



Government of West Bengal

Irrigation & Waterways Directorate

ANNUAL FLOOD REPORT FOR THE YEAR 2017

DIRECTOR

**Advance Planning, Project Evaluation
& Monitoring Cell
Jalasampad Bhavan, Salt Lake
Kolkata - 7000 091**

APRIL, 2017

ANNUAL FLOOD REPORT 2017

INDEX

Page No.

| | |
|---|---------|
| 1. Introduction | 3 |
| 2. River Systems and Flood Problems | 4-16 |
| 3. Details of River Basins and Sub-basins | 16-34 |
| 4. River and Rain Gauges | 35-44 |
| 5. Rainfall | 45-49 |
| 6. Flood Season 2017 | 50-62 |
| 7. Conclusion | 63-64 |
| ANNEXURE-I1 to I 23 | 65-87 |
| ANNEXURE-RF1 to RF4 | 88-93 |
| ANNEXURE-G1 to G26 | 94-119 |
| ANNEXURE-D1 to D4 | 120-127 |
| ANNEXURE-BR | 128 |
| ANNEXURE-FD | 129-131 |
| ANNEXURE-IM1 to IM2 | 132-133 |

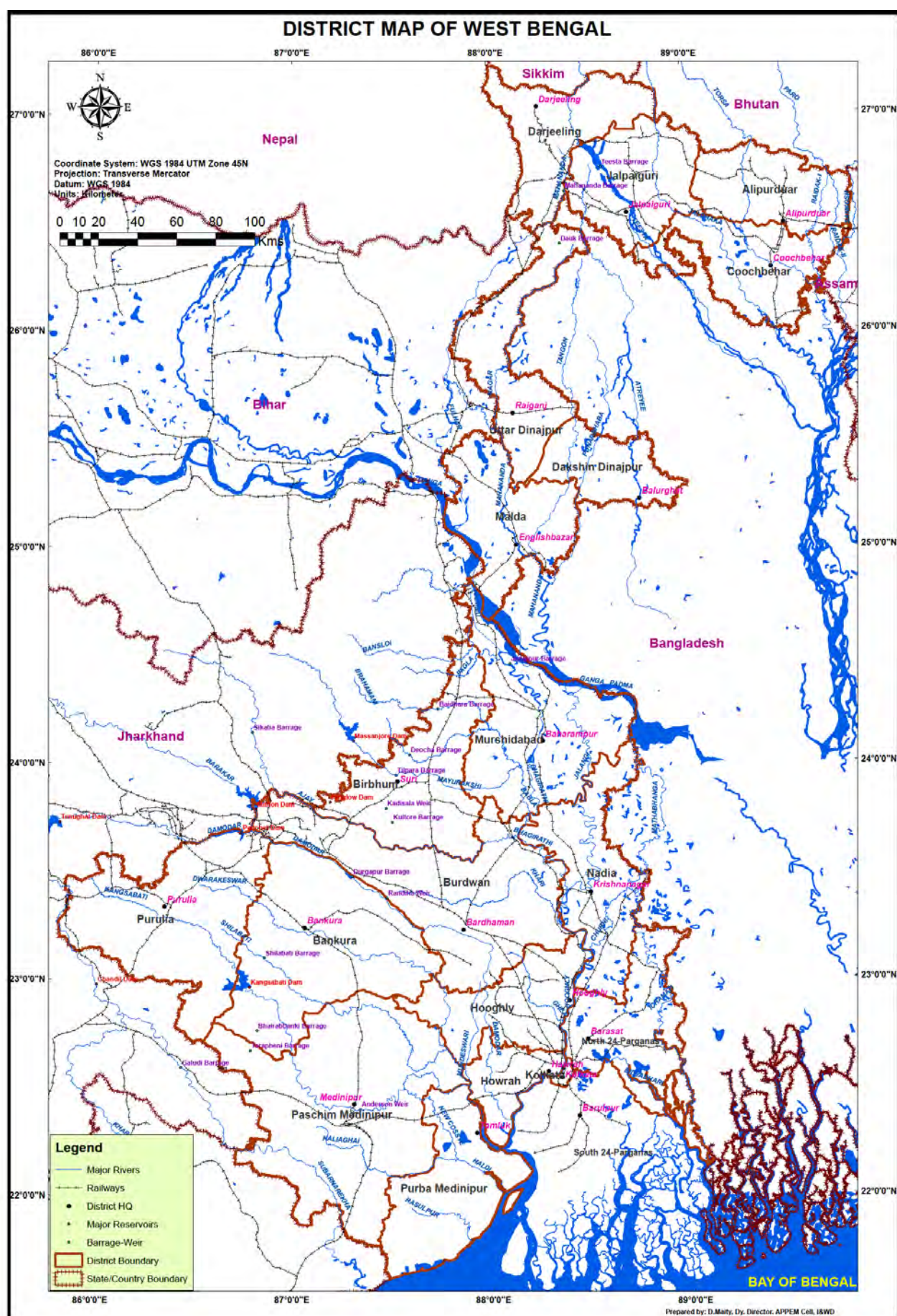
PREFACE

The State of West Bengal is the lower most riparian State in the Ganga Basin and most of the rivers in the State originate from outside the state boundary and are of inter-state/international category, The State is quite often ravaged by destructive flood, even without any appreciable rainfall within the geographical limits of the State, Along with flood, various allied problems like bank erosion, drainage congestion, and cyclonic disaster accentuate the flood situation, The State, being 42.30% of its geographical area flood prone, happens to be one of the prime flood prone States in the country.

The flood, water related disaster in the state of West Bengal has been an annual feature. Some parts of the state are victims of onslaughts offlood each year resulting severe loss to standing crops, cattle and human properties. The state has all possible facets of flood, drainage, bank erosion, cyclonic storm ravages and associated problems. It has been noticed that the furies due to flood have increased during the last two decades.

Embankments in various districts of the State in general and Sundarban areas in particular are used as communication link, particularly during periods of calamity for safe passage of people and carrying relief materials. Disruption of such communication links leads livelihood activities almost to a grinding halt. Moreover, embankments, constructed either decades or century ago, are functioning as lifeline to the people of Sundarban since those prevent entry of high tidal water into the countryside where average ground level is substantially lower than the normal amplitude of high tide. Due to breach as well as washout of embankments major portion of the area becomes disconnected from basic facilities of life.

Many factors such as intensity and duration of rainfall, sedimentation in river bed, natural obstruction etc. play a role in the occurrence of flood. Study of these factors and evaluation of flood hazards every year for a given basin/sub-basin are indispensable for evolution of various flood management measures. Accordingly, Irrigation & Waterways Directorate, at the end of each flood season, prepare annual flood report comprising rainfall patterns, rainfall in the districts, reservoir condition and major flood events of the year.



1. INTRODUCTION

The state West Bengal crowned by the mighty snow-white Himalayas in the North and frothy sea on the South is a combination of land varying from high regions in the north and partly high in the south west to the plains in the rest areas. The state is beset with extensive network of rivers, their tributaries, rivulets, jhoras, canals, tanks beels and low lying pockets of water bodies. With the Tropic of Cancer running across it, the state is situated between 21° 31' & 27° 13'14" North Latitudes and 85° 45'20" & 89° 53' East Longitudes. The salient feature of the State is given below.

Salient Feature

| | | |
|---------------------------|---|---|
| Geographical area | : | 88, 752 sk. km |
| Population (2011 census) | : | 9.13 crore |
| Districts | : | 22 nos. |
| Total blocks | : | 341 nos. |
| Most vulnerable blocks | : | 111 nos. (Flood & Tidal inundation) |
| River basins with code | : | 2A. Ganga 2B. Brahmaputra 6. Subarnarekha |
| Catchment area | : | 1, 80, 628 sq. km |
| Average rainfall | : | 1, 760 mm (Northern area: 2750 mm, Alluvial and Deltaic plain: 1650 mm, Western plateau: 1450 mm) |
| Flood prone area | : | 37, 542 sq. km |
| Area already protected | : | 35, 380 sq. km |
| Length of Embankment | : | 10, 400 km |
| Lenth of Drainage Channel | : | 7, 129 km |
| Surface water potential | : | 132.90 BCM |
| Ground water potential | : | 14.60 BCM |

2. RIVER SYSTEMS AND FLOOD PROBLEMS

West Bengal, a part of Bengal Delta, has a long-recorded history of flood. At present 42.3% of total area of the State is susceptible to flood. Reason is the landmass of the State was formed by the Ganga-Padma system of rivers through the delta building process of which flood being the main carrier of sediments, the bulk of fluvial deposit, in huge volumes. The highest affected area as recorded in 1978 is about 30,607 sq. km and in 2000 is about 23,971 sq. km.

Most of the rivers in the State are either Inter-State or International in character. The flood problems of the state are of different nature at different regions. In North Bengal, the rivers **Teesta, Torsa, Jaldhaka, Raidak** and **Sankosh** after originating in the neighbouring countries of Bhutan and Tibet and the state of Sikkim, flow downwards through the districts of Darjeeling, Jalpaiguri, Alipurduar and Coochbehar to meet the Brahmaputra at different locations in Bangladesh, another neighbouring country. The combined catchment of all this system of rivers up to the international border is 37, 545 sq. km.

The rivers of the districts of Uttar Dinajpur and Dakshin Dinajpur viz. **Tangon, Atreyee** and **Punarbhaba** after originating at Bangladesh pass through these districts and either directly or indirectly contribute upper catchment discharges into the river **Ganga-Padma** at downstream of Farakka in Bangladesh. The combined catchment area of this river system up to the international border is 8, 873 sq. km.

The southern part of district Malda through which the river Ganga flows receives its flood water from about 11 States and is battered by the run-off flow generated from these vast areas. Ultimately the river flows down the Farakka Barrage to Bangladesh. The western side of the Malda district receives floodwater mostly from neighbouring country of Nepal and state of Bihar through a network of rivers called **Mahananda** and **Fulhar**. Fulhar, after flowing straight south, joins with Ganga

upstream of Farakka barrage while Mahananda turns towards south-east and after bifurcating Malda, outfalls into river Ganga-Padma at downstream of Farakka Barrage in Bangladesh. The combined catchment of Mahananda-Fulhar system is 19, 342 sq. km.

Major contributing factors to flood in North Bengal regions are the run-off because of heavy local rainfall, discharge of upper basin areas and also outfall condition in the neighbouring countries. The Mahananda and most of the rivers of Uttar and Dakshin Dinajpur districts get stagnated when the Ganga upstream and downstream of Farakka Barrage runs high thereby not allowing drainage of flood discharge during that period.

In South Bengal, there are certain distinctive features of drainage condition which give rise to flood situation. The flood in this zone becomes voluminous because of the shape of the catchment area, its steep slope starting from a high-level plateau area and sloping sharply down to a flat terrain near the outfall of limited capacity. This feature is again adversely affected by tidal condition as is generally noticed in the month of September, the likely month of occurrence of flood.

Basin-wise there are quite a number of river systems on the west bank of the river Bhagirathi-Hooghly like **Pagla-Bansloi, Dwarka-Brahmani, Mayurakshi-Babla** and **Ajoy**. These rivers together drain out flood water from an area of 18, 177 sq. km, spread over the state of Jharkhand (the old Bihar Plateau) and the districts of Birbhum, part of Murshidabad (west of Bhagirathi) and Burdwan to outfall into river Bhagirathi. Carrying capacity of the river Bhagirathi is only 25% of the combined peak flood discharges generated from these basins because of simultaneous heavy rainfall, as it occurred during the flood of September 2000. In this vast tract of land there is one major reservoir i.e. Massanjore dam over river Mayurakshi which interferes the flood discharge of only 11% of aforesaid combined catchments.

On the left bank of the Bhagirathi river system the **Bhairab-Jalangi-Sealmari** group of rivers originate from Ganga-Padma at Akherigunj in Murshidabad district and meet the Bhagirathi at

Swarupgunj in Nadia District. This system of rivers between them drains a total area of 2, 537 sq. km of Murshidabad and Nadia districts. Generally, this area suffers from flood because of three reasons - (i) high intensity rainfall in the basin area itself (ii) inflow of flood water from Ganga-Padma at its high spate and (iii) drainage congestion at its outfall because of high stage of river Bhagirathi during high tide.

In the **Damodar-Barakar** river system, the rivers originate at Choto Nagpur plateau of Jharkhand and flows down the planes of West Bengal to outfall into the Rupnarayan-Hooghly system through two channels namely Mundeswari and Amta Channel. The catchment area up to Durgapur Barrage is 18,026 sq. km as against total catchment of 24,341 sq. km. In this catchment area there are only 4 (four) reservoirs having a storage capacity of 1.21 BCM. The original concept of flood storage was to have an area reserved for storing a volume of 3.58 BCM. Thus, with this limited flood storage capacity the storage dams at present can modify only the peak flood discharge. Any discharge above 70,000 cusecs downstream of Durgapur barrage may cause flood depending on the outfall condition of the Mundeswari at Harinkhola.

The **Shilabati-Darakeswar** and **Kangsabati-Kaliaghai** river systems which have combined catchment areas of 16, 938 sq. km spread out in the districts of Purulia, Bankura, Paschim and Purba Medinipur outfall into river Rupnarayan and Haldi respectively which finally meet river Hooghly. The Kangsabati-Kumari dam at Mukutmanipur, Bankura intercepts flood discharge of only 22% of the aforesaid combined catchment area. In this basin spillway discharge from Kangsabati dam above 50,000 cusecs may cause flood at lower reaches downstream of Mohanpur Anicut near Midnapore Town depending on tidal condition of the outfall and rainfall in the uncontrolled catchment downstream of Kangsabati dam.

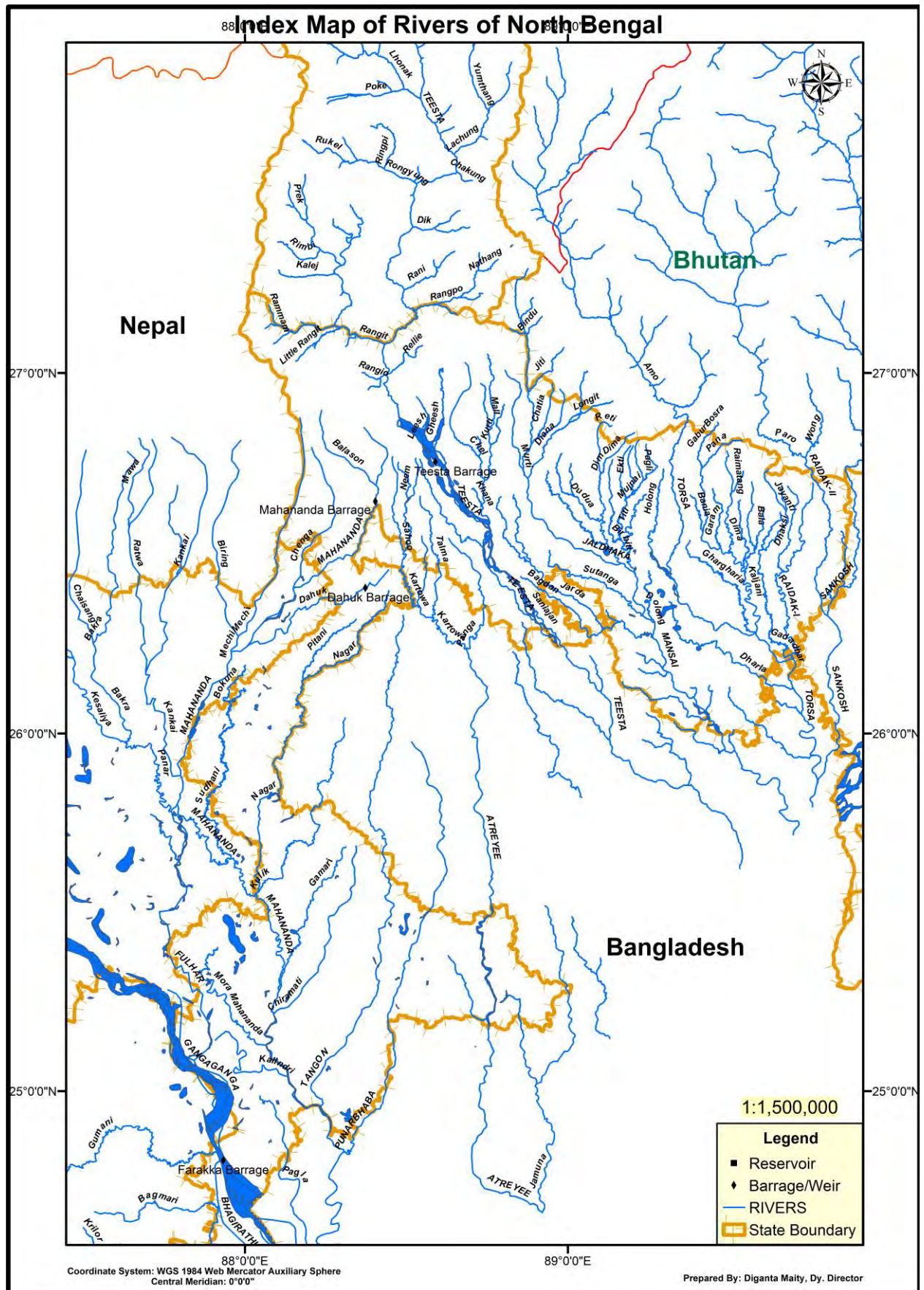
The **Mathabhanga-Churni-Ichamati** system of rivers originate at the Mathabhanga off-taking from Ganga-Padma downstream of Farakka Barrage in Bangladesh and on reaching West Bengal at Majdia in Nadia district, bifurcates in two branches (i) the Churni flowing on South-

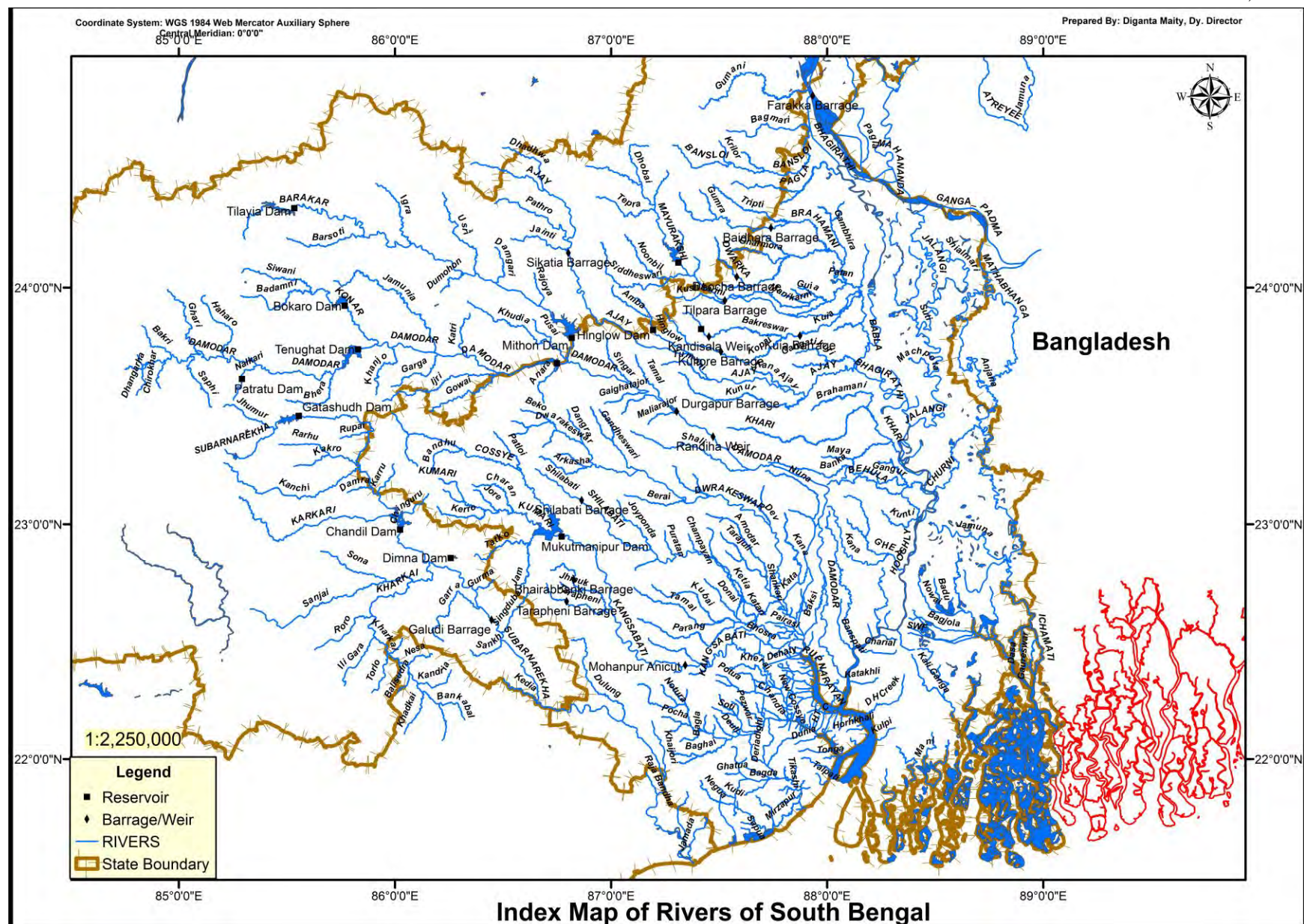
Westerly direction meeting the Bhagirathi at Ranaghat and (ii) the other branch viz. the Ichamati flowing on South-Easterly direction to meet Bay of Bengal through the creek of Raimangal. The main flood situation in this area arises because of inflow from Ganga-Padma (when it rules high), rainfall in the own catchment area and also tide lockage. In flood 2000 a very unusual situation arose where the Bhagirathi transferred a large volume of its floodwater to this basin area by breaching its embankments at several places.

Historical record of flood in West Bengal is given below:

| Flood affected Area (in Sq. Km) | Years of occurrence of Flood | Total No. of Years |
|------------------------------------|---|-----------------------|
| < 500 | 1985, 89, 92, 94, 97, 2001, 2005, 2006, 2013, 2014 & 2016 | 11 |
| 500 – 2000 | 1962, 63, 64, 65, 66, 72, 75, 96, 2003, 2004, 2007, 2009, 2011 & 2015 | 12 |
| 2000 – 5000 | 1960, 61, 67, 69, 70, 74, 76, 80, 81 & 82 | 10 |
| 5000 – 10000 | 1973, 77, 93, 95, 98 & 2008 | 6 |
| 10000 – 15000 | 1968, 79, 83, 90 & 99 | 5 |
| 15000 – 20000 | 1971, 86, 87 & 88 | 4 |
| > 20000 | 1978, 84, 91 & 2000 | 4 |

Index map of rivers of South Bengal and North Bengal and the inventories have been presented below.





| BASIN: BRAHAMAPUTRA | | | SUB-BASIN: LOWER BRAHAMAPUTRA | | |
|---------------------|----------|----------------|-------------------------------|----------|------------------------------------|
| Sl No | RIVER | Tributaries | | Location | |
| | | Primary | Secondary | STATE | District |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | Sankosh | | | Assam | Kokrajhar |
| | | | | WB | Coochbehar |
| | | Chhoto Sankosh | | Assam | Kokrajhar |
| | | | | WB | Alipurduar |
| | | Raidak-II | | WB | Alipurduar, Coochbehar |
| 2 | Torsa | | | WB | Alipurduar, Coochbehar |
| | | Raidak-I | Dhakshi | WB | Alipurduar, Coochbehar |
| | | Gadadhar | Jayanti | WB | Alipurduar |
| | | Kaljani | Bala | WB | Alipurduar |
| | | | Nonai | WB | Alipurduar |
| | | | Dima | WB | Alipurduar |
| | | | Pana | WB | Alipurduar |
| | | | Garam | WB | Alipurduar |
| | | | Bania | WB | Alipurduar |
| | | | Ghargharia | WB | Alipurduar, Coochbehar |
| | | Holong | | WB | Alipurduar, Coochbehar |
| | | Dharala | | WB | Coochbehar |
| 3 | Jaldhaka | | | WB | Jalpaiguri, Coochbehar |
| | | Mujnai | Titi | WB | Alipurduar |
| | | | Pagli | WB | Alipurduar |
| | | | Ekti | WB | Alipurduar |
| | | | Shukti | WB | Alipurduar |
| | | Jurapani | Dudua | WB | Jalpaiguri, Alipurduar |
| | | | Gilandi | WB | Jalpaiguri |
| | | Diana | Longit | WB | Jalpaiguri |
| | | Khuji Diana | Chetia | WB | Jalpaiguri |
| | | Jiti | | WB | Jalpaiguri |
| | | Murti | | WB | Jalpaiguri |
| | | Sutanga | | WB | Coochbehar |
| 4 | Teesta | Jarda | Bagdan | WB | Jalpaiguri, Coochbehar |
| | | Dolong | | WB | Coochbehar |
| | | | | SIKKIM | North Sikkim, South Sikkim |
| | | | | WB | Darjeeling, Jalpaiguri, Coochbehar |
| | | Lachung | Yumthang | SIKKIM | North Sikkim |
| | | Lasha | | SIKKIM | North Sikkim |
| | | Lohnak | Poke, Gome | SIKKIM | North Sikkim |
| | | Rangyung | Ringpi, Rukel | SIKKIM | North Sikkim |
| | | Chakung | | SIKKIM | North Sikkim |
| | | Dick | | SIKKIM | North Sikkim |
| | | Rangit | Rimbi | SIKKIM | West Sikkim |
| | | | Kalej | SIKKIM | West Sikkim |
| | | | Rammam | SIKKIM | West Sikkim |
| | | | Little Rangit | WB | Darjeeling |

| BASIN: BRAHAMAPUTRA | | | SUB-BASIN: LOWER BRAHAMAPUTRA | | |
|---------------------|------------|----------------|--------------------------------------|----------|-----------------------------------|
| Sl. No. | RIVER | Tributaries | | Location | |
| | | Primary | Secondary | STATE | District |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 4 | Teesta | Rani | | SIKKIM | East Sikkim |
| | | Rangpo | Nathang | SIKKIM | East Sikkim |
| | | Relli | | WB | Darjeeling |
| | | Rangio | | WB | Darjeeling |
| | | Leesh | | WB | Darjeeling, Jalpaiguri |
| | | Gheesh | | WB | Darjeeling, Jalpaiguri |
| | | Dharala | | WB | Jalpaiguri |
| | | | Neora | WB | Darjeeling, Jalpaiguri |
| | | | Chel | WB | Darjeeling, Jalpaiguri |
| | | Karla | | WB | Jalpaiguri |
| BASIN: GANGA | | | SUB-BASIN: BHAGIRATHI LOWER & OTHERS | | |
| 1 | Mahananda | | | WB | Darjeeling, Uttar Dinajpur, Malda |
| | | | | BIHAR | Kishanganj, Purnia |
| | | Balason | Rohini | WB | Darjeeling |
| | | Lachka | | WB | Darjeeling |
| | | Taipu | Manjha | WB | Darjeeling |
| | | Mechi | Biring | BIHAR | Kishanganj |
| | | Kankai | Ratwa | BIHAR | Kishanganj, Purnia |
| | | Panar | | BIHAR | Araria, Purnia, Katihar |
| | | | Bakra | BIHAR | Araria, Purnia |
| | | | Kesaliya | BIHAR | Araria, Purnia |
| | | Dauk | | WB | Uttar Dinajpur |
| | | Pitani | Bakuna | WB | Uttar Dinajpur |
| | | Nagar | Sudhani | WB | Uttar Dinajpur |
| | | | Kulik | WB | Uttar Dinajpur |
| | | Chiramati | | WB | Uttar Dinajpur |
| | | Sui | | WB | Uttar Dinajpur |
| | | Tangon | | WB | Uttar & Dakshin Dinajpur, Malda |
| | | Mora Mahananda | | WB | Malda |
| | | Kalindri | | WB | Malda |
| 2 | Fulhar | | | BIHAR | Katihar |
| | | | | WB | Malda |
| 3 | Punarbhaba | | | WB | Dakshin Dinajpur, Malda |
| 4 | Atreyee | | | WB | Dakshin Dinajpur |
| | | Kartowa | Neem | WB | Jalpaiguri |
| | | | Sahoo | WB | Jalpaiguri |
| | | | Chauli | WB | Jalpaiguri |
| | | | Talma | WB | Jalpaiguri |
| | | Panga | | WB | Jalpaiguri |
| | | Jamuna | | WB | Dakshin Dinajpur |
| | | Brahmani | | WB | Dakshin Dinajpur |

| BASIN: GANGA | | | SUB-BASIN: BHAGIRATHI LOWER & OTHERS | | |
|--------------------|-------------|-------------|--------------------------------------|-----------|-------------------------|
| Sl · No · | RIVER | Tributaries | | Location | |
| | | Primary | Secondary | STATE | District |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 5 | Ganga-Padma | Pagla | | WB | Malda |
| | | Gumani | | WB | Murshidabad |
| | | | | JHARKHAND | Godda, Sahebganj |
| 6 | Bansloi | | | JHARKHAND | Pakur |
| | | | | WB | Birbhum, Murshidabad |
| | | Bagmari | | JHARKHAND | Pakur |
| | | | | WB | Murshidabad |
| | | Krilor | | WB | Murshidabad |
| 7 | Pagla | | | JHARKHAND | Pakur |
| | | | | WB | Birbhum, Murshidabad |
| | | Buri | | WB | Birbhum |
| 8 | Dwarka | Brahamani | | JHARKHAND | Dumka |
| | | | | WB | Birbhum, Murshidabad |
| | | | Gumra | JHARKHAND | Dumka |
| | | | | Tripti | JHARKHAND |
| | | | WB | Birbhum | |
| | | Gambhira | Gamri | WB | Birbhum, Murshidabad |
| | | Chailan | | JHARKHAND | Dumka |
| | | | | WB | Birbhum |
| | | Ghormora | | WB | Birbhum |
| | | Kajuli | | WB | Birbhum |
| | | Daoka | Manikarnika | WB | Birbhum, Murshidabad |
| | | Banka | | WB | Murshidabad |
| 9 | Mayurakshi | | | JHARKHAND | Deoghar, Dumka |
| | | | | WB | Birbhum, Murshidabad |
| | | Dhabai | | JHARKHAND | Dumka |
| | | Bhurbhuri | | JHARKHAND | Dumka |
| | | Tepra | | JHARKHAND | Dumka |
| | | Siddeswari | | JHARKHAND | Jamtara, Deoghar, Dumka |
| | | | | Noonbeel | JHARKHAND |
| | | Kushkarini | | JHARKHAND | Jamtara |
| | | | | WB | Birbhum |
| | | Kuia | Bakreswar | WB | Birbhum, Murshidabad |
| | | | | JHARKHAND | Jamtara |
| | | | Kopai | WB | Birbhum |
| 10 | Babla | Mayurakshi | | WB | Murshidabad |
| | | Dwarka | | WB | Murshidabad |

| BASIN: GANGA | | | SUB-BASIN: BHAGIRATHI LOWER & OTHERS | | |
|--------------------|--------------|-------------|--------------------------------------|-----------|--------------------------|
| Sl · No · | RIVER | Tributaries | | Location | |
| | | Primary | Secondary | STATE | District |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 11 | Ajay | | | BIHAR | Munger |
| | | | | JHARKHAND | Deoghar, Jamtara |
| | | Dudhwa | | BIHAR | Munger |
| | | | | JHARKHAND | Deoghar |
| | | Pathro | | JHARKHAND | Giridih, Deoghar |
| | | Pathro | | JHARKHAND | Giridih, Deoghar |
| | | Hinglow | Amba | JHARKHAND | Jamtara |
| | | | | WB | Birbhum |
| | | Tumoni | | WB | Burdwan |
| | | Kunur | | WB | Burdwan |
| | | Kana Ajay | | WB | Birbhum, Burdwan |
| 12 | Jalangi | | | WB | Murshidabad, Nadia |
| | | Sialamari | | WB | Murshidabad |
| | | Suti | Chhoto Bhairab | WB | Murshidabad |
| | | | Bhandardaha | WB | Murshidabad |
| 13 | Churni | Anjana | | WB | Nadia |
| 14 | Ichhamati | Jamuna | | WB | Nadia, North 24-Parganas |
| 15 | Bidyadhari | Nowai | | WB | North 24-Parganas |
| 16 | Khari | Brahmani | | WB | Burdwan |
| | | Banka | | WB | Burdwan |
| 17 | Behula | Gangur | | WB | Burdwan, Hooghly |
| 18 | Kunti | | | WB | Hooghly |
| 19 | Ghea | Kedarmati | | WB | Burdwan, Hooghly |
| | | Kana | | WB | Burdwan, Hooghly |
| 20 | Saraswati | | | WB | Hooghly, Howrah |
| 21 | Kana Damodar | | | WB | Burdwan, Hooghly, Howrah |
| 22 | Amta Channel | | | WB | Burdwan, Hooghly, Howrah |
| 23 | Kalindri | | | WB | South 24-Parganas |
| 24 | Raimangal | | | WB | South 24-Parganas |
| 25 | Bidya | | | WB | South 24-Parganas |
| 26 | Matla | | | WB | South 24-Parganas |
| 27 | Thakuran | | | WB | South 24-Parganas |
| 28 | Saptamukhi | | | WB | South 24-Parganas |
| 29 | Muriganga | | | WB | South 24-Parganas |

| 30 | Bhagirathi-Hooghly | | | WB | Birbhum, Murshidabad, Nadia, Burdwan, Hooghly, Howrah, South & North 24 Parganas, Purba Medinipur |
|--------------|--------------------|----------------------------|--------------------|-----------|---|
| BASIN: GANGA | | | SUB-BASIN: DAMODAR | | |
| Sl No | RIVER | Tributaries | | Location | |
| | | Primary | Secondary | STATE | District |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | Damodar | | | JHARKHAND | Latehar, Chatra, Hazaribag, Ramgarh, Bokaro Dhanbad |
| | | | | WB | Burdwan, Purulia, Bankura, Hooghly, Howrah |
| | | Barakar | | JHARKHAND | Hazaribag, Giridih, Kodarma, Dhanbad |
| | | | Igra | JHARKHAND | Giridih |
| | | | Ushri | | |
| | | | Dumohon | JHARKHAND | Giridih |
| | | | Barsoti | JHARKHAND | Hazaribag |
| | | Barki | | JHARKHAND | Latehar, Chatra, |
| | | Haharo | | JHARKHAND | Hazaribag |
| | | Ghari | | JHARKHAND | Hazaribag |
| | | Bokaro | | JHARKHAND | Hazaribag, Bokaro |
| | | Konar | | JHARKHAND | Hazaribag, Bokaro |
| | | | Siwani | JHARKHAND | Hazaribag |
| | | Jamunia | | JHARKHAND | Hazaribag, Giridih, Bokaro, Dhanbad |
| | | Naikari, Bhera | | JHARKHAND | Ranchi, Ramgarh |
| | | Khanjo, Garga | | JHARKHAND | Bokaro |
| | | Khadia, Katri | | JHARKHAND | Dhanbad |
| | | Gowai, Ijri | | JHARKHAND | Bokaro |
| | | | | WB | Purulia |
| | | Sali | | WB | Bankura |
| | | Singar, Tamal | | WB | Burdwan |
| | | Nuna | | WB | |
| 3 | Mundeswari | Harinkhola | | WB | Burdwan, Hooghly |
| 4 | Darakeswar | | | WB | Purulia, Bankura, Burdwan, Hooghly |
| | | Futiary, Beko, Dudhibheria | | WB | Purulia |
| | | Arkasha | Kansachor | WB | Purulia, Bankura |
| | | Dangra | | WB | Purulia, Bankura |
| | | Gandheswari, Berai, Khukra | | WB | Bankura |
| | | Shankari | | WB | Paschim Medinipur |
| | | | Amodar | WB | Bankura, Paschim |
| | | | Tarajuli | WB | Bankura, Paschim |
| 5 | Shilabati | | | WB | Purulia, Bankura, Paschim Medinipur |

| | | | | | |
|--------------|---------------|---------------------------|-------------------------------|-----------|-------------------------------------|
| | | Jaiponda | | WB | Bankura |
| | | Puratan, Champayan, Ketia | | WB | Bankura, Paschim |
| | | Ruparghghra | | WB | Paschim Medinipur |
| | | Donai | | WB | Paschim Medinipur |
| | | Kubai | Tamal, Parang | WB | Paschim Medinipur |
| | | Katan | | WB | Paschim Medinipur |
| BASIN: GANGA | | | SUB-BASIN: DAMODAR | | |
| Sl. No. | RIVER | Tributaries | | Location | |
| | | Primary | Secondary | STATE | District |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 6 | Kangsabati | | | WB | Purulia, Bankura, Paschim Medinipur |
| | | Saharjore, Bandhu, Patloi | | WB | Purulia |
| | | Kumari | Hanumata, Kerro, Jore, Charan | WB | Purulia |
| | | Jam | | WB | Paschim Medinipur, Bankura, Purulia |
| | | | Tatko | JHARKHAND | Purba Singbhum |
| | | | | WB | Purulia |
| | | Bhairabbanki | Jhinuk | WB | Bankura, Paschim |
| | | | Tarapheni | WB | Paschim Medinipur |
| Kalaichu | | WB | Paschim Medinipur | | |
| 7 | Old Cossye | | | WB | Paschim Medinipur |
| 8 | New Cossye | Kherai | Bakshi | WB | Paschim & Purba |
| 9 | Rupnarayan | Kana Dwarakeswar | | WB | Hooghly, Burdwan |
| | | Polashpai | | WB | Paschim Medinipur |
| | | Durbachaty | | WB | Purba Medinipur |
| 10 | Kaliaghai | | | WB | Paschim & Purba |
| | | Kapaleswari, Deuli | | WB | Paschim Medinipur |
| | | Chandia | | WB | Paschim & Purba |
| | | Baghai | | WB | Paschim & Purba |
| 11 | Haldi | | | WB | Purba Medinipur |
| 12 | Rasulpur | | | WB | Purba Medinipur |
| 13 | Pichabani | | | WB | Purba Medinipur |
| 14 | Negua Channel | | | WB | Paschim & Purba Medinipur |

| BASIN: SUBARNAREKHA | | | | | |
|---------------------|--------------|---------------|-------|-----------|---|
| 1 | Subarnarekha | | | JHARKHAND | Ranchi, Seraikela-Kharswan, Purba Shingbhum |
| | | | | WB | Paschim Medinipur |
| | | | | ODISHA | Balasore |
| | | Jhumur, Rupai | | JHARKHAND | Ranchi |
| | | Kakro | Rarhu | JHARKHAND | Ranchi |
| | | Karru | | JHARKHAND | Ranchi |
| | | | | WB | Purulia |
| | | Kanchi | | JHARKHAND | Ranchi |

| | | | | |
|--|--|----------|-----------|--------------------|
| | | Damra | JHARKHAND | Ranchi, Seraikela- |
| | | Karkari | JHARKHAND | Ranchi, Seraikela- |
| | | Chinguru | WB | Purulia |
| | | | JHARKHAND | Seraikela-Kharswan |
| | | Kharkai | Bankabol, | ODISHA |
| | | | | Mayurbhanj |

| BASIN: SUBARNAREKHA | | | | | |
|---------------------|--------------|---------------------|--|-----------|-------------------|
| Sl No | RIVER | Tributaries | | Location | |
| | | Primary | Secondary | STATE | District |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | Subarnarekha | Kharkai | Bankabol, Khadkari, Kandria, Nesa, Burhai | ODISHA | Mayurbhanj |
| | | | Torlo, Illgara, Roro, Sanjai | JHARKHAND | Paschim Shingbhum |
| | | Garra, Sankh, Kodia | | JHARKHAND | Purba Shingbhum |
| | | Gurma | | JHARKHAND | Purba Shingbhum |
| | | | | WB | Purulia |
| | | Singaduba | | JHARKHAND | Purba Shingbhum |
| | | | | WB | Paschim Medinipur |
| | | Dulung, Khaijori | | WB | Paschim Medinipur |

3. DETAILS OF RIVER BASINS AND SUB-BASINS

The state can be demarcated into three distinct drainage basins namely Ganga (CWC basin code no. 2A), Brahmaputra (CWC basin code no. 2B) and Subarnarekha (CWC basin code no. 6) basins respectively. Ganga basin has been further divided into two parts namely Bhagirathi lower & others and Damodar. These three main river basins can in turn be divided into sub-basins having individual catchment of their own. Index maps of different river sub-basins and basins are presented in Annexure-II to I23.

BRAHAMAPUTRA BASIN

The rainfall in the northern region of the state is generally high. The ground slope is steep, particularly in the Sub-Himalayan regions of the northern districts. Most of these northern districts

belong to Brahmaputra basin. This system consists of a total area of 10,584 sq.km nearly 12% of the geographical area of the state. This basin area is interspersed with a large number of drainage channels which join the main drainage arteries of the regions like the rivers Teesta, Torsa, Raidak, Jaldhaka etc. All these rivers originate from the Himalayas in Bhutan/Sikkim/Tibet and flow across the Terai region and reach the plains of West Bengal and then flow to Bangladesh joining ultimately the Brahmaputra in Bangladesh. The catchment area distribution of this basin and sub-basins bounded within different neighbouring states and countries has been presented in the following table.

| RIVER BASINS AND SUB-BASINS OF WEST BENGAL | | | | | | | | | |
|--|-----------------------|----------------|-------------------------|------------|-------|-----------------|------------|-----------|-------------------|
| CWC Basi n Code | River Basin | Sub- Basins | CATCHMENT AREA (Sq. Km) | | | | | | TOTAL (Sq. Km) |
| | | | Assam | Sikki m | WB | Bangla -desh | Bhuta n | Tibe t | |
| 2B | BRAHAMAPUTRA | | | | | | | | |
| | Brahmaputr a Lower | Jaldhaka | | 76 | 3916 | 351 | 959 | | 5302 |
| | | Raidak | | | 246 | | 4590 | 16 | 4852 |
| | | Sankosh | 175 | | 162 | | 9734 | 75 | 10146 |
| | | Teesta | | 7000 | 3012 | 12 | | 29 | 10053 |
| | | Torsa | | | 3248 | | 2363 | 1581 | 7192 |
| | | Sub-Total | 175 | 7076 | 10584 | 363 | 17646 | 1701 | 37545 |

Sankosh Sub-basin

The river Sankosh with its origin in Bhutan is the eastern most river of Brahmaputra river basin. It serves as the boundary between the two states West Bengal and Assam. It joins with Raidak-II and finally falls into Brahmaputra in Bangladesh by name Gangadhar. The length of Sankosh in West Bengal is 24 km. The total catchment area of this river sub-basin is 10,146 sq. km.

Raidak Sub-basin

It originates in Mt. Akungphu at an altitude of 6,400 m. in Bhutan.

The river Raidak then bifurcates into two channels namely Raidak-I and Raidak-II at Bhutanghat, close to Indo-Bangladesh border. Raidak-I joins the united stream of Torsa and Kaljani, while Raidak-II is joined by Sankosh and finally outfalls into Brahmaputra in Bangladesh by the name Gangadhar. The length of Raidak-II is around 50 km in West Bengal. The total catchment area of Raidak-II river sub-basin is 4,852 sq. km.

Torsa Sub-basin

The river Torsa originates in Chumbi Valley of southern Tibet at an altitude of 7,065 m. It flows through Tibet, Bhutan, West Bengal and Bangladesh. Below Hasimara bridge on NH-31, it bifurcates into two channels viz. Sil-Torsa and Char-Torsa. They reunite at Patla Khowa forest. The river passes by the Coochbehar town and is joined by river Kaljani and Raidak-I. The combined flows outfalls into Brahmaputra near Nageswari at Rangpur in Bangladesh. The total length of this river is 222 km out of which 74 km is situated within West Bengal. The total catchment area of this river sub-basin is 7,192 sq. km.

Jaldhaka Sub-basin

The river Jaldhaka has its origin at Bitang Lake in Sikkim at an altitude of 4,400 m. It flows through Sikkim, Bhutan, West Bengal and Bangladesh. After the river is joined by a number of streams and tributaries both in mountainous and sub-mountainous regions, it finally flows into river Dharala and the combined system, by the name Dharala ultimately outfalls into Brahmaputra in Bangladesh. The total length of this river is 192 km out of which 122 km is situated within West Bengal. The total catchment area of this river Sub-basin is 5,302 sq. km.

Teesta Sub-basin

Teesta, the mighty river of North Bengal originates in the

glaciers of North Sikkim at an altitude of 6,400 m and is formed by the union of two streams viz. Lachen and Lachung at Chungthung in Sikkim. It enters West Bengal at Rangpo and upto Mechi, it forms the boundary between West Bengal and Sikkim. Two of its tributaries, Great-Rangeet and Rammam also serve as the natural boundary between the two states. The river finally outfalls into Brahmaputra in Rangpur district of Bangladesh. The total length of this river is 309 km out of which 103 km is situated within Sikkim and 121 km in West Bengal. The total catchment area of this river Sub-basin is 10,053 sq. km. Under Teesta Barrage Project a barrage has been constructed at Gazoldoba under Jalpaiguri district.

GANGA BASIN

The two holy rivers - Bhagirathi and Alakananda originating from the glaciers of the Himalayas at an altitude of 7,000 m join at Devprayag and the combined stream is known as the Ganga. It emerges into the plains at Rishikesh in Uttaranchal. After flowing exclusively through Uttaranchal and Uttar Pradesh it receives the flow of Yamuna, one of its major tributaries near Allahabad. The other major tributaries of Ganga are Ton, Gomti, Gharghara, Son, Gandak, Kosi and Fulhar. The Ganga forms the boundary between Uttar Pradesh and Bihar for a length of about 110 km and the river then enters Bihar and flows more or less through the middle of the state. After its confluence with the Kosi, the Ganga continues its eastward flows in Bihar for about 40 km.

At Bhagalpur of Bihar, the river begins to flow south-southeast and as it enters West Bengal, the river swings round the Rajmahal hill range and it begins its attrition with the branching away of its first distributary, the Bhagirathi-Hooghly, which goes on to become the Hooghly River after meeting with Jalangi near Nabadwip and ultimately outfalls into the Bay of Bengal near Sagar Island. Just before the border with Bangladesh the Farakka Barrage controls the flow of the Ganges, diverting some of the water into a feeder canal linked to the Hooghly for the purpose

of keeping it relatively silt-free.

The North-Central, South-Central, Western, South-Western and Southern parts of West Bengal constitute the Ganga Basin. This basin is largely divided into two major sub-basins namely Bhagirathi lower and Damodar. The total length of the river Ganga from its point of origin to the point where it falls into sea is about 2,575 km (measured along Bhagirathi and the Hooghly) of which 1,450 km lies in Uttaranchal and Uttar Pradesh, 110 km along Uttar Pradesh and Bihar border, 445 km in Bihar and 570 km in West Bengal.

The Ganga system comprises a total area of 74,575 sq. km within the state of West Bengal. The catchment area distribution of this basin and sub-basins bounded within different neighbouring states and countries has been presented in the following table.

Mahananda-Fulhar Sub-basin

The river Mahananda originates from Ghoom near Darjeeling town in the district of Darjeeling. It is bounded on the north by the Himalayas, in the east by the ridges separating it from Teesta river system, the river Ganga on the South and the Kosi river system in the east. The river bifurcates into two channels at Barsoi in Bihar. Out of the two branches one flows through Bihar by the name Fulhar and the other flows through West Bengal as Mahananda. The river Mahananda carrying the flow of four tributaries namely, Nagar, Kalindri, Tangon and Punarbhaba, drains into the river Ganga from the North-Western side at Godogarighat just downstream of the point where Ganga leaves the boundary of West Bengal. The combined catchment area of these two Sub-basins is 19,342 sq. km. Under Teesta Barrage Project a barrage has been constructed over Mahananda near Siliguri and another pick-up barrage has been constructed over river Dahuk near Chopra of North Dinajpur district which is a tributary of Mahananda.

| RIVER BASINS AND SUB-BASINS OF WEST BENGAL | | | | | | | | | | |
|--|--|---------------------------|-------------------------|-------------|------------|------------|------|------------|--------|-------------------|
| CWC Basi n Code | River Basin | Sub-Basins | CATCHMENT AREA (Sq. Km) | | | | | | | TOTAL (Sq. Km) |
| | | | Biha r | J'khan d | Oriss a | Sikki m | WB | B'des h | Nepal | |
| 2A | GANGA | | | | | | | | | |
| | Bhagirathi and Others (Ganga Lower) | Atreyee | | | | | 1627 | 2262 | | 3889 |
| | | Fulhar | 2940 | | | | 325 | | 2684 | 5949 |
| | | Mahananda | 2739 | | | | 6040 | 1319 | 3295 | 13393 |
| | | Punarbhaba | | | | | 1125 | 1809 | | 2934 |
| | | Tangon | | | | | 1244 | 806 | | 2050 |
| | | Ajay | 386 | 3204 | | | 2503 | | | 6093 |
| | | Amta Channel-Kana Damodar | | | | | 1490 | | | 1490 |
| | | Bansloi | | 1794 | | | 119 | | | 1913 |
| | | Behula | | | | | 549 | | | 549 |
| | | Bhagirathi-Hooghly | | 1292 | | | 4160 | | | 5452 |
| | | Bidyadhari | | | | | 2014 | | | 2014 |
| | | Brahamani | | 985 | | | 154 | | | 1139 |
| | | Churni | | | | | 975 | 1304 | | 2279 |
| | | Dwarka | | 329 | | | 2649 | | | 2978 |
| | | Ganga-Padma | | | | | 1673 | | | 1673 |
| | | Ghea | | | | | 1167 | | | 1167 |
| | | Ichamati | | | | | 2313 | 1063 | | 3376 |
| | | Jalangi | | | | | 2537 | | | 2537 |
| | | Khari | | | | | 2268 | | | 2268 |
| | | Mayurakshi | | 2949 | | | 2529 | | | 5478 |
| | | Pagla | | 239 | | | 337 | | | 576 |
| | | Sundarban | | | | | 6747 | | | 6747 |
| | | Rivers & Creeks | | | | | 3462 | | | 3462 |
| | Damodar | Damodar | | 17087 | | | 4325 | | | 21412 |
| | | Dwarakeswar | | | | | 4292 | | | 4292 |
| | | Haldi | | | | | 614 | | | 614 |
| | | Kaliaghai | | | | | 1913 | | | 1913 |
| | | Kangsabati | | 321 | | | 6324 | | | 6645 |
| | | Mundeswari | | | | | 1439 | | | 1439 |
| | | Pichabani | | | 17 | | 791 | | | 808 |
| | | Rasulpur | | | | | 1556 | | | 1556 |
| | | Rupnarayan | | | | | 1226 | | | 1226 |
| | | Shilabati | | | | | 4088 | | | 4088 |
| Sub-Total | | 6065 | 28200 | 17 | | 74575 | 8563 | 5979 | 123399 | |

Atreyee Sub-basin

Some rivers like Sahu, Neem, Talma, Chaoai, Panga originating from the high lands in districts of Jalpaiguri and meet together to form Kartowa which then enters into Bangladesh by the name Atreyee. The river Atreyee then bifurcates into two channels namely Dheepa and Atreyee. The Western Channel named Atreyee re-enters into West Bengal in South Dinajpur district covering a length of 40 km in the State. It again enters into Bangladesh and ultimately outfalls into river Jamuna after passing through Chalan beel. The total catchment area of this river sub-basin is 3,889 sq. km at the point of leaving West Bengal boundary.

Punarbhaba Sub-basin

The river Dheepa after emerging out from Atreyee in Bangladesh, has taken a South -Western course to enter into South Dinajpur district assuming the name Punarbhaba. Covering a length of about 40 km. in the district it touches the eastern boundary of Maldah district and finally enters into Bangladesh. Further down, Punarbhaba meets the river Mahananda in Bangladesh. The catchment area of this sub-basin is 2,934 sq. km.

Nagar-Kulick, Gamari-Chiramati, Tangon Sub-basins

All these rivers flow through the districts Malda and North Dinajpur and outfall into the river Mahananda. In course of their flow, somewhere they form the boundary either between West Bengal and Bihar or between West Bengal and Bangladesh. Nagar, originating in Bangladesh flows along the boundary of West Bengal and taking a South-eastern course, receives a spill channel of Mahananda and is joined by Kulick, which has also its origin in Bangladesh.

Gamari and Chiramati are two small rivers that flow through North Dinajpur district before they are united. This combined streams finally

outfalls into the river Mahananda. Tangon is a tributary of river Mahananda. It rises in Bangladesh. It flows through the district of North Dinajpur and Malda and meets Mahananda on the boundary of Malda and Bangladesh. The catchment area of Tangon is 2,050 sq. km.

Bhagirathi-Hooghly Sub-basin

Farakka Barrage diverts water from river Ganga into Bhagirathi through a channel known as Feeder canal near Tildanga town of Murshidabad district in order to ensure minimum flow in Bhagirathi especially during dry season. This canal flowing parallel to Ganga passes Dhulian and ends just above Jangipur where Bhagirathi takes its own course. Two right bank tributaries namely Pagla and Bansloi outfall into the Feeder canal before it turns into actual Bhagirathi. It has been renamed as river Hooghly as it passes on the eastern side of Hooghly district until it outfalls into the Bay of Bengal near Sagar island.

During its entire course from origin to outfall, Bhagirathi has formed boundaries between the districts of Burdwan & Nadia, Hooghly & North 24-Parganas, Howrah & Kolkata, Purba Medinipur & South 24-Parganas. River Ajay, Mayurakshi, Damodar (Amta Channel), Rupnarayan and Haldi are the major tributaries on its right bank while river Jalangi and Churni are the major tributaries on its left bank. Some other minor tributaries on its right bank are Khari, Behula, Ghea and Rasulpur. Moreover there are so many small drainage channels and khals which directly outfall into this river from its both banks thus forming local catchment areas of 5, 452 sq. km. The Tolly's Nullah or the Adi Ganga, as it is sometimes called is a small but important tidal creek draining into the river Hooghly from the left in the vicinity of the city of Kolkata.

One important factor which affects the drainage potential of river Hooghly is the effect of tides. The tide runs rapidly on Hooghly and produces a remarkable example of the fluvial phenomenon known as a

‘tidal bore’. This consists of the head-wave of the advancing tide, hemmed in where the estuary narrows suddenly into the river, and often exceeds 2.1 m in height. The difference from the lowest point of low-water in the dry season to the highest point of high-water in the rainy season is reported to be more than 6 m. It has been observed that the incident of flood devastation in the districts of Purba & Paschim Medinipur, Howrah and Hooghly occur mostly when high flood discharges from Jharkhand districts alongwith those from Bankura, Birbhum, Burdwan and Purulia districts of West Bengal synchronizes with high tides in river Hooghly specially during the month of August and September.

Jalangi-Bhairab Sub-basin

The river Jalangi originates from the right bank of the river Padma in Murshidabad district, 165 km. downstream of Farakka. Jalangi is dead for all purposes except during the periods of heavy rain, when it receives water from Padma. The river ends its journey by finally outfalling into the river Bhagirathi near Nabadwip town of Nadia district. The major tributary of Jalangi is river Bhairab which starts its journey from the river Ganga near Lalbag of Murshidabad district. It is now almost a dead channel but during rainy season it receives water from Padma. Catchment area of Jalangi Sub-basin is 2,537 sq. km.

Mathabhanga-Churni Sub-basin

River Mathabhanga originates from the right bank of the Padma, at Munshiganj in Kushtia district of Bangladesh. It bifurcates near Majdia of Nadia in India, creating two channels. The western course, Churni runs a few km through Nadia in a south-west direction to meet Bhagirathi and the other course Ichamati, after traversing a length of 20 km in India, enters into Bangladesh near Mubarakpur. The length of Churni is almost 56 km. Catchment area of Mathabhanga-Churni Sub-basin is 2,279 sq. km.

Ichamati- Bidyadhari Sub-basins

After entering into Bangladesh near Mubarakpur, river Ichamati flows for 35 km in Bangladesh and again re-enters into India at Duttaphulia of Nadia. It forms the international border between India and Bangladesh for 21 km and finally outfalls into river Kalindi of Sundarban area. The length of Ichamati is 208 km with the catchment area of 2,313 sq. km within West Bengal and 1,063 sq. km within Bangladesh. Bidyadhari originates near Haringhata in Nadia district and then flows through Deganga, Habra and Barasat areas of North 24 Parganas before joining the Raimangal River in the Sundarbans. It has been the major drainage system of North 24-Parganas and Kolkata having catchment area of 2,014 sq. km.

Pagla-Bansloi Sub-basins

These rivers originate from the Rajmahal hills in the Sahebganj district of Jharkhand. Flowing eastern across Birbhum district, they entered Murshidabad district as the tributaries of the river Bhagirathi. The combined catchment area of these sub-basins is 2,489 sq. km.

Brahamani-Dwarka Sub-basin

Dwaraka originating in Dumka district of Jharkhand, flows through Birbhum and Murshidabad districts where it joins with Mayurakshi to form Babla which finally outfalls into the river Bhagirathi. Brahamani is the main tributary of Dwarka. It also originates in Dumka district of Jharkhand and flows through Birbhum and Murshidabad districts to meet with Dwarka. There are Baidhara and Deocha barrages across the river Brahamani and Dwarka respectively under the 'Mayurakshi Reservoir Project'. The total catchment area of this sub-basin is 4,117 sq. km.

Mayurakshi-Babla Sub-basin

River Mayurakshi or Mor, the major river in Birbhum district, has a long history of devastating floods. It has its source on Trikut hill, about 16 km from Deoghar in Jharkhand state. Several spill channels – the Manikarnika, Kana Mor etc. take off from the Mayurakshi in its lower reaches. All these rivers including river Dwarka flow into the lower pocket of Hijal beel in the district of Murshidabad. The combined flow when starts journey from the beel named as river Babla which finally drains into the river Bhagirathi. The drainage and flood level in the Hijal Beel is considerably influenced by the ruling level of Bhagirathi.

Massanjore dam and Tilpara barrage have been constructed across this river as a part of 'Mayurakshi Reservoir Project' which is the first major irrigation project in West Bengal after independence. Other important structures of this project situated in Birbhum are Kopai barrage on river Kopai, Bakreswar dam and Kandisala weir over river Bakreswar. The combined flows of Kopai and Bakreswar are called river Kuia which outfalls into Mayurakhshi near Kandi of Murshidabad. Mayurakshi is about 250 km long out of which nearly 100 km passes through West Bengal. The total catchment area of this sub-basin is 5,478 sq. km. River Siddheswari and Noonbeel are two major tributaries of Mayurakshi outfalling into it at 8 km downstream of Massanjore dam and largely contribute the high volume of uncontrolled flood discharge during monsoon.

Ajay Sub-basin

River Ajay originates on a small hill about 300 m high, southwest of Munger in Bihar. It then flows through Jharkhand and enters West Bengal at Simjuri, near Chittaranjan. It forms the border between Burdwan and Birbhum districts and finally joins the Bhagirathi River near Katwa town of Burdwan. Total length of the Ajay is 288 km out of which 152 km lays in West Bengal. The important tributaries of Ajay are Pathro and Jayanti in Jharkhand, Hinglow in Birbhum and Kunur in Burdwan district of West Bengal.

There is a barrage across river Ajay constructed by Govt. of Jharkhand at Sikatia. The floods of this river are flashy and of short duration. There are some pockets in the Ajay-Kunur catchment which suffer from frequent inundation. Large areas of Burdwan, Birbhum and Murshidabad districts experience inundation due to drainage congestion whenever flood of the Ajay coincides with those of the Mayurakshi and Dwarka. A dam has been constructed over the tributary Hinglow for the purpose of irrigation in some parts of Birbhum district. The total catchment area of this Sub-basin is 6,093 sq.km.

Khari-Behula-Ghea Sub-basins

Khari river a minor right bank tributary of river Bhagirathi originates from the swampy field of Kanksa-Panagarh region of Burdwan district and flows mainly eastward and later south-eastward to outfall into river Bhagirathi upstream of Kalna town. Its main tributary is Banka river which acts as a spill channel of river Damodar and after flowing almost parallel to Khari it meets with Khari just before its outfall into Bhagirathi. The catchment area of this sub-basin is 2,268 sq. km.

Behula, also a spill channel of river Damodar originates near Palla village of Burdwan district and after flowing eastward it outfalls into river Bhagirathi upstream of Balagarh town of Hooghly district. Its main tributary is Gangur river. The catchment area of this sub-basin is 549 sq. km.

Ghea is another spill channel of river Damodar, originating in the Burdwan district and after flowing southward and south-eastward through Hooghly district it outfalls into Hooghly river near Champdani town. The main tributaries of this river are Kana and Kunti having a catchment area of 1,167 sq. km.

Damodar-Mundeswari Sub-basins

River Damodar originating from Palamau hills in Jharkhand and flowing through a length of 541 km between several districts of Jharkhand and West Bengal bifurcates into two channels at Beguahana of Burdwan district near Jamalpur. One channel carrying dominant flood discharge has been named as river Mundeswari which drains into Rupnarayan at Bakshi of Howrah district. The other channel after passing through Hooghly and Howrah districts as Amta channel carries its discharge and outfalls into the river Hooghly through an outfall sluice near Uluberia.

The river causes floods in its lower reaches in the districts of Burdwan, Hooghly and Howrah, mainly on the right bank of the river below Beguahana. Earlier known as the 'Sorrow of Bengal' because of its ravaging floods in the plains of West Bengal, the Damodar and its tributaries have been somewhat tamed with the construction of four dams (Mithon, Panchet, Konar and Tilayia) under the control of 'Damodar Valley Corporation (DVC)'. There is another dam at Tenughat across Damodar under the direct control of Government of Jharkhand and in the lower catchment there are one barrage at Durgapur and one weir at Randiha under the direct control of Irrigation & Waterways Department, Government of West Bengal.

Barakar and Bokaro are two major tributaries of Damodar in Jharkhand which meet Damodar from its left bank whereas river Shali in Bankura district of West Bengal is other major tributary situated on its right bank. Harinkhola, Short-Cut channel, Kana Dwarakeswar, Hurhura khal are other important drainage arteries of this catchment which play important role in draining out flood discharge into river Rupnarayan, having tidal influence. The total catchment area of Damodar sub-basin in Jharkhand is 17,087 sq. km and in West Bengal is 4,325 sq. km upto Beguahana point. The local catchment area of Mundeswari sub-basin is 1,439 sq. km and that of Amta Channel-Kana Damodar sub-basin is 1,490 sq. km.

Dwarakeswar Sub-basin

Darakeswar river (also known as Dhalkishore) is a major river in the western part of West Bengal. It originates from Tilboni hill of Chhota Nagpur Plateau in Purulia district and enters Bankura district near Chatna. It mainly flows south-eastward and after entering into Hooghly district it turns south near Arambag town. Its main tributary Gandheswari rising from Bankura district meets Darakeswar near Bankura town. After receiving contributions from other minor tributaries like Arkasha, Berai, Shankari etc. Darakeswar finally joins with Shilabati at Bandar near Ghatal town of Paschim Medinipur district to form river Rupnarayan. There is proposal of "Darakeswar-Gandheswari Reservoir Project" within this sub-basin. The catchment area of this sub-basin is 4, 292 sq. km.

Shilabati Sub-basin

Like Darakeswar, river Shilabati (also known as Shilai) emerging from hilly terrain of Chhota Nagpur Plateau in the Purulia district, traverses south-eastward through the districts of Bankura and Paschim Medinipur to meet with Darakeswar to form Rupnarayan. River Joyponda, Ketia, Donai, Kubai and Parang are major tributaries of Shilabati. There is a small barrage constructed across the river at Kadamdeuli in Bankura district as a part of 'Kangsabati Reservoir Project'. The catchment area of this sub-basin is 4, 088 sq. km.

Kangsabati Sub-basin

The river Kangsabati (also variously known as the Kasai and Cossye) originating from Chhota Nagpur Plateau in the Purulia district and flowing south-eastward, joins with its main tributary Kumari river at Mukutmanipur of Bankura district where a reservoir popularly known as Mukutmanipur dam has been constructed under the 'Kangsabati Reservoir Project' for the purpose of both irrigation and flood control. An Anicut dam built on this river near Midnapore town in 1872 was also added to the

operations of the project. Further down, after entering into the district of Paschim Medinipur it joins with combined streams of Bhairab Banki and Tarafeni rivers. Both the rivers have barrages over them under the 'Kangsabati Reservoir Project'. After travelling further east in a tortuous course it bifurcates into two rivers at Kapastikri of Paschim Medinipur.

Northern branch, known as Old Cossye after flowing through certain distance, further bifurcates into two courses at Daspur of Paschim Medinipur. One course, named as Palaspai khal flow further east to outfall into the Rupnarayan and the main course, known as Durbachati flows south-easterly along the border of both Medinipur districts to outfall into river Rupnarayan. Old Cossye is also connected with river Shilabati through a small channel known as Kanki khal.

The southern course, known as New Cossye, flows further south-easterly direction to meet with river Kaliaghai at Dheubhanga of Purba Medinipur district and forms river Hal-di which flows eastwardly into the river Hooghly at Haldia. Kherai and Bakshi khal is the main tributary of river New Cossye. The total length of Kangsabati is around 465 km. The catchment area of this sub-basin is 6, 645 sq. km. Very often lower portion of this sub-basin specially Ghatal area of Paschim Medinipur and Panskura area of Purba Medinipur districts suffer from inundation due to high flood discharge from its uncontrolled catchment downstream of the Mukutmanipur dam synchronizing with high tide in river Rupnarayan.

Kaliaghai

The river Kaliaghai trickles out from Dudhkundi of Jhargram in Paschim Medinipur district and flows south-easterly through Purba Medinipur to meet the other arm of Kangsabati i.e. New Cossye to form Hal-di. During the course of its journey, it is fed by the flow of its tributaries namely Kapaleswari, Baghai and Chandia. The length of this

river is 121 km and catchment area is 1,913 sq. km. This river is mainly responsible for flood in Sabang area of Paschim Medinipur district.

Rupnarayan Sub-basin

River Rupnarayan is the major drainage artery of south-western districts of South Bengal. Being the main tributary of Hooghly river, it receives tidal discharge of Bay of Bengal throughout the year and plays an important role in draining flood water from vast catchment area. Irrespective of discharges from its major tributaries like Mundeswari, Darakeswar, Shilabati and Kangsabati, it also receives flood water from many local drainage channels like Kata khal of Hooghly, Bakshi khal of Howrah, Chandreswar khal of Paschim Medinipur, Denan-Dehaty-Soadighi-Gangakhali-Pratapkhali-Shankrara khals of Purba Medinipur which directly outfall into Rupnarayan from its both banks. The length of this river is 80 km having local catchment area of 1,226 sq. km.

Haldi Sub-basin

Two rivers New Cossye and Kaliaghahi join at Dheubhanga of Purba Medinipur to form river Haldi which after traversing south-eastward outfalls into river Hooghly near Haldia town. It divides the Purba Medinipur district into two parts, the Northern part can be categorized as drainage area of Tamruk and the southern part can be categorized as Rasulpur-Nandigram drainage area. Except upper catchment discharges from Kaliaghahi-New Cossye sub-basins, river Haldi drains out water from parts of both the above-mentioned drainage areas. The lower portion of the river Haldi is affected by over bank spills and drainage problem during the monsoon as entire stretch of 42 km of the river falls under the tidal influence of river Hooghly. The local catchment area of this sub-basin is 614 sq. km.

Rasulpur Sub-basin

The river Rasulpur is formed by union of two drainage channels namely Bagda and Sadar khals. It is the main drainage channel in Contai sub-division of Purba Medinipur district. The river having length 19 km drains out flood water of 1,556 sq. km into the river Hooghly.

Pichabani-Negua Channel Sub-basin

River Pichabani and Negua Diversion channel systems are used to discharge rain water out from Dubda basin of Purba Medinipur district. The two channels outfall into Bay of Bengal. Catchment area of this sub-basin is 808 sq. km.

Sundarban Drainage Sub-basin

Apart from the rivers described earlier within the Ganga basin, there is a group of rivers in Southern part of the State which falls in the deltaic zone. These tidal rivers, estuaries and creeks are situated on the eastern side of Hooghly river popularly known as Sundarbans which is nothing but an intricate network of number of deltaic islands of the district of South 24-Parganas. These rivers drain off whatsoever fresh discharge comes from country sides, thus ultimately draining into Bay of Bengal. Some important rivers in Sundarban are Muriganga, Mridangabhanga, Saptamukhi, Raimangal, Matla, Bidya, Thakuran, Malancha, Kalindi, Gomar etc. The total land area of Sundarban sub-basin is 6,747 sq. km.

SUBARNAREKHA BASIN

The river Subarnarekha (also called Swarnarekha) though it has small catchment within this state, has got separate entity as it directly falls into the Bay of Bengal. Originating in the Chhotonagpur Range at an elevation of 609 m near Ranchi, it traverses through three states viz. Jharkhand, West Bengal and Orissa. It drains out rain water from a total area of 19, 684 sq. km out of which only 3,593 sq. km falls within Purulia

and Paschim Medinipur districts of West Bengal.

One major dam at Chandil and one barrage at Galudi have been constructed across Subarnarekha in Jharkhand. The important tributaries on the right bank of this river are Kanchi and Karkari which meet Subarnarekha above Chandil dam and another right bank main tributary named as Kharkai meets this river near Jamshedpur upstream of Galudi barrage. Dulung is the main tributary which joins Subarnarekha from its left in the Paschim Medinipur district of West Bengal. The total length of this river is 395 km out of which 83 km falls within West Bengal.

4. RIVER AND RAIN GAUGES

Irrigation and Waterways Department (IWD), Govt. of West Bengal is responsible for maintenance, collection, compilation and dissemination of hydrological and meteorological data for the purpose of monitoring of flood situation for almost all river sub-basins of the State during monsoon. For this purpose, network of river gauges and rain gauges have been established at the important locations and during monsoon flood control rooms in each district are set up including the Central Flood Control Room at Jalasampad Bhawan, Salt Lake, Kolkata-700091.

Apart from IWD, other organizations like Central Water Commission (CWC), Indian Meteorological Department (IMD), State Agricultural Department, Kolkata Port Trust (KoPT), Damodar Valley Corporation (DVC) have set up network of river gauges and rain gauges at different locations for the purpose of monitoring hydrological and meteorological status of the State. These field data mainly include daily rainfall, water level of river and reservoir, river discharge and inflow-outflow from reservoir. In addition to that other information like inflow forecast, meteorological forecast and flood damage are also collected.

Existing Hydro-Met Monitoring System in the State

| Sl. No. | Type | IWD | | | CWC | | | IMD | | | Others | | |
|--|---------------------|-----|----|-----|-----|---|----|-----|----|---|--------|---|---|
| | | P | S | T | P | S | T | P | S | T | P | S | T |
| | | | | | | | | | | | | | |
| 1 | Ordinary Rain Gauge | 75 | 51 | 126 | 23 | | 23 | 7 | 7 | | 3 | | 3 |
| | ARG/AWS/FCS | | 0 | 0 | 0 | | 0 | 58 | 58 | | | | |
| 2 | River Gauge | | 75 | 75 | 14 | | 14 | | | | 1 | | 1 |
| 3 | HOS | 10 | 3 | 13 | 2 | | 2 | | | | | | |
| | | | | | | | | | | | | | |
| P = Perennial | | | | | | | | | | | | | |
| S = Seasonal | | | | | | | | | | | | | |
| T = Total | | | | | | | | | | | | | |
| HOS = Hydrological Observation Station | | | | | | | | | | | | | |

The present flood monitoring and management system in the State comprises with the preparation of Daily Flood Report by Central Flood Control Room of IWD and transmission of the same to the State Disaster Management Department with the Head Quarter at Kolkata. This report is also shared with other organisation like Railway Auothrity, Defence, Kolkata Port Trust (KoPT) etc. on regularly.

During emergency separate Flood Bulletin is issued and the same is disseminated also to the District Disaster Management Cells via email, Fax or SMS. This Daily Flood Report generally contains rainfall, river gauge and discharge, reservoir level/inflow/outflow data of different Stations within and outside the State. Sometimes the location and extent of major damages, the status of affected areas under inundation etc. are also included. These data are collected from different district control rooms under IWD along with other agencies like IMD, CWC and DVC by telephone, email or fax. Daily flood report is also uploaded in the departmental web site www.wbiwd.gov.in.

A comprehensive list of existing Hydro-Met network within the State under the jurisdiction of Irrigation & Waterways Department, Central Water Commission, India Mateorological Department, and other State Govt.

Departments is given in the following tables.

Sub-basin wise List of Hydro-Met Monitoring Stations in North Bengal

| Gauge Station | River | Type of Gauge | District | Maintained by | DL (m) | EDL (m) |
|----------------------------------|-----------|---------------|------------|---------------|--------|---------|
| <i>SUB-BASIN SANKOSH</i> | | | | | | |
| L. R. P. Crossing | Sankosh | Rain / River | Alipurduar | IMD / CWC | 48.50 | 49.40 |
| <i>SUB-BASIN RAIDAK</i> | | | | | | |
| L. R. P. Crossing | Raidak-II | River | Alipurduar | IWD / CWC | 48.40 | 49.30 |
| L. R. P. Crossing | Raidak-I | River | do | IWD / CWC | 47.00 | 47.90 |
| Tufanganj | Raidak-I | Rain / River | Coochbehar | AGRI / CWC | 35.30 | 35.90 |
| <i>SUB-BASIN TORSA</i> | | | | | | |
| Mahua Tea Garden | Torsa | Rain | Alipurduar | IMD | 44.10 | 45.70 |
| Jayanti | Gadadhar | Rain | do | IMD | | |
| Alipurduar | Kaljani | Rain / River | do | IMD / IWD | 44.10 | 45.70 |
| Hasimara | Torsa | Rain / River | do | IWD / CWC | 116.30 | 117.50 |
| Banarhat | Dudua | Rain | Jalpaiguri | IWD | | |
| Coochbehar | Torsa | Rain / River | Coochbehar | IMD / IWD | 42.07 | 42.68 |
| Pundibari | Torsa | Rain | do | IMD | | |
| Dinhata | Torsa | Rain | do | IMD | 42.07 | 42.68 |
| <i>SUB-BASIN JALDHAKA</i> | | | | | | |
| Chengmari | Diana | Rain / River | Jalpaiguri | IMD / CWC | 200.50 | 201.40 |
| Nagrakata | Jaldhaka | River | do | CWC | 160.70 | 161.80 |
| NH-31 Crossing | Jaldhaka | River | do | CWC | 80.10 | 80.90 |
| Mainaguri | Jarda | Rain | do | IMD | | |
| Mathabhanga | Mansai | Rain / River | Coochbehar | CWC / IMD | 47.70 | 48.20 |
| <i>SUB-BASIN TEESTA</i> | | | | | | |
| Gangtok | Teesta | Rain | Darjeeling | IMD | | |
| Darjeeling | Teesta | Rain | do | IMD | | |
| Kalimpong | Teesta | Rain | do | IMD | | |
| Pedong | Teesta | Rain | do | IMD | | |
| Malbazar | Mal | Rain | Jalpaiguri | IWD | | |
| Jalapiguri | Teesta | Rain | do | IWD | | |
| Teestabazar | Teesta | River | Darjeeling | CWC | 211.00 | 213.00 |
| Coronation Bridge | Teesta | River | do | CWC | 150.00 | 153.60 |
| Domohani | Teesta | River | Jalpaiguri | CWC | 85.95 | 86.30 |
| Mekhliganj | Teesta | Rain / River | do | IMD / CWC | | |

| Gauge Station | River | Type of Gauge | District | Maintained by | DL (m) | EDL (m) |
|--|------------|---------------|----------------|---------------|--------|---------|
| <i>SUB-BASIN MAHANANDA-FULHAR</i> | | | | | | |
| Hill Cart Road | Mahananda | River | Darjeeling | IWD | 115.98 | 116.59 |
| Siliguri | Mahananda | Rain | Darjeeling | IWD | | |
| Sonapur | Mahananda | River | North Dinajpur | IWD | 75.77 | 76.38 |
| Chopra | Dauk | River | do | IWD | 69.46 | 70.07 |
| Islampur | Dauk | Rain | do | AGRI | | |
| Makdampur | Nagar | River | do | IWD | 31.54 | 31.86 |
| Raiganj | Kulik | Rain / River | do | AGRI / IWD | 31.20 | 32.69 |
| Pajol | Sui | River | do | IWD | 27.43 | 28.00 |
| Kachua | Sui | River | do | IWD | 25.49 | 26.09 |
| Radhikapur | Tangon | River | do | IWD | 33.45 | 34.05 |
| Itahar | Gamari | Rain / River | do | IMD / IWD | 26.82 | 27.41 |
| Bangshihari | Tangon | River | do | IWD | 25.60 | 26.21 |
| Teljana | Fulhar | River | Malda | IWD | 27.43 | 28.35 |
| Ratua | Fulhar | Rain | do | IMD | | |
| Englishbazar | Mahananda | Rain / River | do | IMD / IWD | 22.75 | 23.50 |
| <i>SUB-BASIN PUNARBHABA</i> | | | | | | |
| Gangarampur | Punarbhaba | Rain / River | South Dinajpur | IWD / IMD | 25.82 | 26.42 |
| Tapan | Punarbhaba | Rain | do | IWD | | |
| <i>SUB-BASIN ATREYEE</i> | | | | | | |
| Balurghat | Atreyee | Rain / River | South Dinajpur | IWD | 23.15 | 23.76 |
| Majhian Agro | Atreyee | Rain | do | IMD | | |
| <i>SUB-BASIN GANGA</i> | | | | | | |
| Manikchakghat | Ganga | River | Malda | IWD | 24.69 | 25.30 |
| Farakka | Ganga | River | do | CWC | 22.25 | 22.85 |

Sub-basin wise List of Hydro-Met Monitoring Stations in South Bengal

| Name of Gauge Station | River | Type of Gauge | District | Maintained by | DL (m) | EDL (m) |
|--|-------------|---------------|-------------------|---------------|--------|---------|
| <i>SUB-BASIN GANGA-PADMA</i> | | | | | | |
| Nimtita | Ganga-Padma | River | Murshidabad | IWD | 21.90 | 21.64 |
| Nurpur | Ganga-Padma | River | do | IWD | 21.03 | 21.64 |
| Geria | Ganga-Padma | River | do | IWD | 20.94 | 21.55 |
| Chakghat | Ganga-Padma | River | do | CWC | 20.88 | 21.49 |
| Akheriganj | Ganga-Padma | River | do | CWC | 18.44 | 19.05 |
| <i>SUB-BASIN BHAGIRATHI-HOOGHLY</i> | | | | | | |
| Jangipur | Bhagirathi | River | Murshidabad | IWD | 20.27 | 20.88 |
| Berhampore | Bhagirathi | Rain / River | do | IMD / IWD | 17.22 | 17.83 |
| Chakdah | Bhagirathi | Rain | Nadia | IMD | | |
| Kalyani | Bhagirathi | Rain | do | IMD | | |
| Katwa | Hooghly | Rain | Burdwan | IWD | 13.71 | 14.32 |
| Kalna | Hooghly | River | do | IWD | 13.71 | 14.32 |
| Chinsurah | Hooghly | Rain | Hooghly | IMD | | |
| Najirganj | Hooghly | Rain | Howrah | IWD | | |
| Siejberia | Hooghly | Rain | do | IWD | | |
| Chitpur | Hooghly | Rain | Kolkata | IWD | | |
| Alipur | Hooghly | Rain | do | IMD | | |
| Charial | Hooghly | Rain | South 24 Parganas | IWD | | |
| Diamond Harbour | Hooghly | Rain | do | IMD | | |
| <i>SUB-BASIN JALANGI-CHURNI</i> | | | | | | |
| Debogram | Jalangi | Rain | Nadia | IMD | | |
| Krishnanagar | Jalangi | Rain | do | IMD | | |
| Swarupganj | Jalangi | River | do | IWD | 8.44 | 9.05 |
| Hanskhali | Churni | River | do | IWD | 7.53 | 8.14 |

Sub-basin wise List of Hydro-Met Monitoring Stations in South Bengal

| Name of Gauge Station | River | Type of Gauge | District | Maintained by | DL (m) | EDL (m) |
|--|-------------|---------------|-------------|---------------|--------|---------|
| <i>SUB-BASIN PAGLA-BANSLOI</i> | | | | | | |
| Pakur | Bagmari | Rain | Jharkhand | IMD | | |
| Maheshpur | Bansloi | Rain | do | IMD | | |
| Bansloi Ry. Bridge | Bansloi | River | Birbhum | IWD | 31.85 | 32.76 |
| Bahutuli | Bansloi | River | Murshidabad | IWD | | |
| Paikar | Pagla | Rain | Birbhum | IWD | | |
| <i>SUB-BASIN BRAHAMANI-DWARKA</i> | | | | | | |
| Shikaripara | Dwarka | Rain | Jharkhand | IMD | | |
| Nalhati | Brahmani | Rain | Birbhum | IWD | | |
| Jagdhari Road Bridge | Brahmani | River | do | IWD | 33.00 | 33.40 |
| Rampurhat | Dwarka | Rain | do | IWD | | |
| Mallarpur | Dwarka | Rain | do | IWD | | |
| Md. Bazar | Dwarka | Rain | do | IWD | | |
| Deocha Bararge | Dwarka | Rain | do | IWD | | |
| Mayureswar | Dwarka | Rain | do | IWD | | |
| Kuli | Manikarni | Rain | Murshidabad | IWD | | |
| Sankoghat | Dwarka | River | do | IWD | 20.40 | 21.30 |
| Ranagram | Dwarka | River | do | IWD | 17.36 | 17.86 |
| <i>SUB-BASIN MAYURAKSHI-BABLA</i> | | | | | | |
| Haripur | Mayurakshi | Rain | Jharkhand | CWC | | |
| Khushiary | Mayurakshi | Rain | do | CWC | | |
| Jama | Mayurakshi | Rain | do | IMD | | |
| Maharo | Mayurakshi | Rain | do | CWC | | |
| Dumka | Mayurakshi | Rain | do | IMD | | |
| Massanjore | Mayurakshi | Rain | do | CWC / IWD | | |
| Kundahit | Siddheswari | Rain | Jharkhand | IMD | | |
| Tatloi | do | Rain | do | IMD | | |
| Tilpara Barrage | Mayurakshi | Rain | Birbhum | CWC | | |
| Suri | Mayurakshi | Rain | do | IMD | | |

| Name of Gauge Station | River | Type of Gauge | District | Maintained by | DL (m) | EDL (m) |
|--|------------|---------------|-------------|---------------|--------|---------|
| Sainthia | Mayurakshi | Rain | Birbhum | IWD | | |
| Kadisala | Bakreswar | Rain | do | IWD | | |
| Kultore Barrage | Kopai | Rain | do | IWD | | |
| Shyambati | Kopai | Rain | do | IWD | | |
| Shekhampur | Bakreswar | Rain | do | IMD | | |
| Kirnahar | Kuia | Rain | do | IWD | | |
| Tarapur | Kuia | River | Murshidabad | IWD | 22.71 | 23.35 |
| Narayanpur | Mayurakshi | Rain / River | do | CWC | 27.988 | 28.79 |
| Kandi | Mayurakshi | Rain | do | IWD | | |
| Salar | Babla | Rain | do | IWD | | |
| Bharatpur | Babla | Rain | do | IWD | | |
| <i>SUB-BASIN AJAY-HINGLOW</i> | | | | | | |
| Deoghar | Ajay | Rain | Jharkhand | IMD | | |
| Jamtara | Ajay | Rain | do | IMD | | |
| Sikatia Barrage | Ajay | Rain | do | CWC | | |
| Hinglow Dam | Hinglow | Rain | Birbhum | IWD | | |
| Khayrashole | Hinglow | Rain | do | IWD | | |
| Debagram | Ajay | Rain | do | IWD | | |
| Nanur | Ajay | Rain | do | IWD | | |
| Gheropara | Ajay | Rain / River | do | CWC | 39.42 | 40.42 |
| Bahiri | Kana Ajay | Rain | Birbhum | IWD | | |
| Amuliaghata | Ajay | Discharge | do | IWD | | |
| Satkahania | Ajay | Rain | do | IWD | | |
| Budra | Ajay | River | do | IWD | 39.42 | 40.34 |
| Bhedra | Ajay | Rain | do | CWC | | |
| Katwa | Ajay | Rain / River | do | IWD | 14.48 | 15.04 |
| Gushkara | Kunur | Rain | do | IWD | | |
| <i>SUB-BASIN DAMODAR-MUNDESWARI</i> | | | | | | |
| Tilayia | Barakar | Rain | Jharkhand | IMD | | |
| Koderma | Barakar | Rain | do | IMD | | |
| Birni | Barakar | Rain | do | IMD | | |
| Giridih | Barakar | Rain | do | IMD | | |

| Name of Gauge Station | River | Type of Gauge | District | Maintained by | DL (m) | EDL (m) |
|-----------------------|---------|---------------|-----------|---------------|--------|---------|
| Tundi | Barakar | Rain | Jharkhand | IMD | | |
| Ichak | Konar | Rain | do | IMD | | |
| Hazaribag | Konar | Rain | do | IMD | | |
| Bokaro | Konar | Rain | do | IMD | | |
| Topchanchi | Damodar | Rain | do | IMD | | |
| Dhanbad | Damodar | Rain | do | IMD | | |
| Tenughat | Damodar | Rain | do | CWC | | |
| Maithon | Damodar | Rain | do | CWC | | |
| Panchet | Damodar | Rain | do | CWC | | |
| Barhi | Barakar | Rain | do | DVC | | |
| Barakatha | Barakar | Rain | do | DVC | | |
| Parsabad | Barakar | Rain | do | DVC | | |
| Barkisuria | Barakar | Rain | do | DVC | | |
| Dhanwar | Barakar | Rain | do | DVC | | |
| Tuladih | Barakar | Rain | do | DVC | | |
| Jamua | Barakar | Rain | do | DVC | | |
| Palganj | Barakar | Rain | do | DVC | | |
| Burmu | Damodar | Rain | do | DVC | | |
| Barkagaon | Damodar | Rain | do | DVC | | |
| Bhurkunda | Damodar | Rain | do | DVC | | |
| Phusro | Damodar | Rain | do | DVC | | |
| Nawadih | Damodar | Rain | do | DVC | | |
| Chandrapura | Damodar | Rain | do | DVC | | |
| Pupunki | Damodar | Rain | do | DVC | | |
| Putki | Damodar | Rain | do | DVC | | |
| Gansadih | Damodar | Rain | do | DVC | | |
| Chandankiary | Damodar | Rain | do | DVC | | |
| Asansol | Damodar | Rain | Burdwan | CWC | | |
| Durgapur Barrage | Damodar | Rain | do | CWC | | |
| Rondia | Damodar | Rain / River | do | IWD | 52.13 | 52.89 |
| Edilpur | Damodar | Rain / River | do | IWD | 32.79 | 32.95 |
| Burdwan | Damodar | Rain | do | IWD / IMD | | |

| Name of Gauge Station | River | Type of Gauge | District | Maintained by | DL (m) | EDL (m) |
|---|---------------|---------------|----------|---------------|--------|---------|
| Jamalpur | Damodar | Rain / River | Burdwan | IWD | 23.24 | 23.54 |
| Seherabazar | Damodar | Rain | do | IWD | | |
| Lohai (Raina) | Damodar | Rain | do | IWD | | |
| Pakhana | Damodar | Rain | do | IWD | | |
| Galsi | Damodar | Rain | do | IWD | | |
| Parga Dam | Damodar | Rain | Purulia | IWD | | |
| Golamarajore Dam | Damodar | Rain | do | IWD | | |
| Champadanga | Damodar | Rain / River | Hooghly | IWD | 12.90 | 13.50 |
| Harinkhola | Mundeswari | Rain / River | do | CWC / IWD | 12.80 | 13.41 |
| Muchighata | Hur Hura | Rain / River | do | IWD | 6.16 | 6.77 |
| Amta | Lower Damodar | Rain / River | Howrah | IWD | 5.64 | 6.24 |
| Domjur | Saraswati | Rain | do | IWD | | |
| Jagatballavpur | Kana Damodar | Rain | do | IMD | | |
| Uluberia | Kana Damodar | Rain | do | IMD | | |
| <i>SUB-BASIN KHARI-BEHULA-GHEA</i> | | | | | | |
| Sanko | Banka | Rain | Burdwan | IWD | | |
| Balgona | Banka | Rain | do | IWD | | |
| Memari | Behula | Rain | do | IWD | | |
| Dhaniakhali | Ghea | Rain | Hooghly | IMD | | |
| Singur | Ghea | Rain | Hooghly | IWD | | |
| <i>SUB-BASIN DWARAKESWAR</i> | | | | | | |
| Patrasayar | Dwarakeswar | Rain | Bankura | IWD | | |
| Indus | Dwarakeswar | Rain | do | IWD | | |
| Sonamukhi | Shali | Rain | do | IWD | | |
| Bankura | Dwarakeswar | Rain / River | do | CWC / IWD | | |
| Kotulpur | Dwarakeswar | Rain | do | IWD | | |
| Kamarpukur | Dwarakeswar | Rain | Hooghly | IWD | | |
| Arambag | Dwarakeswar | Rain / River | do | IWD | 17.22 | 17.83 |
| Sekhpur | Dwarakeswar | River | do | IWD | 11.75 | 12.35 |
| <i>SUB-BASIN SHILABATI</i> | | | | | | |
| Kadamdeuli | Shilabati | Rain | Bankura | IMD | | |

| Name of Gauge Station | River | Type of Gauge | District | Maintained by | DL (m) | EDL (m) |
|------------------------------------|------------|---------------|------------------|---------------|--------|---------|
| Taldangra | Jayponda | Rain | Bankura | IMD | | |
| Amlagora | Shilabati | Rain | Pachim Medinipur | IWD | | |
| Panikotar | Shilabati | Rain | do | IWD | | |
| Adalia | Kubai | Rain | do | IWD | | |
| Banka | Shilabati | River | do | IWD | 15.08 | 15.69 |
| Gadghat | Shilabati | River | do | IWD | 8.99 | 9.60 |
| <i>SUB-BASIN RUPNARAYAN</i> | | | | | | |
| Ghatal | Rupnarayan | Rain | Pachim Medinipur | IWD | | |
| Bandar | Rupnarayan | River | do | IWD | 6.85 | 7.46 |
| Ranichak | Rupnarayan | River | do | IWD | 5.33 | 5.94 |
| Gopiganj | Rupnarayan | River | do | IWD | 5.03 | 5.65 |
| Denan | Rupnarayan | River | Purba Medinipur | IWD | 4.42 | 5.02 |
| Kolaghat | Rupnarayan | Rain | do | IWD | | |
| Tamluk | Rupnarayan | Rain | do | IMD | | |
| Geonkhali | Rupnarayan | River | do | KOPT | | |
| <i>SUB-BASIN KANGSABATI</i> | | | | | | |
| Kotsila | Cossye | Rain | Purulia | IMD | | |
| Jaipur | Cossye | Rain | do | IWD | | |
| Bandhu Dam | Cossye | Rain | do | IWD | | |
| Arsa | Cossye | Rain | do | IWD | | |
| Purulia | Cossye | Rain | do | IWD / IMD | | |
| Patloi Dam | Cossye | Rain | do | IWD | | |
| Simulia | Cossye | Rain | do | CWC | | |
| Tusuma | Cossye | Rain | do | CWC | | |
| Balrampur | Kumari | Rain | do | IWD | | |
| Kumari Dam | Kumari | Rain | do | IWD | | |
| Phulberia | Kumari | Rain | do | CWC | | |
| Purihansa | Kumari | Rain | do | CWC | | |
| Kharidwar | Kumari | Rain | do | CWC | | |
| Kangsabati Dam | Kangsabati | Rain | Bankura | CWC / IWD | | |
| Jhargram | Kangsabati | Rain | Pachim Medinipur | IMD | | |

| Name of Gauge Station | River | Type of Gauge | District | Maintained by | DL (m) | EDL (m) |
|--|-------------------|---------------|------------------|---------------|--------|---------|
| Tarapheni Barrage | Tarapheni | Rain | Pachim Medinipur | IWD | | |
| Midnapore | Kangsabati | Rain | do | IMD | | |
| Mohanpur | Kangsabati | Rain / River | do | CWC / IWD | 25.75 | 26.36 |
| Lachhmapur | Kangsabati | Rain | do | IWD | | |
| Kapastikri | Kangsabati | River | do | IWD | 16.00 | 16.60 |
| Kalmijole | Old Cossye | River | do | IWD | 9.29 | 9.90 |
| Balichak | New Cossye | Rain | do | IWD | | |
| Khanyadihi | Durbachati | River | Purba Medinipur | IWD | 5.03 | 5.65 |
| Panskura | New Cossye | Rain / River | do | IWD | 9.29 | 9.90 |
| Dobandy | New Cossye | River | do | IWD | 5.02 | 5.63 |
| <i>SUB-BASIN KALIAGHAI-HALDI</i> | | | | | | |
| Bakhrabad | Kaliaghai | River | Pachim Medinipur | IWD | 8.40 | 8.85 |
| Dehati | Kaliaghai | River | do | IWD | 6.55 | 7.00 |
| Kalimondop | Kaliaghai | River | do | IWD | 5.03 | 5.65 |
| Sabang | Kapaleswari | Rain | do | IWD | | |
| Narayanbar | Kapaleswari | River | do | IWD | 5.33 | 5.94 |
| Barisha | Chandia | Rain / River | do | IWD | 4.55 | 5.00 |
| Amgachia | Kaliaghai | Rain / River | Purba Medinipur | IWD | 5.79 | 6.40 |
| Itamogra | Haldi | Rain | do | IWD | | |
| Haldia | Haldi | Rain | do | IMD | | |
| <i>SUB-BASIN RASULPUR-PICHABANI</i> | | | | | | |
| Contai | Rasulpur | Rain | Purba Medinipur | IWD | | |
| <i>BASIN SUBARNAREKHA</i> | | | | | | |
| Jhalda | Subarna- rekha | Rain | Purulia | IWD | | |
| Kestobazar Dam | do | Rain | do | IWD | | |
| Khairabera Dam | do | Rain | do | IWD | | |
| Rupai Dam | do | Rain | do | IWD | | |
| Dimu Dam | do | Rain | do | IWD | | |
| Karrior Dam | do | Rain | do | IWD | | |
| | | | | | | |

| Name of Gauge Station | River | Type of Gauge | District | Maintained by | DL (m) | EDL (m) |
|---|---------------|---------------|-------------------|---------------|--------|---------|
| Kesiapata | do | Rain | Pachim Medinipur | IWD | | |
| Gopiballavpur | do | Rain / River | do | IWD | 46.87 | 47.40 |
| Sonakonia | do | River | Purba Medinipur | IWD | 16.15 | 16.75 |
| Digha | do | Rain | do | IWD | | |
| <i>SUB-BASIN ICHAMATI-BIDYADHARI</i> | | | | | | |
| Majdia | Mathabhanga | River | Nadia | IWD | 7.82 | 8.43 |
| Bararckpore | Nowai | Rain | North 24 Parganas | | | |
| Dumdum | Nowai | Rain | do | IMD | | |
| Deganga | Bidyadhari | Rain | do | IMD | | |
| Barasat | Bidyadhari | Rain | do | IWD | | |
| Gaighata | Jamuna | River | do | IWD | 3.90 | 4.50 |
| Gobardanga | Jamuna | River | do | IWD | 3.77 | 4.37 |
| Tentulia | Ichamati | Rain / River | do | IWD | | 5.10 |
| Bangaon | Ichamati | Rain / River | do | AGRI / IWD | 5.08 | 5.28 |
| Basirhat | Ichamati | Rain | do | IMD | | |
| Chowbaga | Bidyadhari | Rain | do | IWD | | |
| <i>SUB-BASIN SUNDARBAN</i> | | | | | | |
| Uttarbhag | Adi Ganga | Rain | South 24 Parganas | IWD | | |
| Baruipur | Adi Ganga | Rain | do | IMD | | |
| Canning | Matla | Rain | do | IMD | | |
| Nimpith | Mani | Rain | do | IMD | | |
| Raidighi | Sapatamukhi | Rain | do | IMD | | |
| Kakdwip | Muriganga | Rain | do | IMD | | |
| Sagar Island | Bay of Bengal | Rain | do | IMD | | |

5. RAINFALL

Due to its physical and geographical position, the State of West Bengal has climatological variations as well. The average rainfall in the state is 1750 mm, of which more than 75% occurs during the monsoon period while the hilly regions at the foot hills of Himalaya receive the heaviest rainfall ranging from 2500 mm to 4000 mm. The southern districts in the plains receive average of 1125 mm to 1875 mm. The main rainfall season in this state is the South-West monsoon season during which the entire land (excepting the extreme north, the extreme north-east and extreme south) gets 75% of the annual rainfall. The gangetic plains of West Bengal get 78% of its annual rainfall during the monsoon period distributed normally from 1st day of June to the end of September. But during last few years, some parts of West Bengal have experienced premature heavy rainfall in the last week of May causing flood. However, the late withdrawal of monsoon even after second week of October has also been observed during these years.

Normal Rainfall Pattern

The river Ganga divides the state into two parts, which are by and large homogeneous from the meteorological point of view. The northern half is designated as 'Sub-Himalayan West Bengal' and the southern half as 'Gangetic West Bengal'. Sub-Himalayan West Bengal is more susceptible to heavy rains both in respect of amount as well as in frequency of occurrence.

Very heavy rain is more frequent in first two months (June and July) than in subsequent, in the Sub-Himalayan West Bengal. In Gangetic West Bengal the frequency is maximum in August followed by June, July and September in that order. On the basis of rainfall distribution, the state can be divided into two broad zones - (i) The Himalayan and Sub-Himalayan Region (ii) The Gangetic Plains

i) Himalayan and Sub-Himalayan Region

The Himalayan and Sub-Himalayan Region comprising the districts-Darjeeling, Jalpaiguri, Coochbehar and Northern part of Islampur Sub-Division of Uttar Dinajpur district of high intensity of rainfall from 2000 mm. to over 4000 mm. about 80% of which is found to occur during monsoon season. On the average Darjeeling, Coochbehar and Jalpaiguri get 114,112,110 rainy days respectively in a year.

The monsoon generally follows a northern track to ultimately break up against Eastern Himalaya causing very heavy rainfall and thereafter trough of low pressure under break monsoon conditions. It then shifts northward to the Himalayan foothills. It has been found that a precipitation between 200 to 300 mm in two hours is not unusual here. For more than 40 occasions, rainfall of 250 mm and above has been registered during 1891-1965.

ii) Gangetic Plains

The gangetic plains which constitute the major portion of the state, can be further sub-divided into the following three sectors on the basis of average rainfall -

Sector - I: Bankura, Burdwan, Hooghly, Nadia and Purulia districts which receive an average rainfall - between 1140 mm and 1400 mm.

Sector - II: Birbhum, Midnapore, Murshidabad and North 24-Parganas having an average annual rainfall between 1400 mm and 1650 mm.

Sector - III: Kolkata, Howrah and South 24-Parganas having an average annual rainfall - between 1650 mm and 1900 mm.

Such regional variations in the precipitation pattern causes flood conditions from time to time.

The Indian Meteorological Department (IMD) categorises the intensity and distribution of daily rainfall in the following manner:

Spatial Distribution of Rainfall

| Distribution | No. of Places | Description |
|-------------------|-------------------|---------------------------------------|
| Isolated | One or two Places | <25% of stations get rainfall |
| Scattered | At a few Places | (26 - 50) % of stations get rainfall |
| Fairly Widespread | At many Places | (51 - 75) % of stations get rainfall |
| Wide spread | At Most place | (76 - 100) % of stations get rainfall |
| Dry | — | No station reported rainfall |

Intensity of Rainfall

| Descriptive Term used | Rainfall amount (in mm) |
|--------------------------|--|
| No Rain | 0.0 |
| Very Light Rain | 0.1 - 2.4 |
| Light Rain | 2.5 - 7.5 |
| Moderate Rain | 7.6 - 35.5 |
| Rather Heavy Rain | 35.6 - 64.4 |
| Heavy Rain | 64.5 - 124.4 |
| Very Heavy Rain | 124.5 - 244.4 |
| Extremely Heavy Rain | > 244.5 |
| Exceptionally Heavy Rain | When the amount is a value near about the highest recorded rainfall at or near the station for the month or season. However, this term will be used only when the actual rainfall amount exceeds 120 mm. |

Weekly/Seasonal Rainfall Distribution on Regional Scale

| | |
|-----------|---|
| Excess | Percentage departure of realised rainfall from normal rainfall is + 20% or more. |
| Normal | Percentage departure of realised rainfall from normal rainfall is between - 19 % to + 19 %. |
| Deficient | Percentage departure of realised rainfall from normal rainfall is between - 20 % to - 59 %. |
| Scanty | Percentage departure of realised rainfall from normal rainfall is between - 60 % to - 99 %. |
| No rain | Percentage departure of realised rainfall from normal rainfall is between - 100 %. |
| | |

| Rainfall Distribution on All India Scale | |
|--|--|
| Normal | Percentage departure of realised rainfall from normal rainfall is within $\pm 10\%$ of the Long Period Average. |
| Below Normal | Percentage departure of realised rainfall from normal rainfall is $< 10\%$ of the Long Period Average. |
| Above Normal | Percentage departure of realised rainfall from normal rainfall is $> 10\%$ of the Long Period Average. |
| All India Drought Year | When the rainfall deficiency is more than 10% and when 20 to 40% of the country is under drought conditions, then the year is termed as All India Drought Year |
| All India Severe Drought Year | When the rainfall deficiency is more than 10% and when the spatial coverage of drought is more than 40% it is called as All India Severe Drought Year. |

Monsoon, 2017

For the State as a whole, the total monsoon rainfall from the month of June to September during the Year 2017 was normal with the variation of only -2.28% from its average normal. In North Bengal (Himalayan and Sub-Himalayan region, the total monsoon rainfall was 4.04% less than its normal average while that of South Bengal (Gangetic Plains) is only 0.92% less as shown in the following table.

| MONSOON RAINFALL (mm) | | | |
|-----------------------|---------|---------|--------------|
| ZONE | Actual | Normal | % Dep |
| North Bengal | 11163.0 | 11633.5 | -4.04 |
| South Bengal | 14849.5 | 14986.9 | -0.92 |

The Pre-monsoon and Post-monsoon variations of rainfall in North and South Bengals are presented below:

| PRE-MONSOON RAINFALL (mm) | | | |
|---------------------------|--------|--------|---------------|
| ZONE | Actual | Normal | % Dep |
| North Bengal | 2158.0 | 2276.9 | -5.22 |
| South Bengal | 2187.2 | 2629.4 | -16.82 |

| POST MONSOON RAINFALL (mm) | | | |
|----------------------------|--------|--------|--------------|
| ZONE | Actual | Normal | % Dep |
| North Bengal | 950.4 | 852.0 | 11.55 |
| South Bengal | 3368.7 | 2019.4 | 66.82 |

*Source: IMD

The Sectoral variations of monthly rainfall in West Bengal during monsoon months have been given below.

Variation of monthly rainfall in Himalayan and Sub-Himalayan West Bengal during monsoon, 2017

| RAINFALL (mm) | JUNE | | | JULY | | | AUGUST | | | SEPTEMBER | | |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|-------|-----------|--------|--------|
| SECTOR | Actual | Normal | Dep | Actual | Normal | Dep | Actual | Normal | Dep | Actual | Normal | Dep |
| NORTH BENGAL | 1953.2 | 2692.7 | -27.46 | 2651.1 | 3622.0 | -26.81 | 4716.3 | 2890.3 | 63.18 | 1842.4 | 2428.5 | -24.13 |

Variation of monthly rainfall in Gangetic Plains during monsoon, 2017

| RAINFALL (mm) | JUNE | | | JULY | | | AUGUST | | | SEPTEMBER | | |
|-----------------------|--------|--------|--------|--------|--------|-------|--------|--------|--------|-----------|--------|--------|
| SECTOR (SOUTH BENGAL) | Actual | Normal | Dep | Actual | Normal | Dep | Actual | Normal | Dep | Actual | Normal | Dep |
| SECTOR-I | 1068.6 | 1112.8 | -3.97 | 2505.3 | 1482.9 | 68.95 | 1260.8 | 1384.1 | -8.91 | 846.5 | 1217.5 | -30.47 |
| SECTOR-II | 803.7 | 1273.2 | -36.88 | 2260.4 | 1720.5 | 31.38 | 1274.4 | 1626.6 | -21.65 | 923.9 | 1504.0 | -38.57 |
| SECTOR-III | 673.3 | 783.4 | -14.05 | 1753.4 | 1021.4 | 71.67 | 924.9 | 968.9 | -4.54 | 554.3 | 891.6 | -37.83 |

*Dep = Departure

*Source: IMD

From the above two tables, the monthly variation of monsoon rainfall between North and South Bengal can be assessed specially during the months of July and August. During July, all the three Sectors of South Bengal received huge excess rainfall from 31% to 72% while North Bengal received 27% less rainfall during this month. Similiarly, during August, North Bengal received 63% excess rainfall while most of the districts of South Bengal experienced rainfall deficit with a maximum of around 22%. As a result of these excess rainfall accompanied with discharges from DVC reservoirs of Jharkhand, severe flood/waterlogging occurred in flood prone district of South Bengal during the end of July. Similarly, during August, some vulnerable parts of North Bengal were afftected with flood.

Districtwise monthly rainfall in West Bengal has been given in Annexure RF1 to RF3. The cumulative rainfall at different Rain gauge stations of different River Sub-Basins recorded for the period from 1st June to 30th September, 2017 have been given given in Annexure RF-4.

6. FLOOD SEASON 2017

Flood season comprises with the months of June, July, August and September. The distribution of total monthly rainfall in the State from June to September shows deficit rainfall of around 23% & 31% during June & September respectively against excess rainfall of 17% & 19% during July & August respectively.

Distribution of Monthly Rainfall in West Bengal during Flood Season, 2017

| Month | Actual Rainfall (mm) | Normal Rainfall (mm) | Departure |
|-----------|----------------------|----------------------|-----------|
| June | 4498.80 | 5862.10 | -23.26% |
| July | 9170.20 | 7846.80 | +16.87% |
| August | 8176.40 | 6869.90 | +19.02% |
| September | 4167.10 | 6041.60 | -31.03% |

*Source: IMD

Flood frequency curves of different rivers in North Bengal have been presented in Annexure-G1 to G10.

Flood Spell of August in North Bengal

As described earlier, due to excessive rainfall, all the river systems, under Brahmaputra basin in Alipurduar, Coochbehar, Darjeeling and Jalpaigui districts of North Bengal experienced one flood spell during the period from 10th to 13th August. This flash flood was passed safely and quickly through the rivers without causing inundation to vulnerable areas but considerable damages to the embankments and protection works were made. The peak flood levels in different river gauge stations have been presented in the table below.

| Sl. No. | River | River Gauge Station | Date of occurrence of Peak Flood | Water Level | Remarks |
|---------|-----------|---------------------|----------------------------------|-------------|------------------|
| 1 | Sankosh | LRP Crossing | 12 th August | 48.95 m | 0.45 m above DL |
| 2 | Raidak-II | LRP Crossing | 12 th August | 47.50 m | At PDL |
| 3 | Raidak-I | LRP Crossing | 12 th August | 47.35 m | 0.35 m above DL |
| 4 | Raidak-I | Tufanganj | 13 th August | 36.69 m | 0.79 m above EDL |

| | | | | | |
|----|----------|-------------------|-------------------------|----------|------------------|
| 5 | Torsa | Hasimara | 12 th August | 116.40 m | 0.10 m above DL |
| 6 | Torsa | Coochbehar | 12 th August | 42.90 m | 0.22 m above EDL |
| 7 | Kaljani | Alipurduar | 12 th August | 46.85 m | 1.15 m above EDL |
| 8 | Jaldhaka | NH 31 Crossing | 12 th August | 80.21 m | 0.11 m above DL |
| 9 | Mansai | Mathabhanga | 13 th August | 48.88 m | 0.68 m above EDL |
| 10 | Teesta | Mekhliganj | 13 th August | 65.95 m | At DL |

The 7 days daily rainfall occurred during 8th to 13th August, 2017 at some of the important rain gauge stations in North Bengal under Brahmaputra basin have been given in the following table.

| Sl. No. | River | Rain Gauge Station | District | Total Amount | Remarks |
|---------|----------|--------------------|------------|--------------|--|
| 1 | Sankosh | Barabisha | Alipurduar | 986.80 mm | One day maximum rainfall of 441.00 mm on 12 th August |
| 2 | Torsa | Hasimara | Jalpaiguri | 1013.60 mm | One day maximum rainfall of 565.00 mm on 12 th August |
| 3 | Torsa | Alipurduar | Alipurduar | 1095.20 mm | One day maximum rainfall of 390.40 mm on 12 th August |
| 4 | Torsa | Coochbehar | Coochbehar | 802.10 mm | One day maximum rainfall of 246.60 mm on 12 th August |
| 5 | Torsa | Tufanganj | Coochbehar | 1061.60 mm | One day maximum rainfall of 430.20 mm on 11 th August |
| 6 | Jaldhaka | Banarhat | Jalpaiguri | 621.00 mm | One day maximum rainfall of 216.00 mm on 12 th August |
| 7 | Jaldhaka | Mainaguri | Jalpaiguri | 549.00 mm | One day maximum rainfall of 170.00 mm on 12 th August |
| 8 | Mansai | Mathabhanga | Coochbehar | 716.20 mm | One day maximum rainfall of 189.40 mm on 12 th August |
| 9 | Teesta | Malbazar | Jalpaiguri | 540.90 mm | One day maximum rainfall of 215.30 mm on 12 th August |

| | | | | | |
|----|--------|------------|------------|-----------|--|
| 10 | Teesta | Jalpaiguri | Jalpaiguri | 593.60 mm | One day maximum rainfall of 295.20 mm on 12 th August |
|----|--------|------------|------------|-----------|--|

The highest water levels of different rivers under Ganga basin within the districts of North & South Dinajpur and Malda during August flood have been presented in the following table. river Mahananda at Englishbazar shows prolonged duration of the flood from 12th August to 10th September. This is due to the fact that high quantum of run-off pushed out from the adjacent State of Bihar into Malda district thereby raising the flood peak, 1.73 m above EDL on 22nd August. Important branch channels of Mahananda like Fulhar, Dahuk, Pitani, Nagar, Tangon, Punarbhaba also ruled high for which large areas were inundated and waterlogged in the aforesaid districts with a considerable duration.

Due to heavy rainfall in the basin area of Atreyee within the neighbouring Country Bangladesh, the large areas of South Dinajpur district also experience waterlogging and drainage congestion during this flood spell.

| Sl. No. | River | River Gauge Station | Date of occurrence of Peak Flood | Water Level | Remarks |
|---------|-------------|---------------------|----------------------------------|-------------|------------------|
| 1 | Mahananda | Hill Curt Road | 12 th August | 115.60 m | 0.38 m below DL |
| 2 | Mahananda | Englishbazar | 22 th August | 23.48 m | 1.73 m above EDL |
| 3 | Fulhar | Teljana | 15 th August | 28.90 m | 0.55 m above EDL |
| 4 | Tangon | Radhikapur | 14 th August | 33.73 m | 0.28 m above DL |
| 5 | Punarbhaba | Gangarampur | 15 th August | 26.77 m | 0.35 m above EDL |
| 6 | Atreyee | Balurghat | 16 th August | 24.47 m | 0.71 m above EDL |
| 7 | Ganga-Padma | Manikchakghat | 22 th August | 24.65 m | 0.05 m below DL |
| 8 | Ganga-Padma | Akherigunj | 22 th August | 16.70 m | 1.13 m below PDL |

Total amount of rainfall occurred during 10th to 13th August, 2017 at different rain gauge stations of North Bengal within Ganga basin have been given in the following table.

| Sl. No. | River | Rain Gauge Station | District | Total Amount | Remarks |
|---------|------------------|--------------------|----------------|--------------|--|
| 1 | Mahananda | Siliguri | Darjeeling | 321.20 mm | One day maximum rainfall of 126.00 mm on 11 th August |
| 2 | Mahananda-Fulhar | Islampur | North Dinajpur | 286.40 mm | One day maximum rainfall of 85.30 mm on 12 th August |
| 3 | Mahananda | Raigunj | North Dinajpur | 378.60 mm | One day maximum rainfall of 158.00 mm on 12 th August |
| 4 | Mahananda | Englishbazar | Malda | 247.60 mm | One day maximum rainfall of 102.00 mm on 12 th August |
| 5 | Atreyee | Balurghat | South Dinajpur | 260.00 mm | One day maximum rainfall of 89.00 mm on 10 th August |
| 6 | Punarbhaba | Gangarampur | South Dinajpur | 375.00 mm | One day maximum rainfall of 200.00 mm on 13 th August |

The rainfall within catchment area of Ganga basin in North Bengal during flood spell of August, 2107 were not so significant but still the water levels in the rivers ruled high above DL/EDL. This is due to the fact that the whole system received considerable run-offs from the adjacent state of Bihar as well as from neighbouring country Bangladesh.

Extent and expenditure involved for restoration of flood damages occurred in different districts of North Bengal have been presented in Annexure-FD.

Flood Spell of July in South Bengal

Flood frequency curves of different rivers in South Bengal have been presented in Annexure G-11 to G-26.

In association with active monsoon conditions, an upper air cyclonic circulation developed over eastern parts of Gangetic West Bengal & neighbourhood in the morning of 12th July. Under its influence, a low-pressure area formed over northwest Bay of Bengal (BoB) off north Odisha & Gangetic West Bengal coast on 15th morning. It concentrated into a depression over northwest and adjoining westcentral Bay of Bengal & coastal areas of Odisha in the morning of 18th. Under its influence, incessant rainfall occurred in various districts of South Bengal i.e. in Kolkata, Howrah,

Purba and Paschim Medinipur, Hooghly, Purba and Paschim Bardhaman, Birbhum, Bankura, Purulia and Murshidabad alongwith in neighbouring State Jharkand during 21st to 30th July.

Release of water from DVC reservoirs outside State boundary combined with run-off of the uncontrolled catchment routed through Durgapur barrage created flood havoc in the vulnerable blocks of Hooghly and Howrah districts during last week of July. From 25th July to 8th August, the cumulative discharge from Durgapur barrge was 26,57,750 acre-feet of water with the peak discharge of 2,49,450 cusecs on 27th July.

The unprecedented rainfall over Bankura and Paschim Medinipur caused flash floods in Dwarakeswar and Shilabati rivers for which western part of Hooghly and vulnerable areas of Paschim Medinipur got inundated and waterlogged. Breaches occurred in left embankment of river Dwarakeswar at Arambag and left embankment of river Shilabati at Ghatal, thereby inundationg Arambag town and Ghatal town respectively,

Unfortunately, new moon was on 23rd July, so spring tides obstructed the flow to the lower stretch of various rivers in the tidal zone and this synchronization of high upland flow and high tides, caused swelling of rivers and drainage channels, which often ran above Extreme Danger Level (EDL) for a substantial period of time. Breaches occurred at variuos stretches in flood embankments in Damodar right, Maja Damodar, Rampur Channel, Madaria khal, Bakshi khal, Short-Cut-Channel etc.in the lower Damodar region.

Most of the channels in Lower Damodar area ruled high above EDL and river gauge stations namely Champadanga, Harinkhola and Muchighata reached near to their respective historical values with respect to HFL, recorded during the flood of 1978.

Total amount of rainfall occurred during 23rd to 26th July at different rain gauge stations within Damodar basin have been given in the following table.

| Sl. No. | River | Rain Gauge Station | District | Total Amount | Remarks |
|---------|--------------|--------------------|----------|--------------|--|
| 1 | Mithon | Tilayia | Koderma | 233.60 mm | One day maximum rainfall of 91.80 mm on 24 th July |
| 2 | Mithon | Mithon | Dhanbad | 287.00 mm | One day maximum rainfall of 102.00 mm on 25 th July |
| 3 | Damodar | Tenughat | Bokaro | 395.00 mm | One day maximum rainfall of 172.20 mm on 25 th July |
| 4 | Damodar | Panchet | Dhanbad | 345.60 mm | One day maximum rainfall of 191.20 mm on 25 th July |
| 5 | Damodar | Asansol | Burdwan | 257.40 mm | One day maximum rainfall of 110.40 mm on 25 th July |
| 6 | Damodar | Durgapur | Burdwan | 195.20 mm | One day maximum rainfall of 103.20 mm on 25 th July |
| 7 | Damodar | Burdwan | Burdwan | 180.20 mm | One day maximum rainfall of 72.60 mm on 23 rd July |
| 8 | Shali | Sonamukhi | Bankura | 195.00 mm | One day maximum rainfall of 80.00 mm on 23 rd July |
| 9 | Amta Channel | Amta | Howrah | 180.00 mm | One day maximum rainfall of 75.00 mm on 23 rd July |
| 10 | Amta Channel | Domjur | Howrah | 206.00 mm | One day maximum rainfall of 93.00 mm on 23 rd July |

The rain gauge station at Panchet again received heavy rainfall (122.20 mm) on 30th July. Similarly in the lower Damodar area, rain gauge station at Amta received 160.00 mm (on 4th & 5th August) and Domjur received 73.00 mm (on 4th August) rainfall.

The occurrence of peak flood levels in different river gauge stations in lower Damodar area have been presented in the table below.

| Sl. No. | River | River Gauge Station | Date of occurrence of Peak Flood | Water Level | Remarks |
|---------|--------------|---------------------|----------------------------------|-------------|------------------|
| 1 | Damodar | Rondia | 27 th July | 51.66 m | 0.47 m below DL |
| 2 | Damodar | Jamalpur | 27 th July | 23.20 m | 0.04 m below DL |
| 3 | Amta Channel | Champadanga | 28 th July | 14.80 m | 1.30 m above EDL |
| 4 | Mundeswari | Harinkhola | 28 th July | 14.50 m | 1.70 m above EDL |
| 5 | Hurhura | Muchighata | 28 th July | 8.68 m | 1.91 m above EDL |

The adjacent catchment areas of Khari-Behula-Gangur and Kana Damodar-Ghea-Kunti received huge local rainfall during 22nd to 27th July which waterlogged vast areas in Purba Bardhaman and Hooghly districts.

| Sl. No. | River | Rain Gauge Station | District | Total Amount | Remarks |
|---------|-------------------|--------------------|-----------------|--------------|--|
| 1 | Khari-Behula | Memari | Purba Bardhaman | 297.60 mm | One day maximum rainfall of 110.00 mm on 27 th July |
| 2 | Ghea-Kana Damodar | Singur | Hooghly | 174.50 mm | One day maximum rainfall of 96.25 mm on 24 th July |

The respective catchment areas of river Shilabati and Dwarakeswar also received heavy rainfall during 22nd to 26th July as presented in the table below.

| Sl. No. | River | Rain Gauge Station | District | Total Amount | Remarks |
|---------|-------------|--------------------|-------------------|--------------|--|
| 1 | Dwarakeswar | Bankura | Bankura | 600.40 mm | One day maximum rainfall of 189.20 mm on 23 rd July |
| 2 | Dwarakeswar | Indas | Bankura | 261.40 mm | One day maximum rainfall of 90.00 mm on 23 rd July |
| 3 | Dwarakeswar | Arambag | Hooghly | 277.00 mm | One day maximum rainfall of 82.50 mm on 22 nd July |
| 4 | Shilabati | Ghatal | Paschim Medinipur | 278.80 mm | One day maximum rainfall of 115.60 mm on 24 th July |

The huge rainfall in Bankura created flash floods in both the rivers raising the peak flood levels as given below.

| Sl. No. | River | River Gauge Station | Date of occurrence of Peak Flood | Water Level | Remarks |
|---------|-------------|---------------------|----------------------------------|-------------|------------------|
| 1 | Dwarakeswar | Arambag | 26 th July | 18.65 m | 0.82 m above EDL |
| 2 | Dwarakeswar | Shakepore | 26 th July | 13.42 m | 1.07 m above EDL |
| 3 | Shilabati | Banka | 24 th July | 15.48 m | 0.46 m above DL |
| 4 | Shilabati | Gadghat | 27 th July | 9.90 m | 0.30 m above EDL |

The other important sub-basins on the western part of river Bhagirathi-Hooghly namely Mayurakshi-Babla and Ajay-Hinglow systems received moderate floods but the flood peaks were well below their respective PDLs. The flood inflow from upper catchment area of Mayurakshi reservoir in Jharkhand was accommodated within the available storage of Massanjore dam. The total inflow received by the reservoir from 22th to 28th July was 74,776 acre-feet.

The rainfall as received at different rain gauge stations within Dwarka-Mayurakshi-Ajay catchment areas during 21st to 27th July are given below.

| Sl. No. | River | Rain Gauge Station | District | Total Amount | Remarks |
|---------|-------------|--------------------|----------|--------------|--|
| 1 | Dwarka | Md. Bazar | Birbhum | 268.75 mm | One day maximum rainfall of 102.75 mm on 21 st July |
| 2 | Dwarka | Mallarpur | Birbhum | 245.70 mm | One day maximum rainfall of 125.20 mm on 21 st July |
| 3 | Dwarka | Deocha | Birbhum | 255.60 mm | One day maximum rainfall of 90.20 mm on 21 st July |
| 4 | Mayurakshi | Massanjore | Dumka | 253.60 mm | One day maximum rainfall of 110.00 mm on 21 st July |
| 5 | Siddheswari | Tatloi | Dumka | 285.40 mm | One day maximum rainfall of 157.60 mm on 21 st July |
| 6 | Mayurakshi | Shyambati | Birbhum | 238.70 mm | One day maximum rainfall of 98.00 mm on 21 st July |
| 7 | Ajay | Sikatia | Deoghar | 271.00 mm | One day maximum rainfall of 96.00 mm on 21 st July |
| 8 | Hinglow | Hinglow | Birbhum | 323.00 mm | One day maximum rainfall of 130.00 mm on 21 st July |

The corresponding peak flood levels of the aforesaid rivers are given below.

| Sl. No. | River | River Gauge Station | Date of occurrence of Peak Flood | Water Level | Remarks |
|---------|------------|---------------------|----------------------------------|-------------|-----------------|
| 1 | Dwarka | Sankoghat | 23 th July | 20.63 m | 0.23 m above DL |
| 2 | Dwarka | Sankoghat | 28 th July | 17.16 m | 0.20 m below DL |
| 3 | Mayurakshi | Narayanpur | 22 nd July | 25.30 m | 1.89 m below DL |
| 4 | Kuia | Tarapur | 24 th July | 21.55 m | 1.16 m below DL |
| 5 | Ajay | Gheropara | 26 th July | 37.18 m | 1.24 m below DL |

In case of Kangsabati river, substantial flood inflow of 4,35,670 acre-feet was accommodated in the Kangsabati reservoir during 23rd to 29th July inspite of substantial rainfall in it' s catchment area during 20th to 26th July, as listed below. The average quantum of flood release from the Mukutmanipur dam was restricted to only 20,000 acre-feet per day (from 27th July to 8th August) considering the heavy local rainfall in the downstream catchment areas of Kangsabati sub-basin.

| Sl. No. | River | Rain Gauge Station | District | Total Amount | Remarks |
|---------|------------|--------------------|-------------------|--------------|--|
| 1 | Cossye | Simulia | Purulia | 424.80 mm | One day maximum rainfall of 99.40 mm on 23 rd July |
| 2 | Cossye | Tusuma | Purulia | 380.40 mm | One day maximum rainfall of 87.00 mm on 25 th July |
| 3 | Kumari | Purihansa | Purulia | 467.60 mm | One day maximum rainfall of 140.00 mm on 25 th July |
| 4 | Kumari | Kharidwar | Purulia | 299.20 mm | One day maximum rainfall of 62.80 mm on 25 th July |
| 5 | Kumari | Phulberia | Purulia | 294.80 mm | One day maximum rainfall of 80.00 mm on 25 th July |
| 6 | Kangsabati | Mukutmanipur | Bankura | 287.40 mm | One day maximum rainfall of 73.00 mm on 25 th July |
| 7 | Kangsabati | Medinipur | Paschim Medinipur | 262.40 mm | One day maximum rainfall of 75.40 mm on 24 th July |
| 8 | Kangsabati | Jhargram | Paschim Medinipur | 235.45 mm | One day maximum rainfall of 96.90 mm on 24 th July |
| 9 | New Cossye | Panskura | Purba Medinipur | 489.00 mm | One day maximum rainfall of 185.20 mm on 22 nd July |
| 10 | Rupnarayan | Tamluk | Purba Medinipur | 437.30 mm | One day maximum rainfall of 200.00 mm on 22 nd July |

Inspite of nominal flood release from Mukutmanipur dam, the run-off from the uncontrolled catchment area downstream of the dam was substantial to create flood in Old Cossye and New Cossye river systems with the observed gauge levels as given in the following table. The river Rupnarayan was already ruling high after catering the flood discharges of lower Damodar-Mundeswari and Dwarakeswar-Shilabati systems which obstructed the draining of flood water of Kangsabati thereby raising the water levels in Old Cossye and New Cossye rivers as shown in the following table.

| Sl. No. | River | River Gauge Station | Date of occurrence of Peak Flood | Water Level | Remarks |
|---------|------------|---------------------|----------------------------------|-------------|------------------|
| 1 | Kangsabati | Mohanpur | 25 th July | 25.92 m | 0.17 m above DL |
| 2 | Kangsabati | Kapastikri | 25 th July | 15.90 m | 0.10 m below DL |
| 3 | Old Cossey | Kalmijole | 26 th July | 10.60 m | 0.70 m above EDL |
| 4 | New Cossey | Panskura | 26 th July | 10.32 m | 0.42 m above EDL |
| 5 | Rupnarayan | Bandar | 27 th July | 8.13 m | 0.67 m above EDL |
| 6 | Rupnarayan | Gopiganj | 28 th July | 5.73 m | 0.42 m above EDL |

The adjacent sub-basins of Kaliaghahi-Haldi system, Rasulpur drainage basin and Subarnarekha basin also experienced flood and waterlogging during last week of July and the cumulative rainfall during 22nd to 25th July as well as occurrence of peak flood levels are given in the following two tables.

| Sl. No. | River | Rain Gauge Station | District | Total Amount | Remarks |
|---------|--------------|--------------------|-------------------|--------------|--|
| 1 | Kaliaghahi | Amgachia | Purba Medinipur | 229.40 mm | One day maximum rainfall of 132.00 mm on 22 nd July |
| 2 | Kapaleswari | Sabang | Paschim Medinipur | 212.50 mm | One day maximum rainfall of 75.00 mm on 22 nd July |
| 3 | Chandia | Barisha | Paschim Medinipur | 290.00 mm | One day maximum rainfall of 192.00 mm on 22 nd July |
| 4 | Haldi | Itamogra | Purulia | 206.80 mm | One day maximum rainfall of 100.00 mm on 22 nd July |
| 5 | Rasulpur | Contai | Purba Madinipur | 238.60 mm | One day maximum rainfall of 178.00 mm on 23 rd July |
| 6 | Subarnarekha | Digha | Purba Madinipur | 144.00 mm | One day maximum rainfall of 111.00 mm on 23 rd July |

| Sl. No. | River | River Gauge Station | Date of occurrence of Peak Flood | Water Level | Remarks |
|---------|--------------|---------------------|----------------------------------|-------------|-----------------|
| 1 | Kaliaghai | Amgachia | 27 th July | 5.79 m | At DL |
| 2 | Chandia | Barisha | 26 th July | 5.85 m | 0.85 m above DL |
| 3 | Kapaleswari | Narayanbarh | 26 th July | 5.66 m | 0.33 m above DL |
| 4 | Subarnarekha | Gopiballavpur | 27 th July | 44.78 m | 0.12 below PDL |
| 5 | Subarnarekha | Sonakonia | 28 th July | 15.15 m | At PDL |

The Rainfall-Runoff data during flood spell from 22nd to 25th July for drainage basin of Ichamati-Bidyadhari alongwith Bhagirathi-Hooghly local catchment are given below.

| Sl. No. | River | Rain Gauge Station | District | Total Amount | Remarks |
|---------|--------------------|--------------------|-------------------|--------------|---|
| 1 | Bhagirathi-Hooghly | Alipore | Kolkata | 205.40 mm | One day maximum rainfall of 73.90 mm on 24 th July |
| 2 | Ichamati | Bangaon | North 24-Parganas | 182.50 mm | One day maximum rainfall of 70.00 mm on 24 th July |
| 3 | Ichamati | Tentulia | North 24-Parganas | 170.00 mm | One day maximum rainfall of 72.00 mm on 25 th July |
| 4 | Bidyadhari | Dumdum | North 24-Parganas | 162.20 mm | One day maximum rainfall of 76.50 mm on 24 th July |
| 5 | Bidyadhari | Chowbaga | South 24-Parganas | 167.00 mm | One day maximum rainfall of 92.00 mm on 24 th July |

| Sl. No. | River | River Gauge Station | Date of occurrence of Peak Flood | Water Level | Remarks |
|---------|--------------------|---------------------|----------------------------------|-------------|------------------|
| 1 | Bhagirathi-Hooghly | Swarupgunj | 29 th July | 8.59 m | 0.15 m above DL |
| 2 | Bhagirathi-Hooghly | Katwa | 29 th July | 13.15 m | 0.05 m above PDL |
| 3 | Mathabhanga | Majdia | 28 th July | 6.66 m | 0.55 m below PDL |
| 4 | Churni | Hanskhali | 29 th July | 5.90 m | 1.02 m below PDL |
| 5 | Ichamati | Bangaon | 30 th July | 3.58 m | 1.12 m below PDL |
| 6 | Jamuna | Gaighata | 29 th July | 4.18 m | 0.27 m below DL |

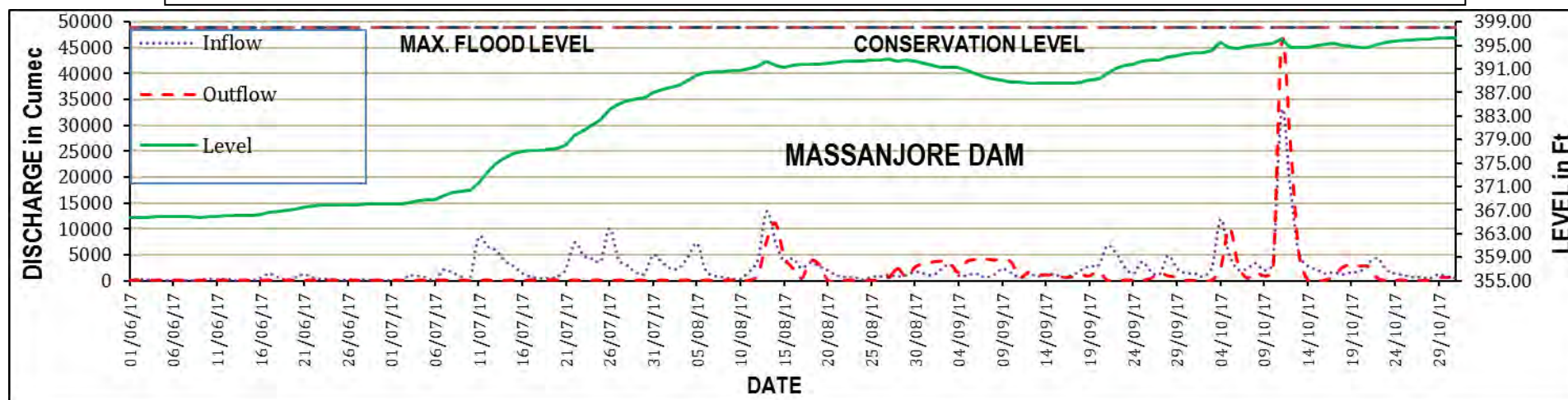
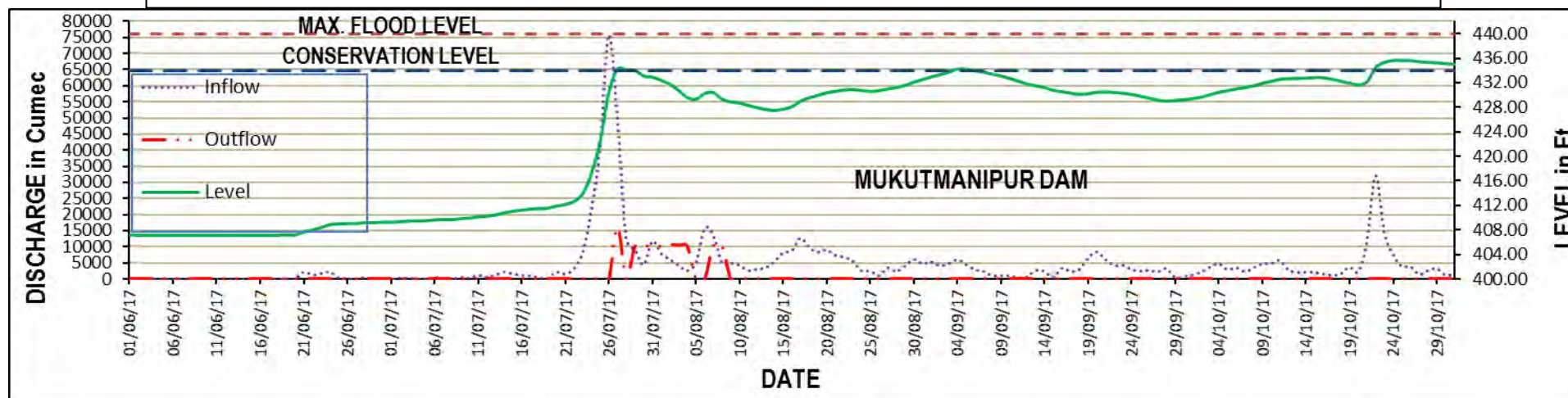
The daily Inflow-Outflow and Reservoir level data of June to September, 2017 for dams and barrages under the control of Irrigation & Waterways Department have been compiled in Annexure-D1 to D4.

Summary statement showing requirement of districtwise SDRF, prepared and submitted by Irrigation & Waterways Department after flood season, 2017 to the Disaster Management Department, for restoration of damaged embankments and other assets has been given in Annexure-FD. A separate list showing the districtwise length of breaches in embankments occurred in different rivers, drainage channels alongwith the canals during flood season, 2017 is given in Annexure-BR.

Index Maps showing locations of area of inundation and waterlogging in South Bengal on 27th July, 2017 and in North Bengal on 13th August, 2017 are presented in Annexure-IM1 and Annexure-IM2.

The list showing districtwise area of inundation on both 27th July, 2017 and 13th August, 2017 composed and prepared by Department of Higher Education, Science and Technology and Biotechnology, Govt. of West Bengal on the basis of Satellite data provided by NRSC, ISRO, DOS, GOI of West Bengal is given in Annexure-BR.

The inflow-outflow data alongwith reservoir levels of Massanjore and Mukutmanipur dams during 1st June to 31st October, 2017 have been presented in the following figures.

INFLOW-OUTFLOW-RESERVOIR LEVEL DATA OF MAYURAKSHI RESERVOIR DURING FLOOD SEASON, 2017

INFLOW-OUTFLOW-RESERVOIR LEVEL DATA OF KANGSABATI RESERVOIR DURING FLOOD SEASON, 2017


7. Conclusion

The West Bengal is basically recipient of run-off generated outside the state. The state has typical basin characteristics. In the north the rainfall is high and the ground slope is steep mainly in the Sub-Himalayan region. The rivers in the Terai region are wide with shallow depth. Due to continuous denudation of forest cover and dolomite mining in the hills, the silt loads are continuously deposited in the river beds, reducing the carrying capacity of the rivers causing the flood.

In the South & Central Region heavy rainfall and run-off coming from the upper catchment cause drainage congestion and inundation due to very flat ground slope of the regions.

Main structural measures of flood control in West Bengal are embankments measuring 10,400 km (approx.) spread over different river systems, constructed over the years. There are major dams across the river Kangsabati, Mayurakshi and Damodar river system. But only in the Damodar system, moderation of the dams during the peak flood is possible to some extent.

The other structural measures like catchment area treatment and afforestation in upper catchment require intervention at Government of India level as they are outside the state. In North Bengal, an elaborate flood warning system maintained by the department warns the people about the trend of rise of the rivers and thus alarms them to take necessary safety measures.


In Central & South Bengal the water level of different rivers together with their danger & extreme danger levels and releases from different dams and reservoirs are intimated to different authorities from time to time during rainy season. Besides, the department also continuously maintains close liaison with the Regional Meteorological Centre (RMC), Kolkata and follows Indian Meteorological Department (IMD) web-site in order to collect information on adverse weather condition during the monsoon period and accordingly adopt suitable flood fighting measures. Central Water Commission (CWC) also extends their co-operation by providing the different river gauge as well as rain gauge data under their jurisdiction.

In addition to above, the department has already undertaken initiative to make available the daily flood data during entire monsoon period every year in public domain through the departmental website www.wbiwd.gov.in.

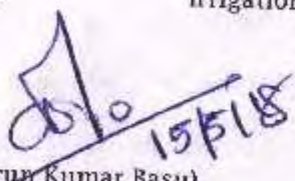
Based upon satellite based modern technologies under National Hydrology Project, the implementation of 'Real Time Data Acquisition System', 'Flood Forecasting System', 'Inundation Area Mapping', 'Water Resources Information System' etc. have been proposed for the purpose of better flood management in the State.


(Digantha Maity)

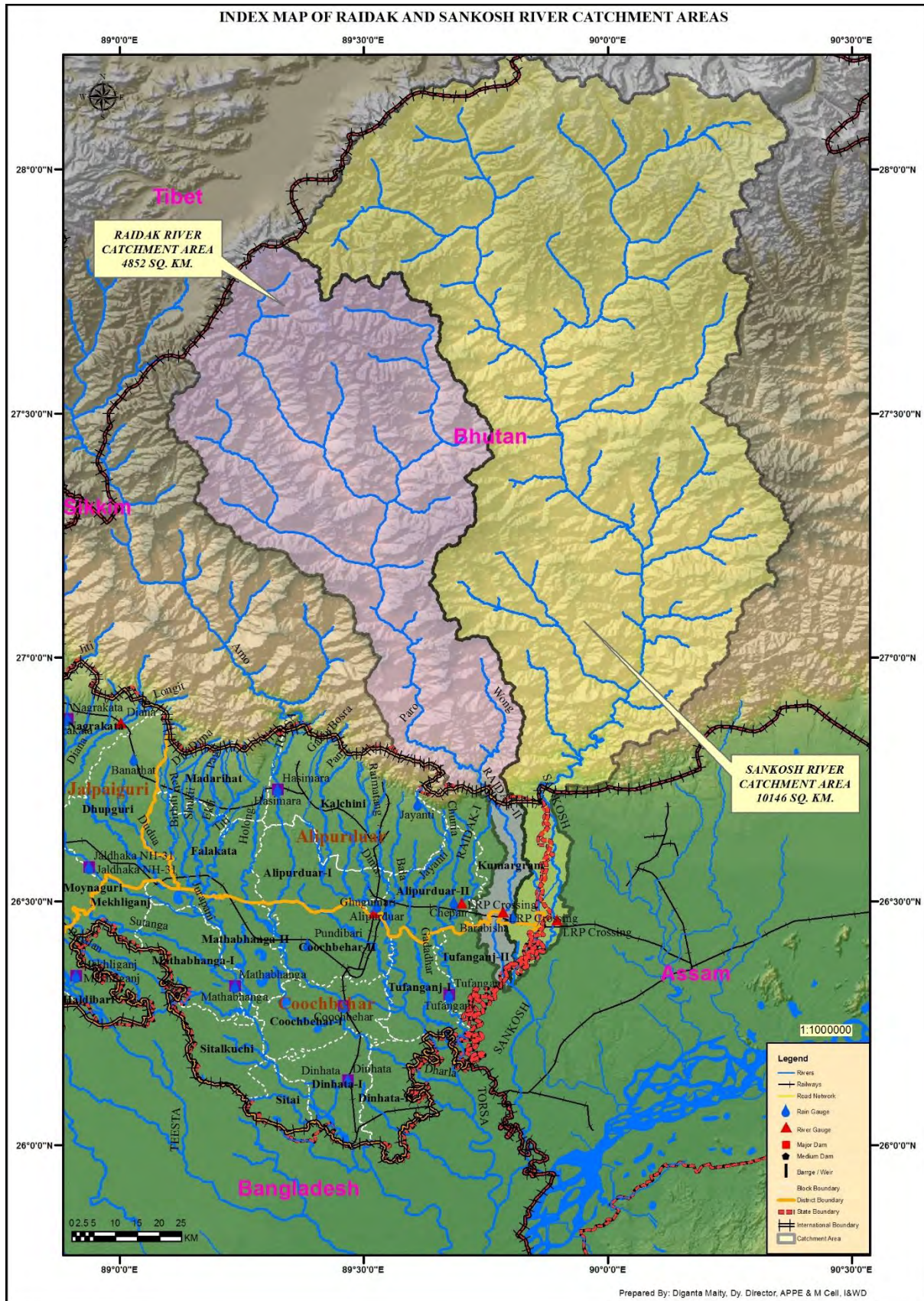
Deputy Director
Advance Planning, Project
Evaluation & Monitoring Cell
Irrigation & Waterways Directorate

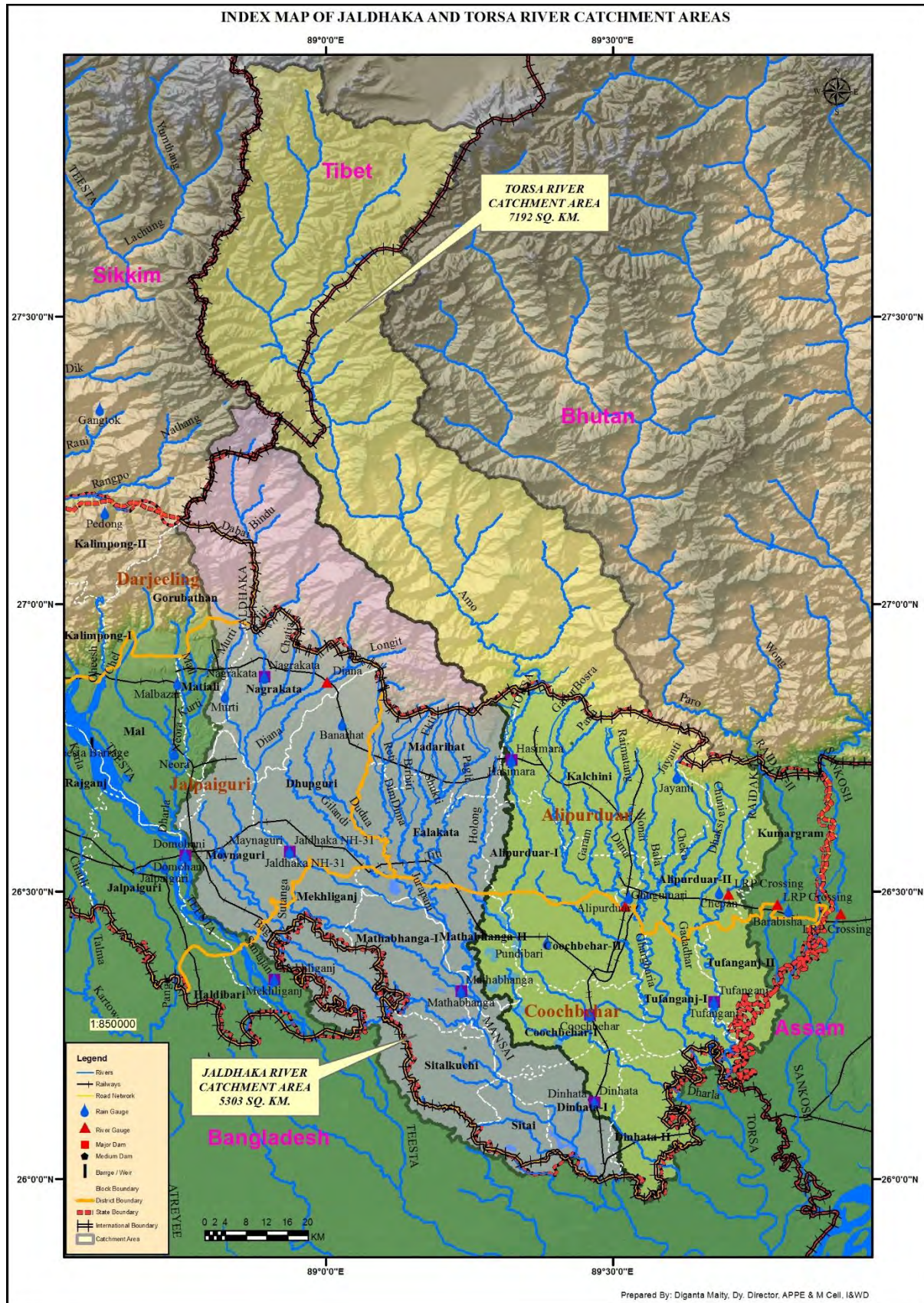

(Dr. Abhijit Saha)

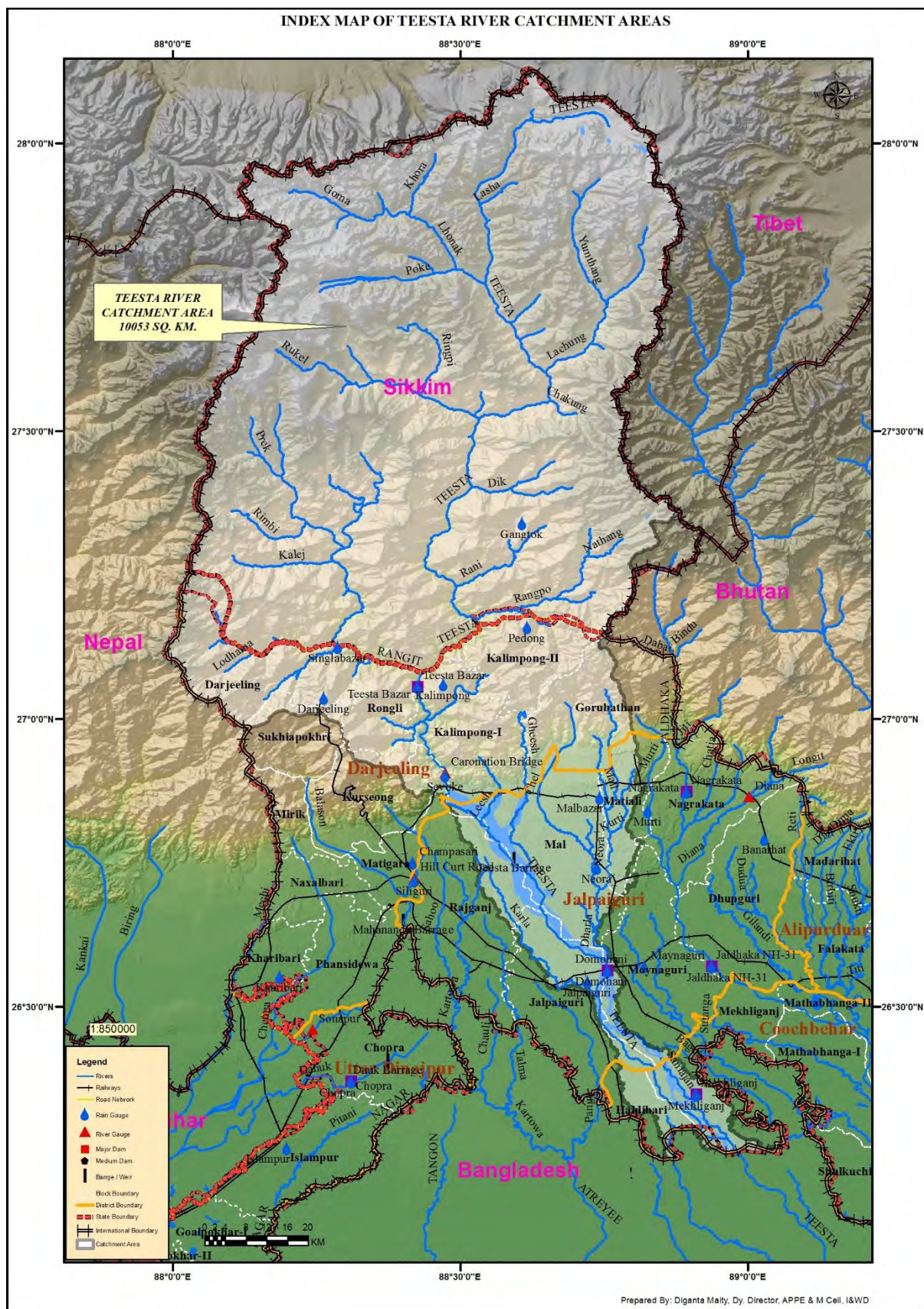
Director
Advance Planning, Project
Evaluation & Monitoring Cell
Irrigation & Waterways Directorate

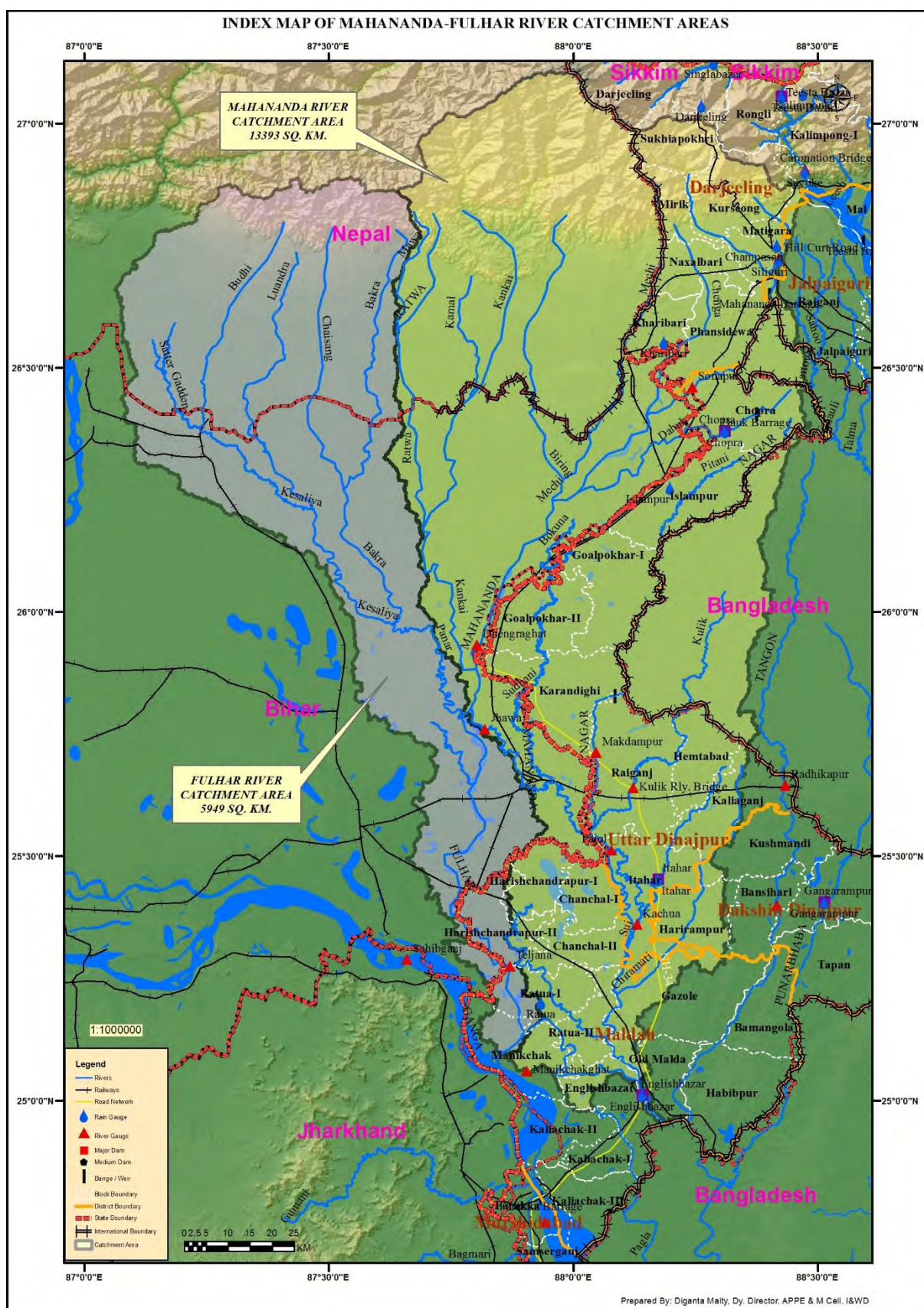

(Arup Kumar Basu)

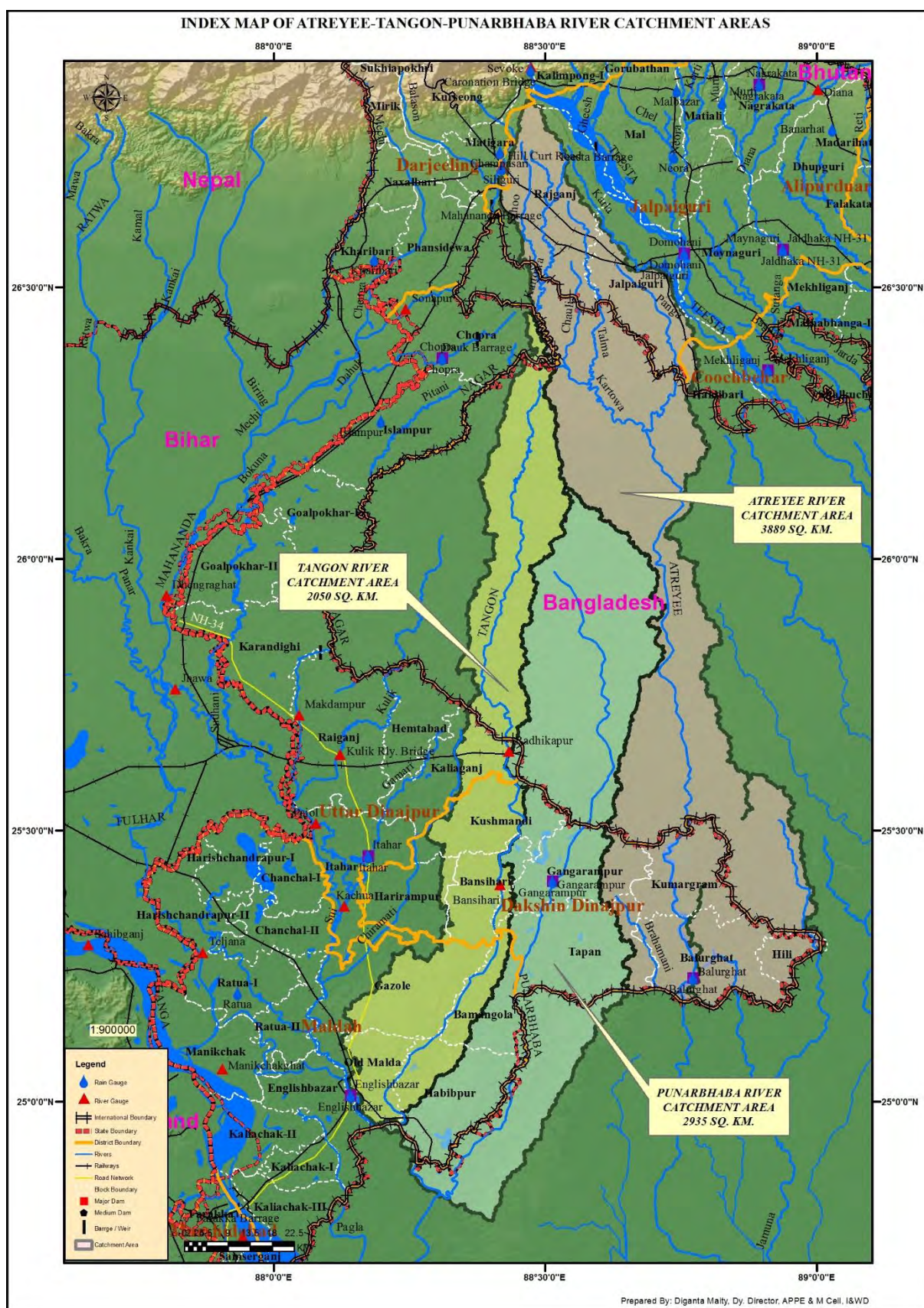
DP & Ex-officio Chief Engineer
Irrigation & Waterways Directorate

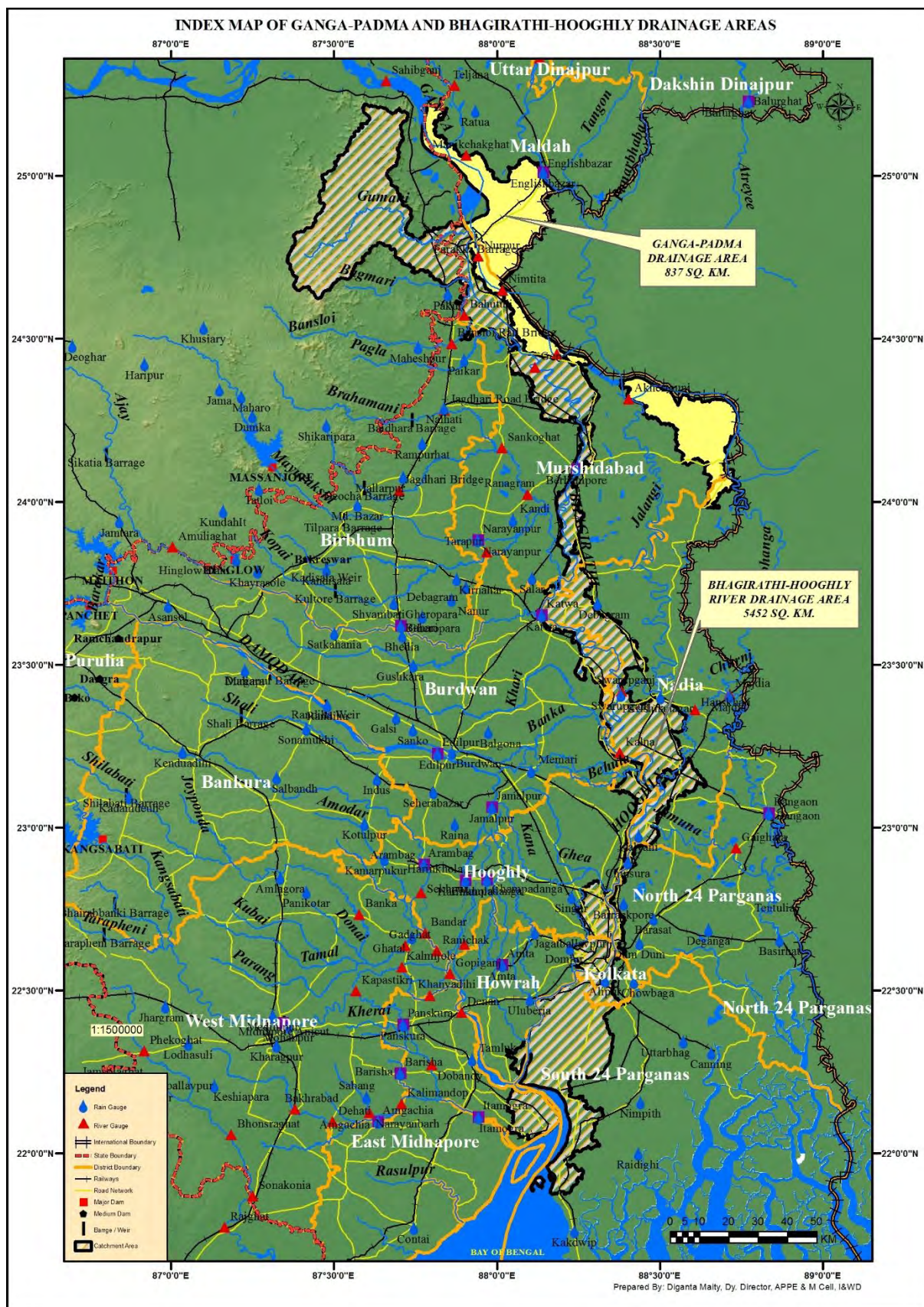
ANNEXURE-I1

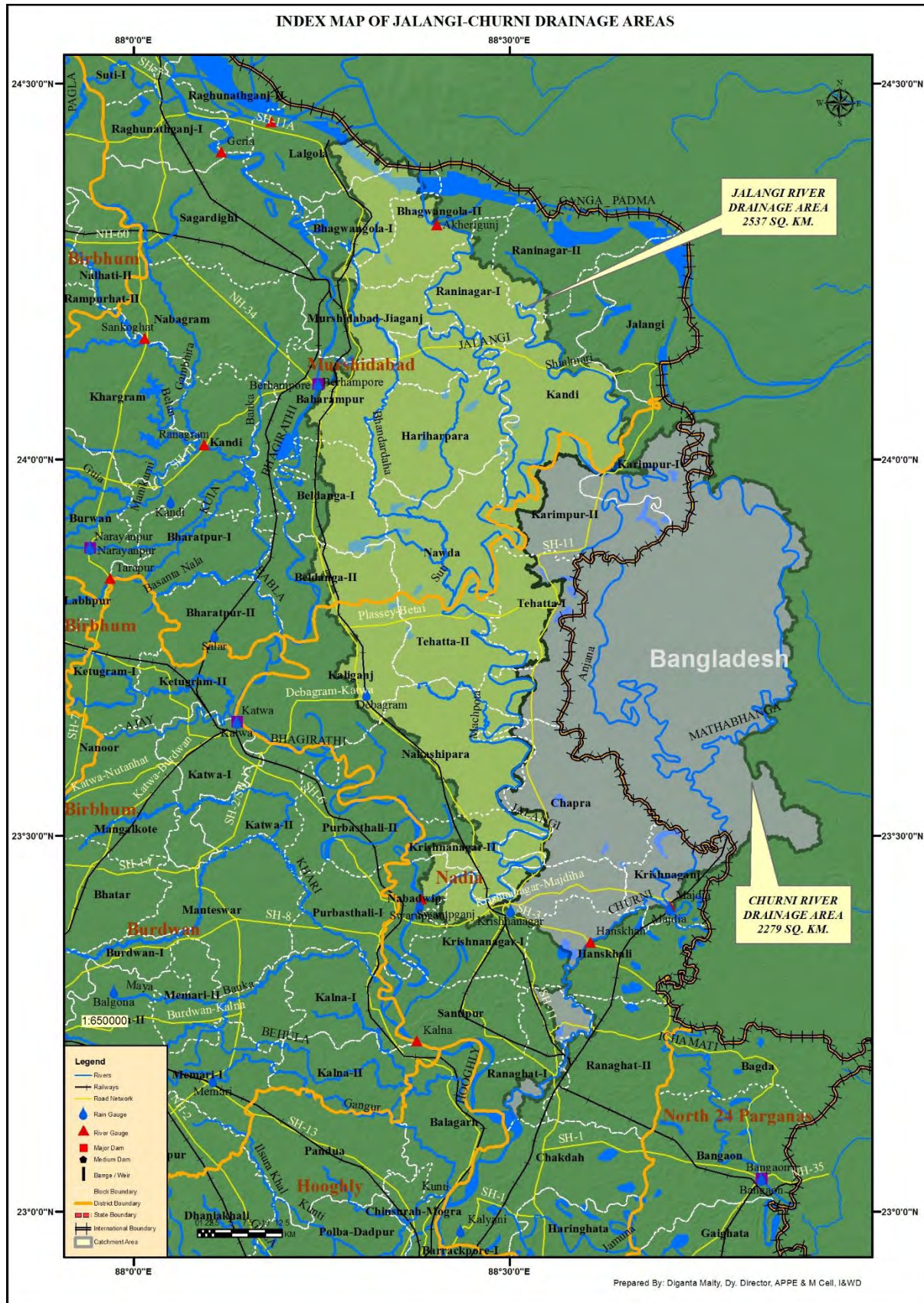
ANNEXURE-I2

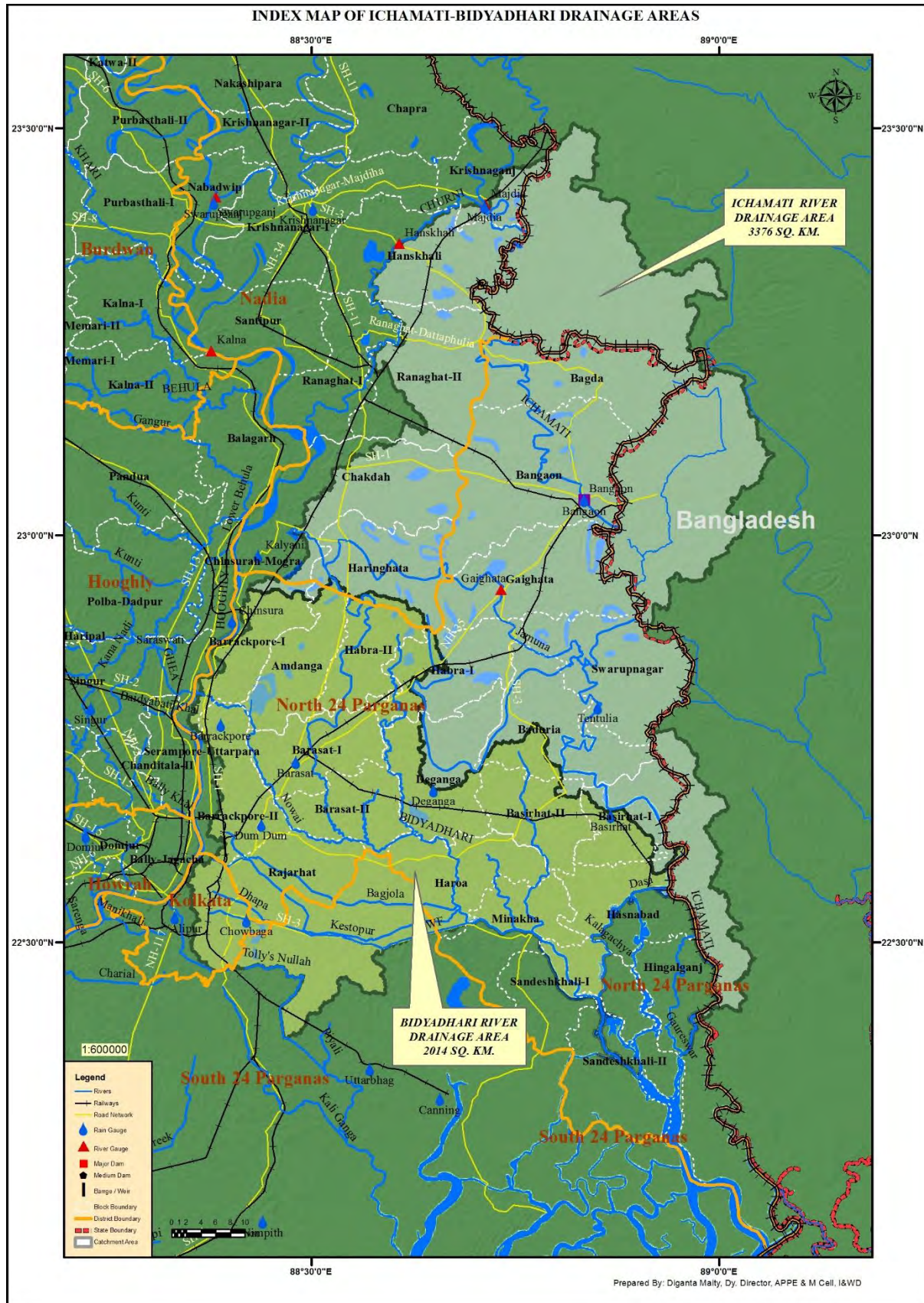
ANNEXURE-I3

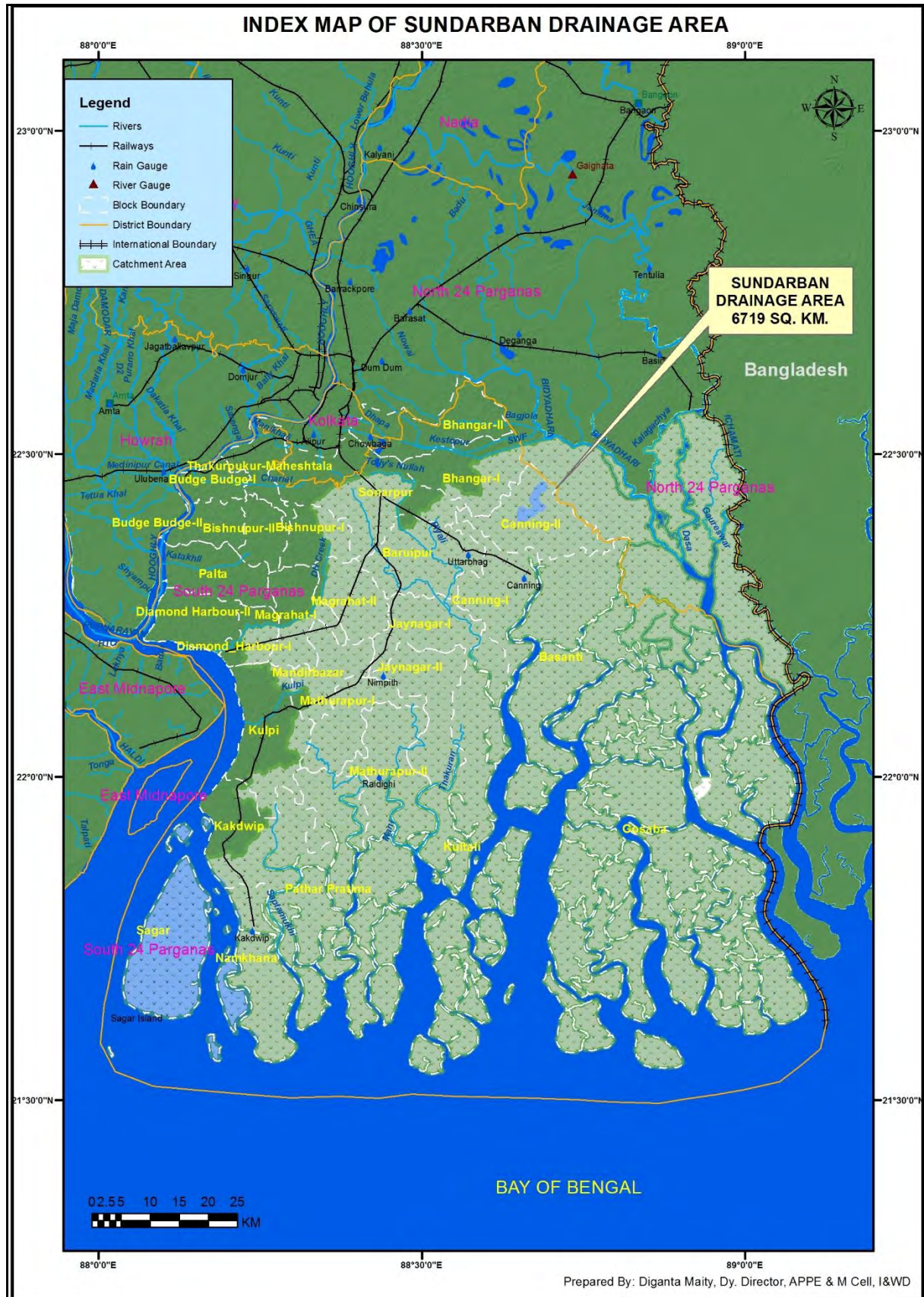
ANNEXURE-I4

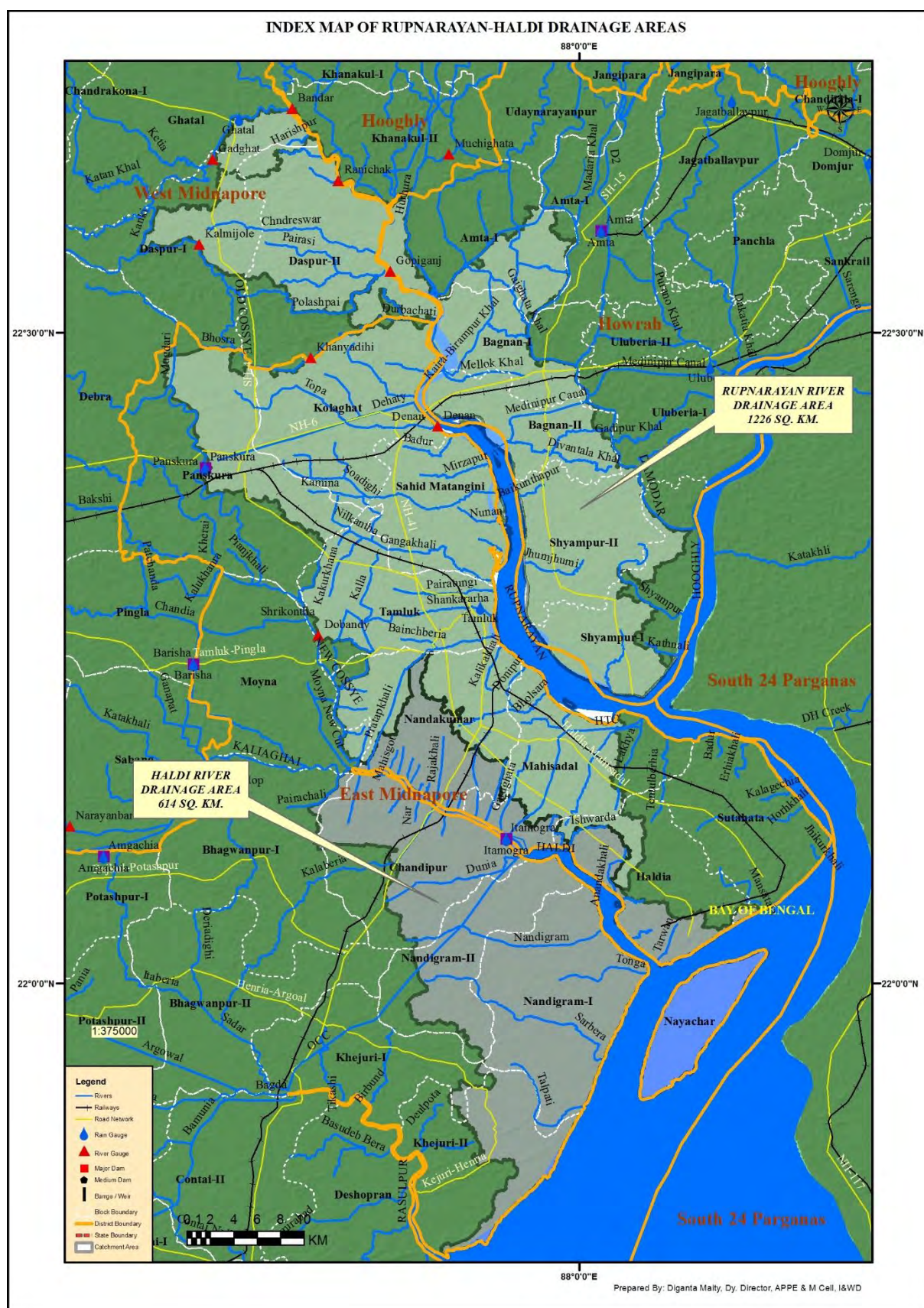
ANNEXURE-I5

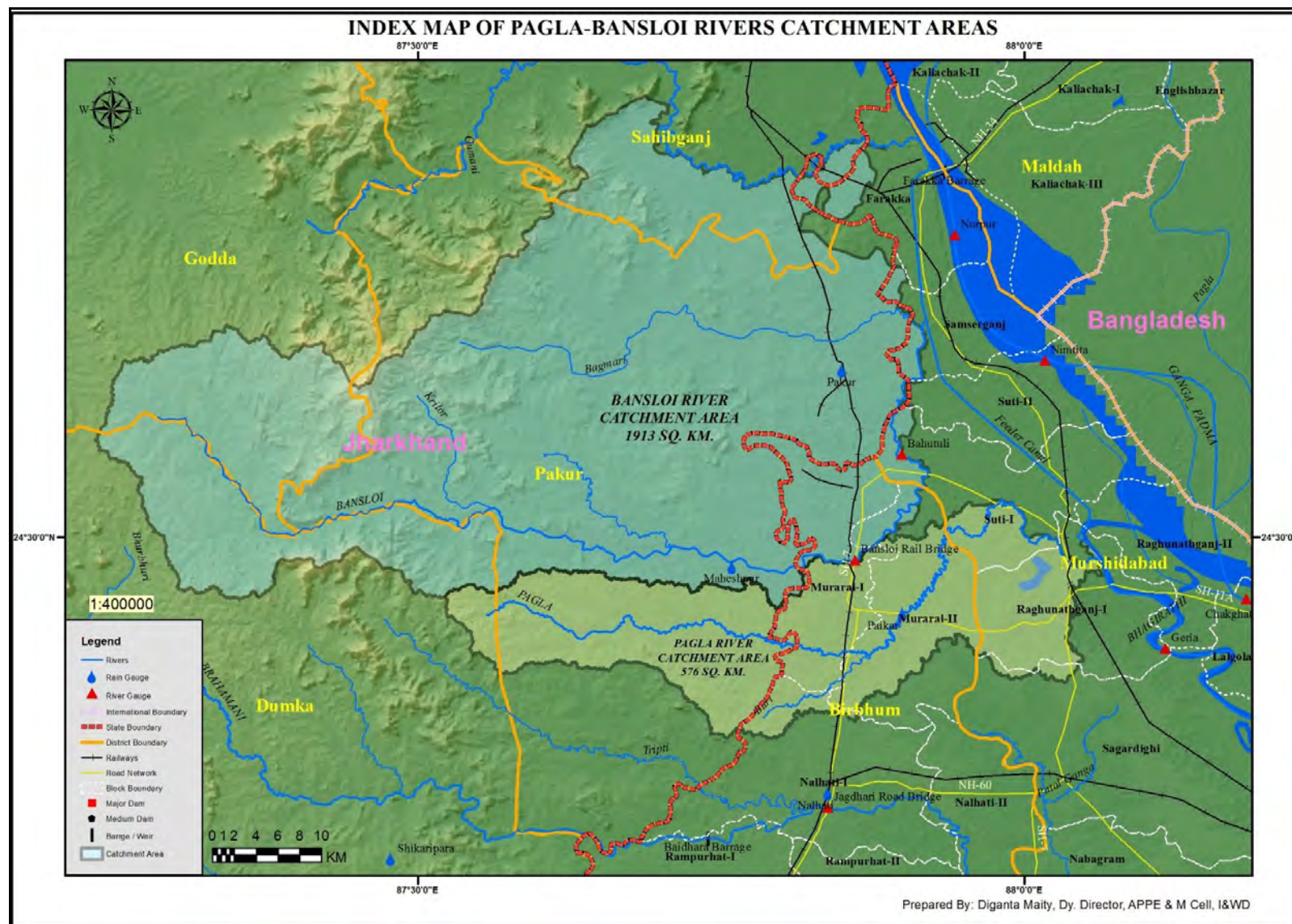
ANNEXURE-I6

ANNEXURE-I7

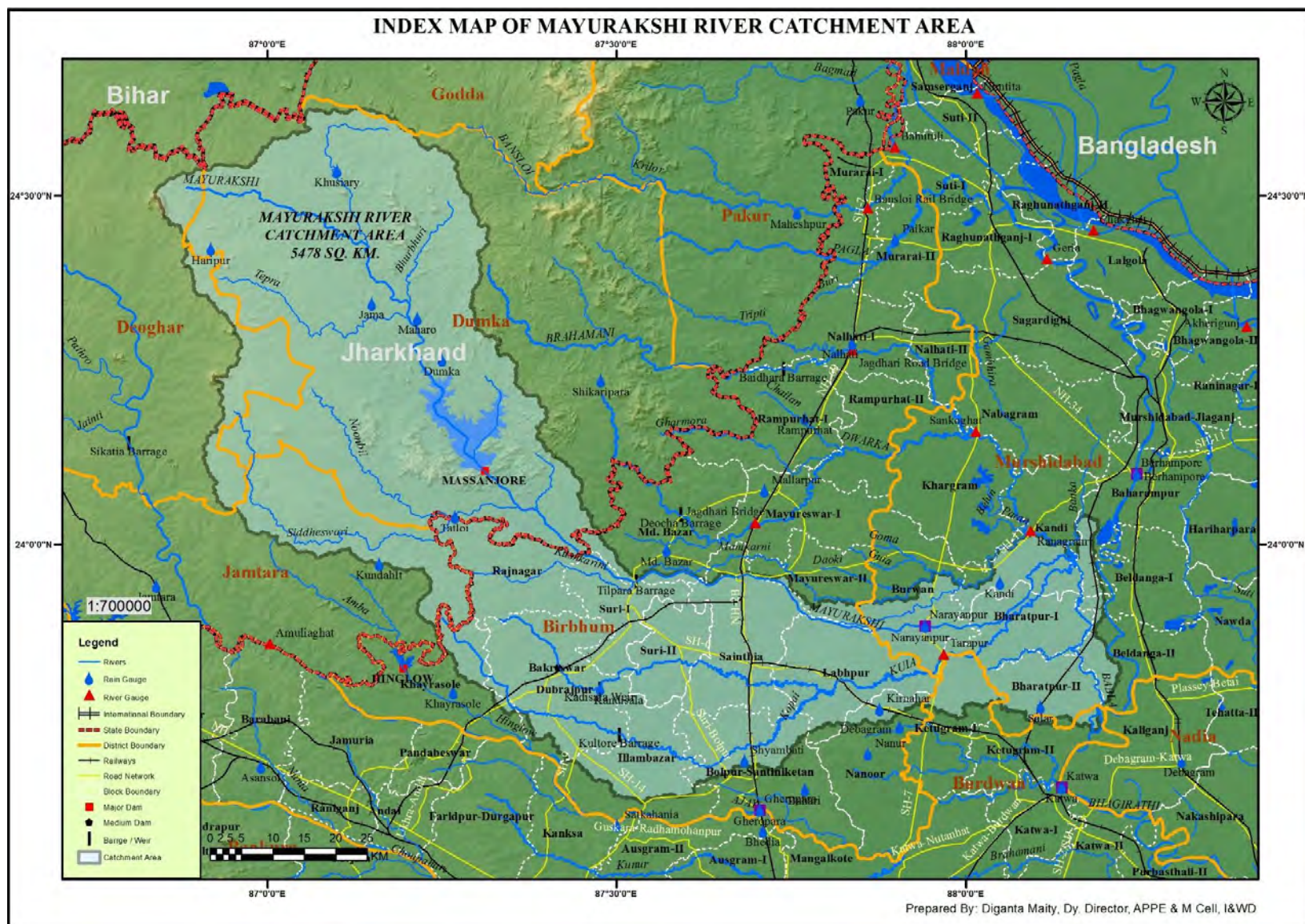
ANNEXURE-I8

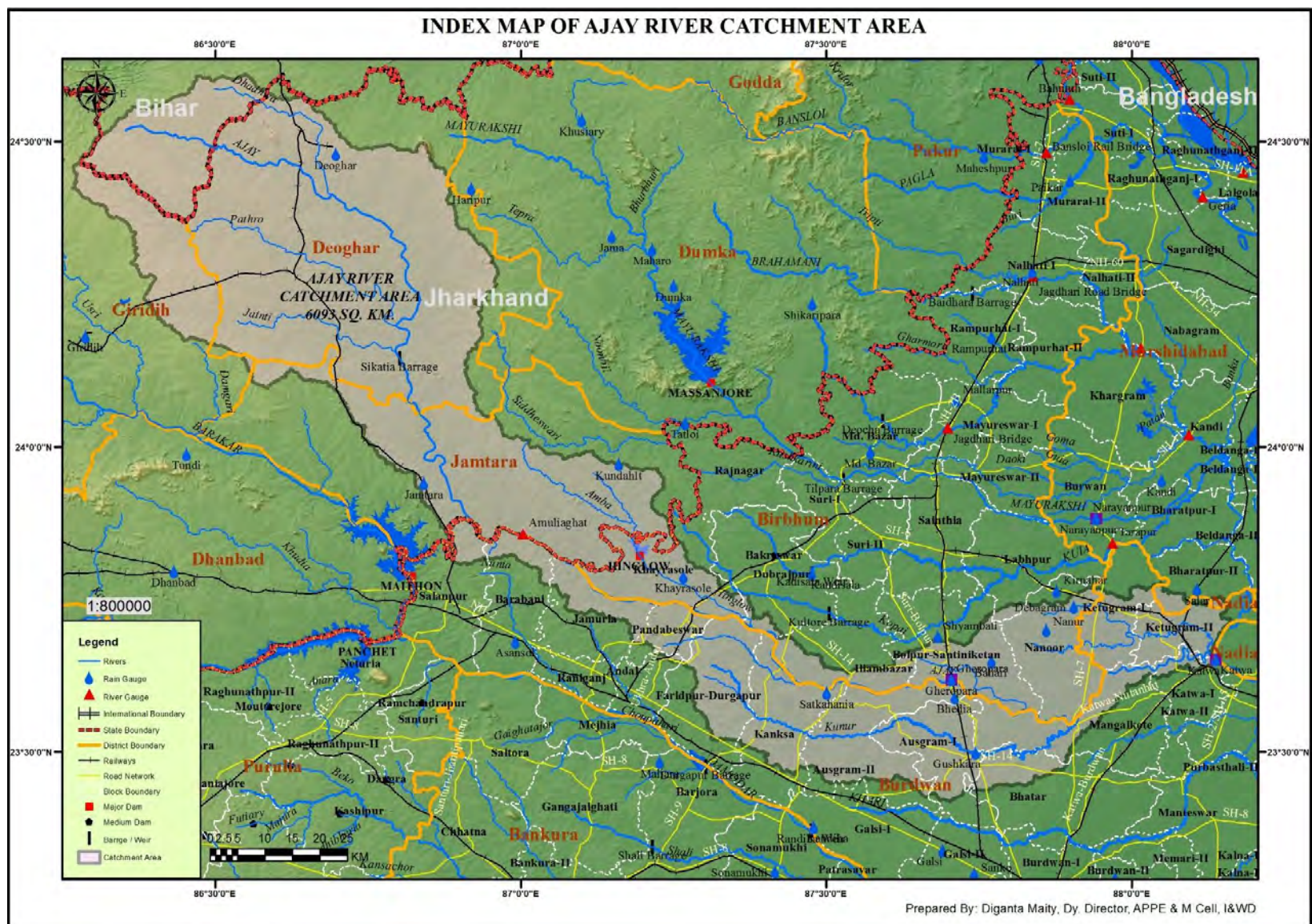
ANNEXURE-I9

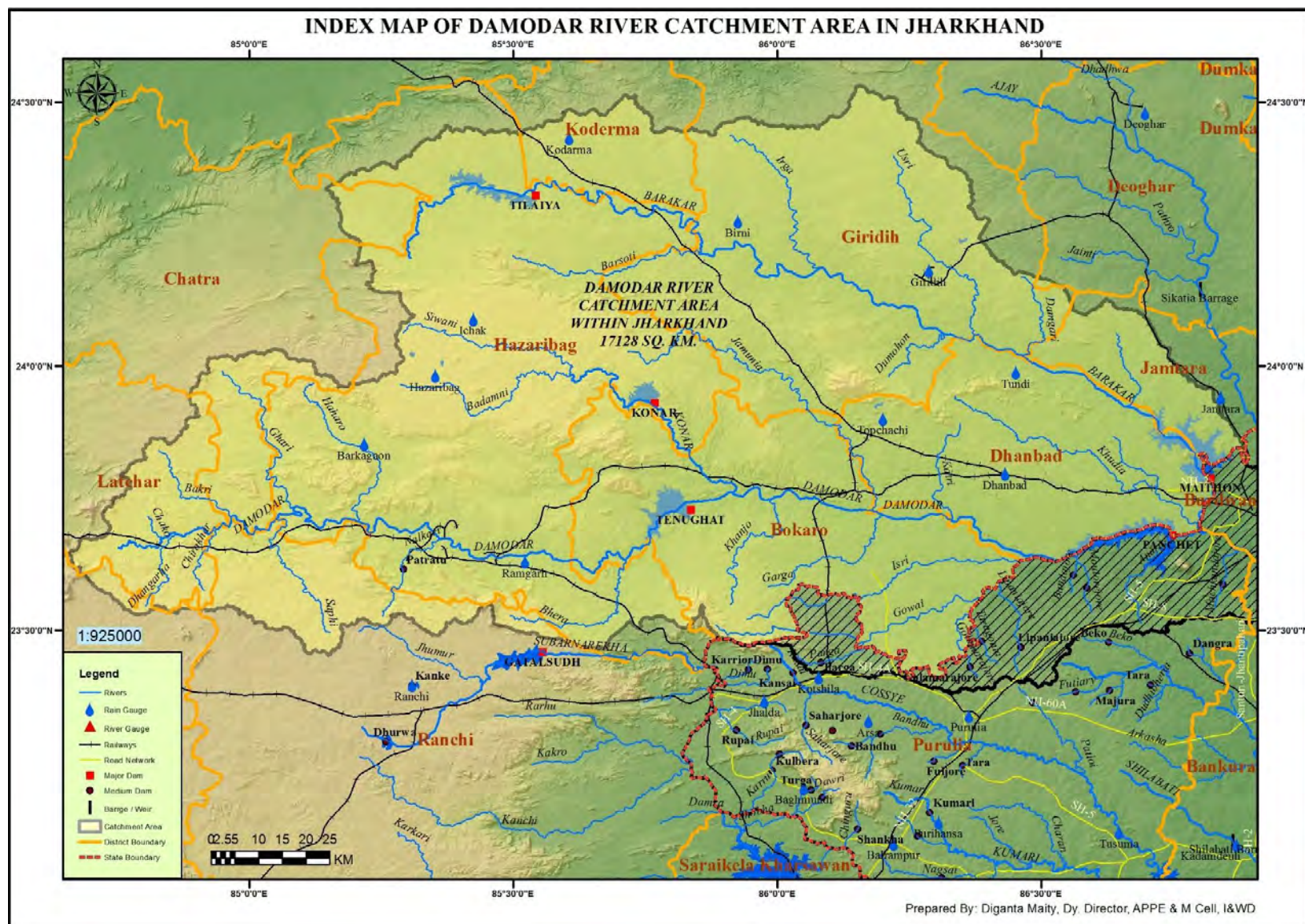
ANNEXURE-I10

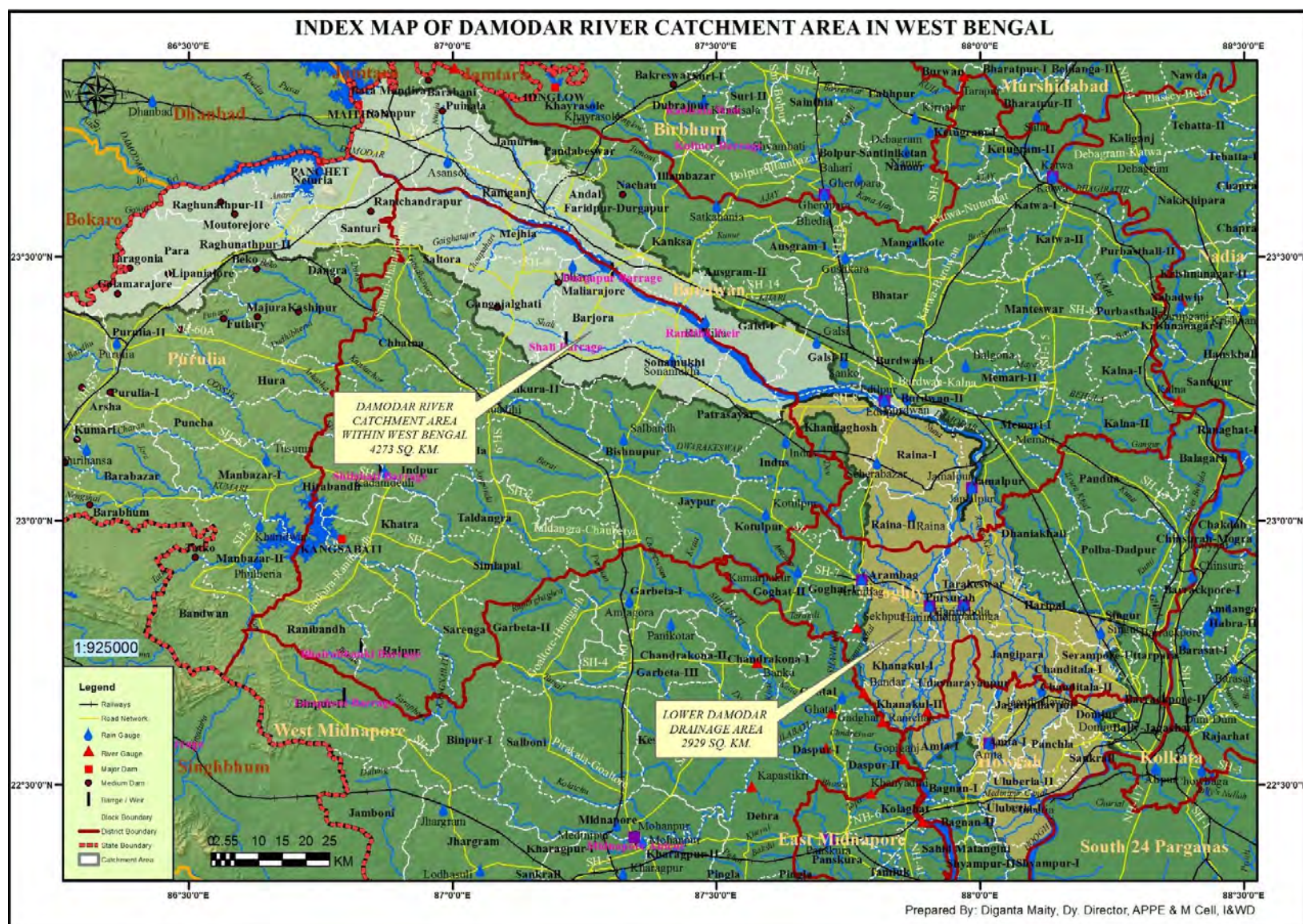
ANNEXURE-I11

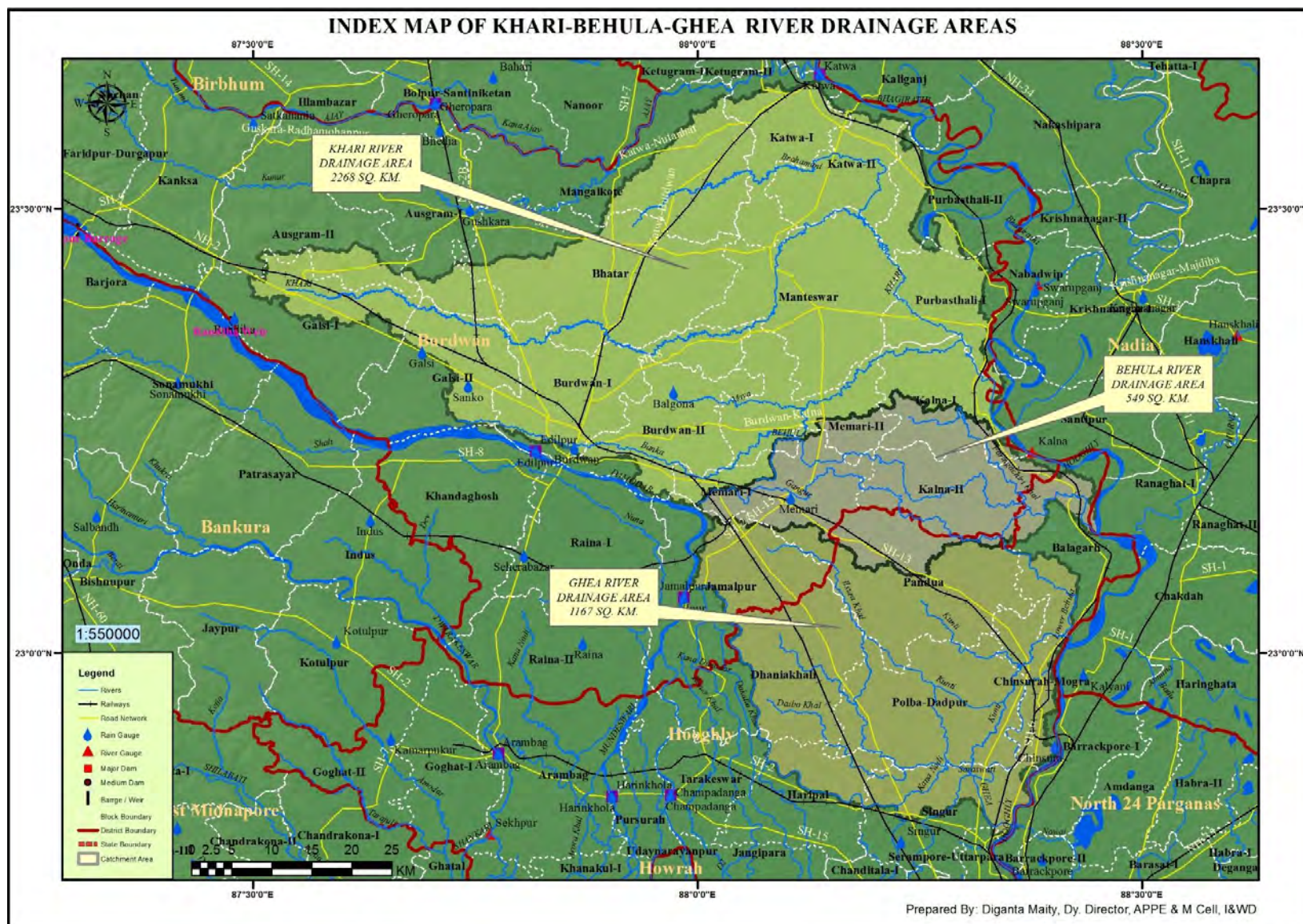
ANNEXURE-I12

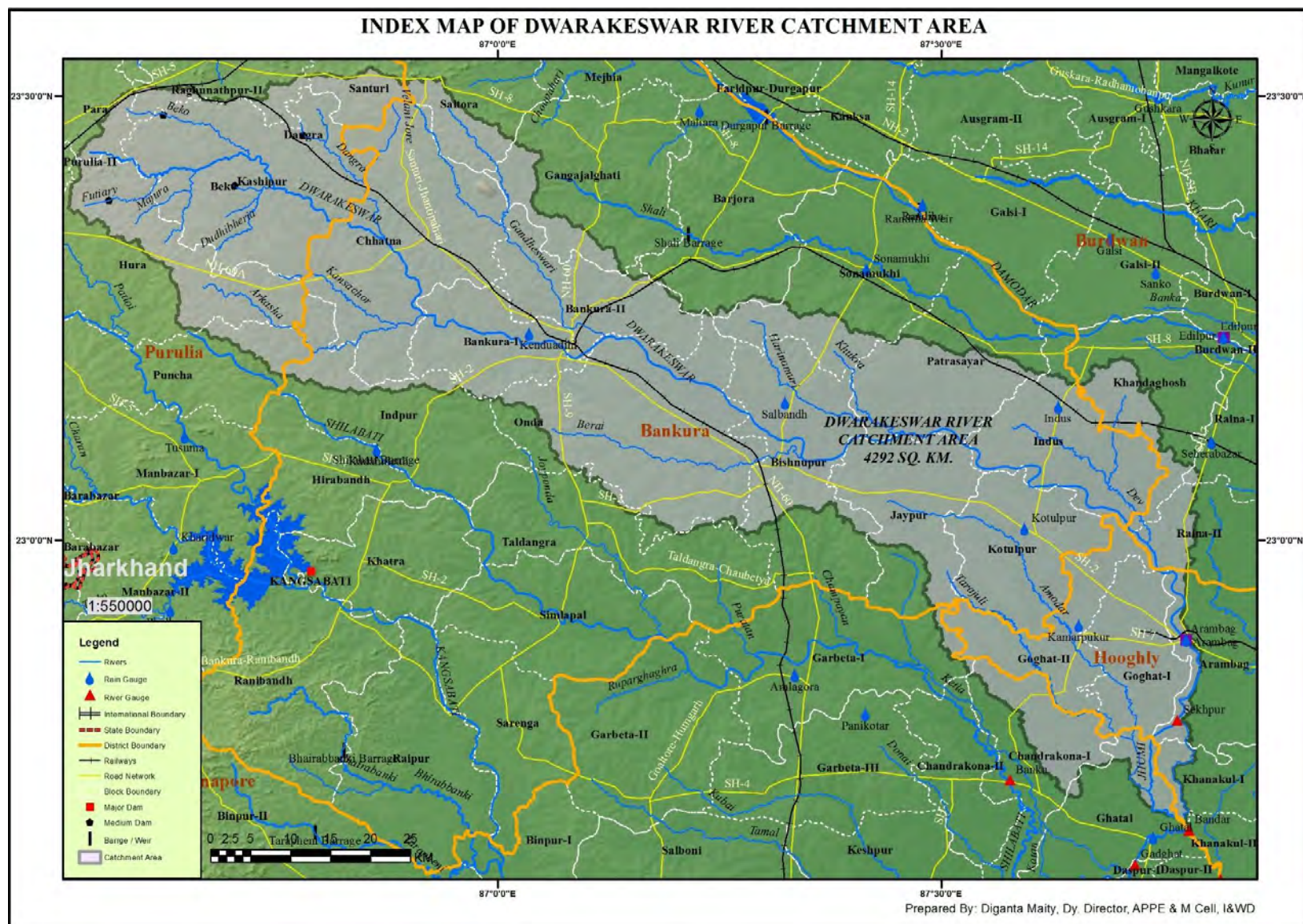
ANNEXURE-I13

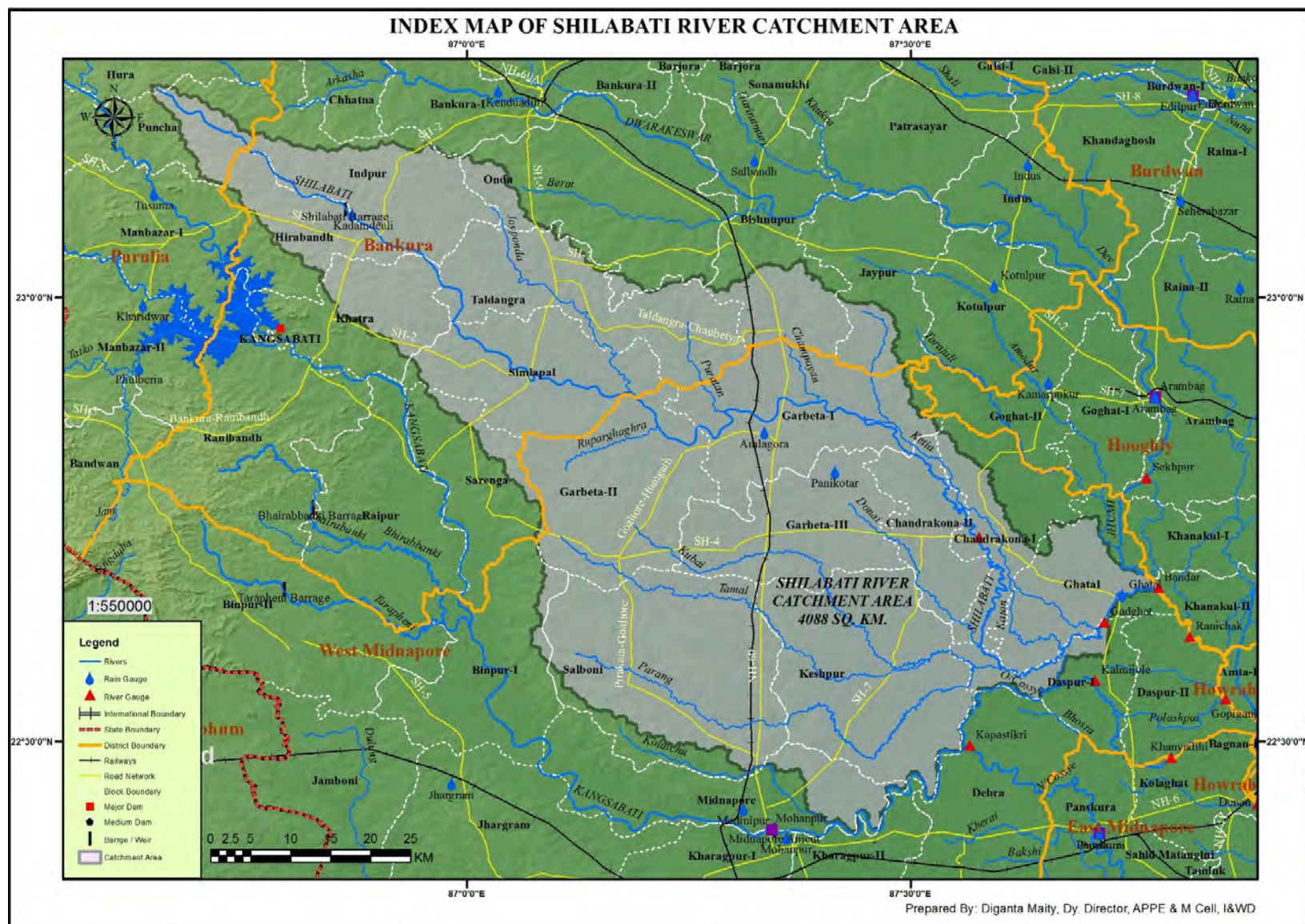
ANNEXURE-I14

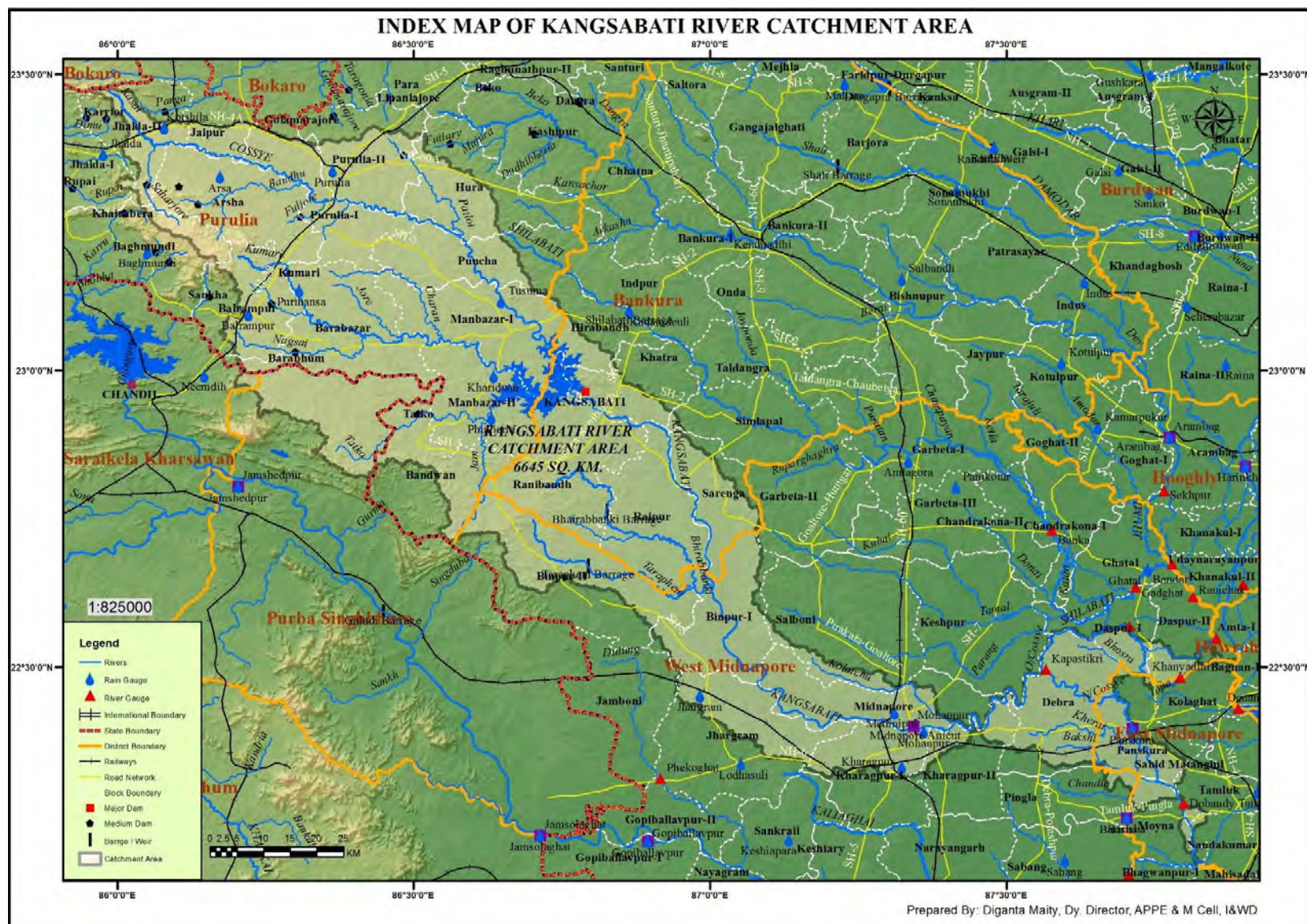
ANNEXURE-I15

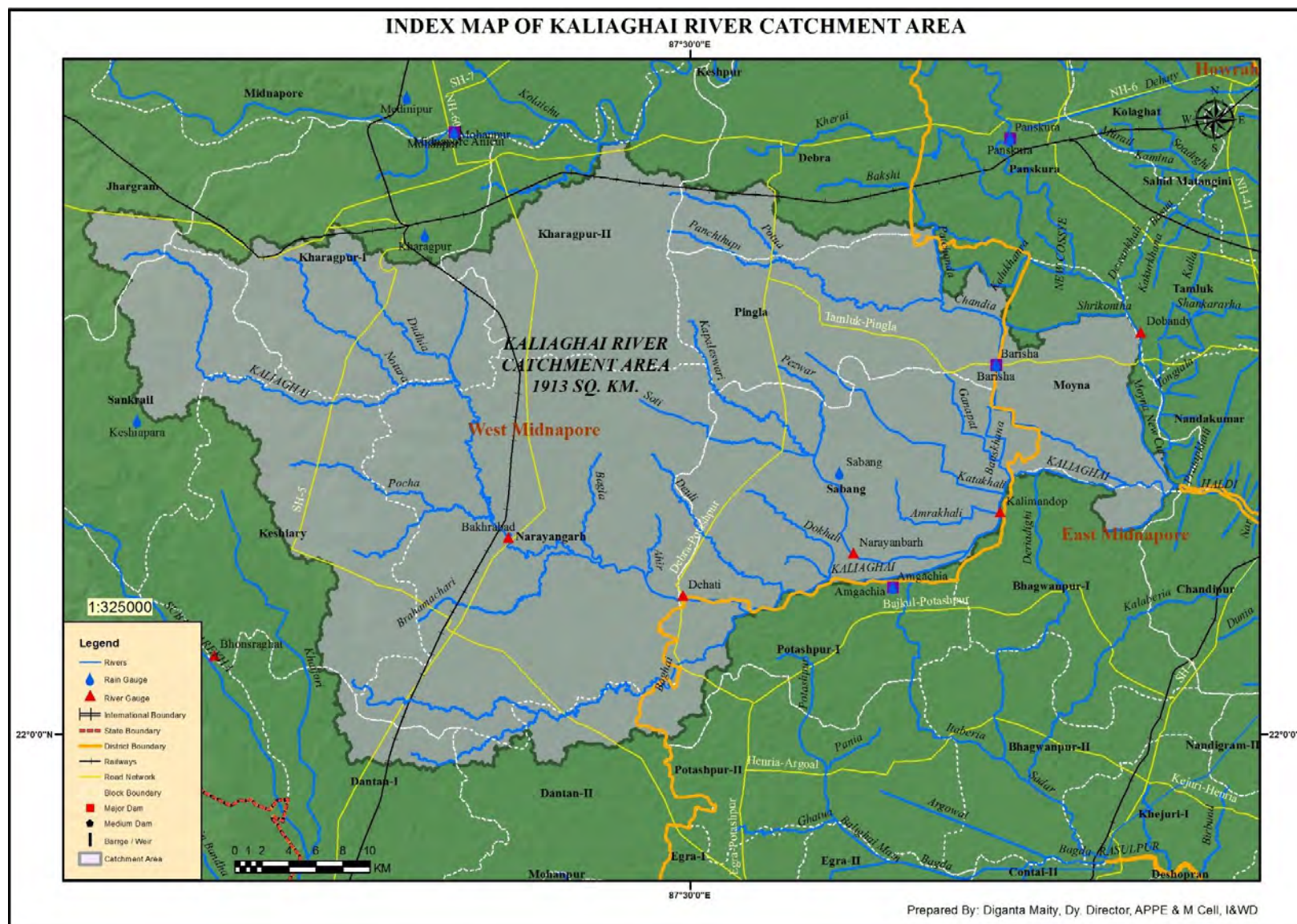
ANNEXURE-I16

ANNEXURE-I17

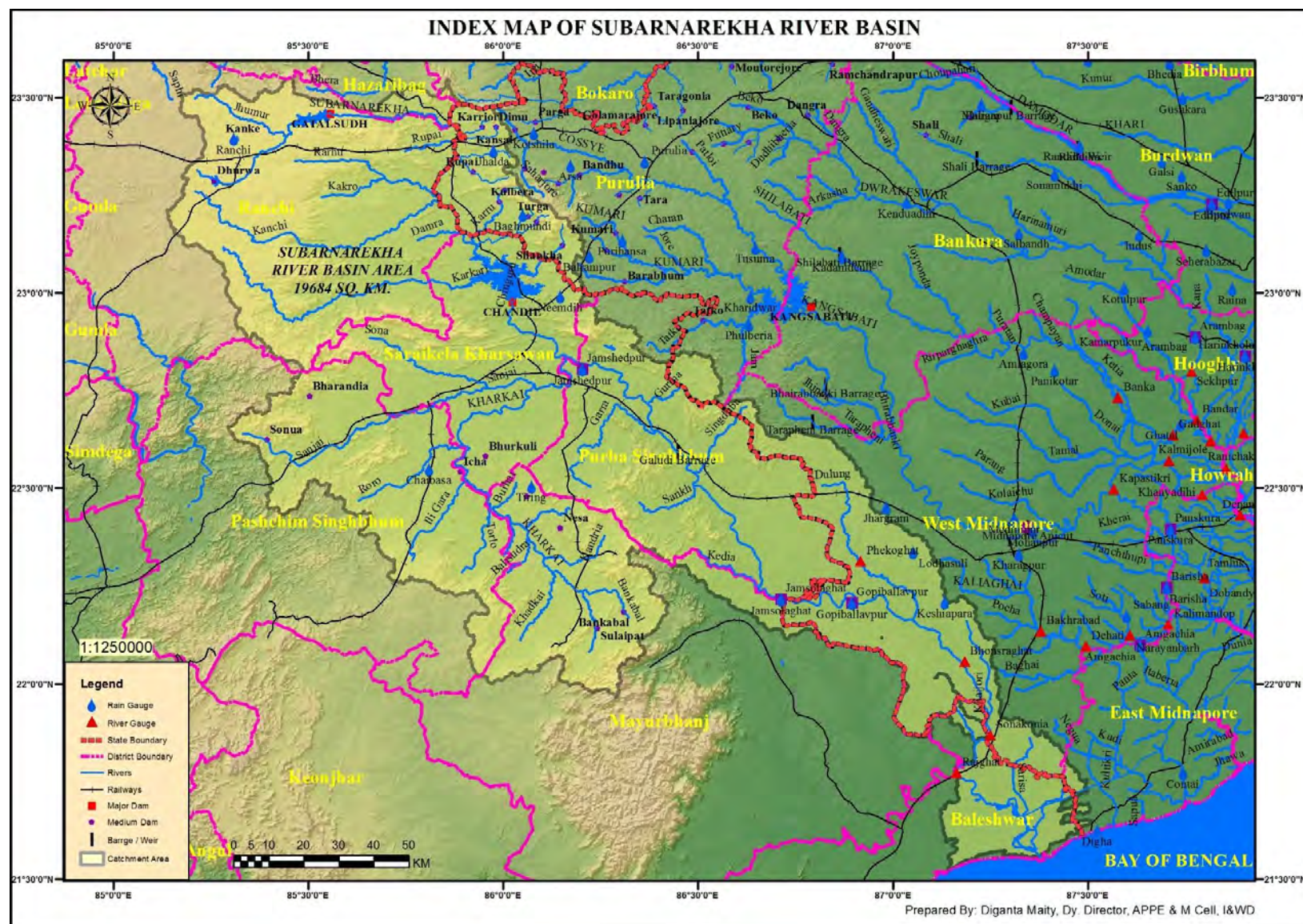
ANNEXURE-I18

ANNEXURE-I19

ANNEXURE-I20

ANNEXURE-I21



ANNEXURE-I23

Annexure RF-1: Districtwise Monthly Rainfall Statistics of West Bengal for the Year 2017

| Month | January | | | February | | | March | | | April | | | May | | |
|-------------------|-------------|--------------|---------------|------------|--------------|---------------|--------------|--------------|--------------|--------------|--------------|---------------|---------------|---------------|---------------|
| Rainfall in mm | Actual | Normal | % Dep | Actual | Normal | % Dep | Actual | Normal | % Dep | Actual | Normal | % Dep | Actual | Normal | % Dep |
| District | | | | | | | | | | | | | | | |
| Coochbehar | 0.1 | 8.9 | -99 | 0.0 | 16.0 | -100 | 64.4 | 32.2 | 100 | 163.5 | 138.9 | 18 | 359.4 | 345.4 | 4 |
| Darjeeling | 0.9 | 48.3 | -98 | 4.6 | 33.8 | -86 | 79.1 | 57.7 | 37 | 61.3 | 130.5 | -53 | 275.2 | 262.3 | 5 |
| Jalpaiguri | 1.9 | 9.2 | -79 | 0.8 | 17.8 | -95 | 83.8 | 39.7 | 111 | 98.2 | 119.3 | -18 | 284.7 | 339.3 | -16 |
| Malda | 0.9 | 13.6 | -93 | 0.0 | 10.5 | -100 | 12.4 | 14.5 | -14 | 94.8 | 34.8 | 172 | 94.9 | 106.2 | -11 |
| North Dinajpur | 3.4 | 21.5 | -84 | 0.0 | 2.0 | -100 | 35.5 | 8.0 | 344 | 128.3 | 35.7 | 259 | 107.4 | 162.9 | -34 |
| South Dinajpur | 1.6 | 8.9 | -83 | 0.0 | 13.3 | -100 | 40.9 | 19.0 | 115 | 91.5 | 58.9 | 55 | 68.5 | 167.8 | -59 |
| TOTAL | 8.8 | 110.4 | -92.03 | 5.4 | 93.4 | -94.22 | 316.1 | 171.1 | 84.75 | 637.6 | 518.1 | 23.07 | 1190.1 | 1383.9 | -14.00 |
| Bankura | 0.0 | 12.0 | -100 | 0.0 | 18.0 | -100 | 16.9 | 22.0 | -23 | 27.9 | 36.3 | -23 | 76.3 | 66.9 | 14 |
| Birbhum | 4.6 | 13.4 | -66 | 0.0 | 16.1 | -100 | 4.8 | 21.2 | -77 | 28.0 | 30.9 | -9 | 160.8 | 78.7 | 104 |
| Burdwan | 1.2 | 10.7 | -88 | 0.0 | 22.2 | -100 | 32.6 | 19.8 | 65 | 28.3 | 37.8 | -25 | 171.2 | 78.8 | 117 |
| East Midnapore | 0.0 | 15.9 | -100 | 0.0 | 18.6 | -100 | 58.7 | 31.8 | 85 | 19.0 | 34.7 | -45 | 89.1 | 108.1 | -18 |
| Hooghly | 0.0 | 11.9 | -100 | 0.0 | 26.6 | -100 | 23.9 | 28.2 | -15 | 11.8 | 50.6 | -77 | 112.8 | 108.5 | 4 |
| Howrah | 0.1 | 12.2 | -99 | 0.0 | 24.9 | -100 | 71.5 | 32.0 | 123 | 11.3 | 52.6 | -79 | 65.4 | 126.4 | -48 |
| Kolkata | 0.1 | 14.4 | -99 | 0.0 | 24.7 | -100 | 138.9 | 33.5 | 315 | 4.5 | 53.1 | -92 | 41.9 | 113.4 | -63 |
| Murshidabad | 2.7 | 16.8 | -84 | 0.0 | 11.2 | -100 | 16.7 | 19.0 | -12 | 53.6 | 34.0 | 58 | 130.3 | 87.0 | 50 |
| Nadia | 0.0 | 12.2 | -100 | 0.0 | 17.6 | -100 | 12.4 | 21.1 | -41 | 12.2 | 42.1 | -71 | 134.7 | 95.2 | 41 |
| North 24 Parganas | 0.0 | 15.6 | -100 | 0.0 | 17.8 | -100 | 44.2 | 30.3 | 46 | 5.2 | 51.5 | -90 | 87.5 | 113.4 | -23 |
| Purulia | 0.1 | 14.3 | -99 | 0.0 | 20.7 | -100 | 13.6 | 24.6 | -45 | 42.8 | 36.1 | 18 | 115.3 | 57.3 | 101 |
| South 24 Parganas | 0.0 | 13.6 | -100 | 0.1 | 26.7 | -99 | 69.8 | 37.9 | 84 | 27.3 | 41.7 | -35 | 41.6 | 125.1 | -67 |
| West Midnapore | 5.0 | 12.2 | -59 | 0.0 | 24.1 | -100 | 43.9 | 39.0 | 13 | 17.4 | 56.8 | -69 | 109.2 | 107.6 | 1 |
| TOTAL | 13.8 | 175.2 | -92.12 | 0.1 | 269.2 | -99.96 | 547.9 | 360.4 | 52.03 | 289.3 | 558.2 | -48.17 | 1336.1 | 1266.4 | 5.50 |

*Source: IMD

Annexure RF-2: Districtwise Monthly Rainfall Statistics of West Bengal for the Year 2017

| Month | June | | | July | | | August | | | September | | |
|-------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Rainfall in mm | Actual | Normal | % Dep | Actual | Normal | % Dep | Actual | Normal | % Dep | Actual | Normal | % Dep |
| District | | | | | | | | | | | | |
| Coochbehar | 416.0 | 668.8 | -38 | 411.6 | 864.9 | -52 | 1100.6 | 733.0 | 50 | 349.7 | 470.9 | -26 |
| Darjeeling | 531.0 | 534.7 | -1 | 760.2 | 756.9 | 0 | 766.5 | 645.9 | 19 | 512.1 | 502.8 | 2 |
| Jalpaiguri | 631.0 | 667.3 | -5 | 569.7 | 931.4 | -39 | 1167.3 | 670.9 | 74 | 596.1 | 488.3 | 22 |
| Malda | 76.5 | 216.6 | -65 | 352.6 | 332.9 | 6 | 557.3 | 284.8 | 96 | 198.5 | 283.0 | -30 |
| North Dinajpur | 148.4 | 316.0 | -53 | 395.8 | 367.0 | 8 | 603.5 | 307.7 | 96 | 102.7 | 403.8 | -75 |
| South Dinajpur | 150.3 | 289.3 | -48 | 161.2 | 368.9 | -56 | 521.1 | 248.0 | 110 | 83.3 | 279.7 | -70 |
| TOTAL | 1953.2 | 2692.7 | -27.46 | 2651.1 | 3622.0 | -26.81 | 4716.3 | 2890.3 | 63.18 | 1842.4 | 2428.5 | -24.13 |
| Bankura | 228.8 | 215.0 | 6 | 634.2 | 303.2 | 109 | 330.4 | 290.7 | 14 | 186.1 | 242.3 | -23 |
| Birbhum | 156.6 | 222.3 | -30 | 487.1 | 313.9 | 55 | 238.6 | 298.8 | -20 | 166.5 | 271.0 | -39 |
| Burdwan | 255.8 | 198.2 | 29 | 464.1 | 294.1 | 58 | 252.9 | 285.3 | -11 | 178.2 | 251.1 | -29 |
| East Midnapore | 158.0 | 253.5 | -38 | 484.5 | 284.9 | 70 | 223.8 | 338.7 | -34 | 213.0 | 343.2 | -38 |
| Hooghly | 186.6 | 243.4 | -23 | 434.6 | 316.1 | 37 | 227.0 | 265.1 | -14 | 160.0 | 243.3 | -34 |
| Howrah | 174.7 | 233.2 | -25 | 629.6 | 343.2 | 83 | 281.8 | 329.4 | -14 | 153.3 | 305.6 | -50 |
| Kolkata | 240.0 | 278.3 | -14 | 621.5 | 361.0 | 72 | 385.9 | 335.2 | 15 | 181.9 | 306.6 | -41 |
| Murshidabad | 134.4 | 237.6 | -43 | 336.7 | 328.6 | 2 | 224.0 | 256.9 | -13 | 163.1 | 256.2 | -36 |
| Nadia | 211.2 | 234.1 | -10 | 404.2 | 270.8 | 49 | 200.9 | 236.0 | -15 | 132.3 | 214.1 | -38 |
| North 24 Parganas | 258.6 | 271.9 | -5 | 502.3 | 317.2 | 58 | 257.2 | 304.3 | -15 | 219.1 | 279.4 | -22 |
| Purulia | 186.2 | 222.1 | -16 | 568.2 | 298.7 | 90 | 249.6 | 307.0 | -19 | 189.9 | 266.7 | -29 |
| South 24 Parganas | 149.2 | 316.0 | -53 | 540.4 | 463.6 | 17 | 276.1 | 416.2 | -34 | 178.6 | 356.8 | -50 |
| West Midnapore | 205.5 | 243.8 | -16 | 411.7 | 329.5 | 25 | 311.9 | 316.0 | -1 | 202.7 | 276.8 | -27 |
| TOTAL | 2545.6 | 3169.4 | -19.68 | 6519.1 | 4224.8 | 54.31 | 3460.1 | 3979.6 | -13.05 | 2324.7 | 3613.1 | -35.66 |

*Source: IMD

Annexure RF-3: Districtwise Monthly Rainfall Statistics of West Bengal for the Year 2017

| Month | October | | | November | | | December | | |
|-------------------|---------------|---------------|--------------|--------------|--------------|---------------|--------------|-------------|---------------|
| Rainfall in mm | Actual | Normal | % Dep | Actual | Normal | % Dep | Actual | Normal | % Dep |
| District | | | | | | | | | |
| Coochbehar | 188.1 | 141.3 | 33 | 0.0 | 15.1 | -100 | 0.0 | 8.3 | -100 |
| Darjeeling | 63.8 | 118.9 | -46 | 7.6 | 16.8 | -55 | 0.0 | 9.9 | -100 |
| Jalpaiguri | 204.4 | 159.9 | 28 | 2.8 | 18.0 | -84 | 1.2 | 7.2 | -83 |
| Malda | 143.9 | 102.5 | 40 | 0.0 | 13.2 | -100 | 5.7 | 6.8 | -16 |
| North Dinajpur | 257.2 | 90.7 | 184 | 0.0 | 9.1 | -100 | 0.0 | 3.2 | -100 |
| South Dinajpur | 75.7 | 112.5 | -33 | 0.0 | 13.0 | -100 | 0.0 | 5.6 | -100 |
| TOTAL | 933.1 | 725.8 | 28.56 | 10.4 | 85.2 | -87.79 | 6.9 | 41.0 | -83.17 |
| Bankura | 249.1 | 105.2 | 137 | 25.3 | 9.8 | 159 | 5.2 | 9.5 | -45 |
| Birbhum | 214.5 | 105.1 | 104 | 2.5 | 15.8 | -84 | 4.7 | 5.6 | -16 |
| Burdwan | 260.1 | 99.8 | 161 | 14.5 | 11.4 | 27 | 9.1 | 6.0 | 51 |
| East Midnapore | 216.2 | 196.9 | 10 | 32.2 | 34.0 | -5 | 22.0 | 9.3 | 137 |
| Hooghly | 212.4 | 102.1 | 108 | 25.2 | 16.0 | 58 | 19.9 | 6.9 | 188 |
| Howrah | 223.1 | 99.1 | 125 | 32.3 | 31.3 | 3 | 14.0 | 10.1 | 38 |
| Kolkata | 247.2 | 155.3 | 59 | 41.7 | 24.8 | 68 | 16.7 | 8.9 | 88 |
| Murshidabad | 108.7 | 126.3 | -14 | 0.9 | 11.0 | -92 | 16.1 | 6.5 | 147 |
| Nadia | 155.2 | 100.2 | 55 | 23.6 | 10.4 | 127 | 21.2 | 7.8 | 171 |
| North 24 Parganas | 288.5 | 130.9 | 120 | 39.0 | 21.8 | 79 | 28.8 | 5.7 | 406 |
| Purulia | 180.5 | 91.5 | 97 | 10.6 | 16.7 | -36 | 1.1 | 7.6 | -86 |
| South 24 Parganas | 310.3 | 218.4 | 42 | 26.7 | 62.3 | -57 | 24.8 | 9.7 | 156 |
| West Midnapore | 203.4 | 106.5 | 91 | 32.1 | 17.9 | 80 | 9.3 | 5.3 | 75 |
| TOTAL | 2869.2 | 1637.3 | 75.24 | 306.6 | 283.2 | 8.26 | 192.9 | 98.9 | 95.05 |

*Source: IMD

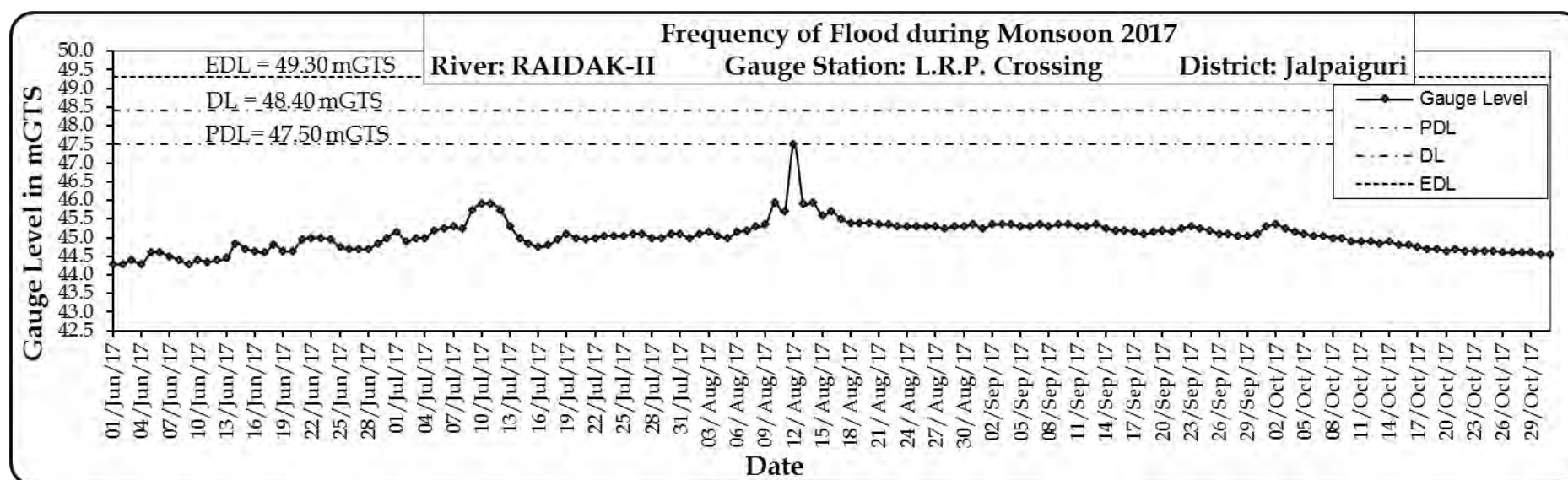
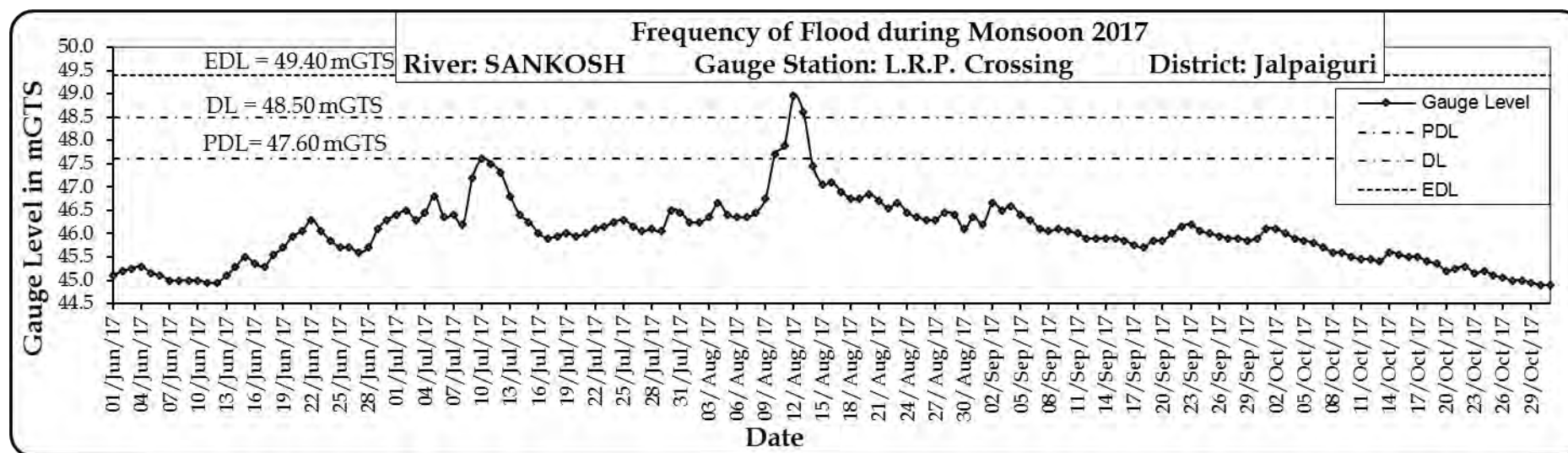
Annexure RF-4: Monthly Rainfall Statistics of Rain Gauge Stations during Monsoon, 2017

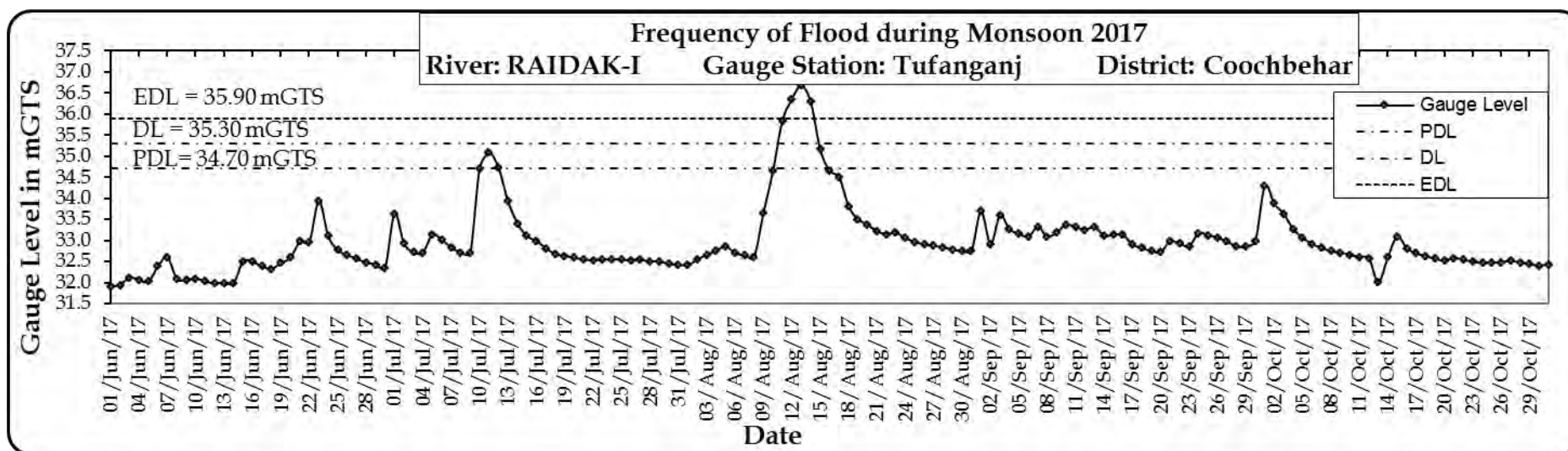
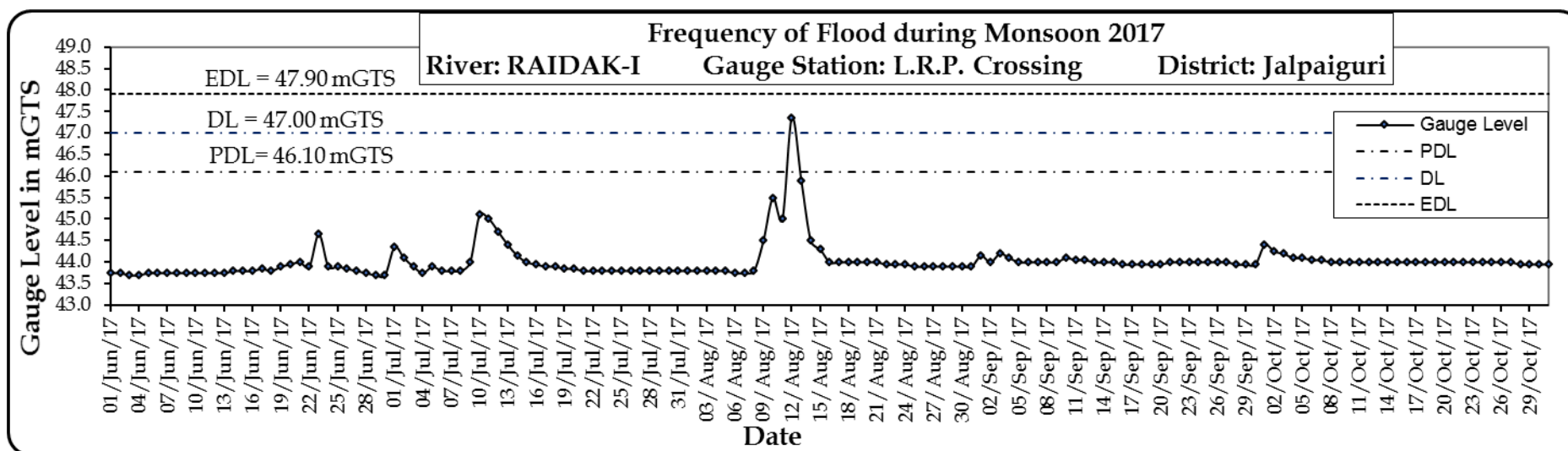
| Sl. No. | RIVER BASIN | DISTRICT | Location of Rain Gauge Station | Districtwise Normal Annual Rainfall (mm) | Jun-17 | Jul-17 | Aug-17 | Sep-17 | TOTAL |
|---------|------------------|------------------|--------------------------------|--|---------|--------|---------|--------|---------|
| 1 | TEESTA | SIKKIM | Gangtok | 2739.00 | 482.10 | 697.60 | 599.90 | 352.90 | 2132.50 |
| 2 | | DARJEELING | Darjeeling | 3118.50 | 25.00 | 110.00 | NA | NA | |
| 3 | | JALPAIGURI | Malbazar | 3463.30 | 1064.16 | 772.90 | 1142.10 | 972.80 | 3951.96 |
| 4 | | JALPAIGURI | Jalpaiguri | | 380.40 | 575.80 | 878.50 | 381.50 | 2216.20 |
| 5 | JALDHAKA | JALPAIGURI | Banarhat | | 1215.20 | 664.60 | 1102.00 | 637.20 | 3619.00 |
| 6 | | JALPAIGURI | Mainaguri | | 459.00 | 531.50 | 923.40 | 277.50 | 2191.40 |
| 7 | | COOCHBEHAR | Mathabhanga | 3443.70 | 645.20 | 366.15 | 883.20 | 363.20 | 2257.75 |
| 8 | SANKOSH | ALIPURDUAR | Barabisha | 3463.30 | 459.20 | 436.00 | 1346.80 | 645.00 | 2887.00 |
| 9 | TORSa | JALPAIGURI | Hasimara | | 785.60 | 808.20 | 1490.80 | 768.00 | 3852.60 |
| 10 | | JALPAIGURI | Alipurduar | | 702.00 | 447.80 | 1428.20 | 782.60 | 3360.60 |
| 11 | | COOCHBEHAR | Coochbehar | 3443.70 | 525.10 | 501.10 | 1171.70 | 527.00 | 2724.90 |
| 12 | | COOCHBEHAR | Tufanganj | | 764.20 | 631.80 | 1195.80 | 659.80 | 3251.60 |
| 13 | MAHANANDA-FULHAR | DARJEELING | Siliguri | 3118.50 | 502.20 | 679.20 | 960.20 | 754.20 | 2895.80 |
| 14 | | UTTAR DINAJPUR | Islampur | 1727.60 | 97.90 | 244.90 | 576.60 | 126.30 | 1045.70 |
| 15 | | UTTAR DINAJPUR | Raiganj | | 205.10 | 256.80 | 460.20 | 186.50 | 1108.60 |
| 16 | | MALDA | English Bazar | | 55.60 | 370.00 | 389.80 | 165.50 | 980.90 |
| 17 | ATREYEE | DAKSHIN DINAJPUR | Balurghat | 1584.90 | 107.00 | 322.80 | 417.60 | 188.40 | 1035.80 |
| 18 | PUNARBHABA | DAKSHIN DINAJPUR | Gangarampur | | 139.00 | 286.40 | 595.50 | 58.00 | 1078.90 |
| 19 | GANGA-BHAGIRATHI | MURSHIDABAD | Berhampore | 1391.10 | 136.60 | 355.80 | 249.80 | 145.40 | 887.60 |
| 20 | | BURDWAN | Katwa | 1315.20 | 147.87 | 493.09 | 219.51 | 261.19 | 1121.66 |
| 21 | JALANGI | NADIA | Swarupganj | 1261.60 | 147.80 | 388.00 | 252.20 | 233.20 | 1021.20 |
| 22 | PAGLA-BANSLOI | BIRBHUM | Paikor | 1392.80 | 118.00 | 330.20 | 255.80 | 158.20 | 862.20 |
| 23 | BRAHAMANI-DWARKA | BIRBHUM | Md. Bazar | | 195.50 | 565.00 | 172.50 | 249.00 | 1182.00 |
| 24 | | BIRBHUM | Rampurhat | | 128.80 | 342.20 | 297.60 | 165.00 | 933.60 |
| 25 | | BIRBHUM | Mallarpur | | 221.40 | 511.60 | 430.80 | 323.50 | 1487.30 |
| 26 | | BIRBHUM | Deocha | | 229.30 | 493.80 | 282.30 | 270.30 | 1275.70 |
| 27 | MAYURAKSHI-BABLA | DUMKA | Haripur | 1391.10 | 106.60 | 401.80 | 149.80 | 291.60 | 949.80 |
| 28 | | DUMKA | Khusiary | | 120.40 | 415.60 | 131.60 | 362.40 | 1030.00 |
| 29 | | DUMKA | Maharo | | 49.20 | 391.60 | 197.20 | 198.60 | 836.60 |
| 30 | | DUMKA | Massanjore | | 112.00 | 620.40 | 119.00 | 162.60 | 1014.00 |
| 31 | | DUMKA | Tantloi | | 103.40 | 579.40 | 117.20 | 117.00 | 917.00 |
| 32 | | BIRBHUM | Tilpara Barrage | 1612.40 | 140.60 | 469.40 | 129.20 | 248.40 | 987.60 |
| 33 | | BIRBHUM | Shyambati | | 201.00 | 590.70 | 333.00 | 261.00 | 1385.70 |
| 34 | | BIRBHUM | Debagram | | 99.20 | 362.70 | 137.90 | 270.80 | 870.60 |
| 35 | | MURSHIDABAD | Kandi | 1391.10 | 150.20 | 447.80 | 184.00 | 104.00 | 886.00 |
| 36 | AJAY-HINGLOW | DEOGHAR | Sikatia | 1162.10 | 227.00 | 582.00 | 149.00 | 67.00 | 1025.00 |
| 37 | | BIRBHUM | Hinglow | 1612.40 | 206.00 | 576.50 | 306.00 | 218.00 | 1306.50 |
| 38 | | BURDWAN | Satkahania | 1315.20 | 96.20 | 205.80 | 104.20 | 64.90 | 471.10 |
| 39 | | BURDWAN | Guskara | | 223.00 | 493.00 | 370.00 | 227.00 | 1313.00 |

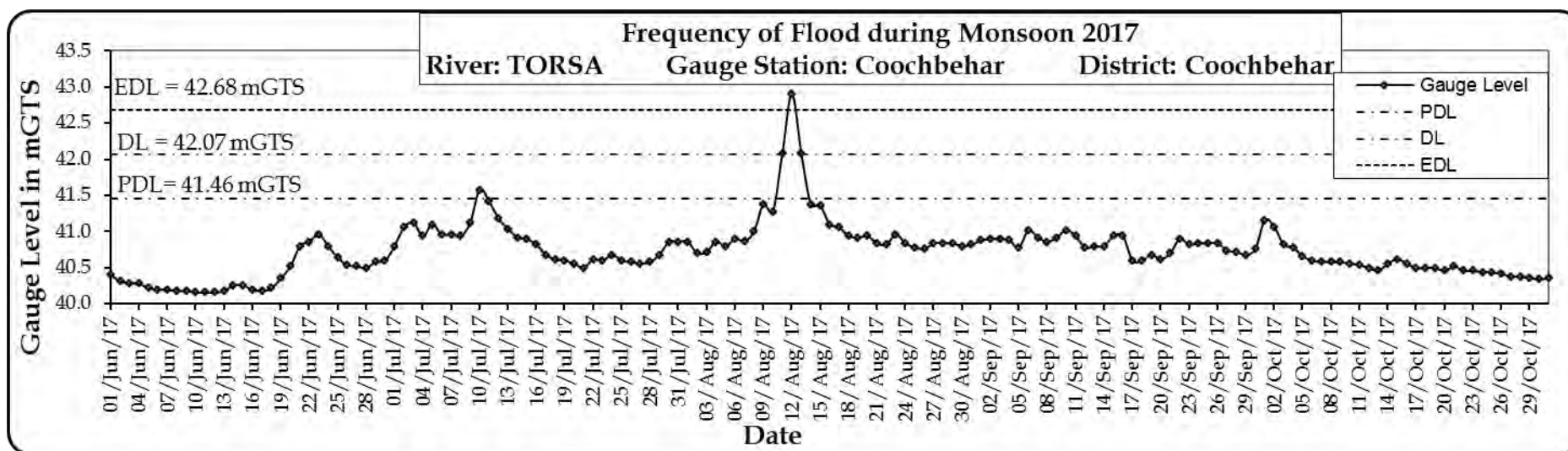
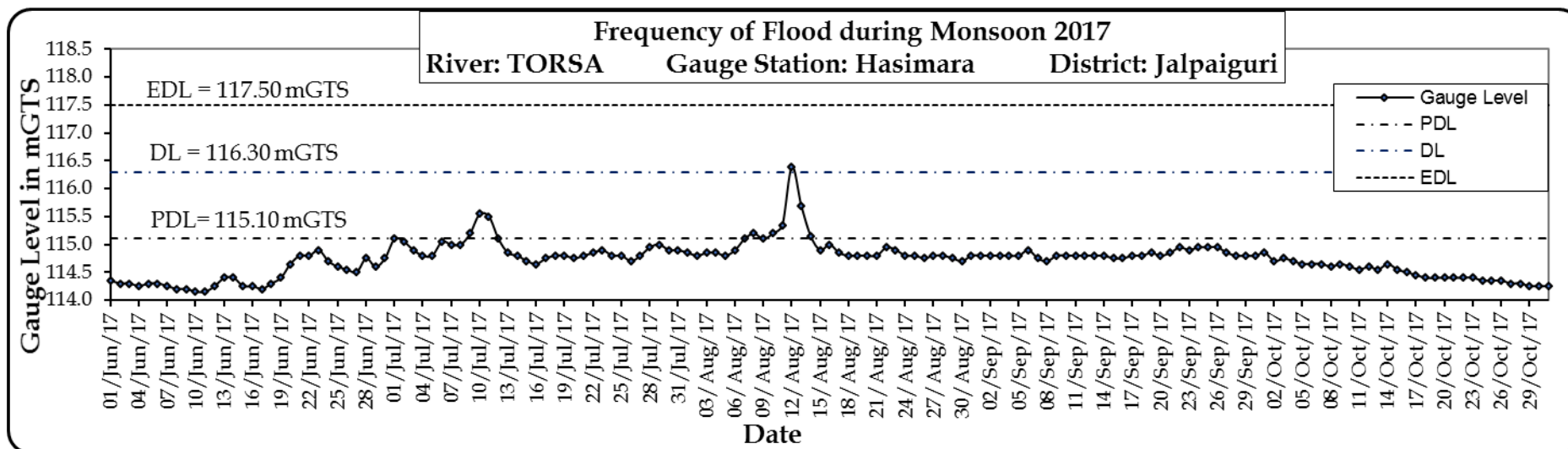
| Sl. No. | RIVER BASIN | DISTRICT | Location of Rain Gauge Station | Districtwise Normal Annual Rainfall (mm) | Jun-17 | Jul-17 | Aug-17 | Sep-17 | TOTAL |
|---------|---------------------------------|-------------------|--------------------------------|--|--------|--------|--------|--------|---------|
| 40 | DAMODAR | KODARMA | Tilaiya | 1116.20 | 88.80 | 516.00 | 216.80 | 102.40 | 924.00 |
| 41 | | BOKARO | Tenughat | 1247.50 | 150.40 | 653.60 | 377.60 | 103.40 | 1285.00 |
| 42 | | DHANBAD | Maithon | 1355.20 | 132.00 | 587.20 | 141.60 | 108.60 | 969.40 |
| 43 | | DHANBAD | Panchet | | 106.80 | 696.60 | 143.20 | 43.40 | 990.00 |
| 44 | | BURDWAN | Asansol | 1315.20 | 135.60 | 617.00 | 135.00 | 144.40 | 1032.00 |
| 45 | | BURDWAN | Durgapur | | 384.20 | 498.20 | 228.80 | 358.60 | 1469.80 |
| 46 | | BURDWAN | Burdwan | | 210.20 | 443.87 | 334.50 | 280.63 | 1269.20 |
| 47 | | BANKURA | Sonamukhi | 1330.90 | 135.00 | 334.00 | 175.50 | 146.00 | 790.50 |
| 48 | KHARI-BEHULA-GHEA MUNDESWARI | BURDWAN | Balgona | 1315.20 | 187.00 | 368.00 | 183.00 | 173.00 | 911.00 |
| 49 | | BURDWAN | Memari | | 308.00 | 414.00 | 202.00 | 296.00 | 1220.00 |
| 50 | | BURDWAN | Seharabazar | 1315.20 | 155.00 | 344.00 | 153.00 | 179.00 | 831.00 |
| 51 | AMTA CHANNEL (DAMODAR) | HOOGLY | Champadanga | 1418.70 | 85.10 | 241.00 | 159.00 | 152.00 | 637.10 |
| 52 | | HOOGLY | Singur | 1600.00 | 133.25 | 384.50 | 232.25 | 215.00 | 965.00 |
| 52 | | HOWRAH | Amta | | 226.00 | 387.00 | 371.00 | 151.00 | 1135.00 |
| 53 | | HOWRAH | Domjur | | 245.00 | 522.00 | 287.00 | 222.00 | 1276.00 |
| 53 | DWARAKESWAR | BANKURA | Bankura | 1330.90 | 275.60 | 809.80 | 486.40 | 103.60 | 1675.40 |
| 54 | | BANKURA | Indus | | 244.50 | 759.30 | 191.70 | 250.90 | 1446.40 |
| 55 | | HOOGLY | Arambag | 1418.70 | 174.75 | 457.75 | 224.00 | 173.50 | 1030.00 |
| 56 | SHILABATI | BANKURA | Amlagora | 1330.90 | 131.80 | 261.00 | 127.40 | 111.60 | 631.80 |
| 57 | | PASCHIM MEDINIPUR | Ghatal | 1535.50 | 244.00 | 505.00 | 356.40 | 268.00 | 1373.40 |
| 58 | KANGSABATI | PURULIA | Simulia | 1363.30 | 217.80 | 650.80 | 218.60 | 151.20 | 1238.40 |
| 59 | | PURULIA | Purihansa | | 245.40 | 585.60 | 314.60 | 426.80 | 1572.40 |
| 60 | | PURULIA | Tusuma | | 230.60 | 526.40 | 228.20 | 263.60 | 1248.80 |
| 61 | | PURULIA | Kharidwar | | 160.80 | 386.40 | 251.00 | 189.60 | 987.80 |
| 62 | | PURULIA | Phulberia | | 142.80 | 408.00 | 252.80 | 240.60 | 1044.20 |
| 63 | | BANKURA | Mukutmanipur | 1330.90 | 226.40 | 462.40 | 239.40 | 254.40 | 1182.60 |
| 64 | | PASCHIM MEDINIPUR | Midnapore | 1535.50 | 308.95 | 346.64 | 323.00 | 255.20 | 1233.79 |
| 65 | | PURBA MEDINIPUR | Panskura | 1669.60 | 287.20 | 794.30 | 611.80 | 429.70 | 2123.00 |
| 66 | RUPNARAYAN | PURBA MEDINIPUR | Tamluk | 1669.60 | 146.75 | 741.75 | 390.75 | 292.25 | 1571.50 |
| 67 | KALIAGHAI | PURBA MEDINIPUR | Amgachia | 1669.60 | 172.10 | 439.80 | 250.00 | 163.00 | 1024.90 |
| 68 | | PASCHIM MEDINIPUR | Sabang | | 252.00 | 452.00 | 326.00 | 390.00 | 1420.00 |
| 69 | | PASCHIM MEDINIPUR | Jhargram | 1535.50 | 71.65 | 431.55 | 281.25 | 88.40 | 872.85 |
| 70 | CHANDIA | PASCHIM MEDINIPUR | Barisha | | 122.80 | 530.20 | 304.25 | 221.00 | 1178.25 |
| 71 | HALDI | PURBA MEDINIPUR | Itamogra | 1669.60 | 141.80 | 581.30 | 270.50 | 200.30 | 1193.90 |
| 72 | RASULPUR | PURBA MEDINIPUR | Contai | 1669.60 | 123.40 | 526.20 | 247.50 | 336.60 | 1233.70 |
| 73 | HOOGHLY | KOLKATA | Alipore | 1709.20 | 243.70 | 621.50 | 372.70 | 94.10 | 1332.00 |

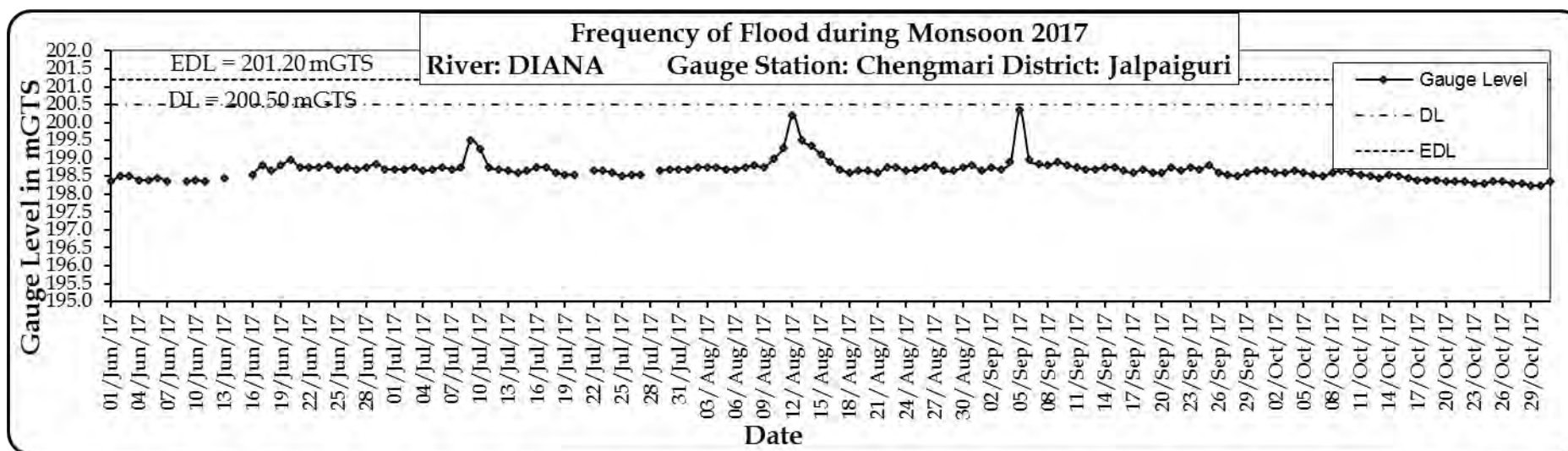
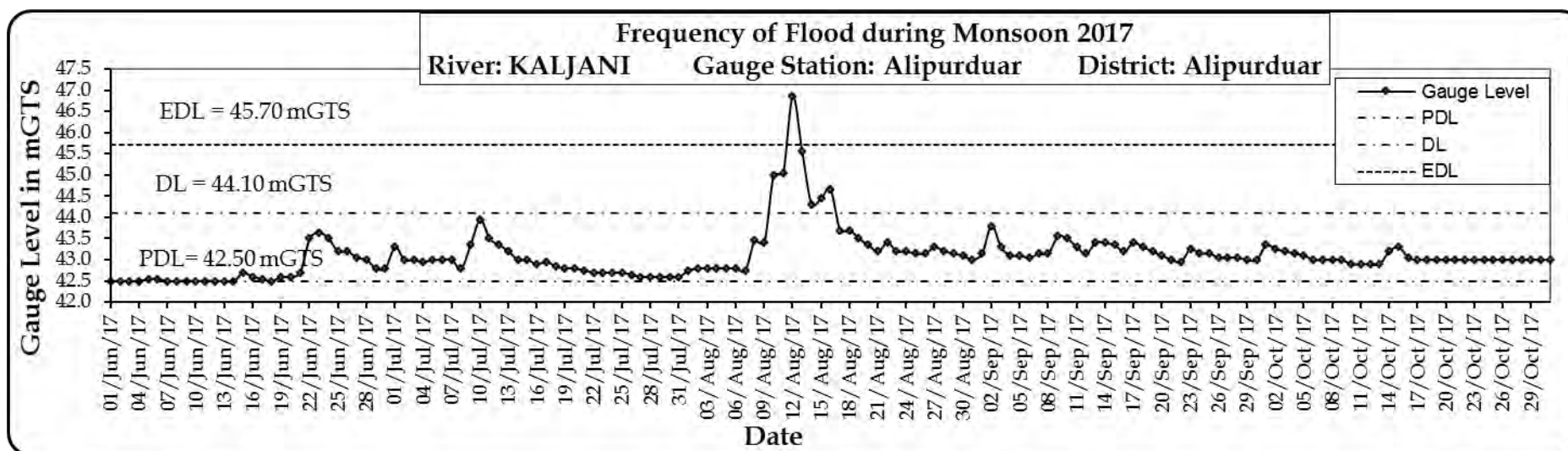
ANNUAL FLOOD REPORT, 2017

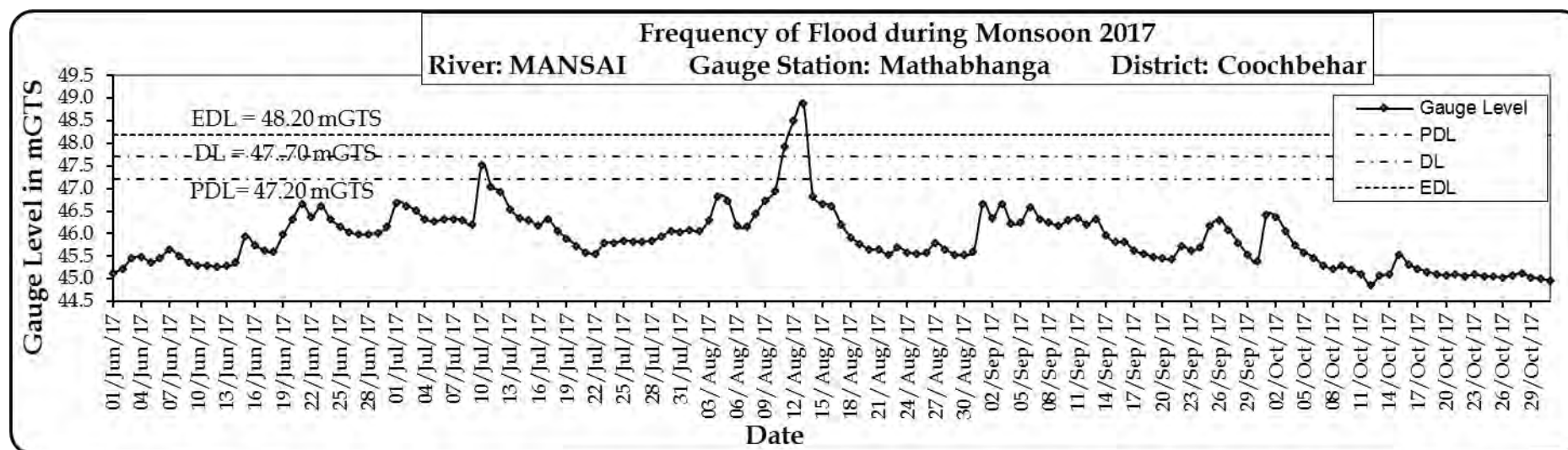
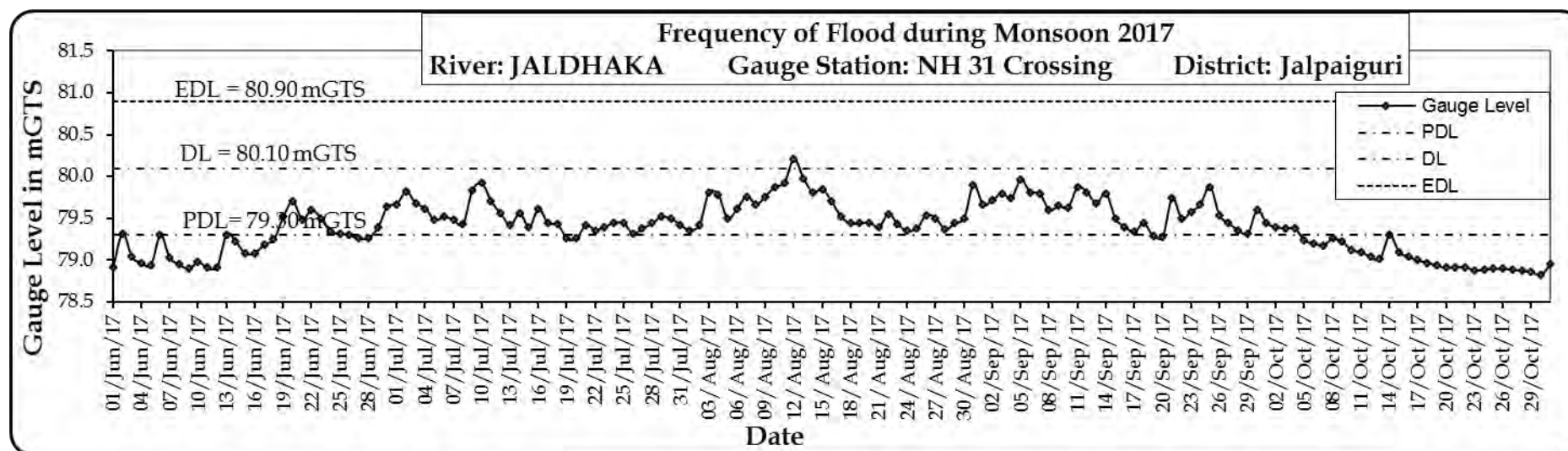
| Sl. No. | RIVER BASIN | DISTRICT | Location of Rain Gauge Station | Districtwise Normal Annual Rainfall (mm) | Jun-17 | Jul-17 | Aug-17 | Sep-17 | TOTAL |
|---------|----------------|-------------------|--------------------------------|--|--------|--------|--------|--------|---------|
| 74 | ICHHAMATI | NORTH 24-PARGANAS | Bangaon | 1559.80 | 249.60 | 442.40 | 161.20 | 229.80 | 1083.00 |
| 75 | | NORTH 24-PARGANAS | Tentulia | 1560.80 | 345.00 | 487.00 | 203.00 | 193.00 | 1228.00 |
| 76 | BIDYADHARI | NORTH 24-PARGANAS | Dumdum | | 195.50 | 610.80 | 117.70 | 174.60 | 1098.60 |
| 77 | | SOUTH 24-PARGANAS | Chowbaga | 2088.00 | 181.00 | 455.00 | 367.00 | 109.00 | 1112.00 |
| 78 | SUNDARBAN AREA | SOUTH 24-PARGANAS | Uttarbhag | | 211.00 | 280.00 | 280.00 | 158.00 | 929.00 |
| 79 | SUBARNAREKHA | PURBA MEDINIPUR | Digha | 1669.60 | 266.35 | 417.00 | 237.00 | 129.00 | 1049.35 |

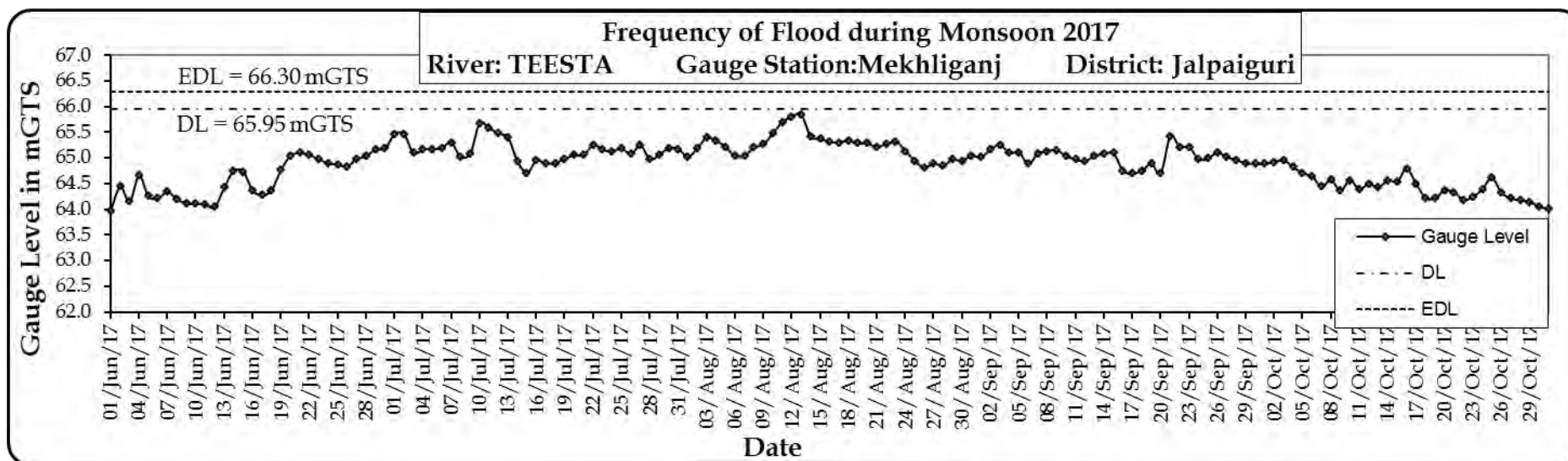
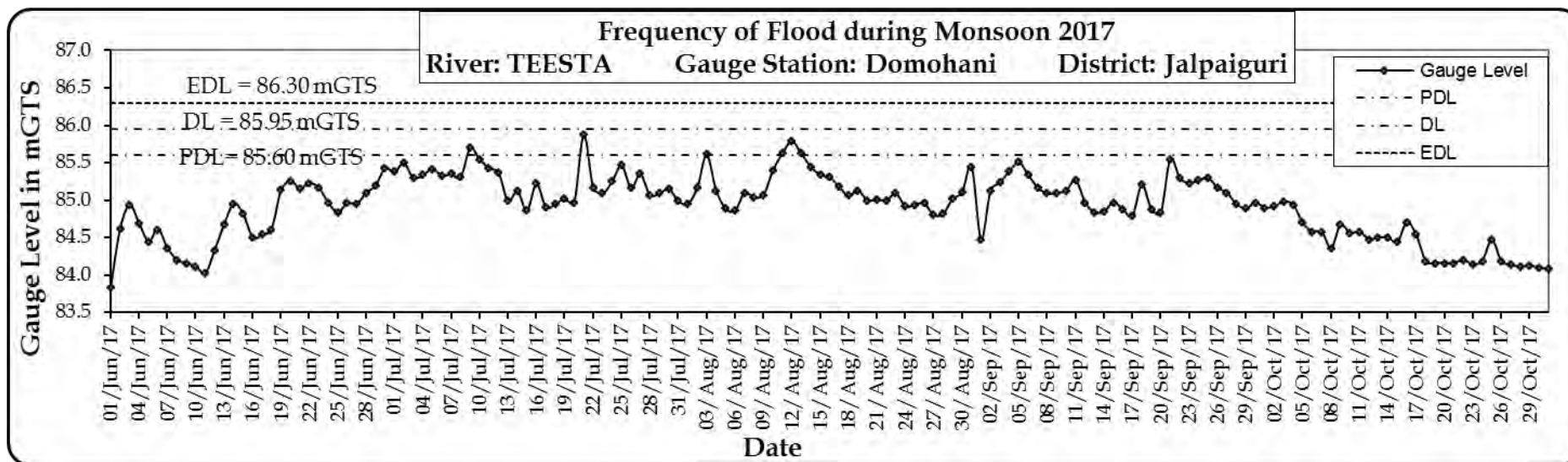
Annexure-G1

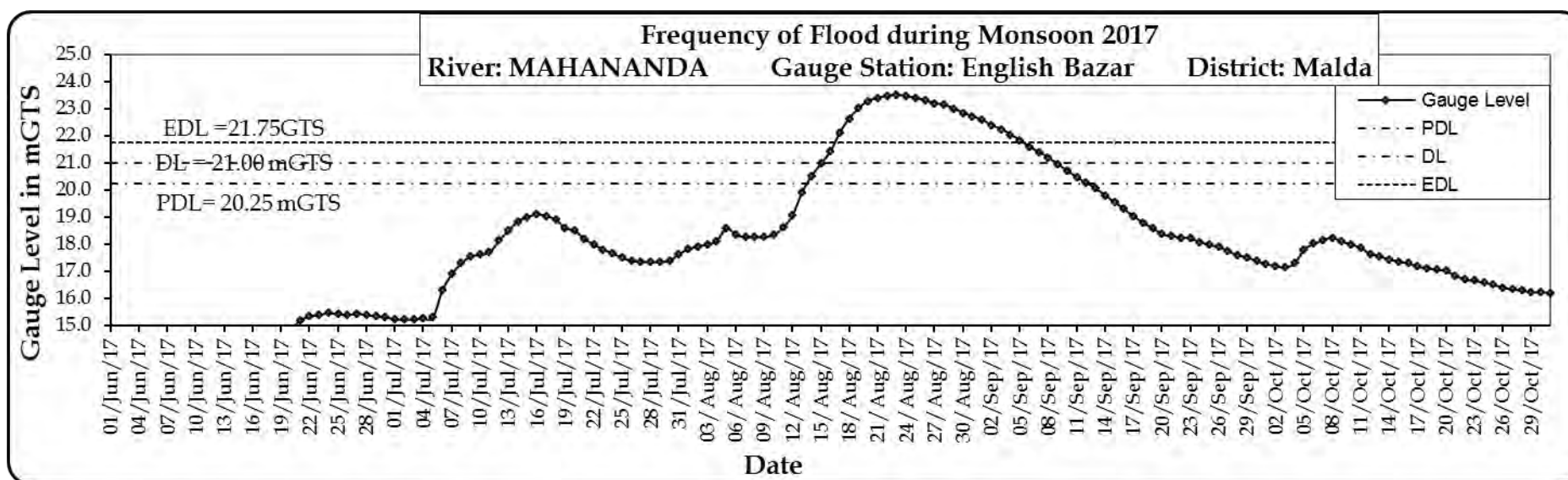
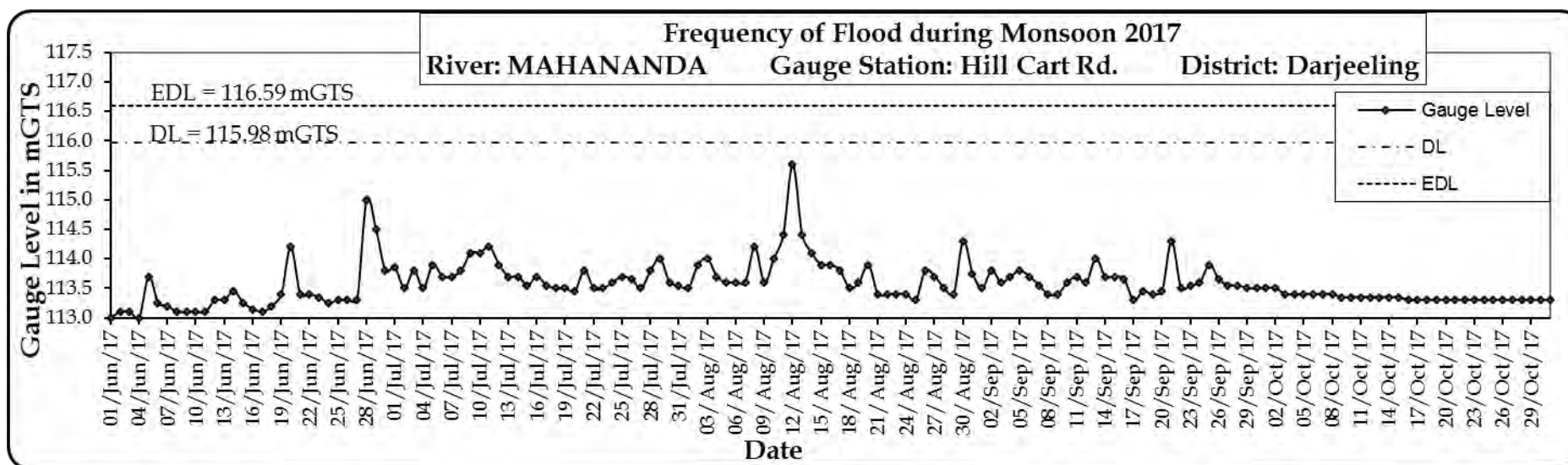
Annexure-G2

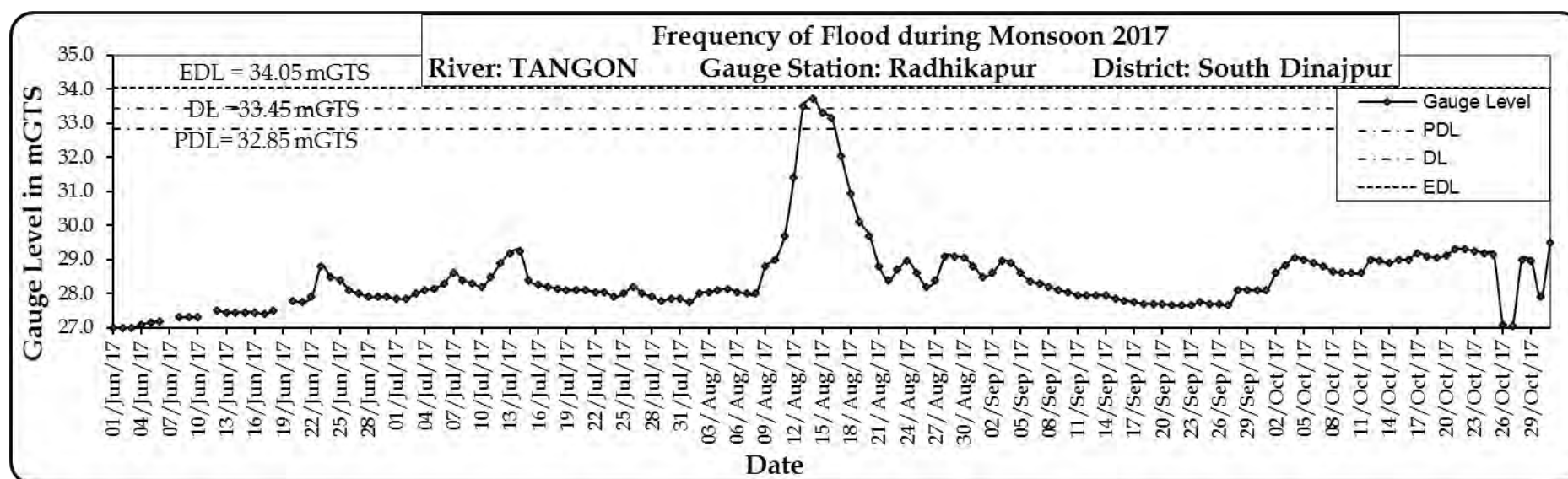
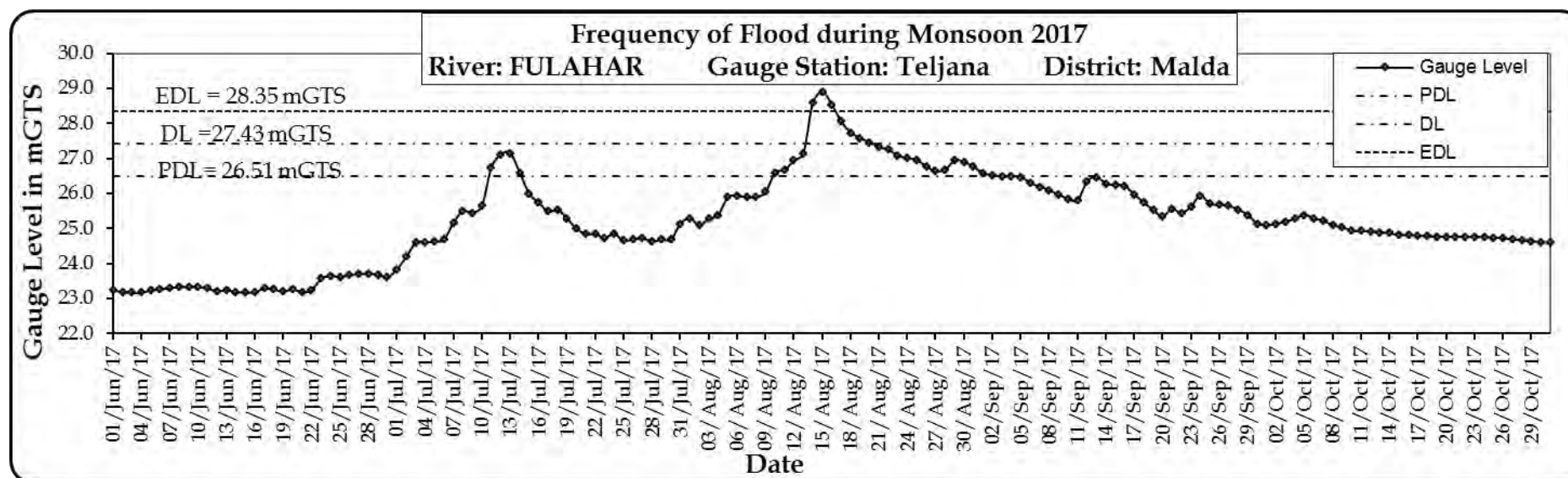
Annexure-G3

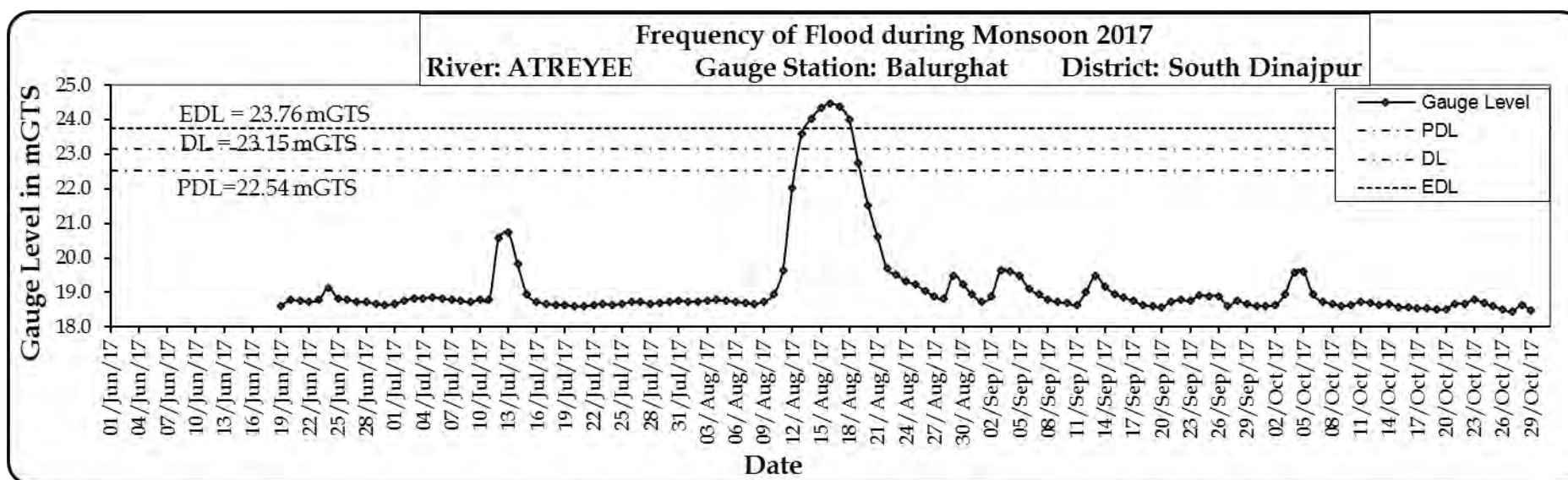
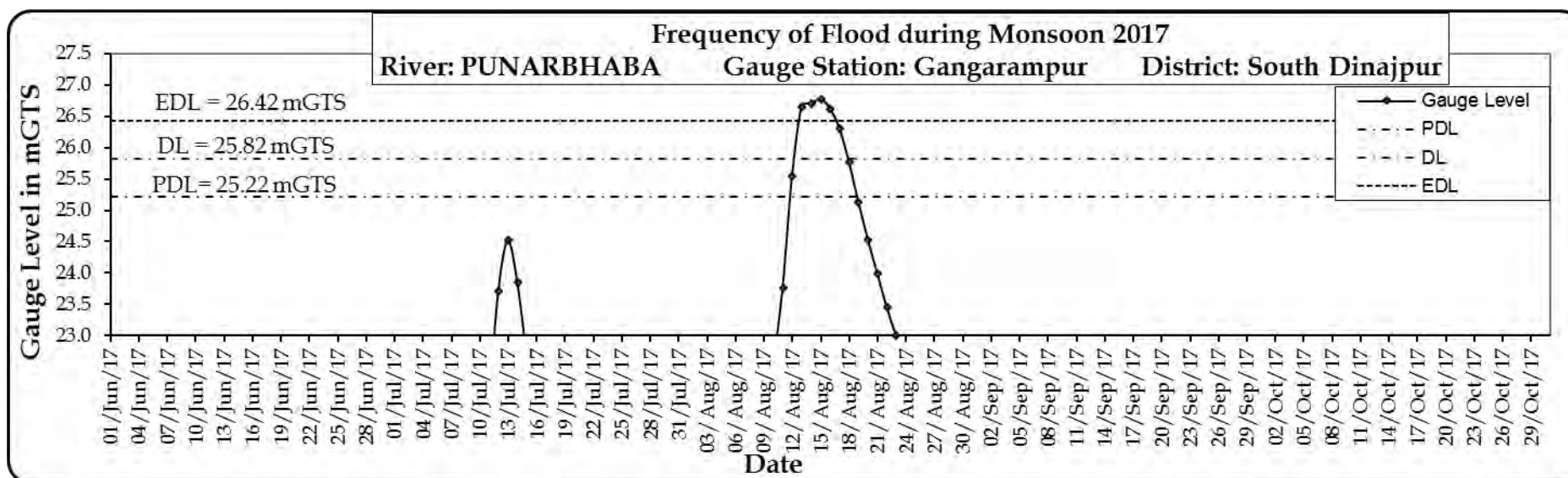
Annexure-G4

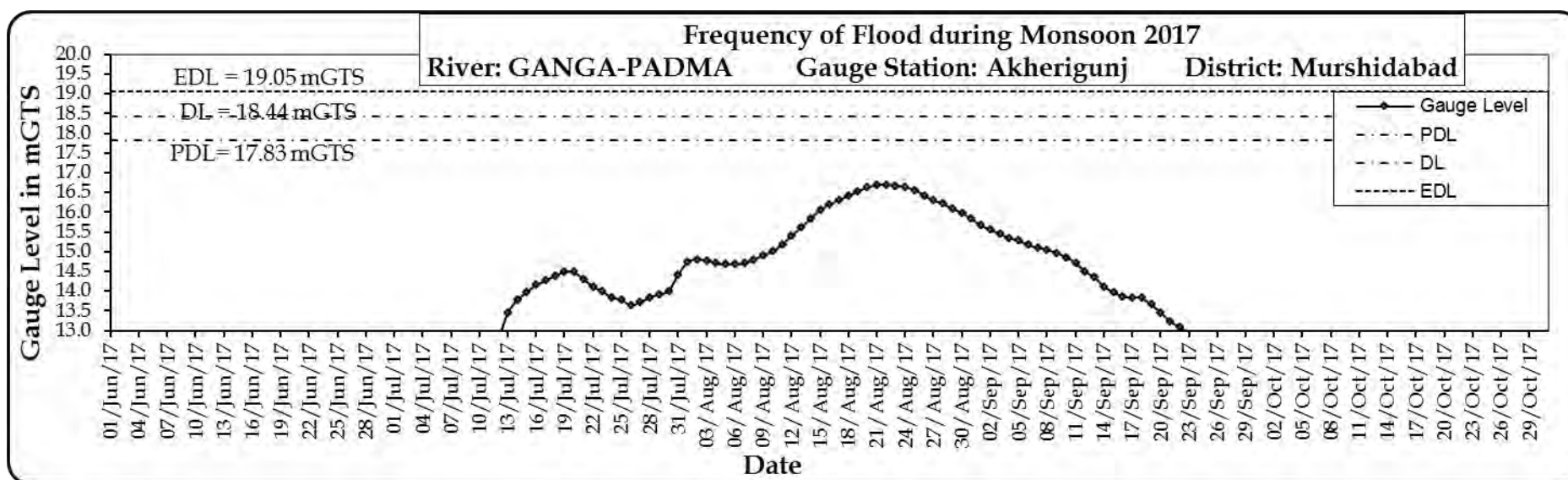
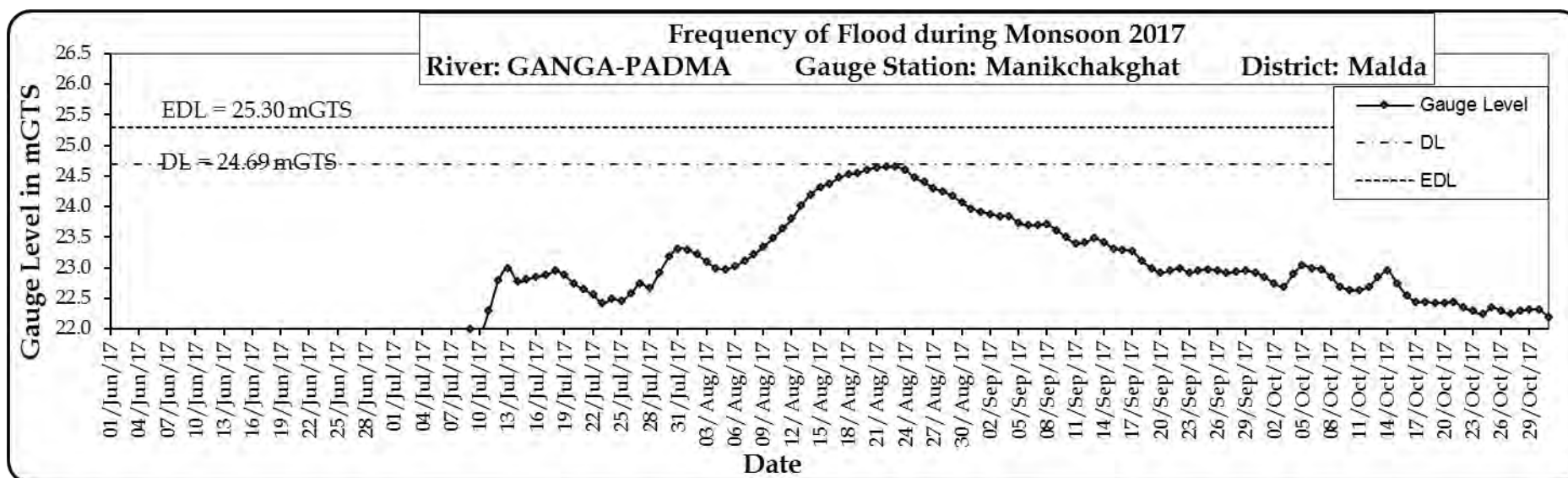
Annexure-G5

Annexure-G6

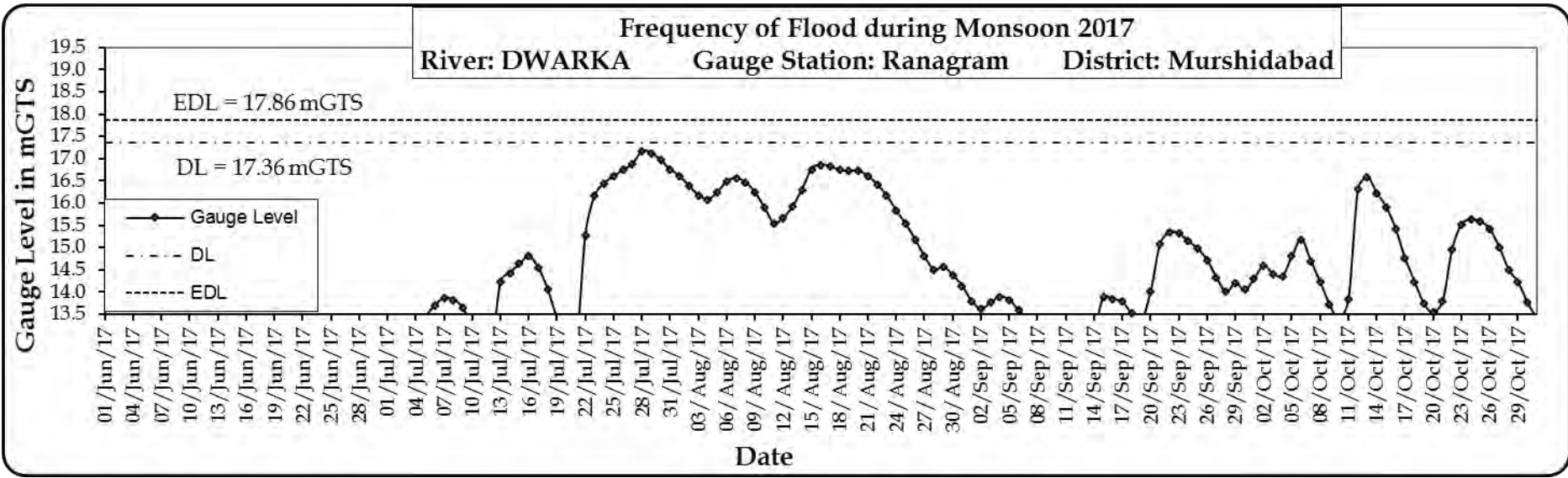
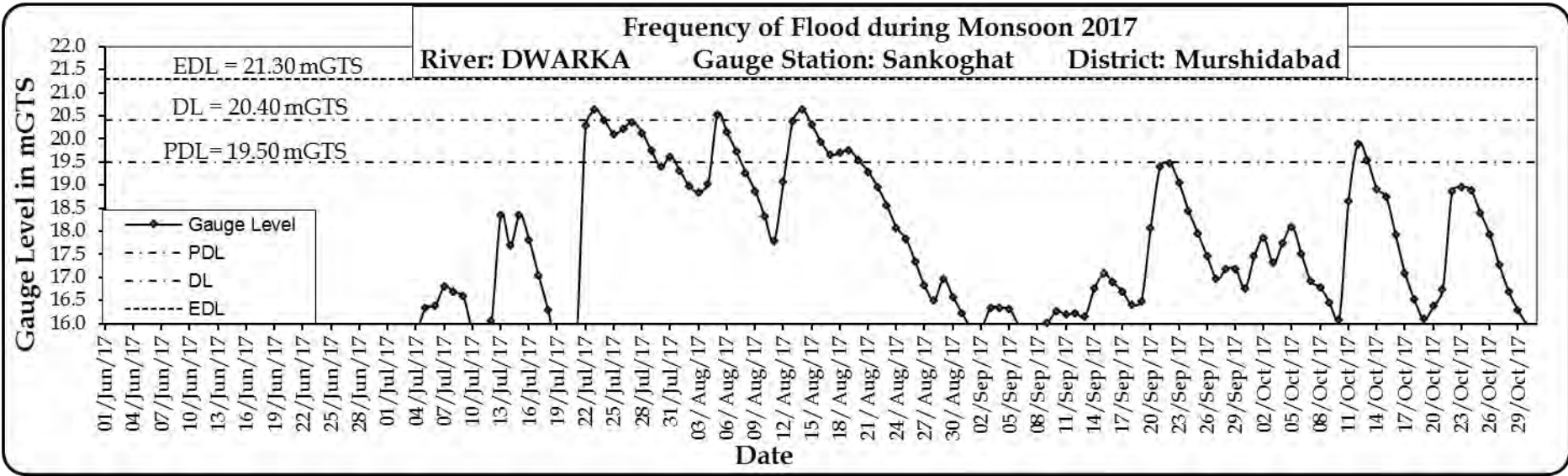
Annexure-G7

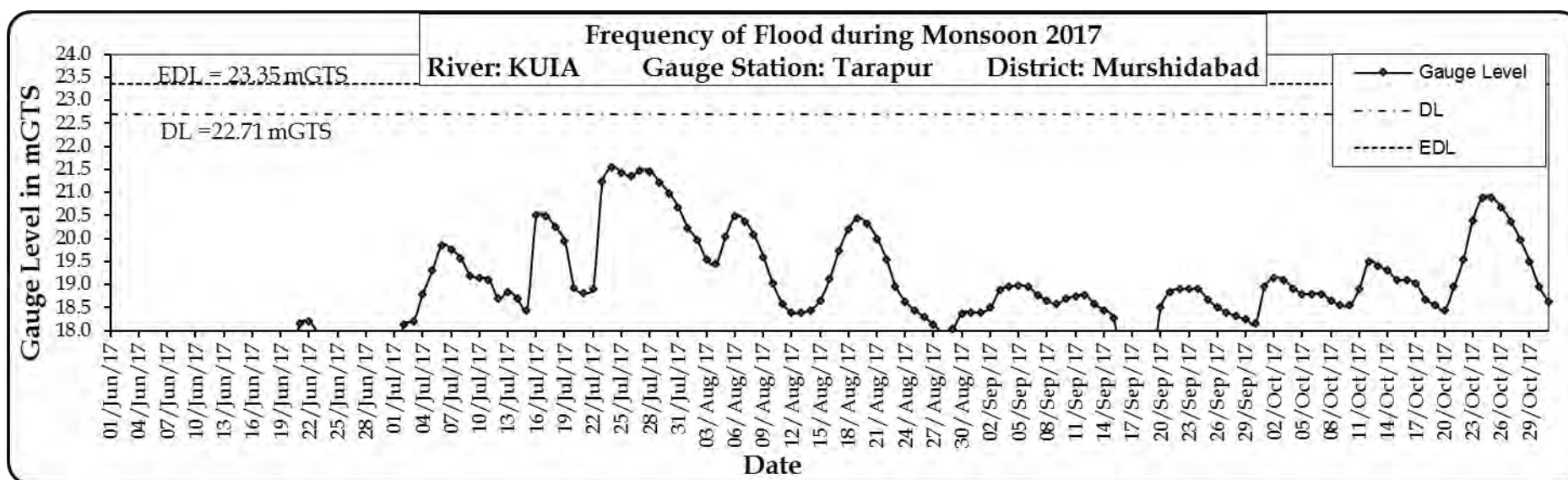
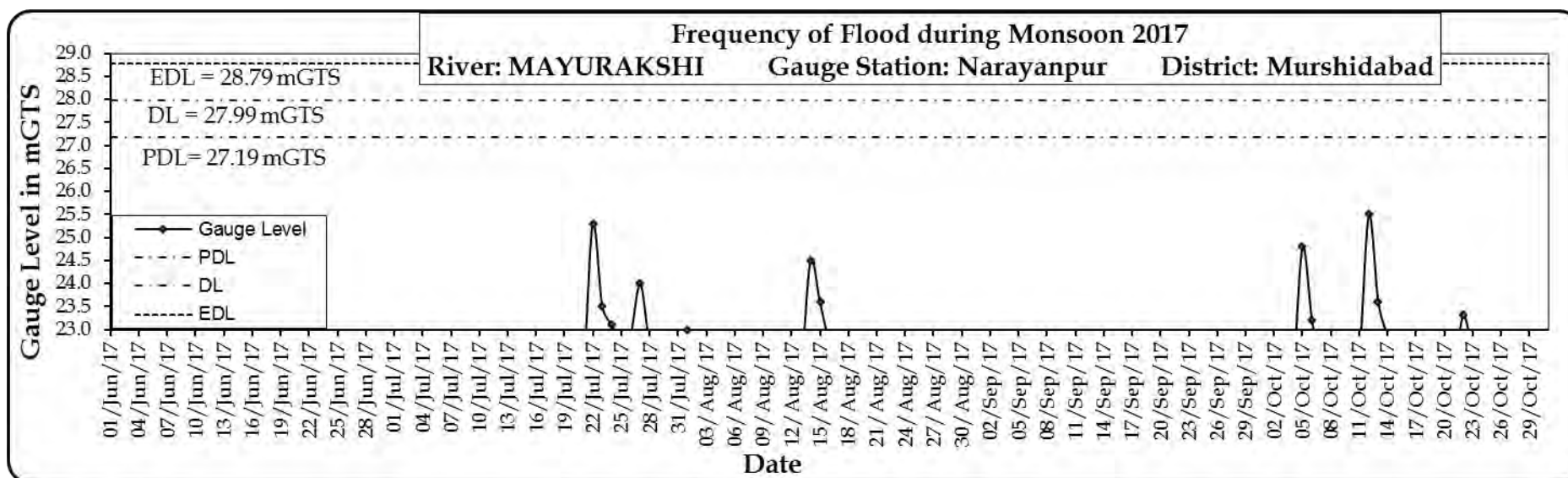
Annexure-G8

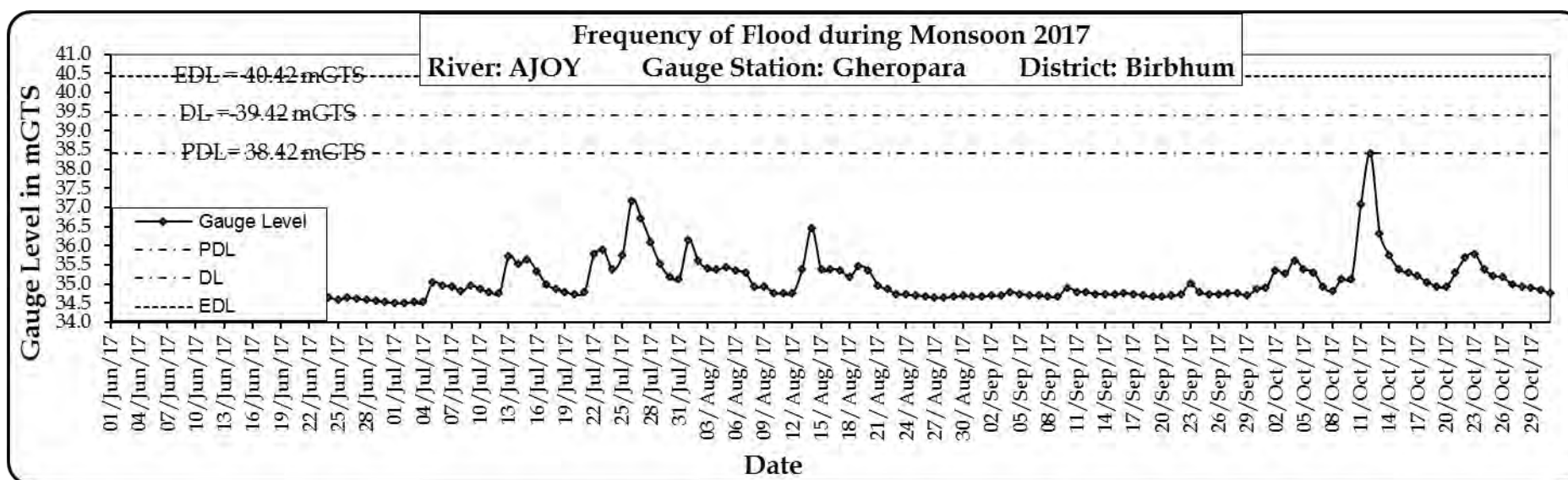
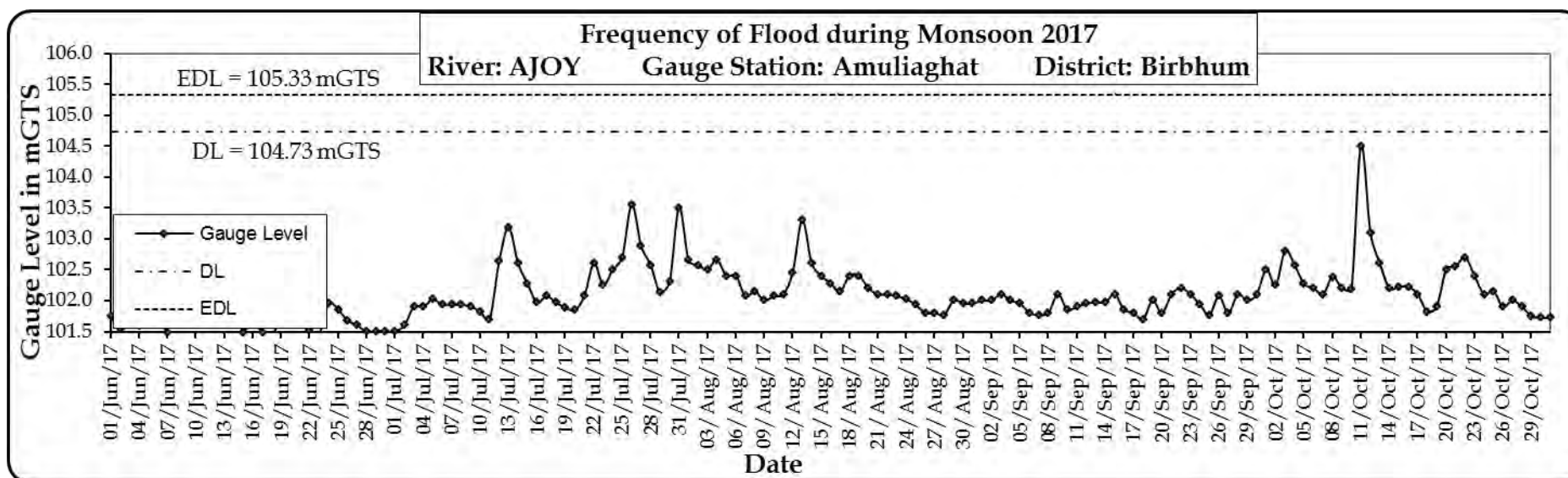
Annexure-G9

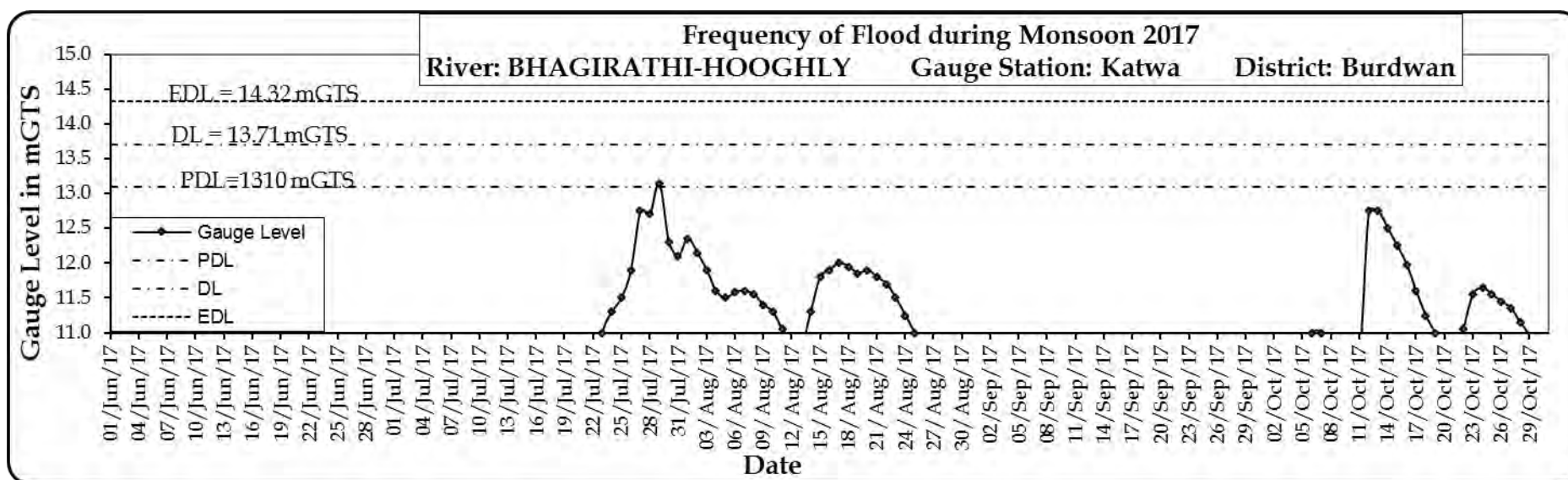
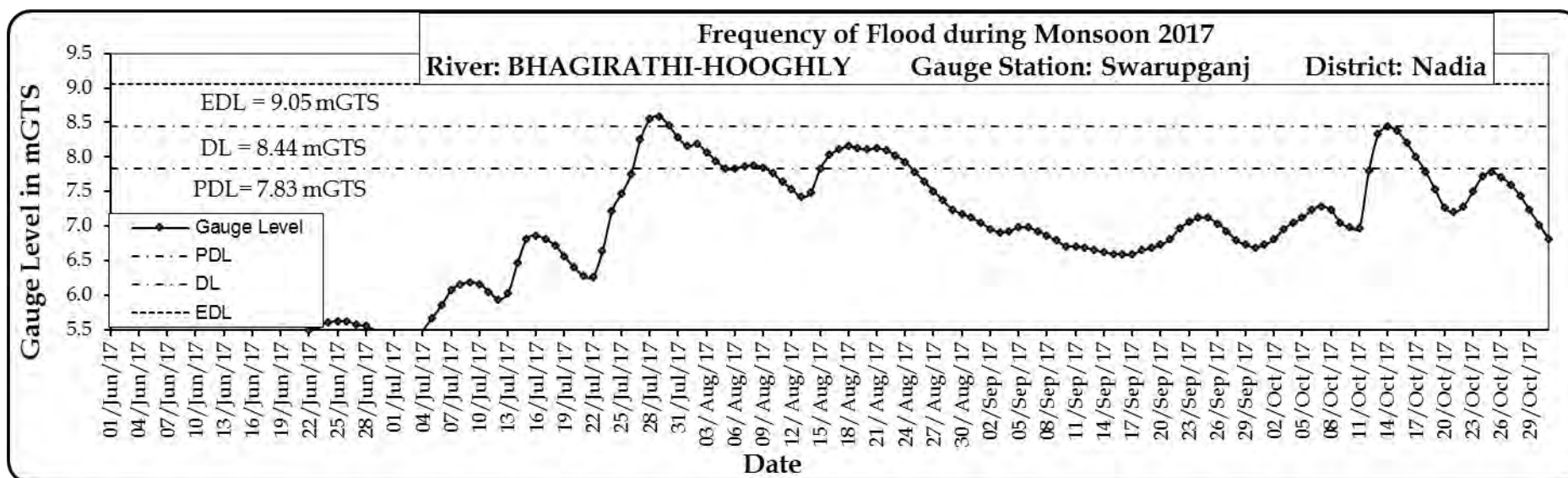
Annexure-G10

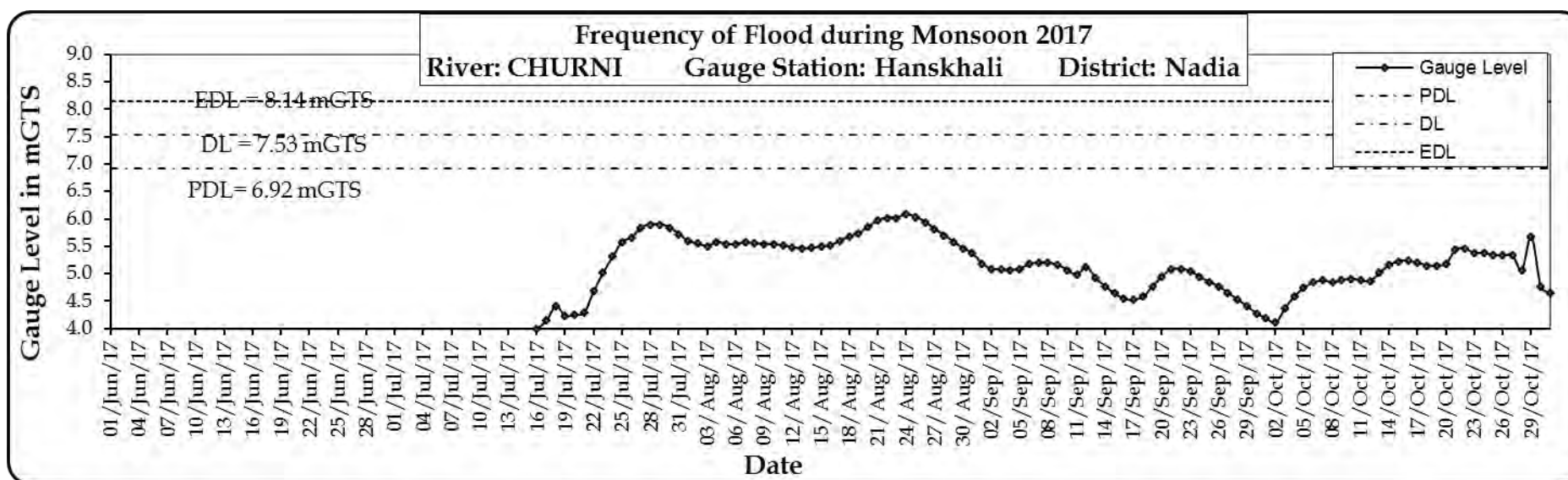
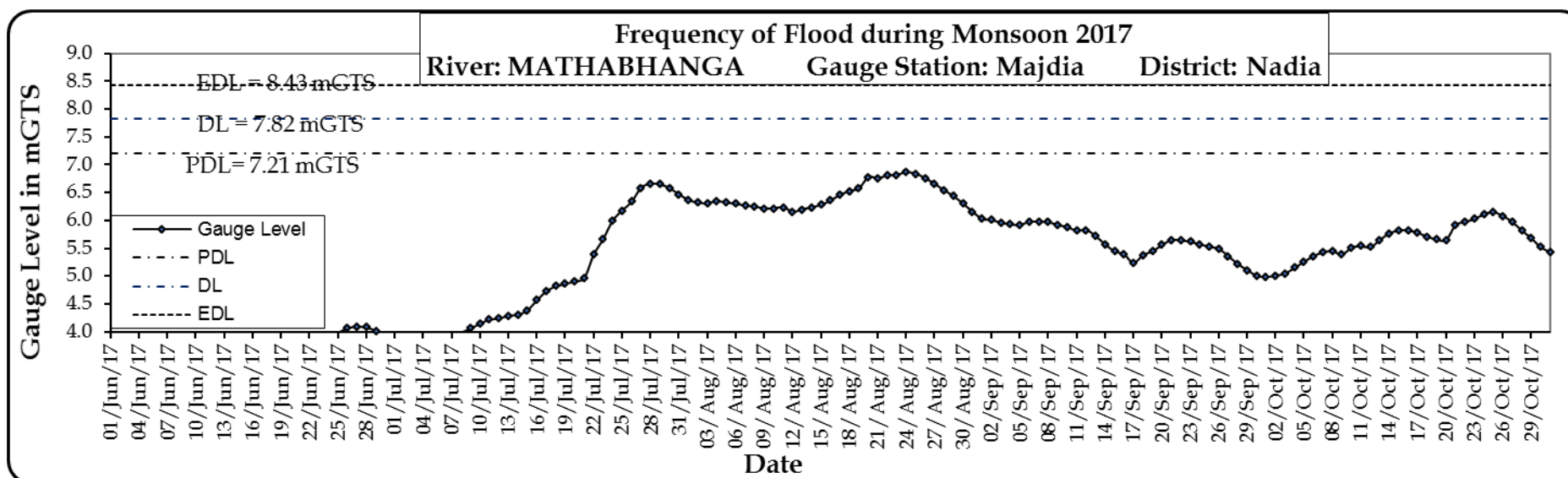
Annexure-G11

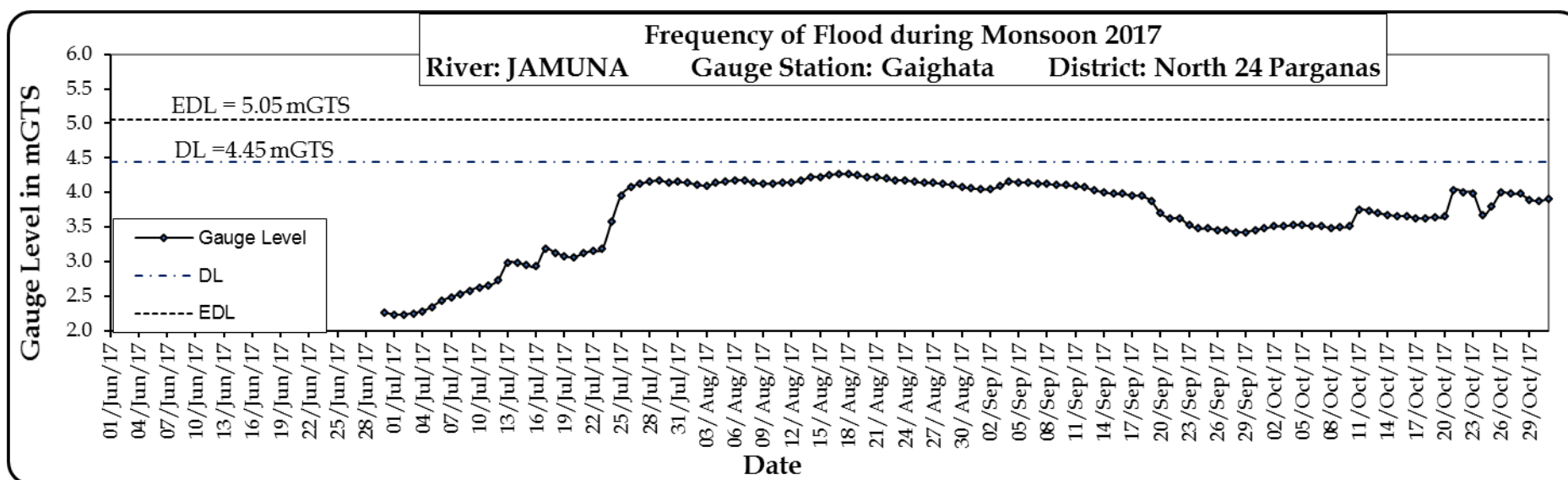
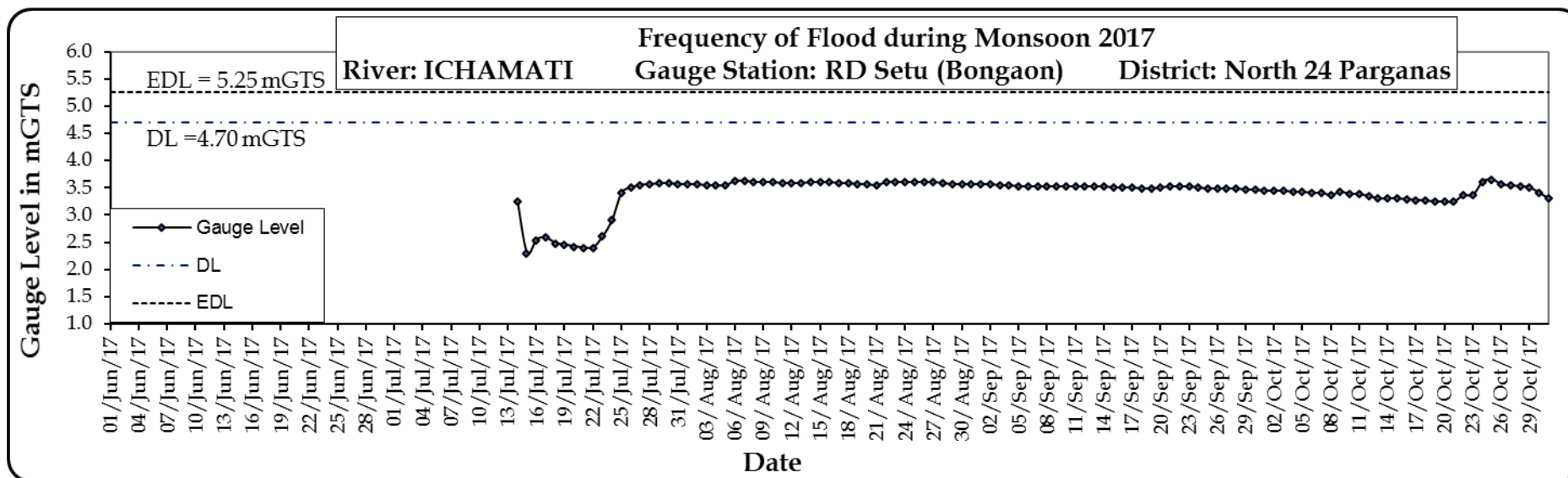


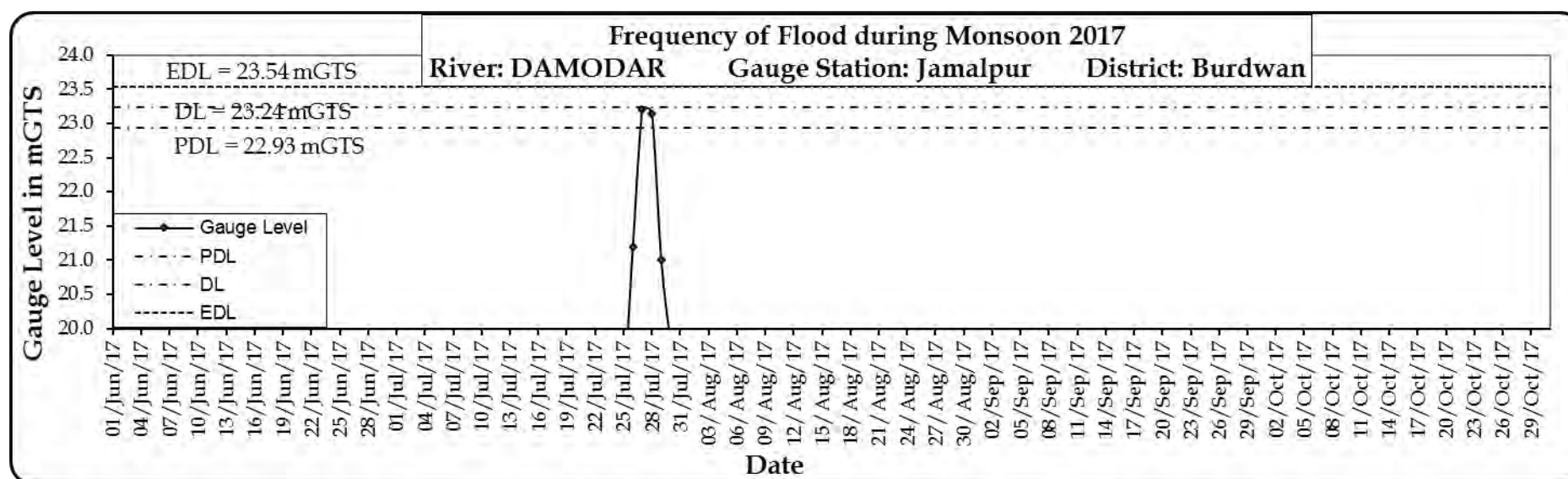
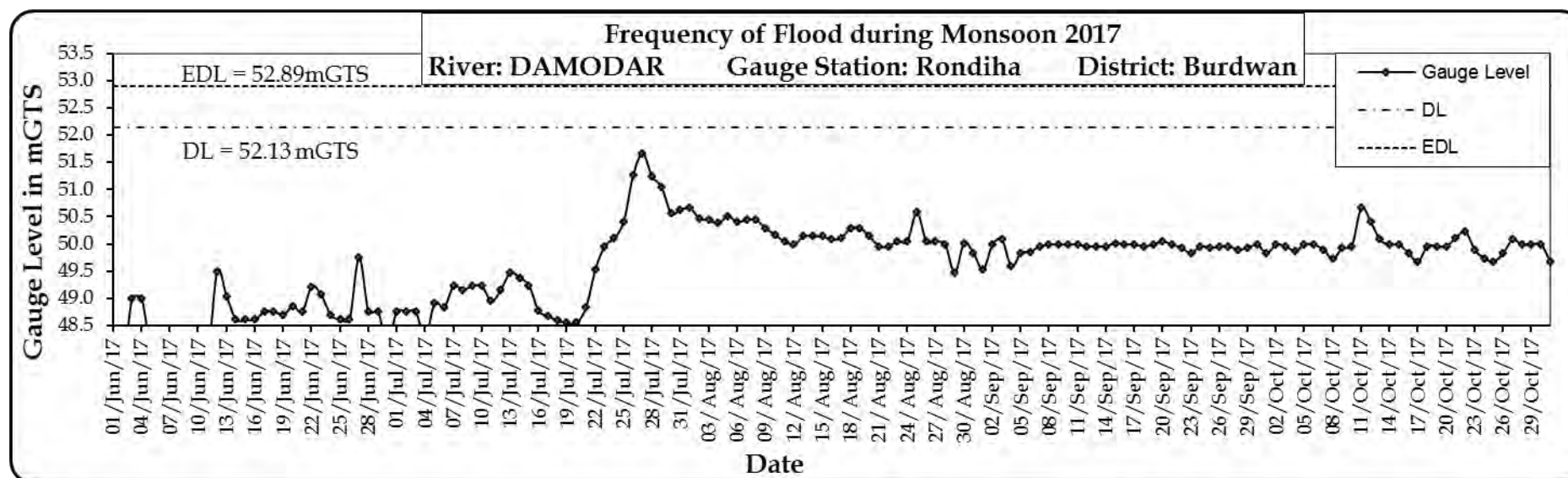
Annexure-G12

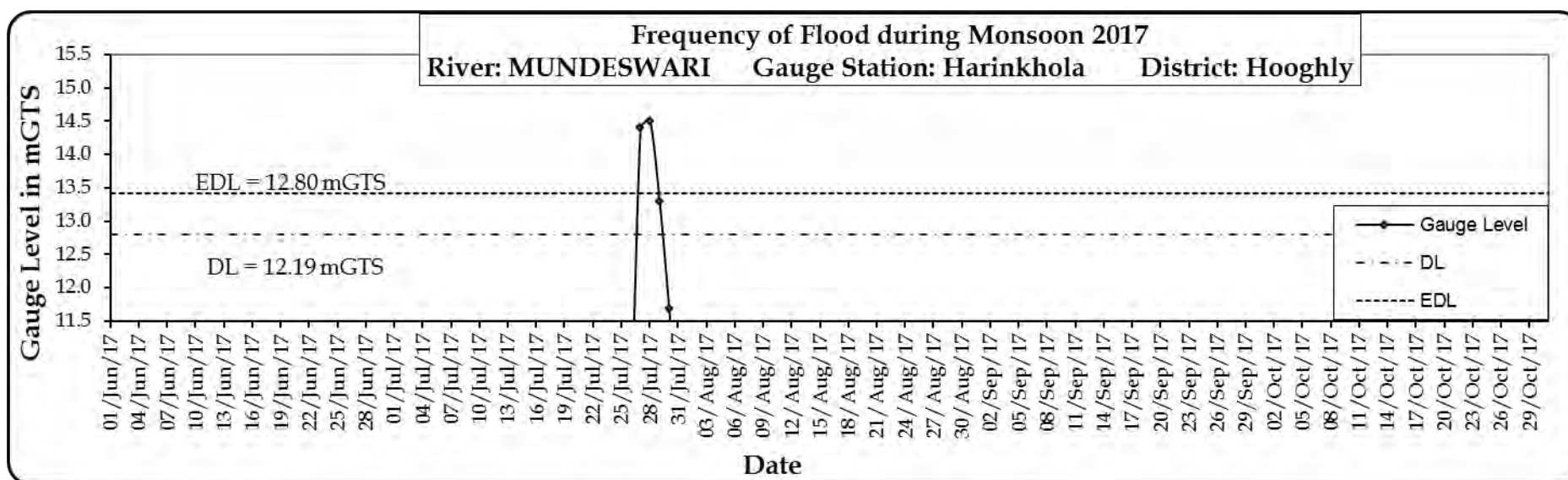
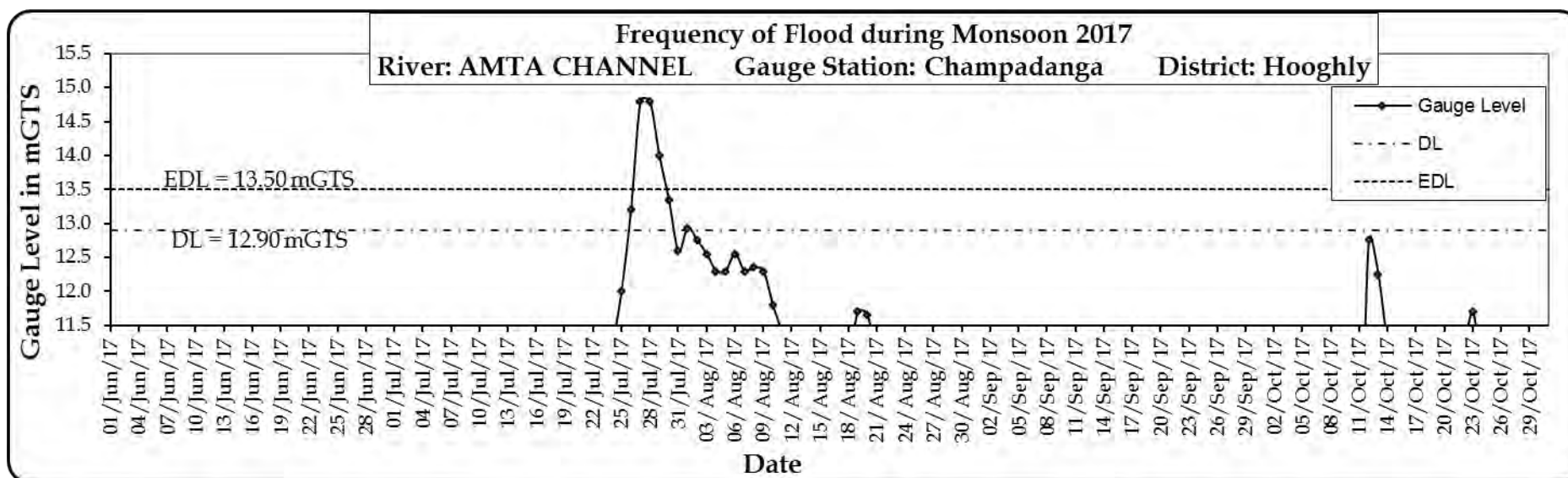
Annexure-G13

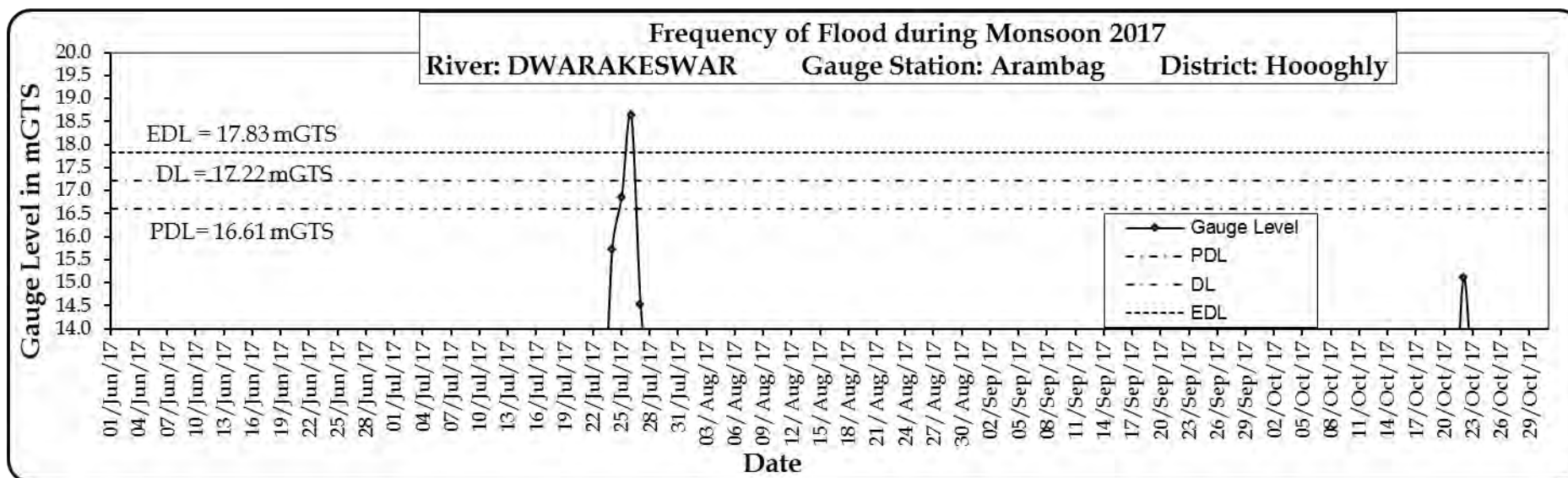
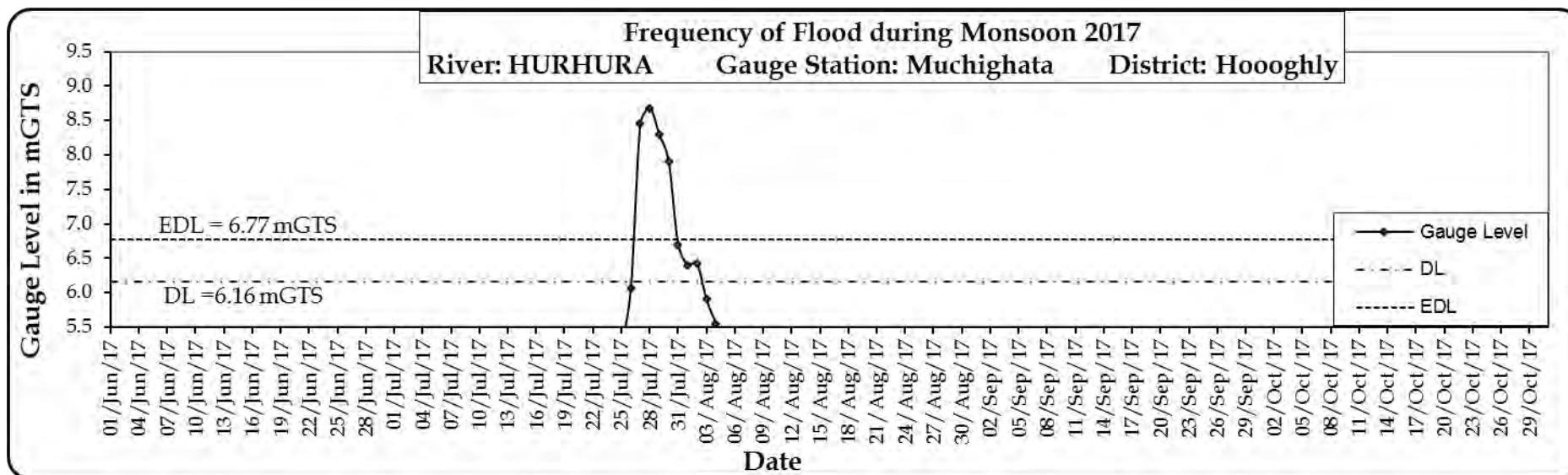
Annexure-G14

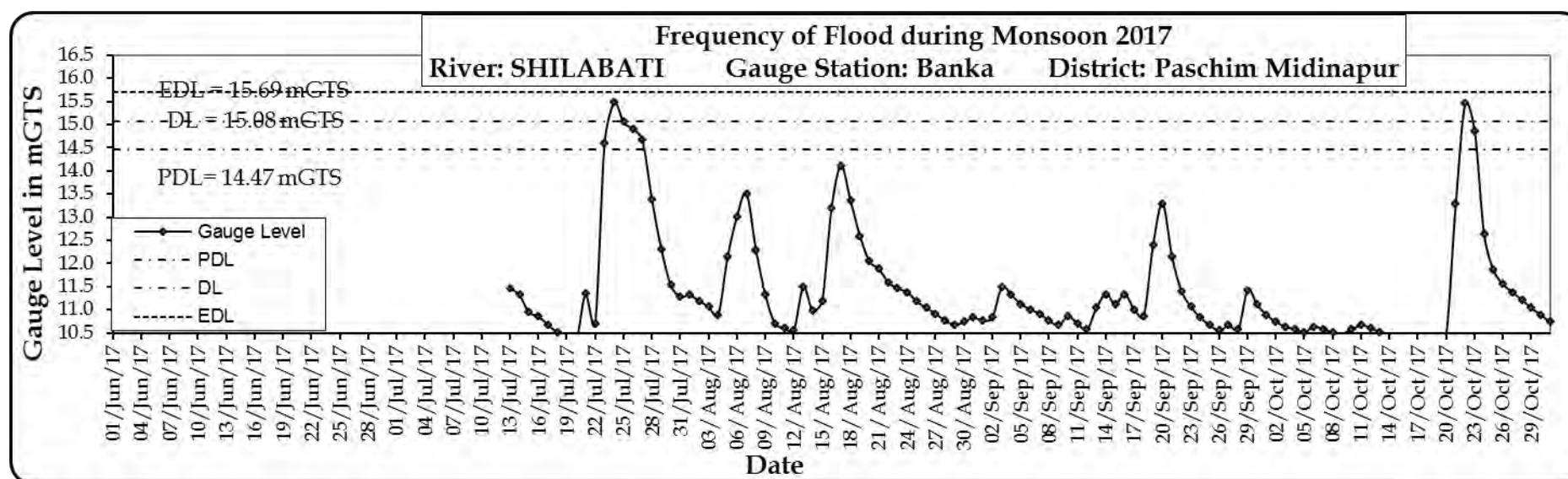
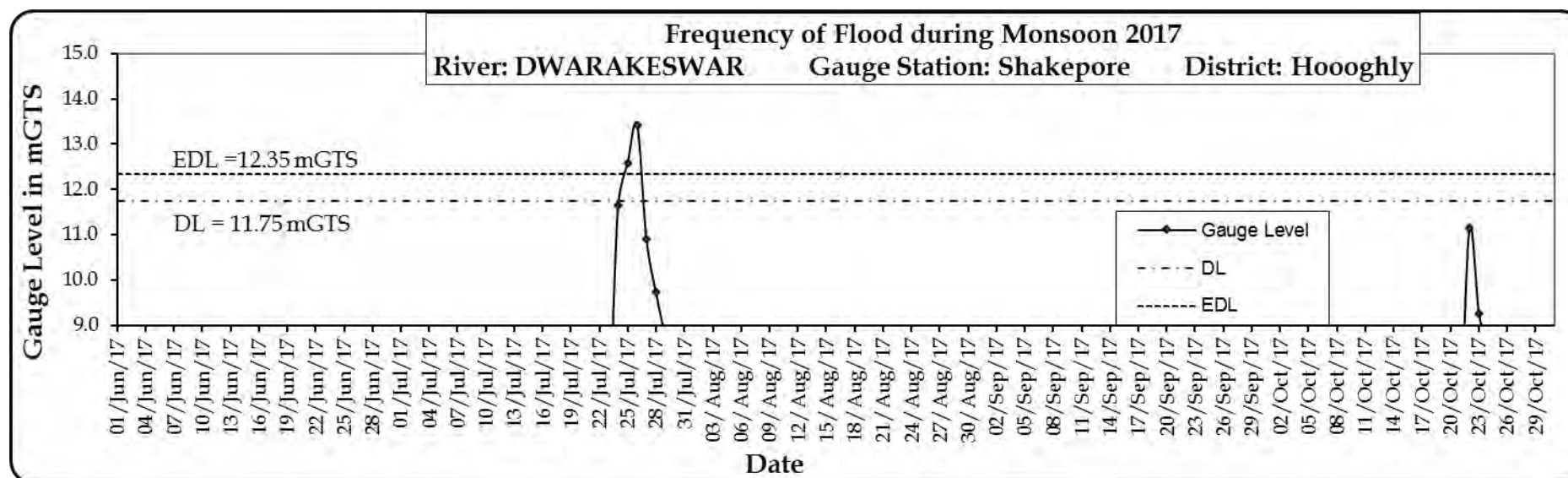
Annexure-G15

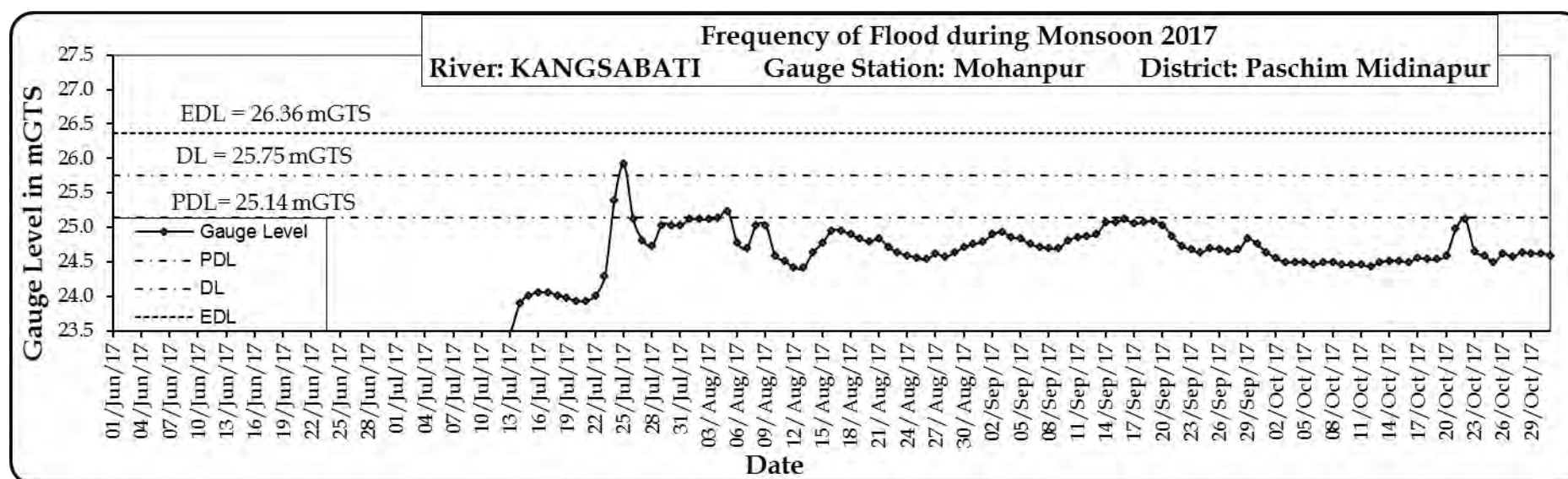
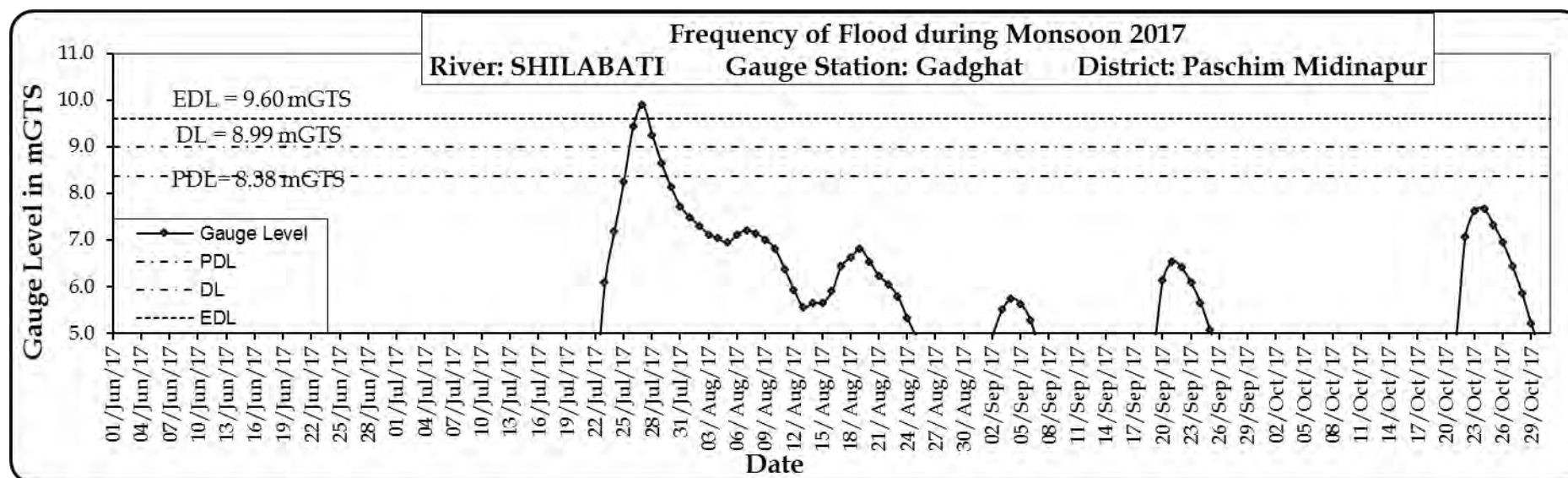
Annexure-G16

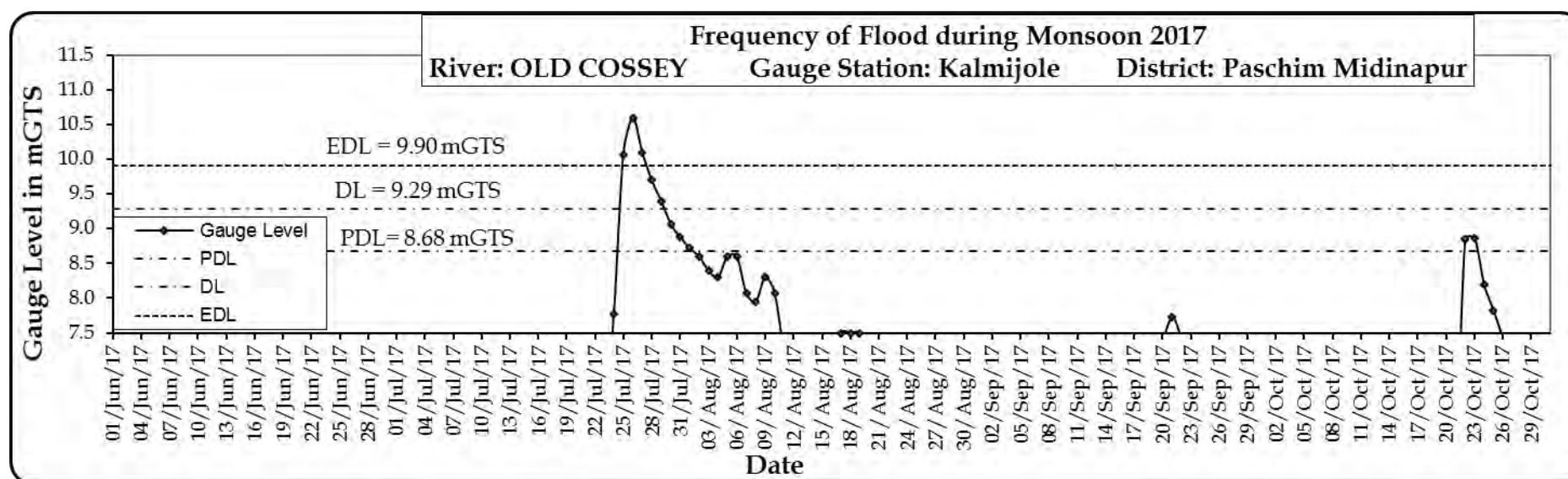
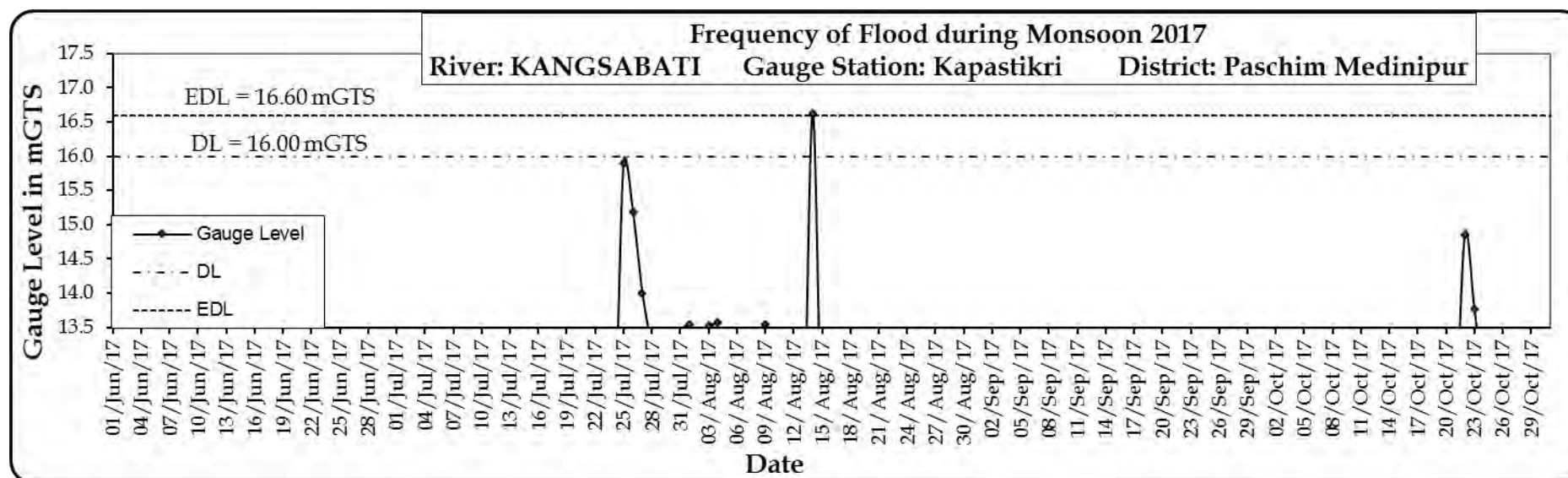
Annexure-G17

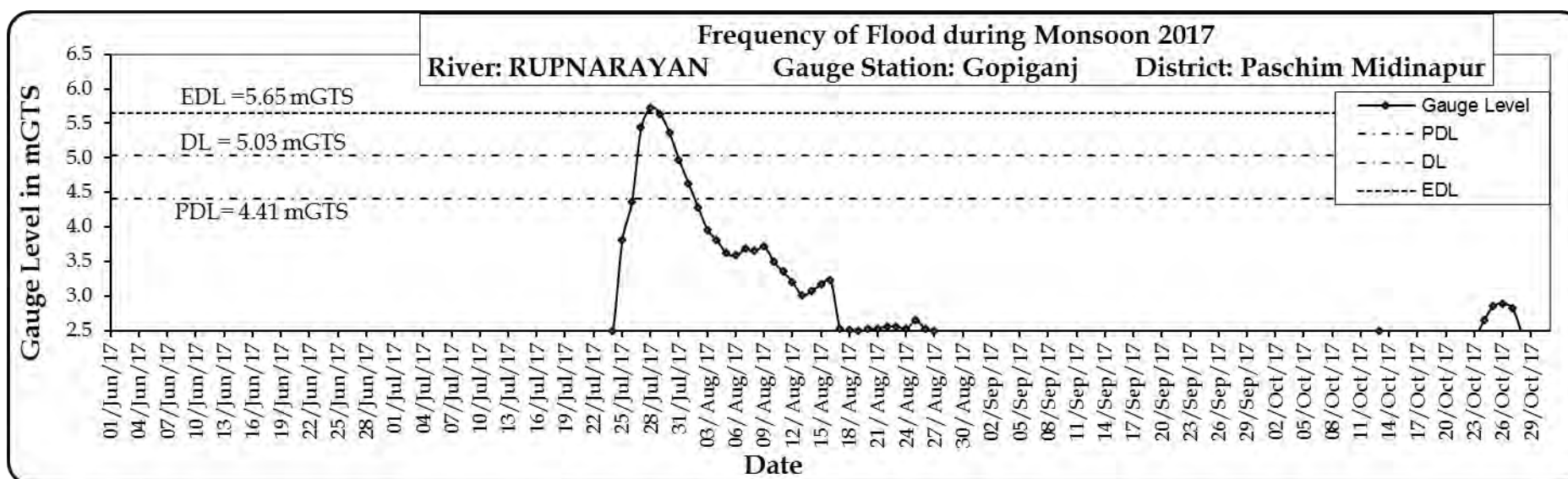
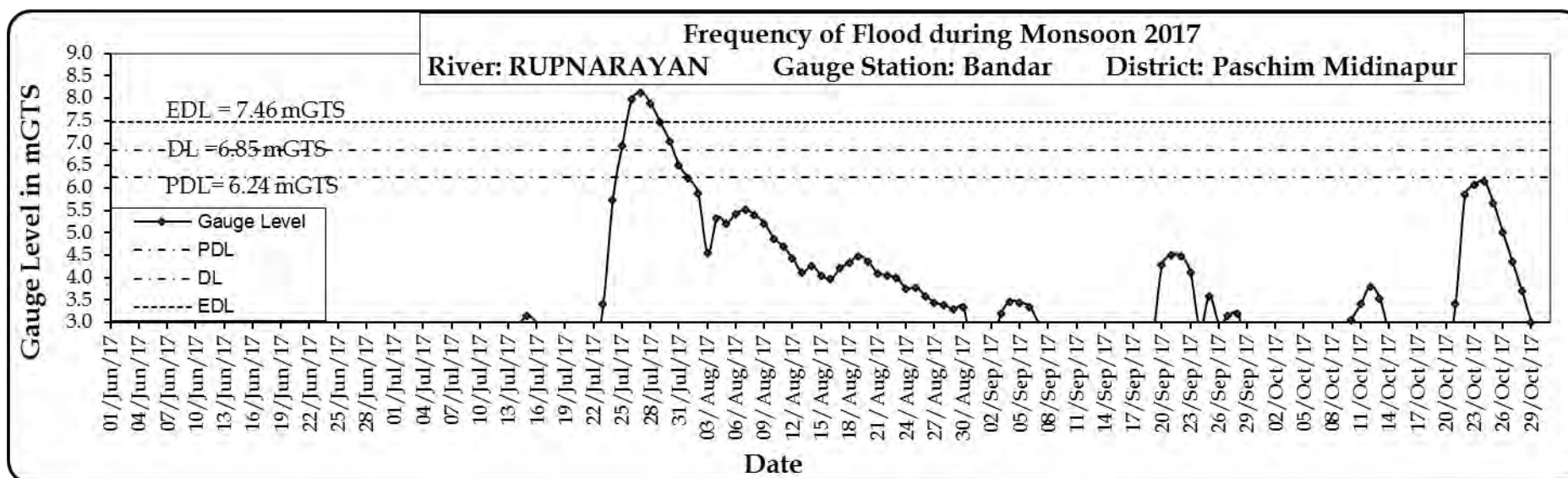
Annexure-G18

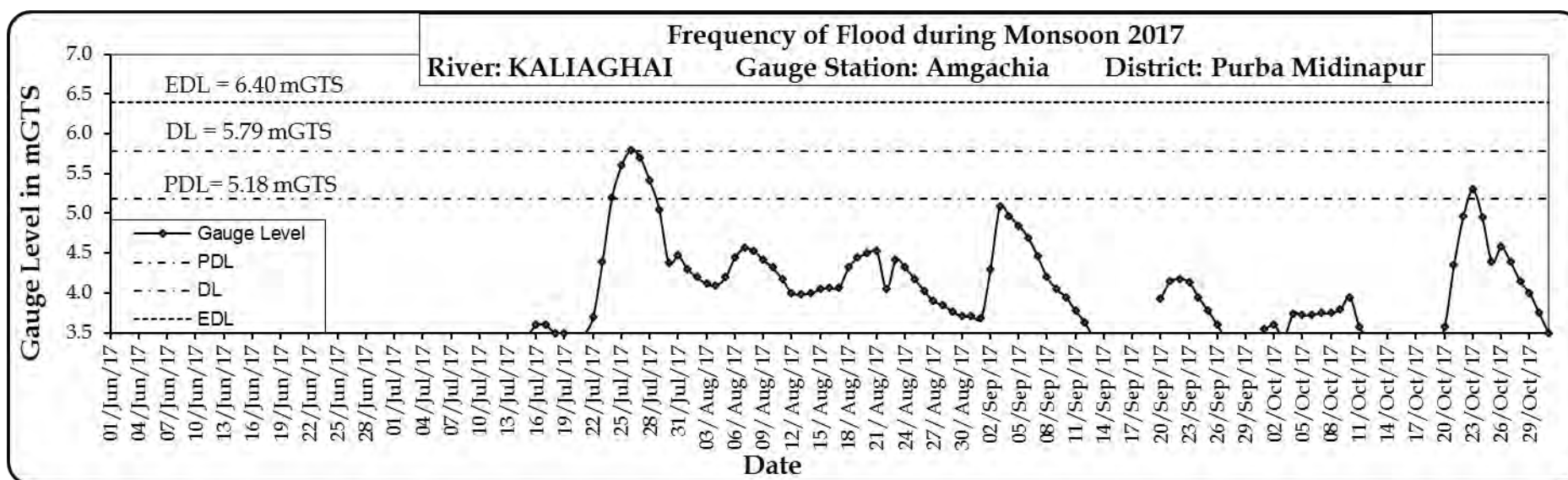
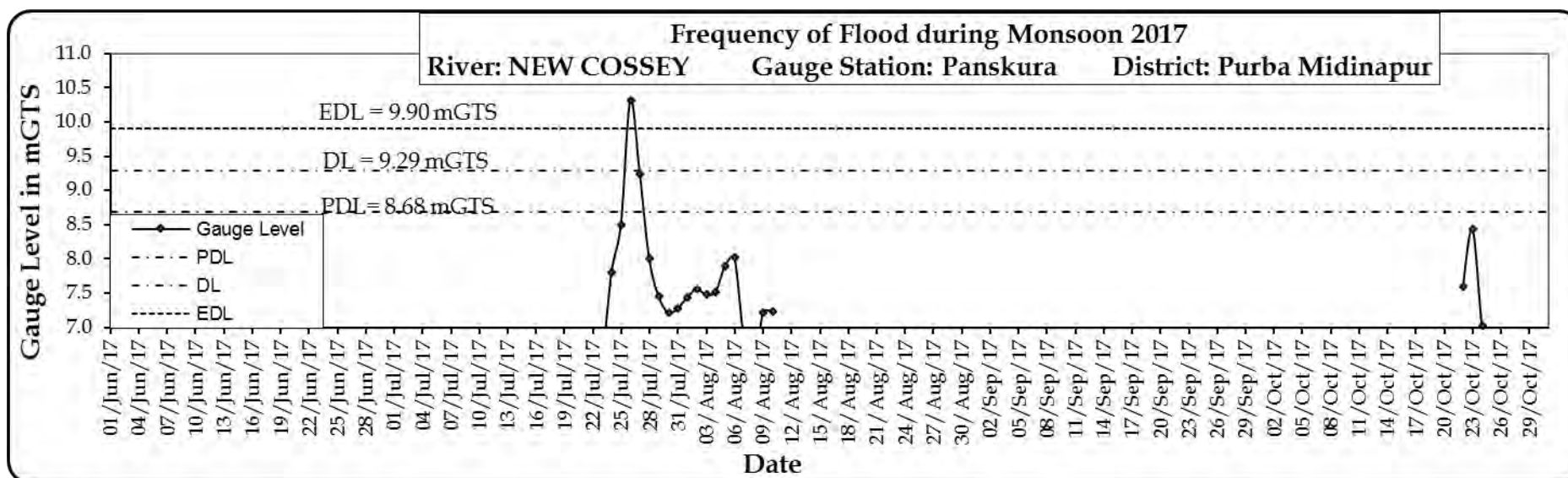
Annexure-G19

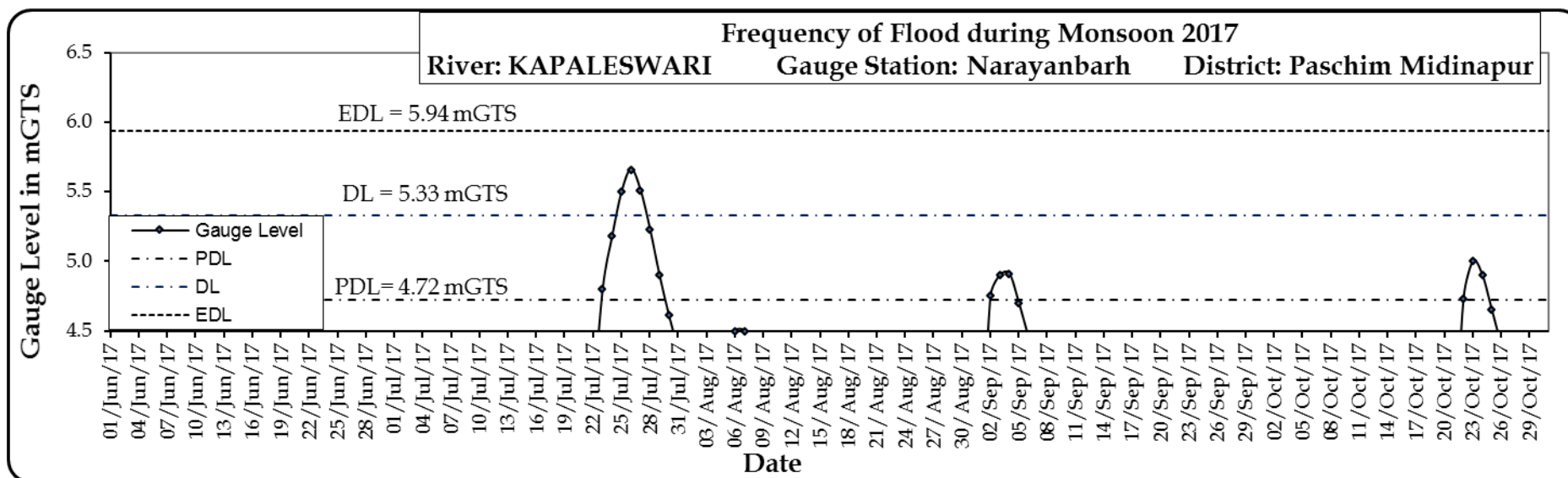
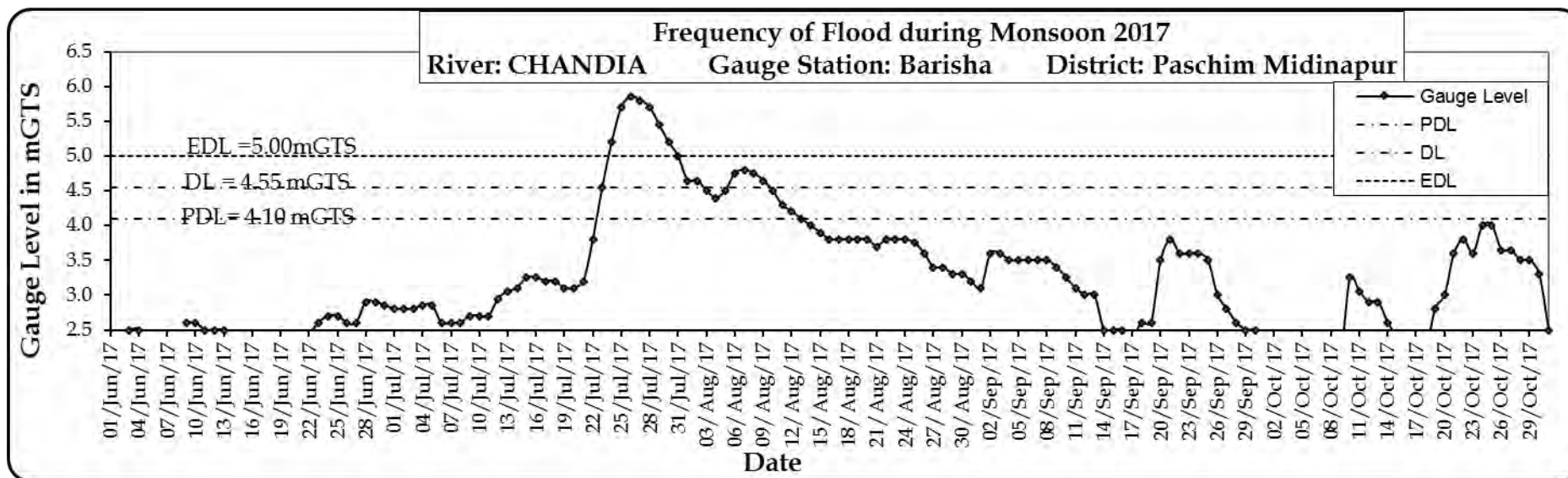
Annexure-G20

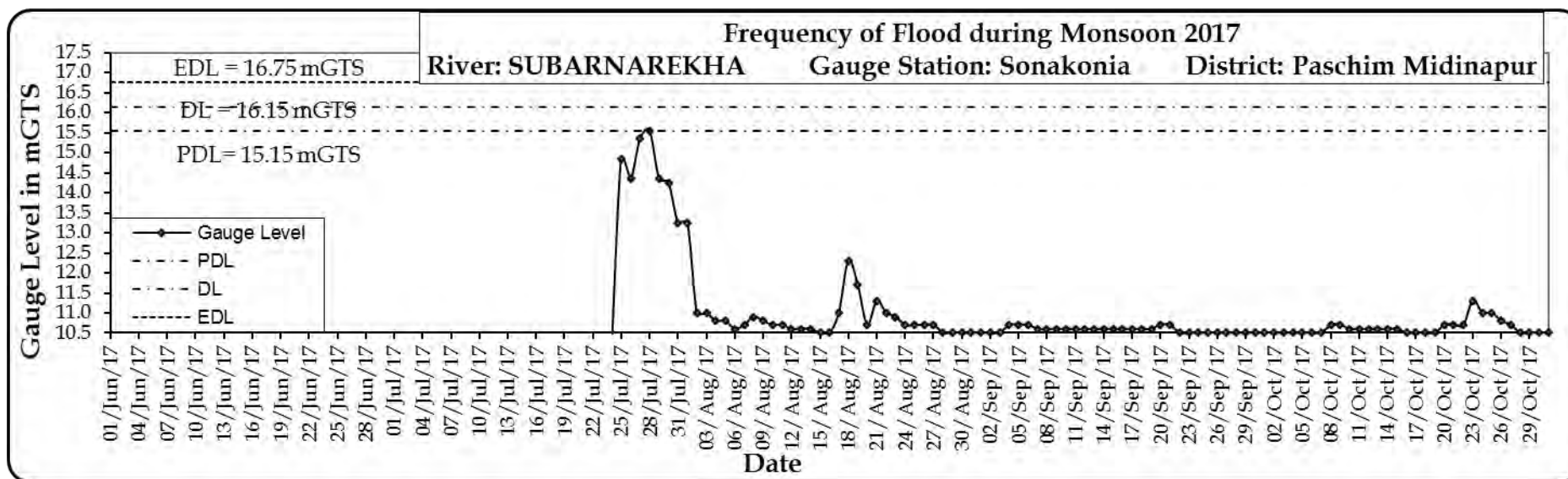
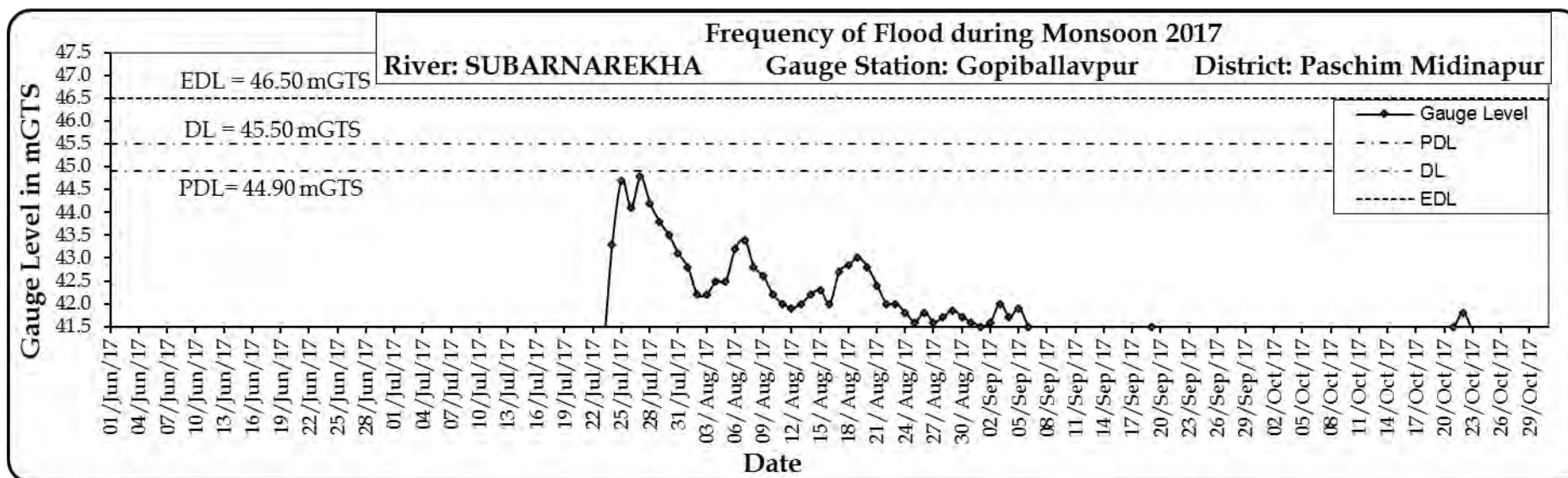
Annexure-G21

Annexure-G22

Annexure-G23

Annexure-G24

Annexure-G25

Annexure-G26

ANNEXURE-D1: Dam-Barrage data during June, 2017

| Date | Dugapur Barrage | | | Massanjore Dam | | | Tilpara Barrage | | | Mukutmanipur Dam | | |
|-----------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|
| | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) |
| 1-Jun-17 | 211.50 | 1575 | 1075 | 365.65 | 0 | 0 | 191.50 | 0 | 0 | 407.25 | 175 | 0 |
| 2-Jun-17 | 211.50 | 1575 | 1075 | 365.75 | 250 | 0 | 190.50 | 0 | 0 | 407.18 | 351 | 0 |
| 3-Jun-17 | 211.50 | 1575 | 1075 | 365.75 | 122 | 0 | 190.50 | 0 | 0 | 407.18 | 0 | 0 |
| 4-Jun-17 | 211.50 | 1575 | 1075 | 365.85 | 125 | 0 | 190.50 | 0 | 0 | 407.18 | 0 | 0 |
| 5-Jun-17 | 211.50 | 1000 | 500 | 365.85 | 0 | 0 | 190.50 | 0 | 0 | 407.20 | 0 | 0 |
| 6-Jun-17 | 211.50 | 550 | 50 | 365.85 | 0 | 0 | 190.50 | 0 | 0 | 407.18 | 0 | 0 |
| 7-Jun-17 | 211.50 | 1050 | 500 | 365.85 | 0 | 0 | 190.50 | 0 | 0 | 407.20 | 0 | 0 |
| 8-Jun-17 | 211.50 | 550 | 50 | 365.85 | 0 | 0 | 190.50 | 0 | 0 | 407.20 | 0 | 0 |
| 9-Jun-17 | 211.50 | 550 | 50 | 365.80 | 0 | 0 | 190.50 | 0 | 0 | 407.20 | 0 | 0 |
| 10-Jun-17 | 211.50 | 550 | 50 | 365.95 | 375 | 0 | 190.50 | 0 | 0 | 407.20 | 0 | 0 |
| 11-Jun-17 | 211.50 | 550 | 50 | 366.00 | 125 | 0 | 190.50 | 0 | 0 | 407.20 | 0 | 0 |
| 12-Jun-17 | 211.50 | 2650 | 2150 | 366.10 | 300 | 0 | 190.50 | 0 | 0 | 407.20 | 0 | 0 |
| 13-Jun-17 | 211.50 | 6950 | 6450 | 366.10 | 0 | 0 | 190.50 | 0 | 0 | 407.20 | 0 | 0 |
| 14-Jun-17 | 211.50 | 5875 | 5375 | 366.10 | 0 | 0 | 190.50 | 0 | 0 | 407.20 | 0 | 0 |
| 15-Jun-17 | 211.50 | 6950 | 6450 | 366.05 | 0 | 0 | 190.50 | 0 | 0 | 407.20 | 0 | 0 |
| 16-Jun-17 | 211.50 | 6950 | 6450 | 366.20 | 450 | 0 | 190.50 | 0 | 0 | 407.18 | 0 | 0 |
| 17-Jun-17 | 211.50 | 6950 | 6450 | 366.65 | 1350 | 0 | 190.50 | 0 | 0 | 407.20 | 0 | 0 |
| 18-Jun-17 | 211.50 | 6950 | 6450 | 366.85 | 600 | 0 | 190.50 | 0 | 0 | 407.20 | 0 | 0 |
| 19-Jun-17 | 211.50 | 6952 | 6452 | 366.90 | 150 | 0 | 195.50 | 0 | 0 | 407.25 | 232 | 0 |
| 20-Jun-17 | 211.50 | 11250 | 10750 | 367.10 | 600 | 0 | 190.50 | 0 | 0 | 407.25 | 0 | 0 |
| 21-Jun-17 | 211.50 | 6950 | 6450 | 367.50 | 1200 | 0 | 190.50 | 0 | 0 | 407.75 | 2318 | 0 |
| 22-Jun-17 | 211.50 | 5875 | 5375 | 367.70 | 600 | 0 | 190.50 | 0 | 0 | 408.05 | 1391 | 0 |
| 23-Jun-17 | 211.50 | 4800 | 4300 | 367.80 | 300 | 0 | 190.50 | 0 | 0 | 408.45 | 1855 | 0 |
| 24-Jun-17 | 211.50 | 4800 | 4300 | 367.90 | 300 | 0 | 190.50 | 0 | 0 | 408.95 | 2318 | 0 |

ANNEXURE-D1: Dam-Barrage data during June,2017 (Contd.)

| Date | Dugapur Barrage | | | Massanjore Dam | | | Tilpara Barrage | | | Mukutmanipur Dam | | |
|-----------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|
| | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) |
| 25-Jun-17 | 211.50 | 3725 | 3225 | 367.90 | 0 | 0 | 190.50 | 0 | 0 | 409.05 | 464 | 0 |
| 26-Jun-17 | 211.50 | 6950 | 6450 | 367.95 | 150 | 0 | 190.50 | 0 | 0 | 409.10 | 232 | 0 |
| 27-Jun-17 | 211.50 | 5875 | 5375 | 367.95 | 0 | 0 | 190.50 | 0 | 0 | 409.10 | 0 | 0 |
| 28-Jun-17 | 211.50 | 6950 | 6450 | 368.00 | 150 | 0 | 190.50 | 0 | 0 | 409.25 | 695 | 0 |
| 29-Jun-17 | 211.50 | 6950 | 6450 | 368.00 | 0 | 0 | 190.50 | 0 | 0 | 409.25 | 0 | 0 |
| 30-Jun-17 | 211.50 | 2650 | 2150 | 368.00 | 0 | 0 | 190.50 | 0 | 0 | 409.30 | 232 | 0 |

ANNEXURE-D2: Dam-Barrage data during July, 2017

| Date | Dugapur Barrage | | | Massanjore Dam | | | Tilpara Barrage | | | Mukutmanipur Dam | | |
|-----------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|
| | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) |
| 1-Jul-17 | 211.50 | 2650 | 2150 | 368.00 | 0 | 0 | 190.50 | 0 | 0 | 409.30 | 0 | 0 |
| 2-Jul-17 | 211.50 | 2650 | 2150 | 368.00 | 0 | 0 | 190.50 | 0 | 0 | 409.40 | 464 | 0 |
| 3-Jul-17 | 211.50 | 2650 | 2150 | 368.30 | 900 | 0 | 190.50 | 0 | 0 | 409.51 | 457 | 0 |
| 4-Jul-17 | 211.50 | 3725 | 3225 | 368.60 | 900 | 0 | 190.50 | 0 | 0 | 409.55 | 232 | 0 |
| 5-Jul-17 | 211.50 | 3725 | 3225 | 368.80 | 600 | 0 | 190.50 | 0 | 0 | 409.55 | 0 | 0 |
| 6-Jul-17 | 211.50 | 4800 | 4300 | 368.80 | 0 | 0 | 190.50 | 0 | 0 | 409.70 | 696 | 0 |
| 7-Jul-17 | 211.50 | 6950 | 6450 | 369.50 | 2100 | 0 | 190.50 | 0 | 0 | 409.75 | 232 | 0 |
| 8-Jul-17 | 211.50 | 6950 | 6450 | 370.00 | 1500 | 0 | 190.50 | 0 | 0 | 409.75 | 0 | 0 |
| 9-Jul-17 | 211.50 | 5875 | 5357 | 370.20 | 700 | 0 | 190.50 | 0 | 0 | 409.90 | 696 | 0 |
| 10-Jul-17 | 211.50 | 3725 | 3225 | 370.30 | 350 | 0 | 190.50 | 0 | 0 | 410.00 | 464 | 0 |
| 11-Jul-17 | 211.50 | 3725 | 3225 | 371.60 | 8399 | 0 | 198.10 | 0 | 0 | 410.20 | 1343 | 0 |
| 12-Jul-17 | 211.50 | 6950 | 6450 | 373.45 | 6588 | 0 | 202.80 | 1715 | 0 | 410.30 | 672 | 0 |
| 13-Jul-17 | 211.50 | 8025 | 7525 | 375.00 | 5813 | 0 | 204.00 | 710 | 0 | 410.50 | 1343 | 0 |
| 14-Jul-17 | 211.50 | 6950 | 6450 | 375.95 | 3800 | 0 | 204.00 | 1353 | 1353 | 410.85 | 2351 | 0 |
| 15-Jul-17 | 211.50 | 2650 | 2150 | 376.65 | 2800 | 0 | 203.90 | 1911 | 1971 | 411.10 | 1679 | 0 |
| 16-Jul-17 | 211.50 | 1575 | 1075 | 377.00 | 1400 | 0 | 203.60 | 885 | 1065 | 411.30 | 1343 | 0 |
| 17-Jul-17 | 211.50 | 1575 | 1075 | 377.15 | 675 | 0 | 203.60 | 387 | 387 | 411.45 | 1008 | 0 |
| 18-Jul-17 | 211.50 | 2650 | 2150 | 377.25 | 450 | 0 | 204.10 | 314 | 10 | 411.55 | 672 | 0 |
| 19-Jul-17 | 211.50 | 2650 | 2150 | 377.35 | 481 | 31 | 204.40 | 192 | 0 | 411.60 | 336 | 0 |
| 20-Jul-17 | 211.50 | 2650 | 2150 | 377.50 | 725 | 50 | 204.70 | 192 | 0 | 411.95 | 2351 | 0 |
| 21-Jul-17 | 211.50 | 4800 | 4300 | 378.00 | 2258 | 0 | 204.90 | 128 | 0 | 412.20 | 1679 | 0 |
| 22-Jul-17 | 211.50 | 11250 | 10750 | 379.60 | 7383 | 0 | 204.20 | 6990 | 4118 | 412.70 | 3358 | 0 |
| 23-Jul-17 | 211.50 | 13400 | 12900 | 380.60 | 4800 | 0 | 203.40 | 3482 | 3969 | 413.95 | 8394 | 0 |
| 24-Jul-17 | 211.50 | 33825 | 33325 | 381.50 | 4200 | 0 | 202.00 | 2517 | 1679 | 417.19 | 21537 | 0 |

ANNEXURE-D2: Dam-Barrage data during July,2017 (Contd.)

| Date | Dugapur Barrage | | | Massanjore Dam | | | Tilpara Barrage | | | Mukutmanipur Dam | | |
|-----------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|
| | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) |
| 25-Jul-17 | 211.50 | 54075 | 53575 | 382.35 | 3788 | 0 | 202.20 | 1534 | 1424 | 422.40 | 41231 | 0 |
| 26-Jul-17 | 211.50 | 190125 | 189625 | 384.20 | 10113 | 0 | 203.00 | 4602 | 4162 | 430.40 | 75898 | 0 |
| 27-Jul-17 | 210.00 | 249950 | 249450 | 385.00 | 4217 | 0 | 202.20 | 4116 | 4556 | 434.20 | 49074 | 16019 |
| 28-Jul-17 | 210.00 | 182750 | 182250 | 385.55 | 2888 | 0 | 202.20 | 1379 | 1379 | 434.10 | 12406 | 0 |
| 29-Jul-17 | 211.00 | 113925 | 113425 | 385.85 | 1575 | 0 | 202.50 | 1766 | 1601 | 434.00 | 9296 | 9998 |
| 30-Jul-17 | 211.00 | 53675 | 53175 | 386.10 | 1338 | 0 | 202.90 | 1418 | 1198 | 433.10 | 4520 | 10180 |
| 31-Jul-17 | 211.50 | 77300 | 76800 | 387.00 | 4950 | 0 | 202.00 | 1923 | 2418 | 432.90 | 11819 | 10175 |

ANNEXURE-D3: Dam-Barrage data during August,2017 (Contd.)

| Date | Dugapur Barrage | | | Massanjore Dam | | | Tilpara Barrage | | | Mukutmanipur Dam | | |
|-----------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|
| | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) |
| 1-Aug-17 | 211.00 | 65675 | 63675 | 387.55 | 3575 | 0 | 204.00 | 2377 | 1227 | 432.40 | 8071 | 10045 |
| 2-Aug-17 | 211.00 | 61475 | 56375 | 387.90 | 2275 | 0 | 204.30 | 1008 | 816 | 431.75 | 6222 | 10579 |
| 3-Aug-17 | 211.00 | 53400 | 47300 | 388.30 | 2450 | 0 | 205.40 | 1234 | 43 | 430.80 | 4402 | 10366 |
| 4-Aug-17 | 211.50 | 53150 | 47400 | 389.05 | 4608 | 0 | 204.30 | 684 | 0 | 429.60 | 2720 | 10063 |
| 5-Aug-17 | 211.50 | 59600 | 54100 | 390.00 | 7196 | 0 | 204.00 | 1816 | 1497 | 429.30 | 5146 | 0 |
| 6-Aug-17 | 211.50 | 47900 | 43400 | 390.35 | 2000 | 0 | 203.00 | 1064 | 1164 | 430.25 | 15901 | 0 |
| 7-Aug-17 | 211.50 | 53675 | 49175 | 390.50 | 900 | 0 | 203.30 | 1174 | 494 | 430.40 | 13574 | 10260 |
| 8-Aug-17 | 211.50 | 53650 | 49150 | 390.60 | 625 | 0 | 203.00 | 992 | 312 | 429.30 | 5068 | 9982 |
| 9-Aug-17 | 211.50 | 40275 | 35475 | 390.65 | 350 | 0 | 203.20 | 620 | 0 | 428.90 | 5072 | 0 |
| 10-Aug-17 | 211.50 | 33450 | 27950 | 390.70 | 350 | 0 | 202.80 | 339 | 0 | 428.70 | 4405 | 0 |
| 11-Aug-17 | 211.50 | 26350 | 19350 | 391.00 | 1725 | 0 | 202.40 | 380 | 0 | 428.30 | 2755 | 0 |
| 12-Aug-17 | 211.50 | 29500 | 21500 | 391.45 | 4094 | 1094 | 202.60 | 710 | 0 | 427.95 | 3219 | 0 |
| 13-Aug-17 | 211.50 | 30800 | 25800 | 392.25 | 13424 | 7582 | 205.80 | 7565 | 3577 | 427.65 | 3639 | 0 |
| 14-Aug-17 | 211.50 | 27575 | 22575 | 391.60 | 7483 | 11064 | 204.50 | 11362 | 10061 | 427.50 | 5561 | 0 |
| 15-Aug-17 | 211.50 | 23850 | 19350 | 391.35 | 3650 | 4629 | 204.40 | 8457 | 5873 | 427.70 | 8266 | 0 |
| 16-Aug-17 | 211.50 | 23850 | 19350 | 391.55 | 4280 | 2305 | 204.60 | 4594 | 1912 | 428.08 | 8968 | 0 |
| 17-Aug-17 | 211.50 | 30950 | 27950 | 391.85 | 2404 | 379 | 205.20 | 2193 | 260 | 429.00 | 12850 | 0 |
| 18-Aug-17 | 211.50 | 41700 | 38700 | 391.80 | 3472 | 3722 | 203.20 | 1939 | 2376 | 429.55 | 9837 | 0 |
| 19-Aug-17 | 211.50 | 35250 | 32250 | 391.75 | 2753 | 3051 | 204.10 | 5345 | 4309 | 429.95 | 8526 | 0 |
| 20-Aug-17 | 211.50 | 19050 | 15050 | 392.05 | 1950 | 0 | 204.40 | 1889 | 1634 | 430.35 | 9192 | 0 |
| 21-Aug-17 | 211.50 | 19550 | 15050 | 392.20 | 975 | 0 | 204.00 | 600 | 860 | 430.60 | 7498 | 0 |
| 22-Aug-17 | 211.50 | 19475 | 13975 | 392.30 | 650 | 0 | 204.30 | 708 | 516 | 430.80 | 6905 | 0 |
| 23-Aug-17 | 211.50 | 21625 | 16125 | 392.40 | 711 | 0 | 204.00 | 325 | 516 | 430.90 | 5698 | 0 |
| 24-Aug-17 | 211.50 | 20475 | 13975 | 392.40 | 75 | 0 | 204.60 | 426 | 43 | 430.75 | 2647 | 0 |

ANNEXURE-D3: Dam-Barrage data during August,2017 (Contd.)

| Date | Dugapur Barrage | | | Massanjore Dam | | | Tilpara Barrage | | | Mukutmanipur Dam | | |
|-----------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|
| | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) |
| 25-Aug-17 | 211.50 | 20475 | 13975 | 392.50 | 765 | 0 | 205.20 | 400 | 0 | 430.60 | 2636 | 0 |
| 26-Aug-17 | 211.50 | 20400 | 12900 | 392.60 | 775 | 0 | 204.90 | 0 | 0 | 430.70 | 1220 | 0 |
| 27-Aug-17 | 211.50 | 12875 | 5375 | 392.65 | 1058 | 608 | 205.40 | 354 | 0 | 431.00 | 3658 | 0 |
| 28-Aug-17 | 211.5 | 12875 | 5375 | 392.4 | 781 | 2283 | 206 | 0 | 0 | 431.2 | 2439 | 0 |
| 29-Aug-17 | 211.50 | 11800 | 4300 | 392.45 | 1017 | 583 | 205.20 | 1420 | 0 | 431.55 | 4268 | 0 |
| 30-Aug-17 | 211.50 | 9950 | 6450 | 392.30 | 1672 | 2547 | 205.20 | 2367 | 0 | 432.10 | 6207 | 0 |
| 31-Aug-17 | 211.50 | 11950 | 6450 | 392.00 | 1361 | 3211 | 205.50 | 3514 | 0 | 432.50 | 4878 | 0 |

ANNEXURE-D4: Dam-Barrage data during September, 2017 (Contd.)

| Date | Dugapur Barrage | | | Massanjore Dam | | | Tilpara Barrage | | | Mukutmanipur Dam | | |
|-----------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|
| | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) |
| 1-Sep-17 | 211.50 | 6050 | 50 | 391.60 | 1021 | 3521 | 205.50 | 4242 | 0 | 432.95 | 5488 | 0 |
| 2-Sep-17 | 211.50 | 6050 | 50 | 391.35 | 2174 | 3699 | 206.00 | 4663 | 0 | 433.30 | 4268 | 0 |
| 3-Sep-17 | 211.50 | 5550 | 50 | 391.30 | 3106 | 3331 | 206.00 | 4346 | 0 | 433.70 | 4878 | 0 |
| 4-Sep-17 | 211.50 | 6575 | 1075 | 391.20 | 950 | 1500 | 204.80 | 3448 | 0 | 434.20 | 6097 | 0 |
| 5-Sep-17 | 211.50 | 7650 | 2150 | 390.75 | 1041 | 3687 | 205.00 | 4428 | 0 | 434.20 | 4668 | 0 |
| 6-Sep-17 | 211.50 | 5550 | 50 | 390.25 | 1324 | 3999 | 205.40 | 4768 | 0 | 433.95 | 3050 | 0 |
| 7-Sep-17 | 211.50 | 2300 | 50 | 389.70 | 614 | 4139 | 205.30 | 4628 | 0 | 433.70 | 2522 | 0 |
| 8-Sep-17 | 211.50 | 3800 | 50 | 389.30 | 1029 | 3923 | 205.50 | 4845 | 0 | 433.40 | 1138 | 0 |
| 9-Sep-17 | 211.50 | 3800 | 50 | 389.05 | 2266 | 4041 | 205.90 | 4990 | 0 | 433.10 | 1147 | 0 |
| 10-Sep-17 | 211.50 | 4300 | 50 | 388.70 | 1436 | 3511 | 205.70 | 4480 | 158 | 432.70 | 1156 | 0 |
| 11-Sep-17 | 211.50 | 1050 | 50 | 388.70 | 614 | 514 | 203.50 | 3929 | 464 | 432.25 | 570 | 0 |
| 12-Sep-17 | 211.50 | 1550 | 50 | 388.65 | 1336 | 1536 | 204.20 | 2328 | 0 | 431.80 | 830 | 0 |
| 13-Sep-17 | 211.50 | 6550 | 50 | 388.60 | 795 | 1095 | 204.50 | 2092 | 0 | 431.50 | 2817 | 0 |
| 14-Sep-17 | 211.50 | 4550 | 50 | 388.60 | 1125 | 1025 | 204.70 | 2028 | 0 | 431.20 | 2489 | 0 |
| 15-Sep-17 | 211.50 | 8050 | 50 | 388.60 | 1145 | 1045 | 205.20 | 2066 | 0 | 430.75 | 618 | 0 |
| 16-Sep-17 | 211.50 | 4550 | 50 | 388.60 | 696 | 596 | 205.60 | 1890 | 0 | 430.55 | 3502 | 0 |
| 17-Sep-17 | 211.50 | 8550 | 50 | 388.65 | 989 | 589 | 205.00 | 1165 | 0 | 430.30 | 2501 | 0 |
| 18-Sep-17 | 211.50 | 7050 | 50 | 388.80 | 2007 | 1007 | 204.80 | 1848 | 0 | 430.10 | 3086 | 0 |
| 19-Sep-17 | 211.50 | 8550 | 50 | 389.10 | 2857 | 861 | 204.10 | 1715 | 0 | 430.20 | 6739 | 0 |
| 20-Sep-17 | 211.50 | 8550 | 50 | 389.25 | 2914 | 1789 | 205.00 | 3107 | 0 | 430.45 | 8565 | 0 |
| 21-Sep-17 | 211.50 | 5550 | 50 | 390.20 | 6725 | 0 | 205.40 | 2134 | 0 | 430.50 | 6163 | 0 |
| 22-Sep-17 | 211.50 | 3550 | 50 | 391.15 | 5375 | 0 | 204.90 | 1542 | 0 | 430.40 | 4331 | 0 |
| 23-Sep-17 | 211.50 | 2050 | 50 | 391.55 | 2650 | 0 | 205.80 | 1596 | 0 | 430.30 | 4321 | 0 |
| 24-Sep-17 | 211.50 | 1550 | 50 | 391.75 | 1350 | 0 | 205.00 | 1124 | 0 | 430.10 | 3049 | 0 |

ANNEXURE-D4: Dam-Barrage data during July,2017 (Contd.)

| Date | Dugapur Barrage | | | Massanjore Dam | | | Tilpara Barrage | | | Mukutmanipur Dam | | |
|-----------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|----------------------|-----------------|------------------|
| | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) | Reservoir Level (ft) | Inflow (Cusecs) | Outflow (Cusecs) |
| 25-Sep-17 | 211.50 | 1550 | 50 | 392.30 | 3625 | 0 | 204.60 | 1095 | 0 | 429.80 | 2541 | 0 |
| 26-Sep-17 | 211.50 | 1050 | 50 | 392.50 | 1752 | 359 | 203.40 | 2243 | 0 | 429.50 | 2845 | 0 |
| 27-Sep-17 | 211.50 | 1050 | 50 | 392.45 | 1181 | 1406 | 204.60 | 2306 | 0 | 429.13 | 2320 | 0 |
| 28-Sep-17 | 211.50 | 1050 | 50 | 393.05 | 4846 | 846 | 205.70 | 2063 | 0 | 429.00 | 3403 | 0 |
| 29-Sep-17 | 211.50 | 1550 | 50 | 393.30 | 2325 | 600 | 205.00 | 793 | 0 | 429.10 | 623 | 0 |
| 30-Sep-17 | 211.50 | 4050 | 50 | 393.50 | 1400 | 0 | 205.50 | 1663 | 0 | 429.25 | 935 | 0 |

| ANNEXURE-BR: Districtwise List of Breaches in the Embankments and Area of Inundation during Flood Season, 2017 | | | | | | | |
|--|-------------------|-------------------|-------------------------|-----------------------------|----------------------|---|-------------------------------|
| Sl. No. | District | Nature of Damages | Number of Damaged Spots | Total Length of Damage (Km) | Length of Breach (m) | Reference | * Area of Inundation (Sq. Km) |
| 1 | Alipurduar | BREACH | 81 | 13.794 | | | 0.00 |
| 2 | Coochbehar | | 137 | 16.792 | | | 0.00 |
| 3 | Dakshin Dinajpur | | 49 | 5.368 | | | 190.00 |
| 4 | Darjeeling | | 62 | 7.195 | | | 0.00 |
| 5 | Jalpaiguri | | 104 | 8.855 | | | 0.00 |
| 6 | Malda | | 52 | 29.063 | | | 118.00 |
| 7 | Uttar Dinajpur | | 28 | 42.48 | | | 371.00 |
| | Sub-Total | | 513 | 123.547 | 0 | | 679.00 |
| 8 | Bankura | | 40 | 40.890 | | | 50.00 |
| 9 | Birbhum | | 9 | 0.868 | 150 | Via Email on dated 06/04/18 of EE, MHQD | 131.00 |
| 10 | Bardhaman | | 36 | 41.212 | 3267 | Memo No. 818/1 dated 10/04/18 of EE, LDID | 884.00 |
| 11 | Hooghly | | 80 | 36.484 | 1280 | do | 305.00 |
| 12 | Howrah | | 191 | 111.974 | 3467 | Memo No. 202E dated 29/01/18 of EE, HWHID | 52.00 |
| 13 | Murshidabad | | 14 | 3.601 | | | 307.00 |
| 14 | Nadia | | 2 | 0.700 | | | 7.00 |
| 15 | North 24 Parganas | | 58 | 8.615 | | | 0.00 |
| 16 | Paschim Medinipur | | 102 | 24.366 | 665 | Memo No. 818/1 dated 10/04/18 of EE, LDID | 368.00 |
| 17 | Purba Medinipur | | 199 | 86.74 | | Via Email on dated 06/04/18 of EE, WMD | 123.00 |
| 18 | Purulia | | 10 | 2.360 | | | 0.00 |
| 19 | South 24 Parganas | | 157 | 40.705 | | | 0.00 |
| | Sub-Total | | 858 | 357.625 | 8829 | | 2177.00 |
| | TOTAL | | 1371 | 481.172 | 8829 | | 2856.00 |

Source: NRSC, GoI Satellite Data on 27th July & 13th August, 2017, processed by DST, HE & BT, Govt. of West Bengal.

Annexure - FD

Summary Statement of minimum requirement of fund out of SDRF during 2017-18 for restoration of damaged embankments and other assets of the Irrigation & Waterways Department due to heavy rainfall from 20th, July'17 to 3rd, August'17 (Phase-I) and from 8th, August'17 to 14th, August'17 (Phase-II) in the South Bengal Districts and North Bengal Districts respectively.

Districtwise Damage Report during Flood Season, 2017

| | | | | | | (₹ In Lakh) |
|---|----------------------|---------------------------------|------------------------------|--|--|----------------------|
| Sl. No. | Name of the District | Name of the Irrigation Division | No. of Damaged Spots located | Reported damaged length (KM) as per CA-II report | Reported requirement of fund as per CA-II report | Period of Occurrence |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | South 24-Parganas | Kakdwip Irrigation Divn | 70 | 20.560 | 448.00 | 21.7.17 to 25.7.17 |
| | | Joynagar Irrigation Divn | 74 | 19.335 | 794.93 | 21.7.17 to 25.7.17 |
| | | Canals Divn | 13 | 0.810 | 46.15 | 24.7.17 to 26.7.17 |
| Sub-Total : South 24 Parganas District | | | 157 | 40.705 | 1289.08 | |
| 2 | North 24-Parganas | Bashirhat Irrigation Divn | 52 | 8.265 | 251.80 | 24.7.17 to 26.7.17 |
| | | Canals Divn | 3 | 0.350 | 35.50 | 24.7.17 to 26.7.17 |
| | | Bidyadhari Drainage Divn | 3 | 0 | 125.00 | 21.7.17 to 1.8.17 |
| Sub-Total : North 24 Parganas District | | | 58 | 8.615 | 412.30 | |
| 3 | Howrah | Howrah Irrigation Divn | 157 | 89.770 | 5722.00 | 26.7.17 to 30.7.17 |
| | | Lower Damodar Const Divn | 34 | 25.671 | 830.00 | 26.7.17 to 3.8.17 |
| Sub-Total : Howrah District | | | 191 | 115.441 | 6552.00 | |
| 4 | Hooghly | Hooghly Irrigation Divn | 49 | 8.274 | 2137.92 | 25.7.17 to 28.7.17 |
| | | Howrah Irrigation Divn | 26 | 15.290 | 1270.00 | 26.7.17 to 30.7.17 |
| | | Lower Damodar Irrgn Divn. | 5 | 14.200 | 325.00 | 27.7.17 to 29.7.17 |
| Sub-Total : Hooghly District | | | 80 | 37.764 | 3732.92 | |
| 5 | Purba Bardhaman | Burdwan Irrigation Divn | 9 | 1.230 | 384.00 | 22.7.17 to 24.7.17 |
| | | Damodar Canal Divn. | 10 | 27.327 | 473.50 | 25.7.17 to 27.7.17 |
| | | Lower Damodar Irrgn Divn. | 5 | 14.185 | 290.00 | 27.7.17 to 29.7.17 |
| | | Right Bank Irrgn Divn | 12 | 1.737 | 234.50 | 27.7.17 to 28.7.17 |
| Sub-Total : Purba Bardhaman District | | | 36 | 44.479 | 1382.00 | |
| 6 | Bankura | Bankura Irrigation Divn | 24 | 15.280 | 3380.00 | 23.7.17 to 26.7.17 |
| | | Kangsabati Canal Divn. II | 7 | 8.74 | 165.00 | 22.7.17 to 26.7.17 |
| | | Kangsabati Canal Divn. III | 6 | 16.200 | 225.00 | 23.7.17 to 26.7.17 |
| | | Right Bank Irrgn Divn | 3 | 0.670 | 105.00 | 26.7.17 to 27.7.17 |
| Sub-Total : Bankura District | | | 40 | 40.890 | 3875.00 | |

Annexure - FD

Summary Statement of minimum requirement of fund out of SDRF during 2017-18 for restoration of damaged embankments and other assets of the Irrigation & Waterways Department due to heavy rainfall from 20th, July'17 to 3rd, August'17 (Phase-I) and from 8th, August'17 to 14th, August'17 (Phase-II) in the South Bengal Districts and North Bengal Districts respectively.

Districtwise Damage Report during Flood Season, 2017

| | | | | | | (₹ In Lakh) |
|---|----------------------|---------------------------------|------------------------------|--|--|----------------------|
| Sl. No. | Name of the District | Name of the Irrigation Division | No. of Damaged Spots located | Reported damaged length (KM) as per CA-II report | Reported requirement of fund as per CA-II report | Period of Occurrence |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7 | Nadia | Nadia Irrigation Divn | 2 | 0.70 | 141.00 | 24.7.17 to 30.7.17 |
| Sub-Total : Nadia District | | | 2 | 0.700 | 141.00 | |
| 8 | Purulia | Purulia Irrigation Divn | 8 | 2.040 | 7.20 | 22.7.17 to 26.7.17 |
| | | Purulia Const Divn (Irr) | 1 | 0.090 | 7.00 | 21.7.17 to 26.7.17 |
| | | Purulia Inv & Plng Divn | 1 | 0.230 | 30.00 | 20.7.17 to 26.7.17 |
| Sub-Total : Purulia District | | | 10 | 2.360 | 44.20 | |
| 9 | Birbhum | Mayurakshi HQ Divn | 9 | 1.018 | 402.50 | 22.7.17 to 26.7.17 |
| Sub-Total : Birbhum District | | | 9 | 1.018 | 402.50 | |
| 10 | Purba Medinipur | Contai Irrigation Divn | 7 | 1.56 | 320.00 | 21.7.17 to 28.7.17 |
| | | East Midnapore Divn | 192 | 85.179 | 1672.07 | 22.7.17 to 24.7.17 |
| Sub-Total : Purba Medinipur District | | | 199 | 86.74 | 1992.07 | |
| 11 | Paschim Medinipur | West Midnapore Divn | 64 | 18.722 | 3459.00 | 21.7.17 to 3.8.17 |
| | | KKB Project Divn | 18 | 4.355 | 258.85 | 22.7.17 to 25.7.17 |
| | | East Midnapore Divn | 19 | 0.954 | 149.00 | 22.7.17 to 24.7.17 |
| | | Subarnarekha HQ Divn | 1 | 1.000 | 210.00 | 22.7.17 to 25.7.17 |
| Sub-Total : Paschim Medinipur District | | | 102 | 25.031 | 4076.85 | |
| 12 | Murshidabad | Berhampore Irrigation Divn | 3 | 0.720 | 280.00 | 21.7.17 to 26.7.17 |
| | | Ganga Anti Erosion Divn-I | 9 | 2.205 | 1945.00 | 20.7.17 to 3.8.17 |
| | | Ganga Anti Erosion Divn-II | 1 | 0.600 | 190.00 | 24.7.17 to 30.7.17 |
| | | Mayurakshi SC Divn | 1 | 0.076 | 10.00 | 27.7.17 to 28.7.17 |
| Sub-Total : Murshidabad District | | | 14 | 3.601 | 2425.00 | |
| 13 | Malda | Malda Irrigation Divn | 2 | 0.17 | 50.22 | 20.7.17 to 2.8.17 |
| | | Mahananda Embkt Divn | 26 | 22.538 | 3826.00 | 13.8.17 to 4.9.17 |
| | | Malda Irrigation Divn | 24 | 6.355 | 2724.25 | 12.8.17 to 13.9.17 |
| Sub-Total : Malda District | | | 52 | 29.063 | 6600.47 | |
| 14 | Dakshin Dinajpur | South Dinajpur Irrgn Divn | 49 | 5.368 | 1622.00 | 12.8.17 to 22.8.17 |
| Sub-Total : Dakshin Dinajpur District | | | 49 | 5.368 | 1622.00 | |

Annexure - FD

Summary Statement of minimum requirement of fund out of SDRF during 2017-18 for restoration of damaged embankments and other assets of the Irrigation & Waterways Department due to heavy rainfall from 20th, July'17 to 3rd, August'17 (Phase-I) and from 8th, August'17 to 14th, August'17 (Phase-II) in the South Bengal Districts and North Bengal Districts respectively.

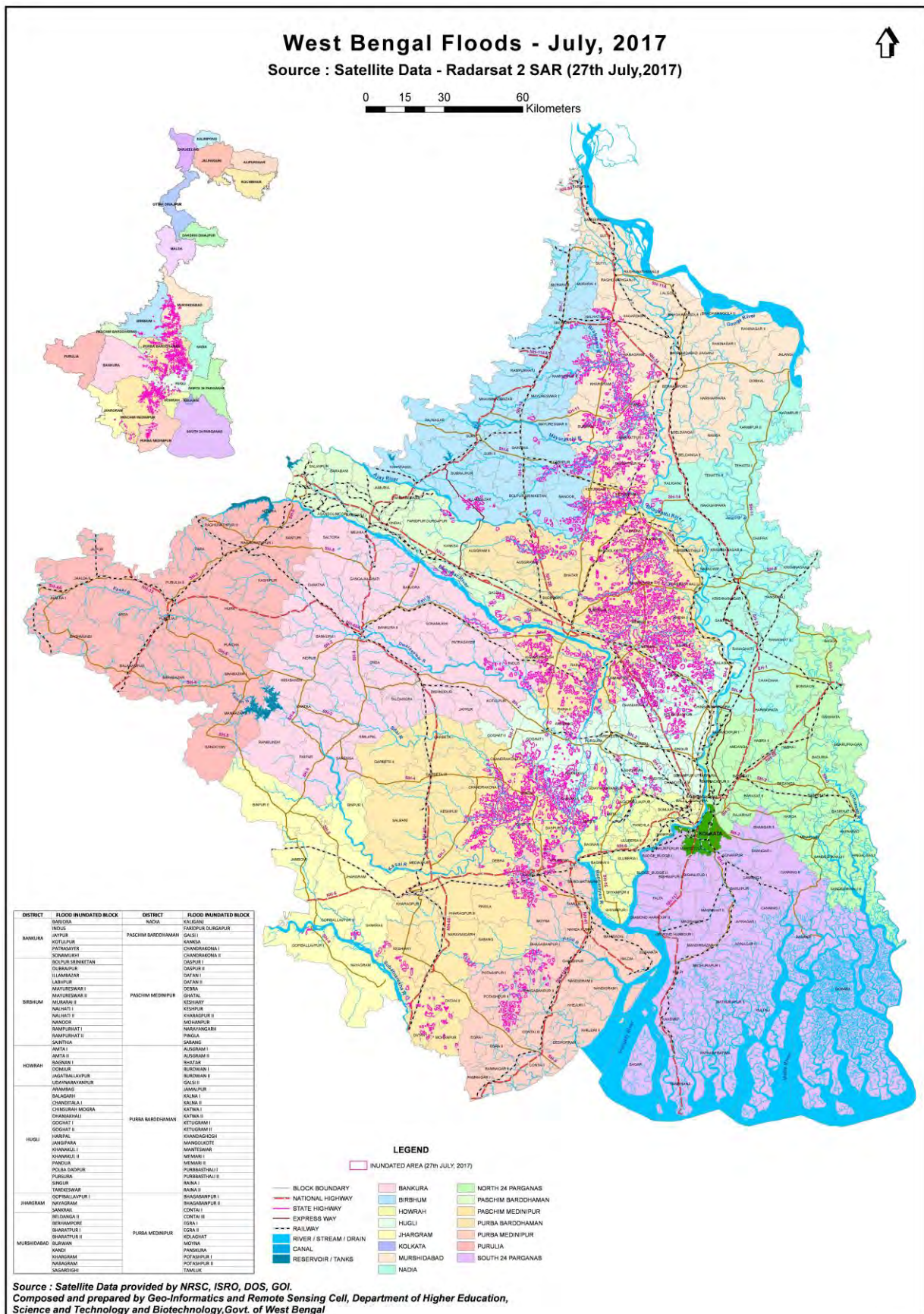
Districtwise Damage Report during Flood Season, 2017

| | | | | | | (₹ In Lakh) |
|--|-----------------------|---------------------------------|------------------------------|--|--|----------------------|
| Sl. No. | Name of the District | Name of the Irrigation Division | No. of Damaged Spots located | Reported damaged length (KM) as per CA-II report | Reported requirement of fund as per CA-II report | Period of Occurrence |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 15 | Uttar Dinajpur | North Dinajpur Irrgn Divn | 28 | 42.48 | 2800.00 | 11.8.17 to 22.8.17 |
| Sub-Total : Uttar Dinajpur District | | | 28 | 42.48 | 2800.00 | |
| 16 | Darjeeling (SMP area) | Siliguri Irrigation Divn | 62 | 7.195 | 285.00 | 11.8.17 to 13.8.17 |
| Sub-Total : Darjeeling District | | | 62 | 7.195 | 285.00 | |
| 17 | Jalpaiguri | Jalpaiguri Irrigation Divn | 92 | 6.575 | 695.00 | 9.8.17 to 13.8.17 |
| | Jalpaiguri | Siliguri Irrigation Divn | 12 | 2.280 | 116.00 | 11.8.17 to 13.8.17 |
| Sub-Total : Jalpaiguri District | | | 104 | 8.855 | 811.00 | |
| 18 | Coochbehar | Coochbehar Irrigation Divn | 104 | 15.867 | 877.50 | 10.8.17 to 15.8.17 |
| | | Jalpaiguri Irrigation Divn | 33 | 0.925 | 228.00 | 9.8.17 to 13.8.17 |
| Sub-Total : Coochbehar District | | | 137 | 16.792 | 1105.50 | |
| 19 | Alipurduar | Alipurduar Irrigation Divn | 81 | 13.794 | 1761.00 | 11.8.17 to 13.8.17 |
| Sub-Total : Alipurduar District | | | 81 | 13.794 | 1761.00 | |
| Grand Total of 19 Districts | | | 1411 | 530.89 | 41309.89 | |

Note-1: Estimated cost of restoration work is prepared as per prevailing SOR of respective circle of I&WD

| | | | | | |
|--|--|------------------------|--|------------------------|-----------------------------|
| | | | | | |
| | | Sd | | Sd | Sd |
| | | Chief Engineer (North) | | Chief Engineer (West) | Chief Engineer (South-West) |
| | | I & W Dte. | | I & W Dte. | I & W Dte. |
| | | Sd | | Sd | Sd |
| | | Joint Secretary | | Chief Engineer (South) | Chief Engineer (North East) |
| | | I & W Department | | I & W Dte. | I & W Dte. |

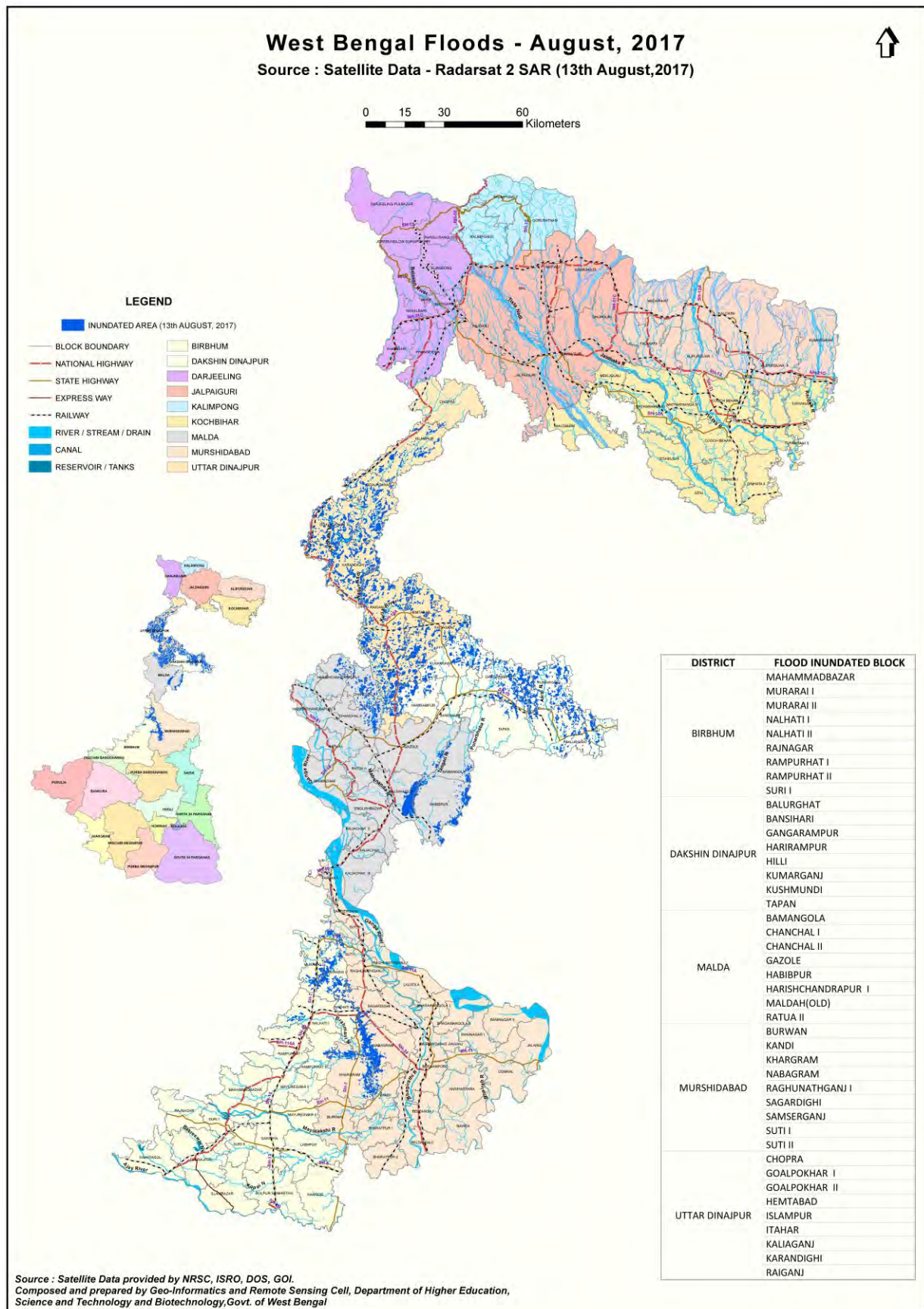
ANNEXURE-IM1: Index Map showing Area of Inundation in South Bengal on 27th July, 2017



Source : Satellite Data provided by NRSC, ISRO, DOS, GOI.
Composed and prepared by Geo-Informatics and Remote Sensing Cell, Department of Higher Education,
Science and Technology and Biotechnology, Govt. of West Bengal

Source: DST, HE & BT, Govt. of West Bengal.

ANNEXURE-IM2: Index Map showing Area of Inundation in South Bengal on 13th August, 2017



Source: DST, HE & BT, Govt. of West Bengal.