damage to infrastructure, agriculture, and industries disrupts business activities and leads to financial losses. Small businesses and informal sectors are particularly vulnerable, as they often lack resources to recover from flood-related damages.
e. **Waterborne Diseases and Health Risks:** Floodwaters can become contaminated with sewage, pollutants, and pathogens, increasing the risk of waterborne diseases such as cholera, typhoid, and hepatitis. Displaced populations living in temporary shelters are particularly vulnerable to health risks due to limited access to clean water, sanitation, and healthcare facilities.
f. **Environmental Consequences**: Floods can have long-term environmental consequences. Erosion caused by floodwaters can lead to the loss of fertile topsoil, affecting agricultural productivity. Floods can also result in the displacement of wildlife and damage to ecosystems, including wetlands and forests.
g. **Social and Psychological Impact**: Floods can have profound social and psychological impacts on affected communities. Displacement, loss of homes, and livelihoods can lead to psychological distress and emotional trauma. Communities may experience social disruption, increased poverty, and inequalities in accessing resources and recovery assistance.

3. Objective

The primary objective of the present study is to understand the flood characteristic of the Hooghly District, being a flood prone district of the state.

4. Database and Methods for Investigation

Most of the data has been collected from secondary sources (Figure 2), for example, the annual flood report published by the Irrigation and Waterway Directorate of Govt. of West Bengal different has been followed to collected flood data of the district. District level Disaster Management Plan Report also used to acquire block level flood data. Maps are prepared using QGIS software with the help of different freely available vector data from Bhuvan-ISRO, Geological Society of India (bhukosh.gsi.gov.in), Census of India etc.

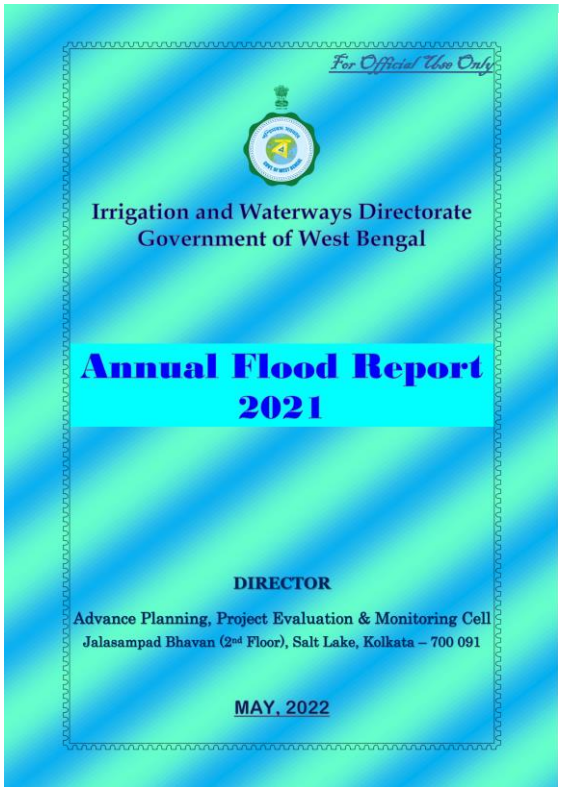

Figure 2: Major secondary source of flood data for the present study

5. Study Area

The district Hooghly is located in between 23° 01´ 20" N to 22° 39´32" N and 87 °30´ 20" E to 88° 30´ 15" E. The total area of this district is 3149 sq.km. (1216sq. mile) which is 3.55 percent of the total geographical area of the West Bengal. The boundary of Hooghly district is covered by the Hooghly River in the east, Bardhhaman in the north. Howrah in the south, Paschim Medinipur in the west, Bankura in the north – west (Figure 3 & 4).

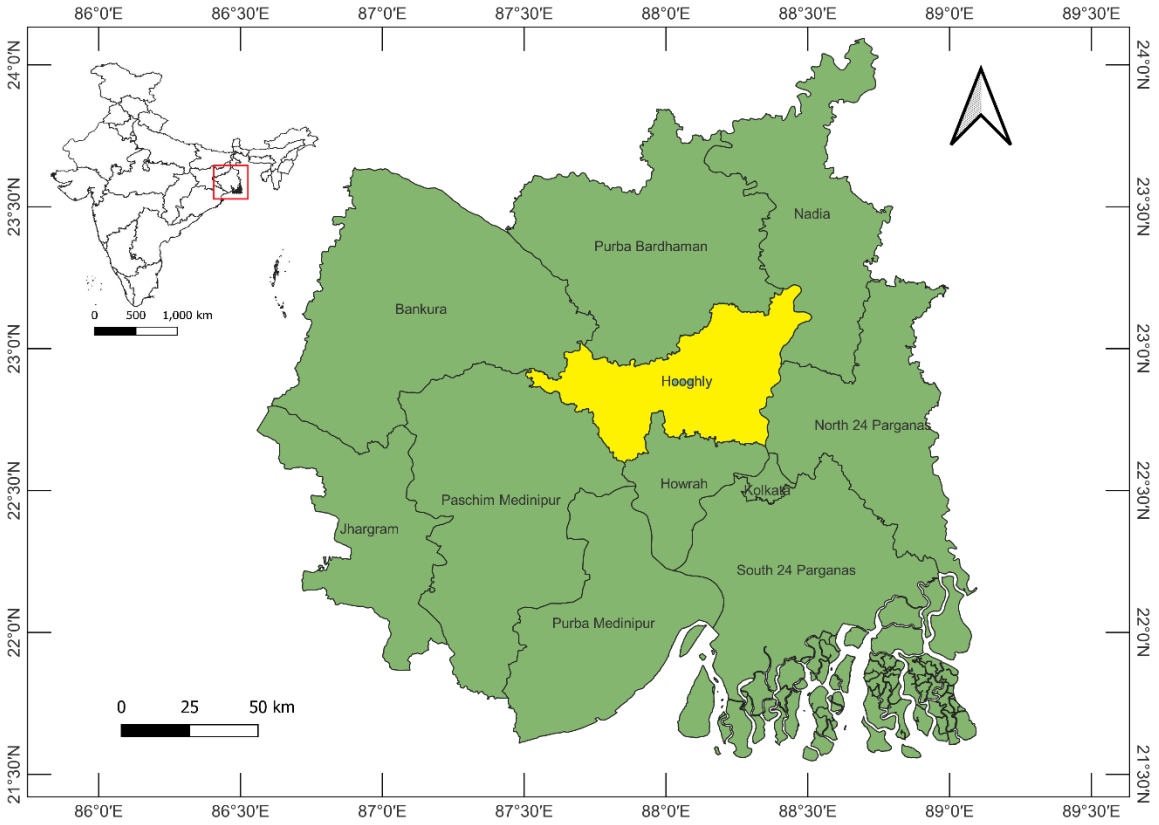

Figure 3: Location map of the Hooghly District

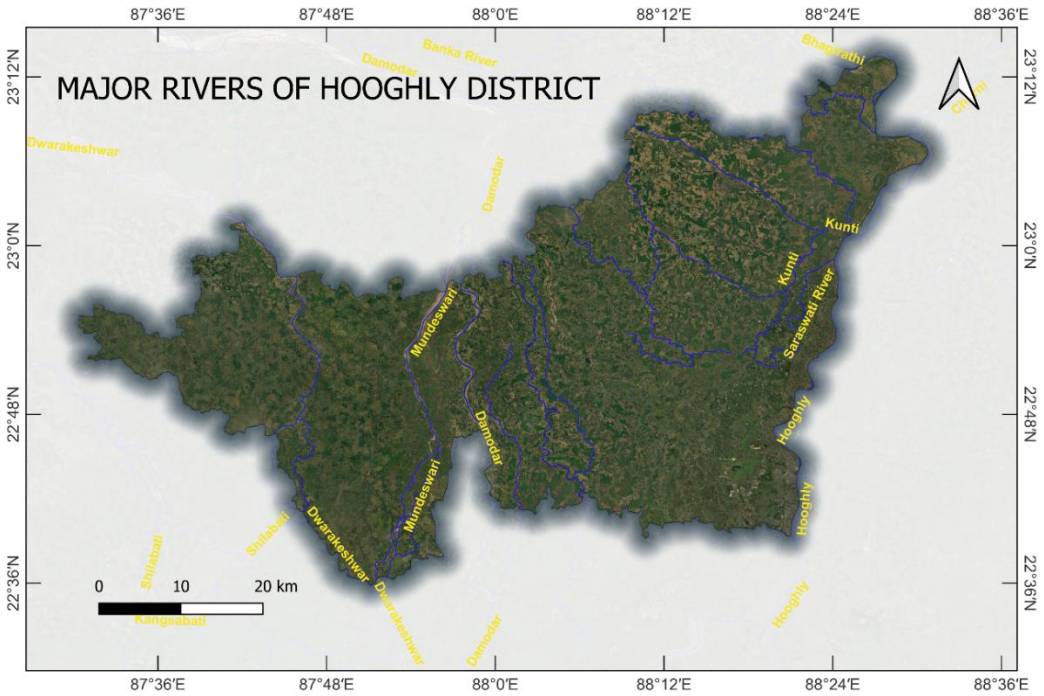

Figure 4: Google Earth view of the Hooghly district with major rivers

5.1. **Relief features:** The district is a completely flat land with no place having more than an elevation of 200mt.According to genesis and evolution of landforms, the district can broadly have divided into two divisions i.e.;

i. Old alluvial plains to the west of river Dwarakeswar.

ii. The monotonous level alluvial plains in the east which can be further divided into

a. Natural levee

b. Meander floor plain

c. Alluvial plain.

5.2 **Geology:** Geology, the entire district is established with alluvium. Sub-surface lithologic down to a depth of 150mt from surface consist mainly of slit, clay and sand of different grades varying from fine to coarse. The eastern parts are clayey and deep; while the western part of the district are loamy.

5.3 **Climate**: Hooghly district has a Tropical Savanna climate.

i)Temperature-The district does not suffer from the extreme of temperature which remains within favorable range for cropping and other resource use. The annual mean temperature is 26.8 c although mean temperature range from 16 c to 33 c and maximum temperature in Hooghly often exceed 38 c.

ii) Rainfall-Rainfall is the most important factor which directly affect the cropping pattern and the nature & sequence of agricultural operation. Maximum rainfall occurs during the monsoon in august and the average annual total rainfall is above 1400mm.

5.4 Transport: Transport plays an important role in economic development. Road, railways and waterways are the major means of transport in the district. National highway 57 k.m, State highway 234 k.m, District Road 313 k.m,1210 k.m of other district road, 8169 k.m of village roads and 447.6 k.m of Prime minister's Gramin Sarak Yojana Road covered the road communication of this district. The railway communication of the district especially all the suburban area is very developed. Bandel is the railway headquarter of the district. There are four junction of Hooghly and these are; Bandel junction, Dankuni junction, Kamarkundu junction and

Seoraphuli junction. The railway of the district is under Howrah division. There are so many blocks in this district covered by waterways. Hooghly, Damodar and Darakeswar rivers connected the different blocks by waterways.

5.5 Land and Livestock Resources Soil is the most important and ubiquitous resource of the earth. The soil of Hooghly district is fertile, therefore the development of agriculture practice increasing day by day. The soils of Hooghly district are classified into three; these are as follows; Clayey soil-belongs to 64.84(000ha)area which is 29 percent of the total area of the district. Clayey loam soil-The proportion of 36 percent of area is under clayey loam soil generally found in the eastern part of the district. Loamy soil-Such type of soil located in eastern and western part of the district. The soil is very much fertile.

5.6 Land use land cover: Based on the classification scheme of the "Directorate of agriculture govt .of W.B" land use of the area may be divided into following (figure 5):

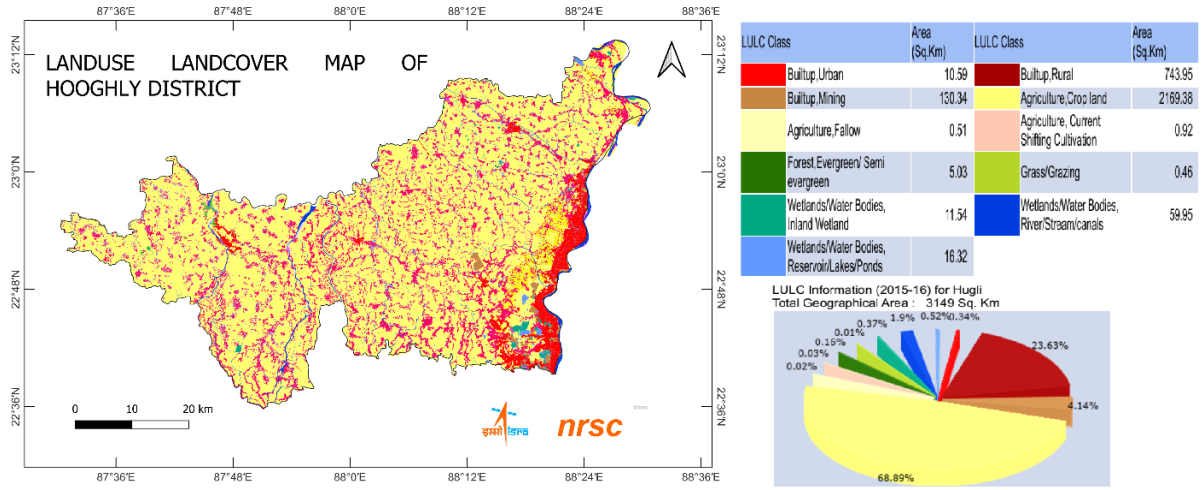

Figure 5: Land use land cover map of the Hooghly District as per NRSC Bhuvan, 2015-2016

5.7 Cropping pattern: The principal crops in the Hooghly districts are paddy, wheat, potato, jute, chilies, oil seeds and ginger. fruits and vegetables are also cash crops of the districts. It covers 66.29 thousand hectares of area. The main vegetables are produced in the districts are tomato, cabbage, cauliflower, peas, brinjal, onion, ladies finger and radish.

5.8 Human Resource: Distribution of population-The total population of the district is 5520389 which are distributed in 18th development blocks over an area 3149 sq. km. Distribution of population are divided into two; Rural population & Urban population. The total no. of male population is 2814653 and female population is 2705736.The no. of male and female population lived in rural areas is 3390646(61.42%). the rest 2129749(38.58%) lived in an urban areas mainly Serampore and Chandannagore sub- division. Higher concentration of rural population in Hooghly district is due to extensive fertile agricultural land. Density of population- The density of population in Hooghly district is 1753/sq. k.m which is more than the state population density (1029/sq. k.m). There is marked spatial variation in the density of population. The highest density of population found in Serampore sub-division (3479/sq. k.m) and lowest density of population is found in Arambag sub –division. There are many factors are responsible for the variation of density of population; such as agricultural, industrial development and the problem of flood in major areas of and Arambag sub- division. Occupational structure: Analysis of the occupational structure of population forms an important component of human resource assessment. The working population of the district has been grouped in two broad categories; total workers (39.01%) & non-workers (60. 99%). Total workers included cultivators (12.06%), agricultural laborers (27.10%), household workers (5.19%) and other workers (55.65%). Distribution of population over different categories of workers (number) & non-workers in the district Hooghly, 2011.

Table 2: Sector wise distribution of different types work participation

Sub - division	Total workers	Cultivators	Agricultural labourers	Household workers	Other workers	Non-workers
Sadar sub-division	700721	82685	270518	26828	320690	956797
Chandannagor	428460	51081	89685	21678	266016	698716
Serampore	551235	24649	51375	36518	43869	918614
Arambag	472454	101265	171802	26804	172583	792148
District total	215280	259680	583380	111828	1197982	3366275

Source: Census of india,2011

6. Result and Discussion

5.1 Characteristic of Flood in Hooghly

The Hooghly district, located in the Indian state of West Bengal, has a long history of flooding due to its proximity to the Hooghly River and the Bay of Bengal, and located in the downstream area of Damodar River Basin (Figure 6). The region's low-lying topography and the annual monsoon rains contribute to the recurrent occurrence of floods. Here is a brief overview of the flood history in the Hooghly district:

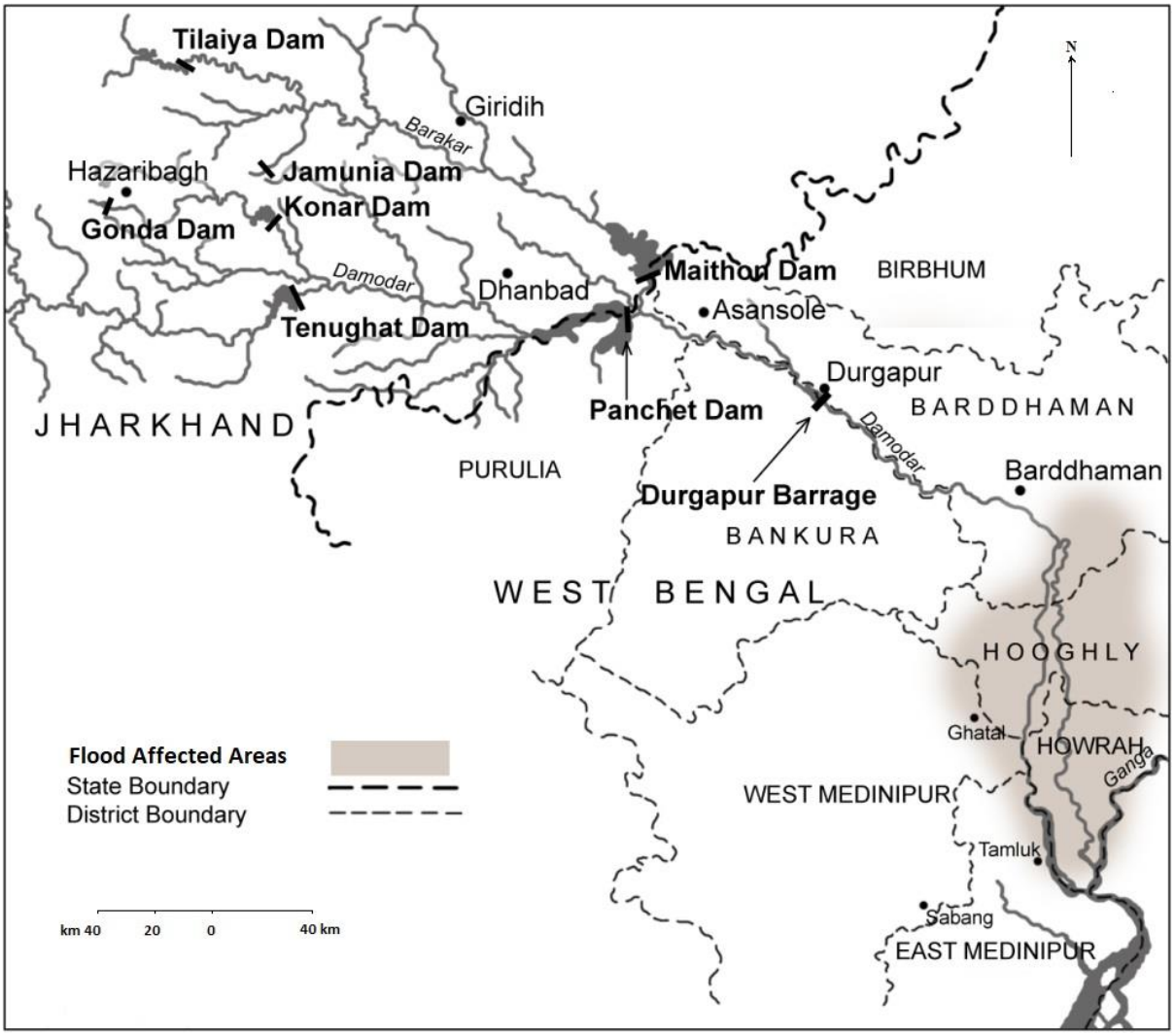

Figure 6: Flood Prone area of the Hooghly district being located in the downstream area of Damodar Valley (Source: https://drpranabkrdas.home.blog/2020/04/22/analysis-of-flood-incidences-in-damodar-valley-and-its-impact-on-deltaic-west-bengal/ accessed on 25th June 2023)

- Historical References: Historical records indicate that the Hooghly district has experienced floods for centuries. The region's vulnerability to flooding is mentioned in various accounts, including colonial-era documents.
- Damodar River Floods: The Damodar River, which joins the Hooghly River, is known for its erratic behaviour and devastating floods. The Hooghly district, being downstream of the Damodar River, is often affected by these floods. The Damodar Flood Plains and their interaction with the Hooghly River system contribute to flooding in the district.
- Annual Monsoon Flooding: The monsoon season, typically from June to September, brings heavy rainfall to the Hooghly district. The excessive rainfall, coupled with the high discharge from the Ganges and its distributaries, leads to flooding in low-lying areas along the Hooghly River.
- The district is located on the eastern bank of the Hooghly River makes it susceptible to flooding during high tides and heavy rainfall events.
- The situation of flood in Hooghly district are made naturally and un-naturally.
- The mostly affected areas are located around the Damodar, Mundeswari, dwarakeshwar and Rupnarayana rivers. The people of Khanakul and Arambagh block are mostly affected by the flood.
- The flood prone map (figure 7 and 8) of the district shows the south western part of the district is mainly affected by the flood and major affected blocks are Khanakul -I and II, Pursura, Part of Arambag, Goghat – I.

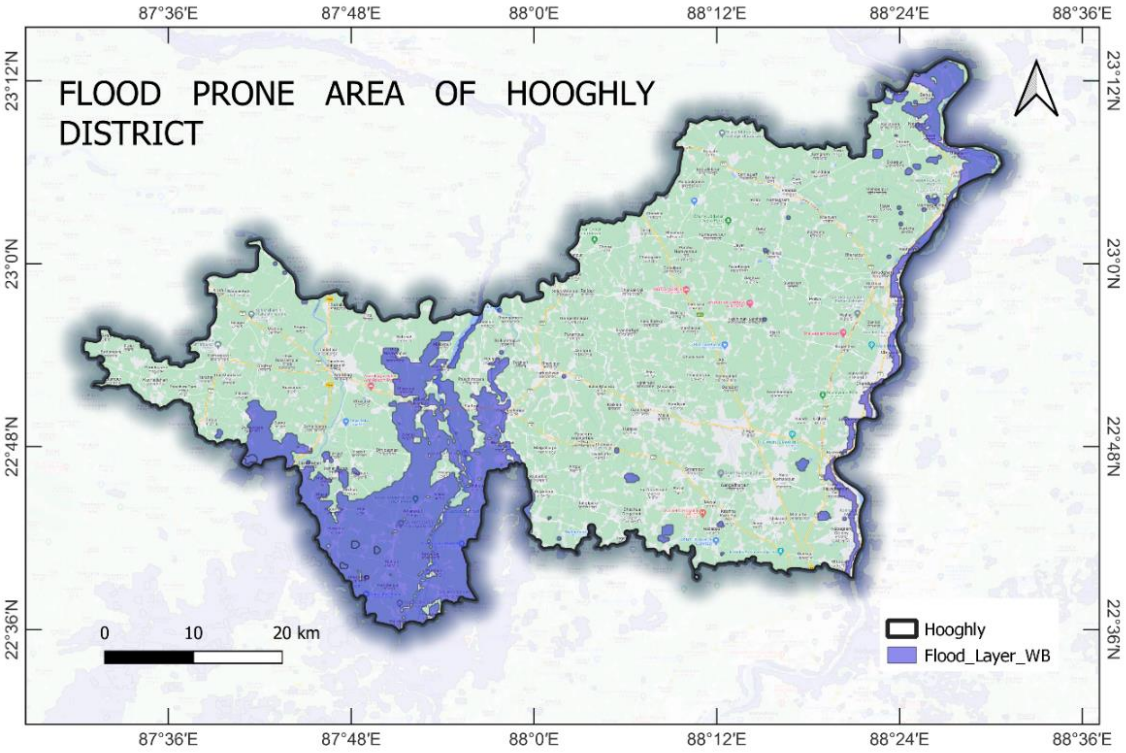

Figure 7: Flood prone area of Hooghly District

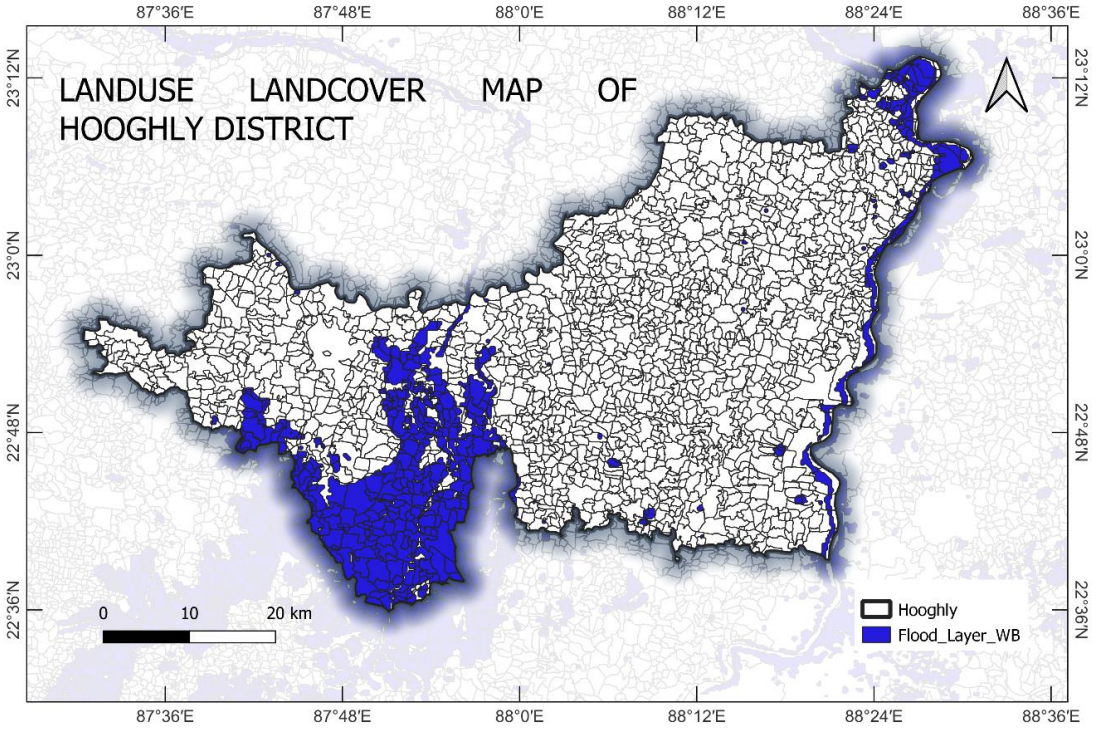

Figure 8: Flood prone villages of the Hooghly District

5.2 Major Causes of Flood in Hooghly District

The Hooghly district experiences floods due to a combination of natural and human-induced factors. The major causes of flooding in the Hooghly district include:

- **Monsoon Rainfall**: The primary cause of flooding in the Hooghly district is the heavy rainfall during the monsoon season. The district receives significant precipitation from the southwest monsoon, which leads to a substantial increase in water levels in the Hooghly River and its tributaries.
- **Topography and Drainage**: The low-lying topography of the Hooghly district makes it susceptible to flooding. The region has numerous low-lying areas and floodplains, which are more prone to inundation during heavy rainfall events. Additionally, inadequate drainage infrastructure in urban areas can exacerbate flooding by impeding the proper flow of water.
- **High Discharge from Rivers**: The Hooghly district is located downstream of the Ganges and its tributaries, including the Damodar River. During the monsoon season, these rivers carry a substantial amount of water, leading to high water discharge in the Hooghly River. The increased flow can overwhelm the river channel and cause flooding in the district.
- **Damodar River Floods**: The Damodar River, known for its erratic behavior, can contribute to flooding in the Hooghly district. As the Damodar River joins the Hooghly River, its floodwaters can impact the district, particularly in areas close to the confluence.
- **Climate Change**: Climate change is believed to be a contributing factor to the increased frequency and intensity of floods in the Hooghly district. Changing weather patterns, including prolonged and heavy rainfall events, can lead to more frequent and severe flooding.
- **Riverbank Erosion**: The force of floodwaters can cause erosion of the riverbanks, especially during high discharge events. Riverbank erosion can weaken the stability of structures built along the river and contribute to the spread of floods in adjacent areas.
- **Deforestation and Encroachment**: Deforestation in the catchment areas and encroachment of floodplains can worsen flooding in the Hooghly district. Tree cover helps in water absorption and reduces soil erosion, while encroachment on floodplains reduces the natural storage capacity for floodwaters.

- Damodar River has not been dredging properly for a long time. As a result, a lot of silt has accumulated. Also, the DVC releases a lot of water during the monsoon season. But due to lack of dredging, Damodar river cannot hold that flow as a result the river overflows its banks and creates a flood situation.
- The residents of Goghat, Arambagh and Khanakul say that the entire area is surrounded by four rivers. They are Damodor, Mundeswari, Rupnarayana and Dwarakeshwar. When it rains in torrents, these four rivers flood and consume the entire area.
- Due to lack of proper drainage system, stagnant water can't get out. As a result, the situation became dire.
- Every year river embankment is damaged but not permanently repaired.

5.3 Effect of Flood on Livelihood of Hooghly

Death: The most serious effects of any severe flood is loss of life. According to experts a rise of only 6-10 inches of water is enough to pull a person into the current. In Hooghly district flood is the early year disaster. there many districts are affected 2021 7th august 6 people have died in Hooghly. a boat capsized in Chhtrasal killing 1 person.

Property damage: According to "TIMES OF INDIA" in Hooghly district many people said that every year they are homeless in this situation. There are many schools, colleges and also the hospital and home are damaged in early 2002,2015,2017,2021 severe flood. In 2021 over 1000 houses completely destroyed (**Figures 9 and 10**).

Habitat deviation: When people's houses are completely damaged in flood. Many people are forced to move from their own habitat. The catastrophic flood have erased the existence of Jangalpara village in Hooghly Pursura (2017). 300 families that inhabited this village.

Loss in agricultural field: The flood prone countries, agricultural field face heavy loss. In Hooghly district blocks are like Pursura mainly Arambagh, Khankul block i, ii main crops are Boro paddy, potatoes, tomato, cucumber etc. in 2021 over 30,000 hectors of crop destroyed. In 2007 Khanakul II amount of damage vegetables were around 99% and the percentage of cultivation affected area is more than 60% of total area. For this cause the price level of market becomes high due to damaged of

vegetables. According to the report of ISRO, about 13 sq. km. area of the district is turned into wasteland of which about 90% is due to flood only.

Figure 9: A two-storey house, which went under water at the flooded-Bandar village near Khanakul in Hooghly district three days ago, completely collapsed on early Tuesday morning. Source: P.C.: Ananda Adhikari**;** https://www.telegraphindia.com/west-bengal/building-crumbles-at-the-flooded-bandar-village-near-khanakul-in-hooghly/cid/1825197 accessed on 25th June 2023)

As per the report of Department of Disaster Management of Hooghly district, the block level consequence of flood vulnerability has been tabled below.

G.P. WISE WATER LOGGING AREAS UNDER ARAMBAGH BLOCK

Sl No.	Name of Gram Panchayat	No & Name of Village water logged
1	Arandi-I	4(Pratapnagar, Sitalpur,Arandi, Satmasa)
2	Arandi-II	6(Laghuchak, Tilakchak, Chandraban,Siyara, Hiyatpur)
3	Batanal	4(Bhalia ,Narayanpur , Telua, Batanal,)

4	**Gourhati-I**	5(Kapsit, Bhabanipur,Ratanpur,parabagnan, dihibagnan)
5	**Gourhati-II**	2(Gourhati, Fatechak)
6	**Harinkhola-I**	5(sayerpara, Madhurpur, shyamgram, haraditya, Bakharchak)
7	**Harinkhola-II**	6(Amgram, Birati, Tajpur,Katabani, Sultanpur panpith)
8	**Madhabpur**	8(Hamirbati,paira, Hariharbati pandugram, Joysingchak, selalpur badsulichak, ranhat)
9	**Maloypur-I**	6(Moloypur,Haripur,tala, Balia, bachnari, Ghargohal)
10	**Maloypur-II**	6(Purba Keshabpur, Chakanar,chakbense Dihalpara,banamalipur)
11	**Mayapur-I**	6(Adambandh, Mayapur, Mohanpur, Balarampur Malipukur, Susnipara)
12	**Mayapur-II**	5(Bolundi, Mahespur, kashtadahi,Keledona, Dihiboyra)
13	**Salepur-I**	4(Salepur Paschimpara,manikpat,sekhpur)
14	**Salepur-II**	4(Daharkundu, Rangtakhali,basantabati, dongal)
15	**Tirol**	7(Chandibati, Bora ,tiro,lKarui,Puin,Tirol, Moigram)
TOTAL		78

BLOCK DEVELOPMENT GOGHAT-II

Name of the Gram Panchayat	Flood Prone areas
1. Kumarganj	Purba & Paschim Chakla, Kamla,Riya;Rayan; Ashudhola, Puina, Pundahit, Ashpur, Jitarpjur & Mashidbera.
2. Bengai	Saljhar, Samantakhanda, Agai, Senai, Bengai, Narasinghabati & Gouripur.
3. Kamarpukur	Kamarpukur, Horisova, P. Amarpur. Pukuria Dwariapur Subirchak & Madhubati.
4. Mandaran	Betboni, Naldubi, Kajla, Rangamati & Garh-Mandaran
5. Hazipur	Harihar, Paba, Bahagol, Hazipur, Mandala & Debkhanda.
6. aschimpara	Kultala, Bhatsala, Paschimpara, Gurulia, Sundarpur
7. Shyambazar	Khejurbandi, Pandugram, Mamudpur & Laskarpukur
8. Badanganj Fului – I	Fului
9. Badanganj Fului – II	Betra, Majuria & Selampur

BLOCK DEVELOPMENT OFFICE GOGHAT-I

Vulnerability and vulnerable areas to various Hazards:-

Sl. No.	Name of GP	Vulnerable for	Cause of Vulnerability	Name of Vulnerable Mouza	Vulnerable for Cyclone(Y/N)
1	Nakunda	Flood Flood	Tarajuli Khal	Dewanchawk, Kulia, Kota, Rawtara	YES
			Amodar River	Darinakunda, Nakunda, Gohalpota, Dumurpara	
2	Bali	Flood	Darakeswar	Dighra, Bali, Jagatpur, Penchera, Shyamballavpur, Damodarpur, Mirzapur, Udayrajpur, Kalagachia, Khilgram, Kanaipur,	YES
3	Bhadur	Flood	Darakeswar	Mandal ganti, Adra, Peari-Nagar, Birampur, Surjapur, Methul, Bhanjapara & Beli.	YES
4	Kumursha	Flood	Darakeswar	Balibela, Hariharpur, Mathura, Shyambati, Ballavbati & Purba-Amarpur	YES
5	Saora	Flood	Darakeswar	Saorah, Goalpara, Jyot-Mohabbat, Muktarpur, Dakshin Balarampur & Blelekusma	YES
6	Raghubati	Flood	Rain Water	Sulut, Khatogram, Bijolkona, Rajgram, Bajua & Santoshpur	YES
7	Goghat	Flood	Rain Water	Dahiakanda, Kurmona, Sunia, Solepur, Chuturia	YES

Figure 10: Effect of flood in a village of Hooghly district (2015) (Source: https://www.indiatimes.com/news/india/west-bengal-rains-7-dead-lakhs-displaced-from-homes-as-water-discharged-from-dams-flood-state-546357.html accessed on 25th June 2023)

BLOCK DEVELOPMENT OFFICE KHANAKUL-I

- **HIGHLY VULNERABLE AREA**

Sl. No.	Name of G.P.	Name of Vulnerable Village	Reason of vulnerability
1	Balipur	Daspur (410.21acre)	Low land
		Purba-Radhanagar(627.87acre)	River embankment
2	Tantisal	Udna(546.68acre)	River embankment/Erosion
3	Arunda	Garbere(184.96acre)	Low land
		Dharashimul(467.05acre)	Low land
		Par-Chabbispur(543.66acre)	Low land
		Bandaipur(310.00acre)	Low land
		Solasta(198.52acre)	River embankment
		Uttar-Sudamchak(120.72acre)	River embankment
		Chak-Jalkar(184.84acre)	River embankment
		Jogikundu(155.77acre)	River embankment
		Joiramchak(189.44acre)	River embankment
		Kabilpur(596.92acre)	River embankment
4	Kishorepur-I	Kishorepur(421.40acre)	River embankment
		Niranjanbati(400.42acre)	River embankment
		Bamankhana(405.55acre)	River embankment
5	Thakuranichak	Paschim Thakuranichak(1049.19acre)	River embankment
		Purba Thakuranichak(626.62acre)	River embankment
		Mainan(1000.29acre)	Low land
6	Ghoshpur	Paschim Ghoshpur(346.02acre)	River embankment
		Madhabkundu(168.92acre)	River embankment
7	Pole-II	Saibona(241.55acre)	Low land
		Chakveduya(390.52acre)	Low land
		Patul(1039.46acre)	Low land
8	Pole – I	Shulut(255.40acre)	Low land
9	Rammohan-I	Sarda(465.92acre)	River embankment
		Jakri(213.15acre)	River embankment
10	Khanakul – II	Dharampur(442.24acre)	Low land
		Joygolanandapur(126.54acre)	Low land
		Kamdebpur(147.51acre)	Low land

Vulnerable Areas :

Place	**Khanakul –II**	**Nature of Vulnerability**
Gram Panchayat	**Village**	
Chingra	Chingra, Ketedal, Ranjitbati, Dosuti	Most vulnerable
Dhanyaghori	Dhanyaghori, Kaknan, Bandar, Ghoradaha, Kaknan	Most vulnerable
Jagatpur	Jagatpur, Bar-Nandanpur, Nandanpur, Jalpata, Basabati	Most vulnerable
Marokhana	Marokhana, Dhaldanga, Sundarpur, Chandkundu, Hanua, Sosapota, Kamdebchak	Most vulnerable
Natibpur –I	Joyrampur, Mandarchak, Tentulia, Routhkhana	Vulnerable
	Ganeshpur, Baligori	Most vulnerable
Natibpur –II	Natibpur, Balpai, Doulatchak	Most vulnerable
Sabalsinghapur	Sabalsinghapur, Harischak, Par-Harischak	Most vulnerable
Palaspai –I	Palaspai, Magri, Mostafapur, Chak-Magri, Katasia, Barboun, Champanagari	Most vulnerable
Palaspai –II	Hayatpur, Chak-Hayatpur, Narendrapur, Khuniachak, Bhairabpur	Most vulnerable
Rajhati –I	Kumarhat	Vulnerable
	Ramchandrapur, Hirapur, Kushali, Radhakrishnapur, Khantara	Most vulnerable
Rajhati –II	Rajhati (Part), Senhat	Vulnerable
	Rajhati (Part), Mamakpur, Sripur, Madhyaranga	Most vulnerable

7. Possible Plans for Preparedness, Mitigation and Management

a. To enhance preparedness, mitigate the impact of floods, and effectively manage flood situations in the Hooghly district, several plans and measures can be implemented. Here are some possible strategies for flood preparedness, mitigation, and management:

b. Early Warning Systems: Implement robust early warning systems that utilize weather forecasting, river monitoring, and real-time data to provide timely and accurate information about potential flood events. This allows authorities to issue timely warnings to residents, enabling them to take necessary precautions and evacuate if required.

c. Floodplain Zoning: Develop comprehensive floodplain zoning regulations to guide land use and restrict construction in high-risk flood-prone areas. This helps reduce vulnerability by preventing encroachment and ensuring that essential infrastructure is located in safer zones.

d. Infrastructure Development: Construct and maintain robust infrastructure, such as embankments, levees, and floodwalls, to protect vulnerable areas from flooding. These structures help contain floodwaters and prevent or minimize damage to critical assets, including residential areas, agricultural land, and public infrastructure.
e. Drainage System Improvement: Enhance the drainage infrastructure in urban areas to ensure efficient and rapid removal of excess water. This includes cleaning and desilting of drainage channels, construction of stormwater drains, and the installation of pumping stations where necessary.
f. Ecosystem Restoration: Promote the restoration and conservation of natural ecosystems, including wetlands and floodplains. These areas act as natural buffers during floods, absorbing and storing excess water, reducing the impact downstream, and improving the overall resilience of the region.
g. Public Awareness and Education: Conduct public awareness campaigns to educate residents about flood risks, preparedness measures, and appropriate response strategies. This can include disseminating information about evacuation routes, emergency contacts, and safety precautions during flood events.
h. Coordination and Emergency Response: Establish effective coordination mechanisms among relevant stakeholders, including government agencies, local authorities, community organizations, and non-governmental organizations (NGOs). Develop emergency response plans and conduct regular drills to ensure a coordinated and efficient response during flood emergencies.
i. Climate Change Adaptation: Integrate climate change adaptation strategies into flood management plans. This includes considering future climate projections, implementing sustainable land and water management practices, and incorporating resilient infrastructure designs to withstand changing flood patterns.
j. Research and Monitoring: Invest in research and monitoring programs to improve understanding of flood dynamics, river behavior, and flood forecasting techniques. This can help enhance flood models, develop more accurate prediction systems, and support evidence-based decision-making for flood management.
k. International Cooperation: Collaborate with international organizations, neighboring regions, and countries to share knowledge, experiences, and best practices in flood preparedness, mitigation, and management. This can foster exchange of expertise, technical assistance, and financial support to strengthen flood resilience in the Hooghly district.
l. Implementing these plans and measures requires a comprehensive and coordinated approach involving multiple stakeholders, sustained funding, and long-term commitment. Regular evaluations, updates, and adaptations to the flood management strategies are also essential to ensure their effectiveness in an evolving environment.

8. Conclusion

Overall, the study finds Hooghly district is one of the major flood-prone districts of the state. Damodar river system is the major cause of such situation; therefore, the south-western part of the district is significantly affected by the flood every year. In particular, Khanakul I and II, Goghat I and II, Pursura, and Arambag are the major flood affected block of the district. However, the eastern part of the district is also influence by flood due the presence of Hooghly River system and cannels of DVC. The government has taken different steps to report all type of caused and damages by flood across the district which is help to mitigate the problem of flood.

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