HUGLI

DOCUMENTATION OF GANGA FROM GOMUKH TO GANGASAGAR

Report submitted by:

The Natural Heritage Division

CHAPTER 1: INTRODUCTION 1-8

I. **Data-Information Collection & Measurements**

II. **Photo & Videogrpahy**

1.4D. Post Field Analysis

I. **Collection & Scrutinization of Field Data/Survey sheets**

II. **GPS Data analysis**

III. **Water & Soil Sample data analysis**

IV. **Preparation of Theme Maps**

1.4E. Validating Field & Analised Data

I. **Landuse Land cover units**

II. **GPS locations**

III. **Water Sample analysis data**

IV. **Flora/Fauna**

1.4F. Preparation & Submission of Report

I. **Preparation of Draft Report**

II. **Report Correction**

III. **Final Report Submission**

LIST OF PHOTOGRAPHS / PLATES

Plate 1: Chinsura Ghat , Hugli , 22° 54.054'N 88° 24.229'E

Plate 2: Tribeni Ghat , Hugli 22° 59.078'N 88° 24.097'E

Plate 3: The usual riparian vegetation , Mograhat , 23° 12.995'N 88° 28.305'E

Plate 4: Sabujdweep ,a tourist spot in the midst of Bhagirathi Hugli , near the confluence of Behula River , Somra , Hugli

Plate 5: Kuntighat , Nayasarai , 23° 0.734'N 88° 25.093'E

Plate 6: Saraswati River outfall , Tribeni , 22° 58.996'N 88° 24.098'E

Plate7: Effect of tidal bore in the Kotrang Municipality area , 22° 40.192'N 88° 21.100'E

Plate 8: Behula River joining with Hugli River , 23° 8.072'N 88° 26.946'E

Plate 9: Clogged path of Behula river near Abdulpur , 23° 9.826'N 88° 26.189'E

Plate 10: Kunti Nadi , 23° 1.101'N 88° 25.298'E opening up near Kuntighat

Plate 11 : Nayasarai Marshes 23° 0.558'N 88° 24.922'E

Plate 12 : Confluence of Kunti River with Hugli River 23° 0.679'N 88° 25.255'E

Plate 13 : Along River Saraswati , Chinsurah

Plate 14 : Bally Khal Outfall bordering the districts of Haora and Hugli 22° 39.308'N 88° 20.962'E

Plate 15 : Lal Dighi , Chandannagar , one of the oldest dighi / lake of Chandannagar

Plate 16&17: Saraswati River near Tribeni

Plate 18: Ficus religiosa (Aswatha) near Kuntighat with the Kali Temple , 23° 1.091'N 88° 25.151'E

Plate 19 : Ficus bengalensis (Bot) and Tara Tirtha , Kotrung Municipality , 22° 40.916'N 88° 21.312'E

Plate 20 : Debipukur Ghat , Battala , Hindmotor , 22° 40.817'N 88° 21.255'E

Plate 21 : Konnagar Battala Ghat , 22° 42.054'N 88° 21.578'E

Plate 22 : Konnagar Baro Mandir Ghat 22° 42.414'N 88° 21.490'E

Plate 23: Baro Mandir, Konnagar, established in 1821 on the weaster bank of the Ganges near Konnagar Ferry Ghat is beautiful creation. On the opposite of the river is Panihati Baromandir.. The Baro Mandir in Konnagar has its own brand of unique charm. In fact, countless visitors just can't stop gushing about the place. In short, rest assure that a trip to Baro Mandir Konnagar will leave you with a lifetime of fond memories.

Plate 24 & 25: The temple called Deshkali mandir is situated at Guptipara near buro bazar. The temple is very old and famous to devotees. The very old and big banyan tree situated on the

compound of the deshkali temple has created beautiful atmospheres in that area that is used to take rest for devotees.

Plate 26 : The Jubilee Bridge , Hugli

Plate 27 : Sampreeti Bridge on River Hugli.

Plate 28: Uttarpara Doltala Ghat

Plate 29 : Uttarpara Ferry Ghat

Plate 30: Uttarpara – Ariadaha Ferry Ghat

Plate 31 : Uttarpara Ram Ghat ,

Plate 32 : Tribeni Ferry Ghat

Plate 33&34: Vegetables transported through River Kunti , 23° 1.201'N 88° 24.618'E

Plate 35 : Chandannagar Ferry Ghat

Plate 36: Tribeni Burning Ghat

Plate 37: Chandannagar Boraichanditala Ghat

Plate 38: Konnagar Ghat

Plate 39: Paddy is the major agricultural crop of the study area, Singur 22° 44.841'N 88° 18.791'E

Plate 40: Potato farming in the study area , Mogra –Chinsurah Block

Plate 41 : Aman Paddy cultivation , Gournagar , Balagarh 23° 7.259'N 88°29.303'E

Plate 42: Machan Crop like Gourd , Pumkins are cultivated in the homesteads . Lakshmirani in her field , Dumurdaha 23° 2.104'N 88° 26.216'E

Plate 43 & 44: Boat making is going on at Balagarh , 23° 7.418'N 88° 28.645'E

Plate 45: Boat making centre , Balagarh , 23° 7.418'N 88° 28.645'E

Plate 46: Boat making centre , Balagarh , 23° 7.418'N 88° 28.645'E

Plate 47 & 48 : Boat making centre , Balagarh , 23° 7.418'N 88° 28.645'E

Plate 49 : Brick Field near Arabindapally , Uttarpara – Kotrang , 22° 41.262'N 88° 21.483'E

Plate 50: 22° 44.253'N 88° 21.373'E, Mahesh Bosepara , Hugli

Plate 51: 22° 47.192'N 88° 19.933'E, Baidyapara , Hugli

Plate 52: 22° 52.245'N 88° 22.955'E,Nikaripara , Chandannagar , Hugli

Plate 53: 22° 55.776'N 88° 24.067'E, Kuntighat , Hugli

Plate 54: 22° 57.415'N 88° 24.326'E, Mithanpukur More , Bansberia, Hugli

Plate 55: 23° 2.168'N 88° 26.264'E , Dumurdaha Char , Hugli

Plate 56: Flooded Mogra area, Source : Telegraph , India.

LIST OF MAPS & DIAGRAMS

ABBREVIATIONS

AISLUS	All India Soil & Landuse Survey
As	Arsenic
ASI	Archaeological Survey of India
BGL	Below Ground Level
BOD	Biochemical Oxygen Demand
CGWB	Central Ground Water Board
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CPT	Calcutta Port Trust
DEM	Digital Elevation Model
DO	Dissolve Oxygen
DPMS	District Planning Map Series
DWF	Dry Water Flow
E-Waste	Electronic Waste
EC	Electrical Conductivity
EKW	East Kolkata Wetlands
EMP	Environmental Management Plan
ETM	Enhance Thematic Mapper
FCC	False Colour Composite
GAP	Ganga Action Plan
GCP	Ground Control Point
GIS	Geographic Information System
GOI	Government of India
GoWB	Government of West Bengal
GPS	Global Positioning System
GSI	Geological Survey of India
HWL	High Water Level
IMD	Indian Meteorological Department
INTACH	Indian National Trust for Art & Cultural Heritage
IWMED	Institute of Wetland Management & Ecological Design

K	Potassium
KEIP	Kolkata Environment Improvement Project
KIT	Kolkata Improvement Trust
KMA	Kolkata Metropolitan Area
KMC	Kolkata Municipal Corporation
KMDA	Kolkata Metropolitan Development Authority
LULC	Landuse Land cover
LWL	Low Water Level
MSL	Mean Sea Level
MSS	Multi Spectral Scanner
MWL	Mean Water Level
N	Nitrogen
Na	Sodium
NATMO	National Atlas & Thematic Mapping Organisation
NBSS&LUP	National Bureau of Soil Survey & Landuse Planning
NDVI	Normalised Differential Vegetation Index
NH	Natural Heritage
NMCG	National Mission for Clean Ganga
NTFP	Non Timber Forest Product
pH	Hydrogen Ion Concentration
PPT	Precipitation
RF	Rainfall
RGB	Red Green Blue
RS	Remote Sensing
SPM	Suspended Particulate Matter
SRTM	Shuttle Radar Topographic Mission
SWID	State Water Investigation Directorate
TM	Thematic Mapper
UNDP	United Nations Development Programme
USGS	United Nations Geological Survey
WBPCB	West Bengal Pollution Control Board
WF	Wetland Fauna

REFERENCE BOOKS – NATURAL HERITAGE REPORT OF HUGLI

1. BENG.AL DISTRICT -GAZETTEERS .Hooghly. BY L. S. ~S. O'MALLEY,Manmohan Chakroborty , 1912

2. District Census Handbook

3. Inventory of Soil Resources of Hooghly District, SLUSI

4. Atlas of changing river courses in West Bengal 1767-2010 / Kalyan Rudra

by Rudra, Kalyan . : Sea Explorers' Institute, 2012 , Kolkata : Shisu Sahitya Samsad Pvt.

5. Anthropogeomorphology of Bhagirathi-Hooghly River System, Balai Chandra Das (Editor), Sandipan Ghosh (Editor), Aznarul Islam (Editor), Suvendu Roy (Editor)

6. The Hooghly River: A Sacred and Secular Waterway, Robert Ivermee

7. DISTRICT HUMAN DEVELOPMENT REPORT HOOGHLY, DEVELOPMENT & PLANNING DEPARTMENT GOVERNMENT OF WEST BENGAL

8. Hydrological changes and their impact on fluvial environment of the lower damodar basin over a period of fifty years of damming The Mighty Damodar River in Eastern India

9.Disaster Management , District Hugli , GOVERNMENT OF WEST BENGAL
OFFICE OF THE DISTRICT MAGISTRATE AND COLLECTOR
HOOGHLY , DEPARTMENT OF DISASTER MANAGEMENT AND CIVIL DEFENCE

10. **REVIEW ON POLLUTION STATUS OF RIVER BHAGIRATHI-HOOGHLY IN THE STRETCH OF WEST BENGAL, INDIA**

11. History of Portuguese in Bengal , J.J.A Campos

12. DISTRICTHUMANDEVELOPMENTREPORT, SOUTH 24 PARGANAS, DEVELOPMENT & PLANNING DEPARTMENT
GOVERNMENT OF WEST BENGAL

13. CGWB REPORT

14. Bhagirathi-Hooghly Basin , Prof.Kanan Bagchi

15. Ethnobotanical information on some aquatic plants of Hugli, West Bengal

16. River Systems and Water Resources of West Bengal: A Review

17. http://faunaofindia.nic.in/PDFVolumes/records/105/01-02/0025-0035.pdf

18. Water Resources and its quality in West Bengal , WBPCB , DR. Kalyan Rudra

19.Website – KMA , WBPCC, CGWB,West Bengal Forest Department, NBSS & LUP, AISLUS, Serampur,Chandannagar, Konnagar,Baidyabati,Risra,Chinsura,Bansberia,Kotrung, Uttarpara municipalities Website

20.Various Newspaper Portals – TOI , Indian Express , AnandaBazar

Chapter 1: Introduction

1.1.Background of the Project

Namami Gange Programme', is an Integrated Conservation Mission, approved as 'Flagship Programme' by the Union Government in June 2014 with the twin objectives of effective abatement of pollution, conservation and rejuvenation of National River Ganga.

1.1A. Key achievements under Namami Gange programme:

a. **Creating Sewerage Treatment Capacity:-** 63 sewerage management projects under implementation in the States of Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal.12 new sewerage management Projects Launched in these states. Work is under construction for creating Sewerage capacity of 1187.33 (MLD).Hybrid Annuity PPP Model based two projects has been initiated for Jagjeetpur, Haridwar and Ramanna, Varanasi.

b. **Creating River-Front Development:-**28 River-Front Development projects and 33 Entry level Projects for construction, modernization and renovation of 182 Ghats and 118 crematoria have been initiated.

c. **River Surface Cleaning:-**River Surface cleaning for collection of floating solid waste from the surface of the Ghats and River and its disposal are afoot and pushed into service at 11 locations.

d. **Bio-Diversity Conservation:-** Several Bio-Diversity conservation projects are namely: Biodiversity Conservation and Ganga Rejuvenation, Fish and Fishery Conservation in Ganga River, Ganges River Dolphin Conservation Education Programme has been initiated. 5 Bio-Diversity center's at Dehradun, Narora, Allahabad, Varanasi and Barrackpore has been developed for restoration of identified priority species.

e. **Afforestation:** Forestry interventions for Ganga through Wildlife Institute of India; Central Inland Fisheries Research Institute and Centre for Environment Education has been initiated. Forestry interventions for Ganga have been executed as per the Detailed Project Report prepared by Forest Research Institute, Dehradun for a period of 5 years (2016-2021) at project cost of Rs.2300 Crores. Work has been commenced in 7 districts of Uttarakhand for medicinal plants.

f. **Public Awareness:** A series of activities such as events, workshops, seminars and conferences and numerous IEC activities were organized to make a strong pitch for public outreach and community participation in the programme. Various awareness activities through rallies, campaigns, exhibitions, *shram daan*, cleanliness drives, competitions, plantation drives and development and distribution of resource materials were organized and for wider publicity the mass mediums such as TV/Radio, print media advertisements, advertorials, featured articles and advertorials were published. Gange Theme song was released widely and played on digital media to enhance the visibility of the programme. NMCG ensured presence at Social Media platforms like Facebook, Twitter, YouTube etc.

g. **Industrial Effluent Monitoring:** The number of Grossly Polluting Industries (GPIs) in April, 2019 is 1072. Regulation and enforcement through regular and surprise inspections of GPIs is carried out for compliance verification against stipulated environmental norms. The GPIs are also inspected on annual basis for compliance

verification of the pollution norms and process modification, wherever required through third party technical institutes. First round of inspection of GPIs by the third-party technical institutes has been carried out in 2017. Second round of inspection of GPIs has been completed in 2018. Out of 961 GPIs inspected in 2018, 636 are complying, 110 are non-complying and 215 are self-closed. Action has been taken against 110 non-complying GPIs and is issued closure directions under Section 5 of the E (P) Act. Online Continuous Effluent Monitoring Stations (OCEMS) connectivity established to CPCB server in 885 out of 1072 GPIs.

h. **Ganga Gram:** Ministry of Drinking Water and Sanitation (MoDWS) identified 1674 Gram Panchayats situated on the bank of River Ganga in 5 State (Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, West Bengal). Rs. 578 Crores has been released to Ministry of Drinking Water and Sanitation (MoDWS) for construction of toilets in 1674 Gram Panchayats of 5 Ganga Basin States. Out of the targeted 15, 27,105 units, MoDWS has completed construction of 8, 53,397 toilets. Consortium of 7 IITs has been engaged in the preparation of Ganga River basin Plan and 65 villages have been adopted by 13 IITs to develop as model villages. **UNDP** has been engaged as the executing agency for rural sanitation programme and to develop Jharkhand as a model State at an estimated cost of Rs. 127 Crore.

National Mission for Clean Ganga (NMCG) endeavors to deploy best available knowledge and resources across the world for Ganga rejuvenation. Clean Ganga has been a perennial attraction for many international countries that have expertise in river rejuvenation. Countries such as Australia, United Kingdom, Germany, Finland, Israel etc. have shown interest in collaborating with India for Ganga rejuvenation. Memorandums of Understanding (MoUs) were signed with various Central Ministries viz.- Ministry of Human Resource Development, Ministry of Rural Development, Ministry of Railways, Ministry of Shipping, Ministry of Tourism, Ministry of Ayush, Ministry of Petroleum, Ministry of Youth Affairs and Sports, Ministry of Drinking Water & Sanitation and Ministry of Agriculture for synergizing the Government schemes.

1.1B. Why we need "Namami Gange" programmes:

a. River Ganga has significant economic, environmental and cultural value in India.

b. Rising in the Himalayas and flowing to the Bay of Bengal, the river traverses a course of more than 2,500 km through the plains of north and eastern India.

c. The Ganga basin - which also extends into parts of Nepal, China and Bangladesh - accounts for 26 per cent of India's landmass.

d. The Ganga also serves as one of India's holiest rivers whose cultural and spiritual significance transcends the boundaries of the basin.

1.1C. Aim & Objective of NMCG

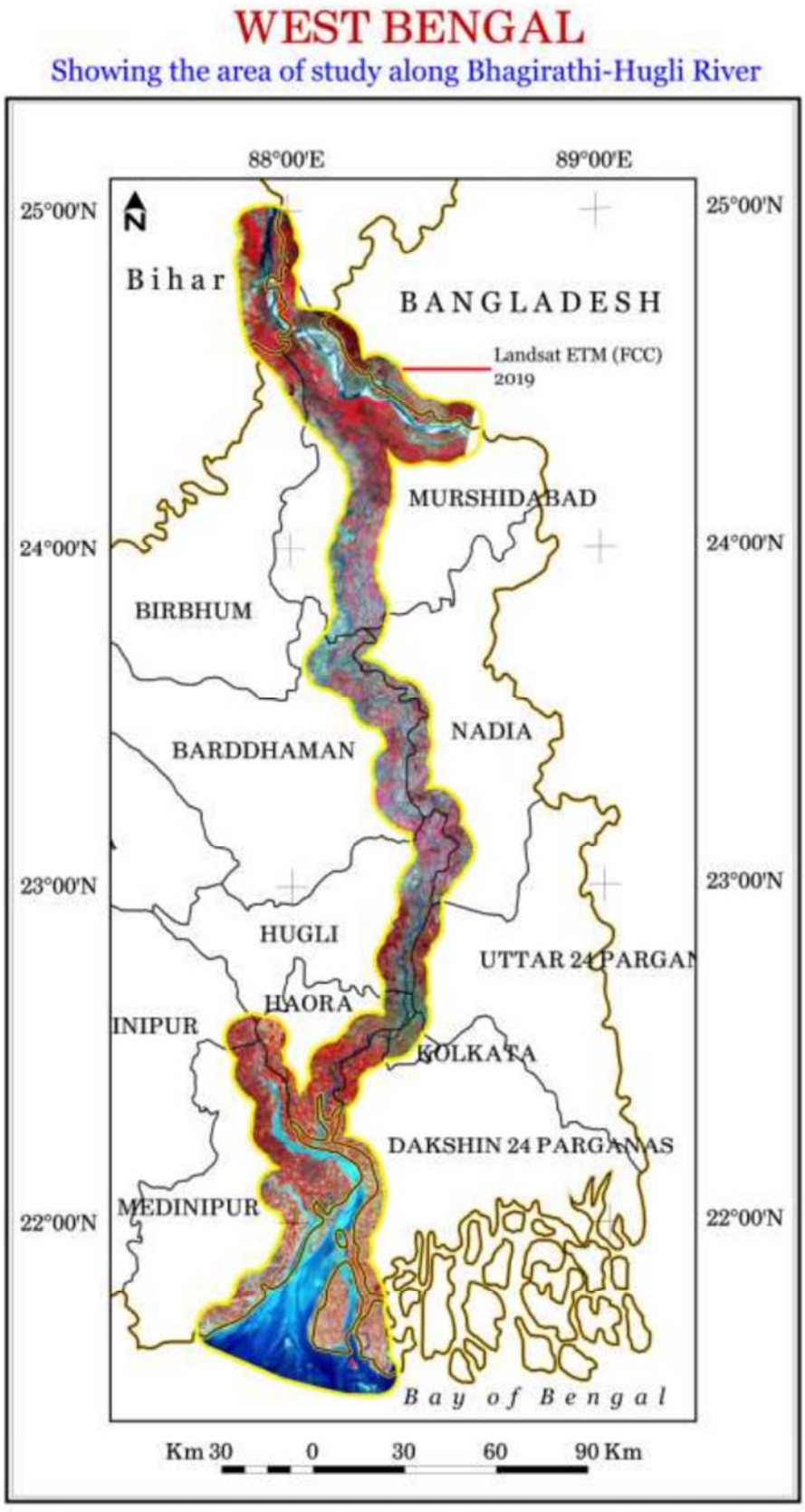
The aims and objectives of NMCG are to accomplish the mandate of National Ganga River Basin Authority (NGRBA) are:

1. To ensure effective abatement of pollution and rejuvenation of the river Ganga by adopting a river basin approach to promote inter-sectoral co-ordination for comprehensive planning and management and
2. To maintain minimum ecological flows in the river Ganga with the aim of ensuring water quality and environmentally sustainable development.

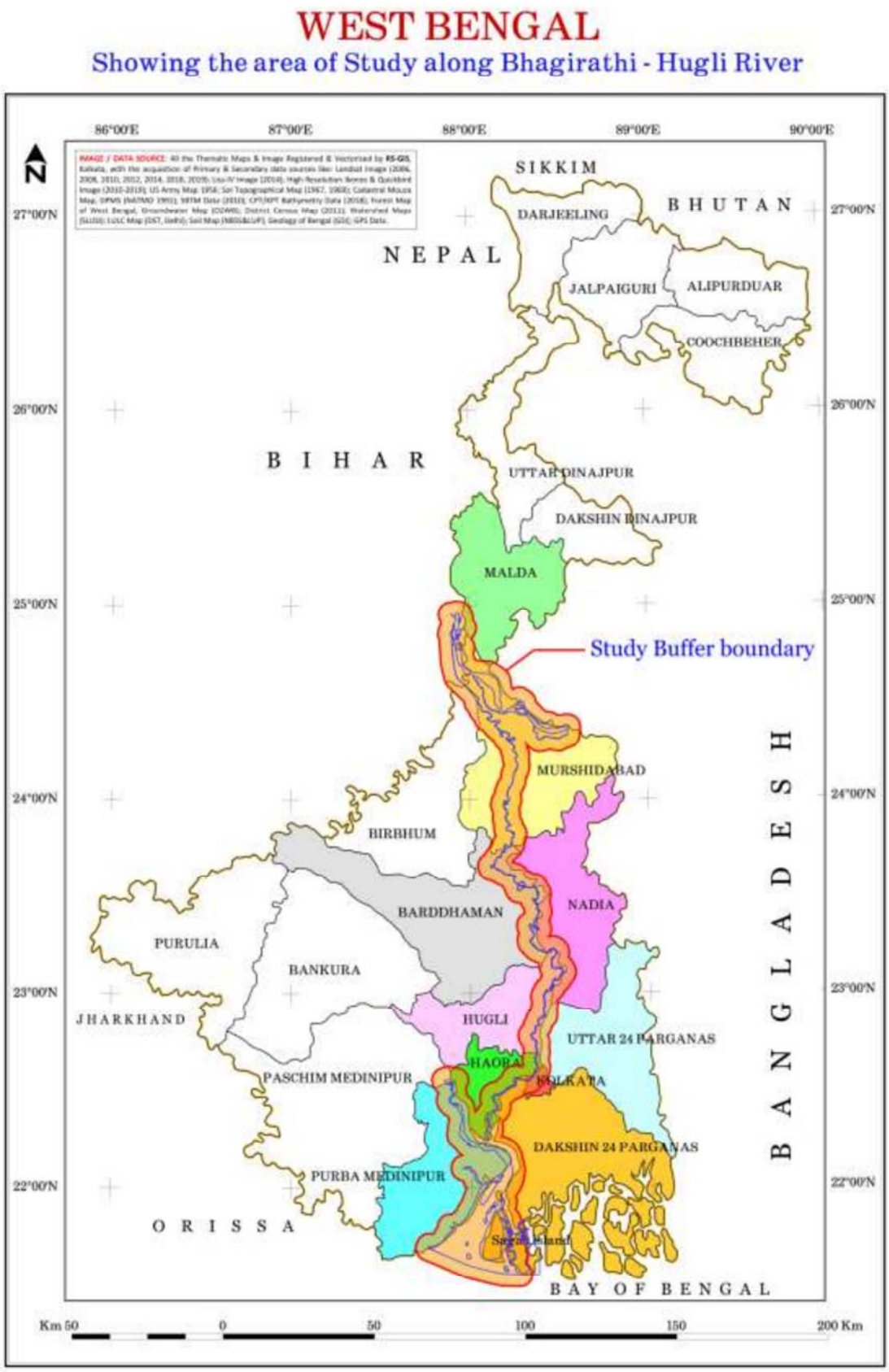
1.2. GANGA CULTURAL DOCUMENTATION

India is endowed with rich water resources with approximately 45,000 km long riverine systems criss-cross the length and breadth of the country. The Ganga river basin is the largest of the basins of India with an area of 8,61,452 Sq.km in India, draining into the 11 states of the country, Uttarakhand, Uttar Pradesh, Haryana, Himachal Pradesh, Delhi, Bihar, Jharkhand, Rajasthan, Madhya Pradesh, Chhattisgarh and West Bengal. The Ganga river has many tributaries, both in the Himalayan region before it enters the plains at Haridwar and further downstream before its confluence with the Bay of Bengal. The basin has a total drainage length of about 624235.73 Sq.km. The Ganga basin lies between east longitudes 73°2' to 89°5' and north latitudes 21°6' to 31°21' having maximum length and width of approx. 1,543 km and 1024 km. The average water resource potential of the basin has been assessed as 525020 Million Cubic Meters (MCM).

Sl.	Head Details			Quantitative Information		Remarks
1.	State Name: West Bengal			-	-	
2.	Geographical Extension of Bhagirathi-Hugli			N N	E E	
3.	Areal coverage in 5km Buffer					
4.	Areal coverage in 10km Buffer					
5.	Total Number of Districts coverage			10		
6.	District wise Police Station & Ward coverage	**District**		Number of PS/ Wards	Length of Hugli River	
		A	Malda	04	88 Km	
		B	Murshidabad	13	520 Km	
		C	Nadia	09	112 Km	
		D	Barddhaman	04	138 Km	
		E	Hugli	09	91 Km	
		F	Haora	09	69 Km	
		G	North 24 Parganas	09	42 Km	
		H	South 24 Parganas	09	110 Km	
		I	Kolkata	144 Wards	20Km	
		J	Purba Medinipur	06	92 Km	
7.	Total Length of the Bhagirathi-Hugli River in the Lower Part			1282 Km.		



Map 1 – Map of West Bengal showing the study area



Map 2 - Map of West Bengal showing the overall location of the Study area.

1.3. Documenting Natural Heritage & Ecological Interdependencies

Natural Heritage would not replicate the work of scientific institutions Biodiversity Conservation is being studied and implemented by Wildlife Institute of India to cover Golden Mahseer, Dolphins, Crocodiles, Turtles and Otters and other fauna under conservation programme. These studies would be referred to.

1.3A. Changes in Flows, Water Levels: The documentation of natural heritage at several sites and banks will look at the changes in flows, earlier course of the river if any and observable changes in water level as revealed in discussions with resource persons and local communities.

1.3B. Floodplains Crops and natural riparian flora and fauna, ox-bow lakes would be recorded

1.3C. Species-Fauna, Flora, Birds and others: Observations of riparian communities regarding changes in flora and fauna both riparian and in-stream would be recorded

1.3D. Sacred Groves: Landscapes that have both ecological and religious significance, where religion has ensured conservation of natural landscapes shall be noted

1.3E. Sacred Species: Certain species and specific trees are considered sacred because of associated religious beliefs or biological significance. It is because of their presence that several landscapes and sites stand safe. Many of these trees have a close association with the river during performance of some rituals. For instance, Bhojapatra is a birch tree native to the Himalayas, growing at elevations up to 4,500 m. The specific epithet, *utilis*, refers to the many uses of the different parts of the tree. The white, paper-like bark of the tree was used in ancient times for writing Sanskrit scriptures and texts. It is still used as paper for the writing of sacred mantras, with the bark placed in an amulet and worn for protection. In the sacred forests of Bhojwasa, around Gaumukh, such forests have been protected by pilgrims and resident communities, for eons.

1.3F. Community Understanding of Riparian Rights: Several communities, like the fishermen of the lower delta regions, have been caught in conflict with incumbent authorities in British and Independent India over riparian rights. The project aims to develop an understanding of what constitutes community riparian rights and whether communities are in conflict with authorities over the same.

1.3G. Confluence Points: The course of the Ganga is dotted with several confluence points of lower order streams which will be marked geospatially to understand the catchment and wider system of this river. The documentation also aims to name the minor tributaries that flow within this system and join it at various places.

1.3H. Review of Scientific Research on the Waters: Many scientific papers have been published on the Ganga and features of its water that keep it free of decay. These papers will be referred to recording what they suggest in terms of keeping the waters pristine.

1.4. METHODOLOGY

1.4A. Capacity Building:

a. **Training arrangement:** Two phases of training have given to the Field Coordinators, Field survey staff and the Project Resource persons. First phase of training has conducted by the Project Funding Authority i.e. INTACH, Delhi and second phase of training will be conducted by the Project Implementing Agency i.e. RS-GIS, Kolkata.

b. **Development of Project Team:** A Project team has formed according to the need of the objective of the present Project. It is formed headed by the coordinator and the Social Scientist. Other members of the Project team are the GIS-Remote Sensing Expert, Field assistant (Geography background), Local Resource persons, Camera person and Hydrologist, Soil Scientist, Botanist, Zoologist & Agriculture scientist.

c. **Acquisition / Procurement/ Purchase of Gadgets /Equipments / Analysis:** Following Gadgets/Equipments have been purchased for the implementation of the Project work: GPS machine, Satellite Image (Two seasons, Recent Data), Soft / hard copy Cadastral maps, Soil / Water storage Kit, Measuring Tape/ Compass/ Dumpy level, Topographical / DPMS, Laboratory Test / Analysis, procurement of other secondary Data / Information / Maps from Census, Irrigation, Ground water, Soil, Agriculture, Forest etc. Purchase of Books, Reproduction of Survey formats & Stationeries etc.

1.4B. Pre-Field Survey:

a. **Literature review:** Library work, Study of published and unpublished reports, News paper articles, Journals and Research papers.
b. **Collection of Secondary Data/ Information (Maps) from Govt. Departments:** GSI, NATMO, CGWB, NBSS & LUP, IMD, SWID, PHED, KMC Office, Survey of India (SoI), KOPT, West Bengal Fisheries Corporation, Irrigation & Waterways GoWB, West Bengal Forest Deptt. PWD, Census of India, AISLUS etc.
c. **Satellite Data Acquisition (Real-time):** NRSA Hyderabad, University of Calcutta (Deptt. of Geography), USGS Earth Explorer.
d. **Base-Map Preparation** (for whole Project area)**:** Consulting Topographical maps, Census maps, DPMS & Recent Multi spectral Satellite Image.

1.4C. Field Survey:

a. **Data-Information Collection & Measurements:** Collection of detail information with GPS locations, related to- Surface Morphology /Relief/ Physiography, Geology, Climatic conditions, Bank erosion, Embankment condition, Depth of river Bhagirathi-Hugli, Shifting river course and Paleo-channels, Status of Confluence and Off-take points of rivers, Canals, Flood events and Tide levels, Heritage water structures, Wetlands, Ground water regime, Soil, Water quality, Riparian Flora-Fauna, Sacred trees, Landuse-Land cover types, Impact of Dams/Barrages/Mining, Utilization of Flood plain, Riparian Rights etc.

b. **Photo & Videogrpahy:** Professional photographers having enough experience of Physical, Social, Ecological & Environmental issues will be engaged for Digital documentation of different events related to the Natural phenomenon.

1.4D. Post Field Analysis:

a. **Collection & Scrutinization of Field Data/Survey sheets:** Region / Block/ PS/ Mouza wise *Proforma for Listing the Natural Heritage* survey sheets will be checked / verified with the concern persons.

b. **GPS Data analysis:** Collecting the Ground Control Points (GCP's) & GPS-Tracks of Land surface & Waterbodies, the database will be processed through Map-Source Software

c. **Water & Soil Sample data analysis:** Sample will be supplied for analysis in reputed Govt. Departments or Private agencies.

d. **Preparation of Theme Maps:** Location, Administrative, Relief, Geology, Geomorphology, Drainage, Waterbody, Canals, Groundwater, Soil, Rainfall-Temperature, Vegetation, Tidal fluctuations, Landuse-Land cover, Shifting of Rivers, Embankment status, Population growth, Flood condition, Watershed divisions, GPS locations of specific units, Urbanization level etc.

1.4E. Validating Field & Analised Data:

a. **Landuse Land cover units:** Physical & Cultural units on land surface to be verified after revisit the area with recent Satellite Image.
b. **GPS locations:** After Overlaying the data on Satellite Image (Google Earth Image) Cross-checking will be done
c. **Water Sample analysis data:** COD, BOD, pH, EC, DO, Turbidity analysis of Water samples.
d. **Flora/Fauna:** Riparian, Sacred Species with their environment.

1.4E. Preparation & Submission of Report

a. **Preparation of Draft Report:** Preliminary Draft Report in Soft & Hard copy mode (1 Colour Printed) of each District will be submitted to INTACH, Kolkata Convener for Verification / Correction

b. **Report Correction:** Any corrections made by the funding authority will be incorporated judiciously into the Final Report.

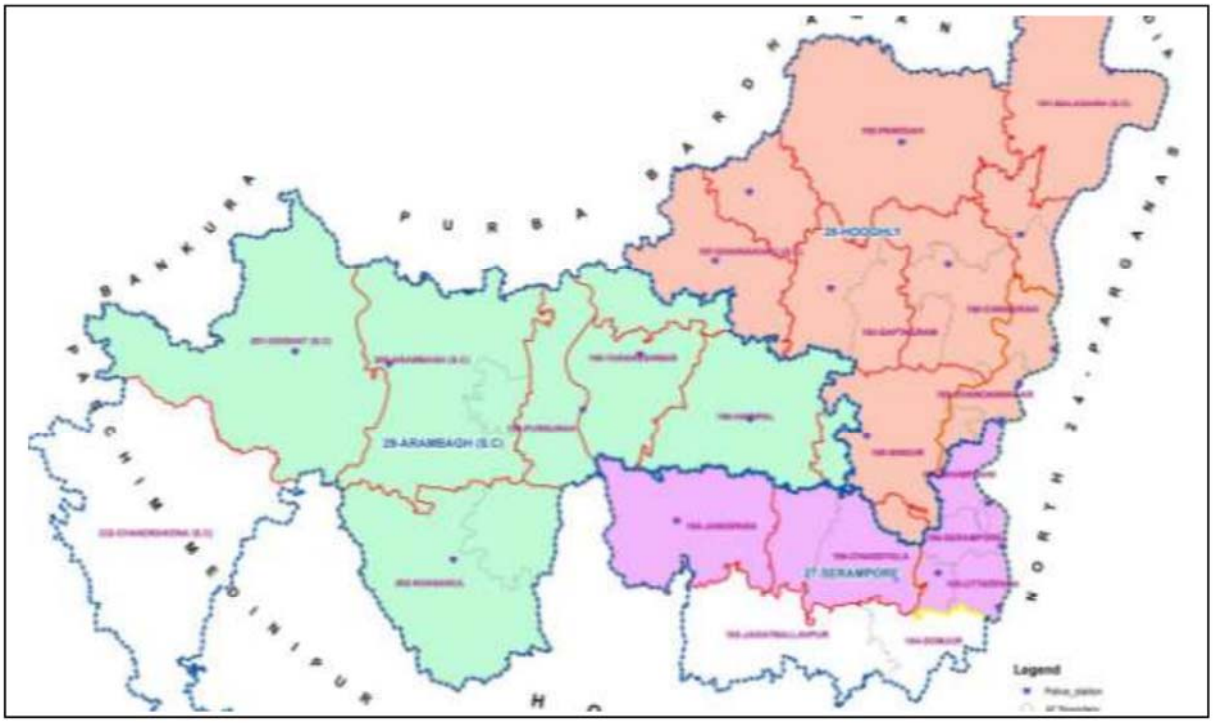
c. **Final Report Submission:** Final Report in form of Soft Copy will be submitted District wise and Hard copy Report will be submitted after completing the all Districts in three phases.

CHAPTER 2 : LOCATIONAL SETTING

2.1. Hugli district is one of the districts of the state of West Bengal in India. It can alternatively be spelt Hoogli or Hugli. The district is named after the Hugli River. This district with its Headquarters located at Chinsurah town is within the Burdwan Division of the State of West Bengal. So far history goes, the name "Hugli" is derived probably from the 'HOGLA', a tall reed, which grows in abundance on the riverbanks and in the marshy low lands below them. At dawn of history this part of the country was probably included in the territory held by the Suhmas, a tribe mentioned in juxtaposition with the Angas, Vangas and Pundras in the Mahabharata and also in the Mahabhashya, a grammar dating back to the second century B.C.

2.2. It is bounded on the north by Purba and Paschim Bardhaman ; on the east by Nadia and North 24 Parganas ; on the south by Haora and on the west by Midnapur & Bankura River Hugli forms the eastern boundary of the district.

2.3. In shape the district resembles an irregular parallelogram with a triangular projection on the extreme west beyond the Dwarakeswar river. The portion lying between the Hugli and the Dwarakeswar is a flat alluvial plain intersected by a number of sluggish rivers and



Map 3 – District Map with Blocks, Source : District Census

streams. The monotony of the dead level is broken by the raised village sites and high river banks ; by a sandy ridge, 10 or 12 feet high, east of the Dwarakeswar, which runs close to, and was probably thrown up by the Kana Dwarakeswar ; by artificial river embankments, and by a high embankment from Tribeni to Mahanad.

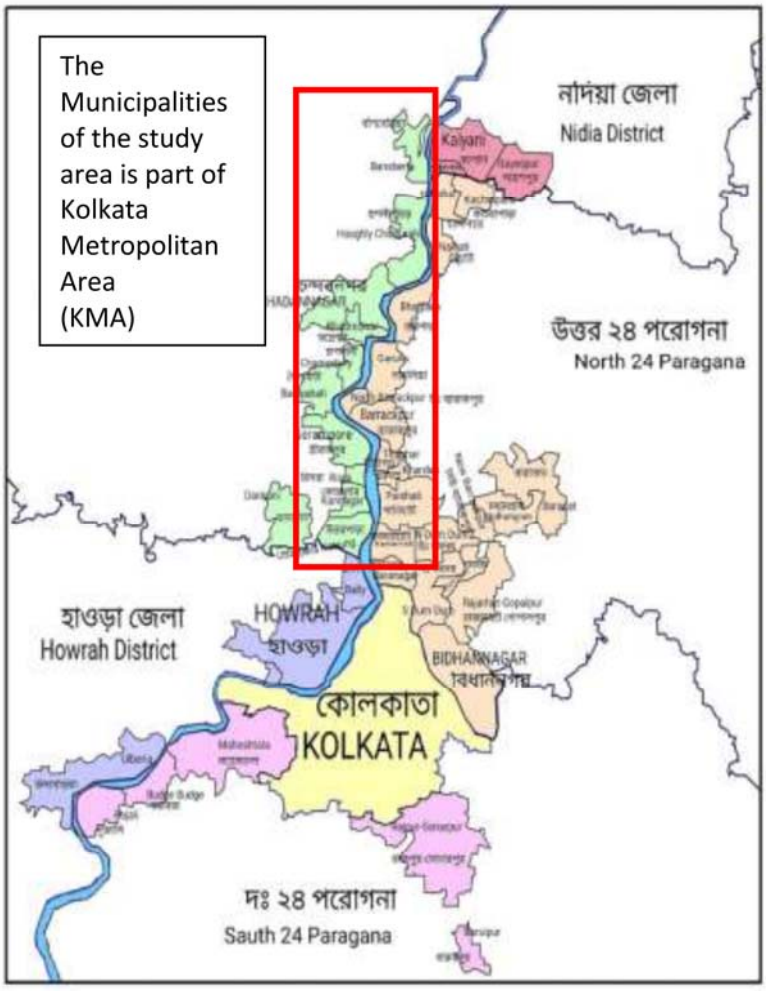
2.4. Between the rivers are a number of saucer-shaped depressions, which, according to their level, form extensive marshes or still more extensive stretches of rice fields. These depressions receive the drainage of the surrounding lands, and in the rains discharge their contents by small channels into the larger streams. Such is the general appearance of this tract, but in reality the country slopes gradually from the north and west towards the south and east .

2.5. The district is mainly the product of its rivers, and is watered, drained and partially changed by them. Hence for a correct knowledge of its physiography, as well as of its economic and sanitary conditions, a description of the river system is of no little importance. Under this term are included, first, the large rivers, secondly, the smaller streams, and lastly, the village channels. The large rivers are four in number, viz., the Hugli, forming the eastern boundary, the DSmodar separating the Serampore subdi-vision from the Arambagh thana, the Dwarakeswar forming the dividing line between the latter, and the Goghat thana, and its continuation, the Rupnarayan, forming the southwestern boundary for many miles.

2.6. The smaller streams, as a rule, flow from north to south and are either the offshoots or tributaries of the big rivers. They are fairly numerous, and form the main drainage channels of the district. Among them may be mentioned the Behula, the Kana Nadi, the Kunti Nadi (also called the Magra Khal or Kana Nadi), the Saraswati, the Kausiki, the Kantul with the Gopalnagar,the Khi & -with the Julka, the Kana Damodar, the Madaria, the Besia or Sankibhanga, the Mundeswarithe Kana Dwarakeswar, the Sankrft, the Jhumjhumi, the Amodar and the Tarajuli. Lastly, there are the village channels draining the village low lands, which in the rains usually join the larger streams or discharge their waters into one or other of them, but are often so silted up as to have no visible outfall After the rains their water is lost mainly by percolation, all that is left being stagnant pools in the deeper portions of the river beds.

2.7. Study Area: River Ganga in form of its most important distributary, Bhagirathi - Hugli covers about **92 km stretch** bordering this mighty district . For our Study area (7km along the bank of the river) we have 4 Blocks – 1.South Uttarpara - 2.Singur 3.Magra-Chuchura 4.Balagarh

District	Block	Area	Municipalities	Area
Hugli	SOUTH UTTARPARA	85.62	Uttarpara -Kotrung	11.75
	SINGUR	197.21	Konnagar	4.67
	MAGRA_CHUCHURA	99.25	Rishra	6.48
	BALAGARH	206.79	Serampore	17.60
			Baidyabati	12.03
			Bhadreswar	8.28
			Champadani	6.5
			Chandernagar	19
			Hugli_Chinsurah	17.29
			Bansberia	9.072



Map 4 : Map of KMA showing the municipalities

DISTRICT HUGLI - NATURAL HERITAGE DOCUMENTATION

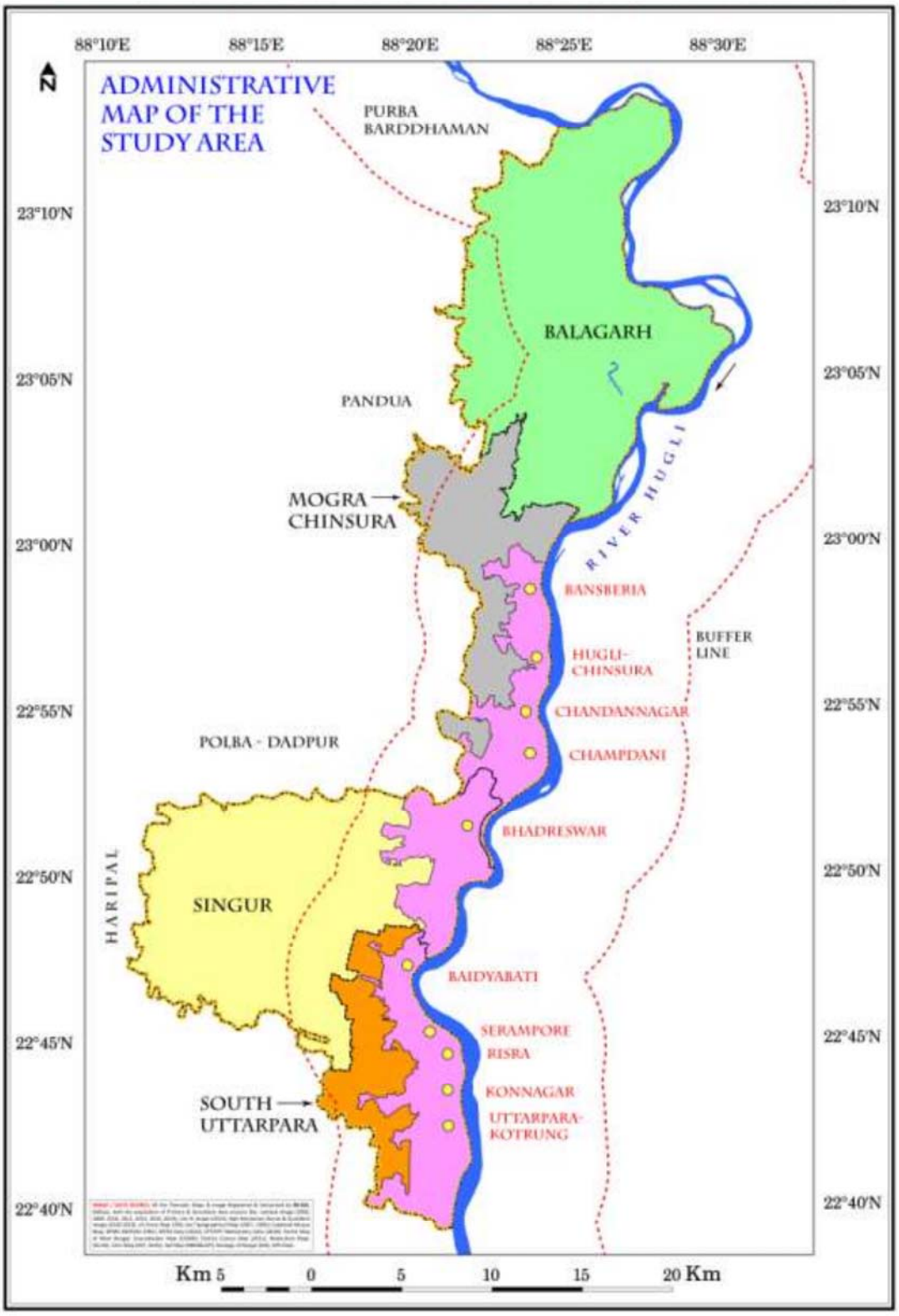


Plate 1 – Chinsura Ghat , Hugli , 22° 54.054'N 88° 24.229'E

Plate2 : Tribeni Ghat , 22° 59.078'N 88° 24.097'E

2.8. The Bhagirathi first touches Hugli a little south of the Kalna of Purba Bardhaman near Balagarh,. Thence it flows southwards as far as Tribeni where it is bifurcated into Jamuna and Saraswati. Both the rivers are in bad shape . The river is then jacketed from both sides beyond Tribeni as it coincides with the boundary of Kolkata Metropolitan Development Authority. Some of the major municipalities are found along Hugli River in this district. They are – a. Chuchura (Chinsura) b. Chandannagor c. Hugli d. Bansberia e. Serampore f. Konnagar g. Uttarpara etc. All of them are densely populated .

Map 6 : The Landsat , FCC image shows the highly meandering course of Bhagirathi-Hugli , Hugli .

CHAPTER III : PHYSICAL SETTING OF THE

Hugli district is located in the stable shelf on the southeastern part of the Lower Bengal Delta. The geosyncline trough of the Bengal basin had witnessed several marine transgressive and regressive phases since tertiary times where late tertiary estuarine to deltaic sediments were deposited (GSI, 2006). The entire district is covered with recent alluvium (Quaternary deposit), mainly composed of sand, silt and clay with the older alluvium is only restricted to the western fringe of the district (CGWB, 2008). The principal rivers Hugli, Damodar and Dwarkeswar with their tributaries have a gradual descent from north-west to south and south-east almost parallel to each other following the natural trend of the landscape (DHDR, 2011). According to genesis and evolution of land forms, the district can broadly be divided into two division's viz. (i) old alluvial plain occurring in the west of river Dwarakeswar and (ii) the monotonous level alluvial plain in the east. The eastern plain is intersected by a number of sluggish rivers and streams resulting formation of natural levees along the bank of rivers and depressed lands, marshes in the interfluve area of the rivers (Sarkar et al., 2001).Geomorphologically, the study area consists of the mature deltaic plains (25.35%), Para deltaic fan surface (46.23%), Present flood plains (16.90%), Deeply weathered plains/duricrust (1.76%) and Upland Plains (7.78%) . The geomorphology of the deltaic plain in the study area is a combination of delta of Hugli (Ganga) and Saraswati distributary system and their tributary channels belonging to the Damodar river. It is moderate to good for groundwater occurrence. The duricrust and Upland Plain origin due to the denudational processes and this parts of the study area fall under low prospects of groundwater occurrence

3.1. Relief: The district may be regarded as containing two main natural divisions, the plains and the uplands, the River Dwarakeswar forming the dividing line. The uplands are all comprised in **Goghat Block ,** which has an area of 378 sq.km or less than one-eighth of the district area. Here there is a perceptible rise in the surface, the drainage of which is carried off by numerous small streams. They all ultimately debouch into the River Dwarakeswar, and all have the usual characteristics of hill streams. They have a rapid current rising suddenly and falling as suddenly, they are generally dry after the rains, and they have sandy beds.

3.1.a. The remainder of the district presents several varieties of Chars - deltaic formation. First, the big rivers are busy throwing up chars year after year, a process of land formation which is best seen in the Hugli. Its deep stream is constantly varying its course, now swinging to the left and now to the right, cutting away the bank on one side and rebuilding it on the other, and all the while forming islands or banks on the sides or in the middle of its bed Successive floods and deposits of silt or sand add to the latter, and thus gradually raise the chari permanently above flood-level; or they sweep away the mobile deposits until no trace of the char is visible. This work of **alluviation** and **diluviation** goes on chiefly at the river bends

Map 9 : Confluence of Kunti River with Bhagirathi Hugli 23° 0.729'N 88° 25.097'E

or at the point of confluence with other streams, where the current is obstructed or becomes sluggish For example, in the large bend between **Guptipara** and **Sukhsagar**, or at its confluence with the **Kunti at Nayasarai**, numerous chare have been thrown up, and the deep mid-stream is frequently changing and incidentally furnishing a fruitful source of litigation.

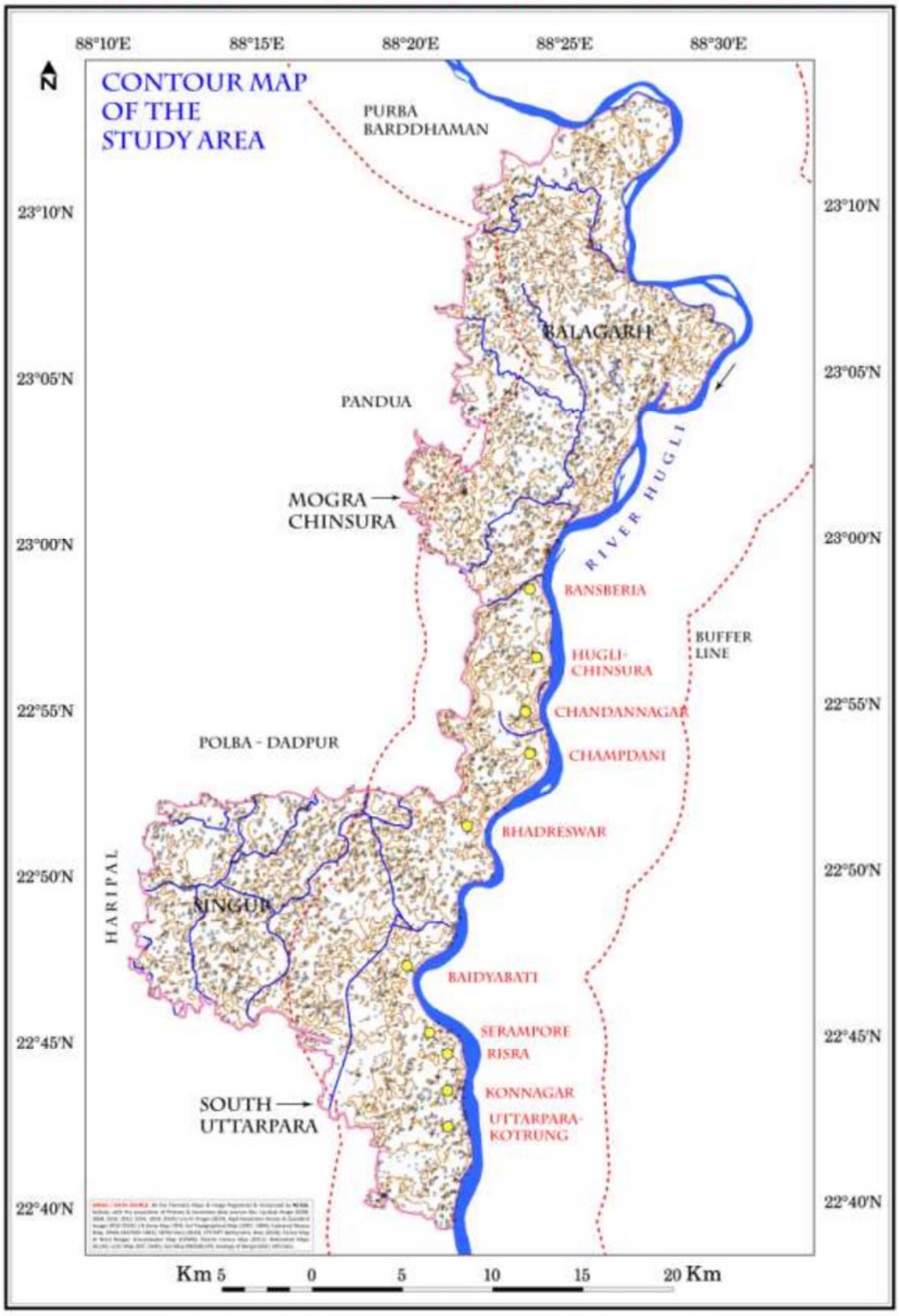
3.1.b. Further inland, between the Damodar and the Dwarakeswar, Lowlands, there is a tract of low-lying land, which, unless protected by embankments, is more or less liable to constant floods, as the boundary rivers, with their connected streams, are gradually raising their beds by annual deposits of silt and sand. In the rains this tract becomes a sheet of water, from which the village sites stand out like small islands. Owing to its liability to submersion,

cultivation is precarious. The peasant cannot count with certainty on getting a good crop of winter rice; no upland crops, such as jute, rice, or vegetables, can be safely grown; and roads cannot be properly kept up The smaller streams also come down in flood, and frequently change their courses, intertwining with one another in the lower parts of their courses in the most unexpected way. They also add to the general uncertainty of the crops, for if they deposit alluvial silt, excellent rabi crops are raised, but if sand, the land becomes sterile.

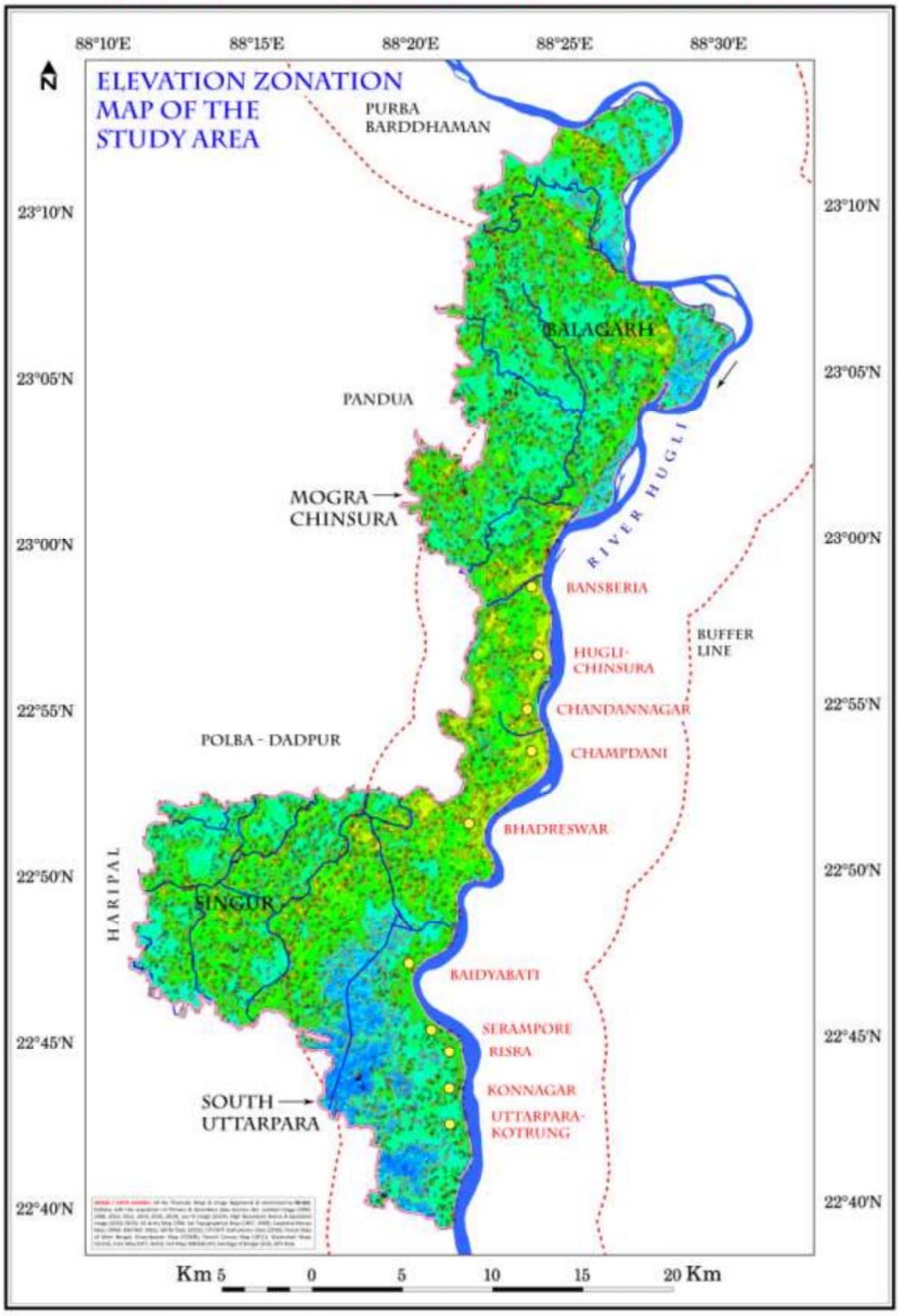
3.1.c. In the tract bounded by the Hugli and the Dsmodar the rivers are restrained by embankments, and, the level of the country being somewhat higher, the crops are fairly secure against floods. This area can be broadly divided into two sections, the high riparian strips of land along the banks of the rivers and the saucer-shaped depressions between them. The former are more or less occupied by village sites or high lands growing jute, autumn rice or vegetables. The depressions are turned into extensive rice fields, or, if still lower in level, form long marshes. These marshy depressions are especially numerous in the Serampore subdivision, being found between the Hugli and the Saraswati (i.«. the Dankuni marsh), between the Saraswati and the Kausiki, between the Kausiki and Kana Damodar, and between the Kana Damodar and the main channel of the Damodar.

3.1.d. Another peculiarity is that moat of the smaller streams have more or less silted up and have no visible outfall—a fact which accounts for them frequency with which the name hand (one-eyed) is applied to them. Such silting up is particularly noticeable in the Hugli subdivision above the **Kana Nadi.** Numerous small channels drain this tract during the rains, but they are so much silted up, that there is no current after the cessation of the monsoon. The stream is then represented by a succession of stagnant pools in the deeper parts of its bed, while the land, being undrained except by percolation, becomes water-logged. Thanas Polba, Dhaniakhali and Pandua, furnish numerous instances of this feature of the river system.

DISTRICT HUGLI - NATURAL HERITAGE DOCUMENTATION



DISTRICT HUGLI - NATURAL HERITAGE DOCUMENTATION



3.2. River System :

The district is mainly the product of its rivers, and is still watered, drained and partially changed by them. Hence for a correct knowledge of its physiography, as well as of its economic and sanitary conditions, a description of the river system is of no little importance. Under this term are included, first, the large rivers, secondly, the smaller streams, and lastly, the village channels. The large rivers are four in number, viz., the **Hugli**, forming the eastern boundary, the **Damodar** separating the Serampore subdi-vision from the Arambagh thana, the **Dwarakeswar** forming the dividing line between the latter, and the Goghat thana, and its continuation, the **Rupnarayan**, forming the south-western boundary for many miles. In our study area however it is mainly River Hugli which forms the eastern boundary. The smaller streams, as a rule, flow from north to south and are either the offshoots or tributaries of the big rivers. They are fairly numerous, and form the main drainage channels of the district. Among them may be mentioned the **Behula,** the **Kana Nadi**, the **Kunti Nadi** (also called the Magra Khal or Kana Nadi), the **Saraswati**, the **Kausiki**, the **Kantul** with the Gopalnagar,the Ghia -with the Julka, the Kana Damodar, the Madaria, the Besia or Sankibhanga, the Mundeswari, the Kana Dwarakeswar, the Sankra, the Jhumjhumi, the Amodar and the Tarajuli. Lastly, there are the village channels draining the village low lands, which in the rains usually join the larger streams or discharge their waters into one or other of them, but are often so silted up as to have no visible outfall After the rains their water is lost mainly by percolation, all that is left being stagnant pools in the deeper portions of the river beds.

The western bank of the Hugli is high and, where not occupied by houses, is covered by thick vegetation, except where eharh have been thrown up. The Damodar is embanked all along its eastern bank and is low-lying on the opposite side. The Dwarakeswar is bounded on the west by the uplands and southwards from Bali Daltonganj by embankments, with the result that floods are confined to the river bed and the low-lying Arambagh and Khanakul thanas. In the western part of the Hugli and Serampore subdivisions the narrow silted-up channels are unable to carry off with sufficient rapidity the volume of water which pours into them in times of heavy rain. They consequently overflow, causing considerable damage to the crops in thanas **Kristanagar** and **Chanditala** in the **Serampore** subdivision, and lower down in thana **Jagatballabhpur** and the eastern part of thana **Amta** in the Howrah district.

3.3. Climate : The climate of the district, on the whole, differs but little from that of Kolkata, being hot and moist. The weather is pleasantly cool, however, in the cold season, which lasts from November to February, the mean temperature falling to 18^0C. in January, with a diurnal variation of 2l)° to 25°. During this season the prevailing winds are from the north and north-west. Much dew is precipitated in the first two months, and humidity is reduced to 60 per cent, of saturation. Clouds almost entirely disappear, and the rainfall is scanty, usually not exceeding an inch. After the first week of November cyclones from the sea also cease ; but storms occasionally spring up from inland.

The hot season begins in March, and continues till the first week of June. The wind blows from the sea, veering from southwest to south ; and the mean pressure falls slowly from 29‘90 to 29'60. As the season advances, the weather grows hotter and hotter, tempered, however, in the afternoon by a fairly cool sea-breeze. The temperature rises from 26° C in March to 40°C in the first week of June, and both day and night grow almost equally hot, the mean diurnal variation falling to about 15° in May. Humidity and aqueous vapour pressure increase, though slowly, the mean humidity rising from between 60 and 70 per cent, in March to between 70 and 80 per cent, in May, and the mean aqueous pressure from '650 in March to '850 in May The number of cloudy days increases, and rainfall rises to over 5 inches in May. Hailstorms occur in March and April, and a few land storms in March. Sea storms first begin to be frequent in May with some severe cyclones. Towards the end of May and the beginning of Jime, the sea breeze often fails, making the days sultry and the nights oppressive, this being the prelude to the burst of the southwest monsoon.

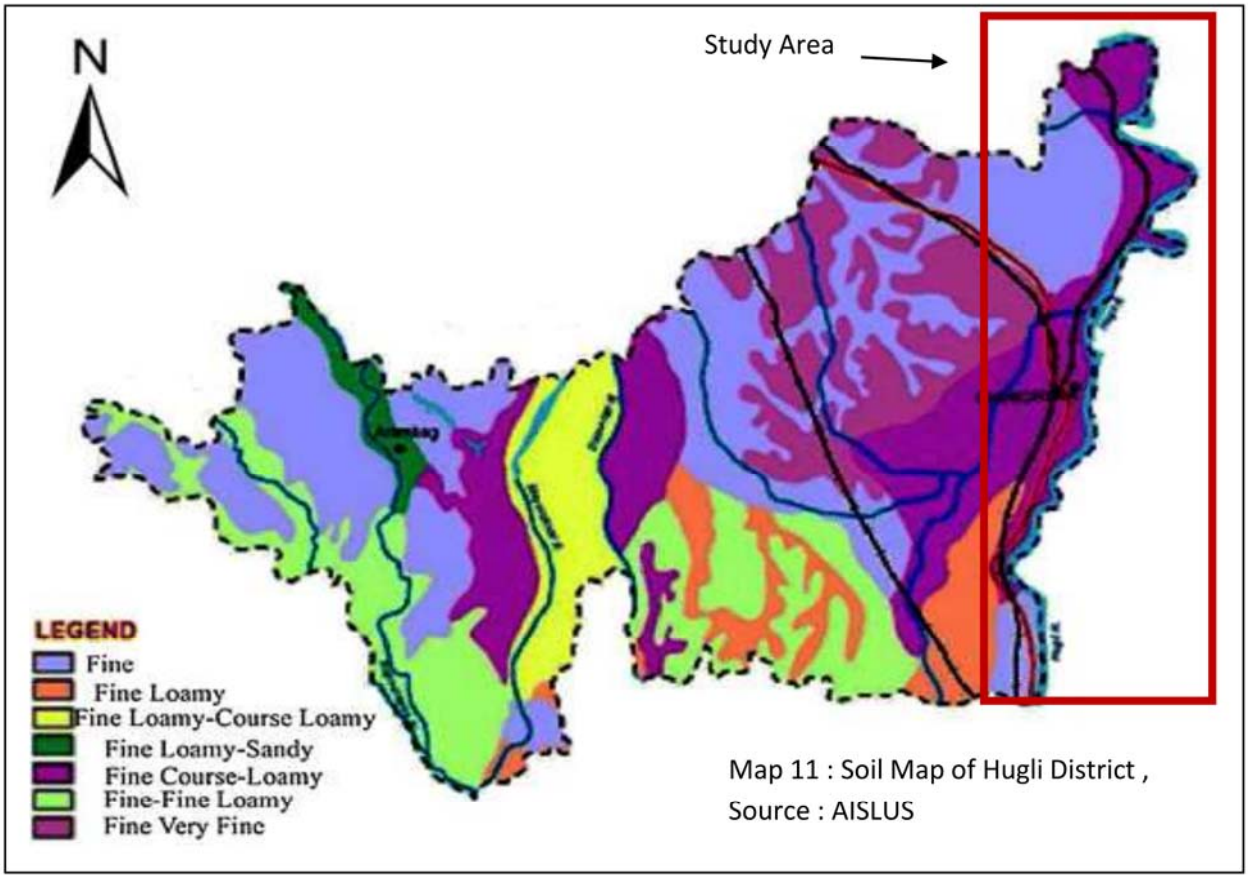
The rainy season begins with the arrival of the south - west monsoon, generally in the second week of June, and lasts till October. The air becomes somewhat cooler with the abundant rainfall, temperature falling from 40°C in June to 25°C to 27°C in September ; but the diurnal variation is small, being not more than 10°C. Humidity is necessarily high, rising to 90 per cent of saturation in July and August ; Cloudy, days are relatively numerous, and the rainfall heavy, the largest monthly fall, viz., over 12 inches, being recorded in July and August. Cyclones and storms form in the north-west corner of the Bay in the last three months (July to September). Though not so hot, the weather is trying and sultry from the middle of August to the middle of September, this period being vulgarly known as “1 Pacha Bhadra”, etc., the sodden month of Bhadra.

The south-west monsoon returns seaward between October and the first week of November. The days are fairly hot, but the nights become cooler, the diurnal variation being 15°. Humidity is reduced, but very slowly, to 75 per cent. Dews become heavier and more frequent at night, clouds decrease, and the monthly rainfall becomes less than 5 inches. During the retreat of the monsoon, storms and cyclones are frequent, some of the severest cyclones occurring in the last week of October and the first week of November. The rainfall of the Hugli district is ordinarily ample, Rainfall. averaging nearly 149 cm per annum.

3.4. Soil : Soils of the area are taxonomically classified into three orders i.e. Alfisol, Inceptisols and Entisols. All the 18 soils series identified in the area are further classified into 7 sub-orders, 8 great groups, 14 subgroups and 18 families. Soils of the district have tremendous potential for variety of agriculture crops. Proper crop rotation and diversification of crops are necessary for sustainable agricultural production. The entire district is covered with recent alluvium (Quaternary deposit), mainly composed of sand, silt and clay with the older alluvium is only restricted to the western fringe of the district (CGWB, 2008). The principal rivers Hugli, Damodar and Dwarkeswar with their tributaries have a gradual descent from north-west to south and south-east almost parallel to each other following the natural trend of the landscape (DHDR, 2011). According to genesis and evolution of land forms, the district can broadly be divided into two division's viz. (i) old alluvial plain occurring in the west of river Dwarakeswar and (ii) the monotonous level alluvial plain in the east. The eastern plain is intersected by a number of sluggish rivers and streams resulting formation of natural levees along the bank of rivers and depressed lands, marshes in the interfluve area of the rivers (Sarkar et al., 2001).

Based on soil texture data the study area is classified as four types namely: loam, silty clay, silty clay loam, sandy loam (Fig. 4b). The soils are dominantly loam (55.09%) followed by silty clay loam (22.60%), silty clay (21.95%) and sandy loam (0.35%). Silty clay loam soils are mostly found in Balagarh, Chinsurah, Khanakul and chanditala areas. Silty clay soils are mostly found in Polba, Goghat, Serampur, Bhadreswar and Arambag areas. Sandy loam soils are located in some small area of Goghat and Khanakul blocks. Loamy soils are mostly spread over the entire district. Sandy soil has low runoff potential and high infiltration rate, hence sandy based soil was given highest weight (Table 3). While the clayey soil has

comparatively lower infiltration rates and high runoff potential, hence clayey mixed soil was given comparatively the lower weights.



Map 11 : Soil Map of Hugli District ,
Source : AISLUS

3.5. Geology : Quaternary sediments (i.e. newer alluvium and older alluvium) of huge thickness cover entire district. Four types of geologic lithology namely a) sand, silt and dark grey clay (83.36%) (Chinsurah formation) b) sand, sandy loam, silt and silty clay (11.72%) (Sijua formation) c) Very fine sand (1.51%) (Present day deposit) d) Lateritised boulder, conglomerate (3.42%) (Lalgrah formation) arefound in the study area (Fig. 5a). The alluvial sediments in the area viz, the Sijua formation, the Chinsurah formation, and Present-day flood plain deposits are identified along the Dwarakeswar, Damodar and Hugli rivers. Chinsurah formation covers the central and eastern part of the district. It is thin in the central part and generally thickness to the east. Sediments vary from fine sand, silt and clay to plastic clay. The oldest of the alluvium is Sijua formation and it covers the major portion along the western part of the area and lies unconformably over the Lalgrah formation. It is composed mainly of sand, sandy loam which is gradually change to silt and silty clay in the lower reaches. Present day flood plain deposits occur along the course and banks of the river flowing in the area (GSI, 2006). The sediments range from loose unconsolidated, sub angular,

coarse vary to coarse grey sands and gravels grading gradually to greyish white silt and clay. The lateritic uplands designated as Lalgrah formation present to the west and north of the Kamarpukur. It consist of lateritised boulder conglomerate, rework secondary laterite and lateritised grit and is frequently capped by brownish red [1 me3 m thick residual soil (latosol)]. Over the flatted top eroded surface of the Archaean basement estuarine to deltic sediments were deposited during the late tertiary period which have been grouped as Bhairab Banki formation. Laterization of this formation gave rise to the Lalgrah formation.

3.6. Natural Vegetation: There are no forests in the district, barring **"Sabujdwip" ,**a char near the confluence of Behula and Hugli vegetation is found. Besides, patches of scrub jungle occur in thana Goghat, where plants characteristic of dry uplands make their appearance, such as species of *Gmelina, Wendlandia, Stipa, Fragus and Evolious*, which are not found, or occur only as planted species, in the rice plain. The vegetation is, on the whole, however, somewhat sparse, lacking both the large trees of the uplands and the luxuriant undergrowth of the lowlands The rest of the Arambagh subdivision is too much cut up by rivers and creeks to permit of extensive cultivation, and has the usual aquatic plants and marsh weeds common to alluvial lands. The tract between the Damodar and the Hughli contains the plants generally found in Lower Bengal, both cultivated and wild. First, there are reeds, sedges and aquatic plants in the marshes and swampy rice fields ; next, weeds, shrubs and smaller plants in the fields and commons a little higher up ;lastly, surrounding the village itself, a belt of bamboos, cocoanuts, palms, mangoes, figs, jack and other trees. The river banks, where not occupied by houses, ghats or roads, are lined with bamboos, figs, tamarisks and date-palms with thick undergrowth The chars, being usually sandy, have very few trees ; but where covered with silt, grow excellent rabi crops, and if slightly raised, rice crops Inland, the tanks and stagnant pools are covered with lotuses, libes, pands, both large and small, and other aquatic varieties. Generally speaking, the most noticeable botanical feature of the district is the luxuriant growth of plant life natural to a soil of great natural fertility with an abundant rainfall.

The total areas was surveyed and the list of tree species has been documented in the following table.

Plate 3 : The usual riparian vegetation , Mograhat , 23° 12.995'N 88° 28.305'E

food or for sale ; and in some of the towns a few geese. Animals, turkeys and guinea-fowls. Among wild animals, jackals are occasionally found in the north of the district from Balagarh to Guptipara, and are also found elsewhere.

Stavorinus, writing about 1769-70, says that "tigers are very numerous in the woods, and often sally out into the inhabited places ; there are likewise a vast number of vdld buffaloes in the woods."* Both tigers and wild buffaloes have long since disappeared, the last occasion on which a tiger is reported to have been seen being in 1830 among the ruins of Satgaon. Monkeys abound aU. over the district, especially the hanumdn or Inigur (SemnopUheoits Enlellm). Wild hogs are common in some parts, and do a good deal of damage to crops in the Ilooghly subdivision. Jackals are numerous, and other common mammals are the musk-rat, common rat, mouse, small grey-striped squirrel, civet cat, and mongoose Hares occur in some parts, especially round Dhaniakhali, but are nowhere common. Deer have long since been exterminated. Both the ordinary small bat and the flying fox are frequent. The Gangetic tortoise (called shmiik) is common in the Hugli.

Plate 4: Sabujdweep ,a tourist spot in the midst of Bhagirathi Hugli , near the confluence of Behula River , Somra , Hugli

Map 12: Sabujdweep near Char Noapara 23° 8.761'N 88° 27.002'E

Present Condition of Flora and Fauna of the Study Area including Sabuj Dwip

Brief methodology for the floral and faunal survey is given below.

1. Sampling was done mostly in random manner. 2. The total area was surveyed by walking at day time. 3. Surveys were conducted for the maximum possible hours in day time. 4. Tree species were documented through physical verification on foot and photographed each species as much as possible. 5. For faunal species we emphasized mainly on the direct sighting. Also call of various birds and amphibians and nesting of some faunal species were considered as direct evidences. 6. Observing mammals depend critically on the size of the species and its natural history. Diurnal species are common and highly visible. Nocturnal species, however, are rare and difficult to detect. Small mammals like the field rats were found near their burrows, particularly during their entry or exit times in or out from their burrows respectively. In some cases, dung deposits and footprints were also observed that served as a potential clue for the presence and absence of the concerned species. These secondary evidences were all noted with time and space co-ordinates.

Table 1a.– List of Trees in the study area

Sl.1	Name of the species	Scientific name	Family
1	African Tulip	*Spathodia campanulata*	Bignoniaceae
2	Allspice Tre	*Pimenta dioica*	Myrtaceae
3	Amla	*Emblica officinalis*	Euphorbiaceae
4	Ashoka Tree	*Saraca asoka*	Fabeceae
5	Bahera	*Terminalia bellirica*	Combretaceae
6	Banyan Tree	*Ficus benghalensis*	Moraceae
7	Bhawarmal, Bohar Biharukh	*Hymenodictyon orixense*	Rubiaceae
8	Buddha Coconut	*Pterygota alata*	Sterculiaceae
9	Burma Teak	*Tectona grandis*	Verbenaceae
10	Butterfly Tree	*Bauhinia purpurea*	Caesalpiniaceae
11	Caledonia Pine/ Christmas Tree	*Araucaria cookii*	Arucariaceae
12	Banana	*Musa*	Bananas
13	Chhatiyan / Devil's Tree	*Alstonia scholaris*	Apocynaceae
14	Cluster Fig	*Ficus glomerata*	Moraceae
15	Copper Pod Tree	*Peltoforum pterocarpum*	Caesalpiniaceae
16	Custard Apple	*Annona reticulata*	Annonaceae
17	Drumstick Tree	*Moringa oleifera*	Moringaceae
18	Dysoxylum	*Dysoxylum sp. Dysoxylum costulatum Miq.*	Miliaceae
19	Elephant Apple	*Dillenia indica*	Dilleniaceae
20	Eucalyptus	*Eucalyptus spp.*	Myrtaceae
21	False White Teak	*Trewia nudiflora*	Euphorbiaceae
22	Ficus	*Ficus sp.*	Moraceae
23	Flame tree	*Butea monosperma*	Faboideae
24	Gardenia,	*Cape jasmine Gardenia jasminoides*	Rubiaceae
25	Gliricidia	*Gliricidia sepium*	Fabaceae

26	Gold Mohur	*Flame Tree Delonix regia*	Caesalpiniaceae
27	Golden Apple	*Aegle marmelos*	Rutaceae
28	Golden Shower	*Acacia auriculiformis*	Fabaceae
29	Guava	*Psidium guajava*	Myrtaceae
30	Gulab Jamun	*Syzygium jambos*	Myrtaceae
31	Haritaki	*Terminalia chebula*	Combretaceae
32	Indian Almond	*Terminalia catappa*	Combretaceae
33	Indian Blackberry	*Syzygium cumini*	Myrtaceae
34	Indian Blackberry (Small)	*Syzygium sp.*	Myrtaceae
35	Indian Cork Tree	*Millingtonia hortensis*	Bignoniaceae
36	Indian Fir / Cementry Tree	*Polialthia longifolia*	Annonaceae
37	Indian Jujube	*Ber Ziziphus mauritiana*	Rhamnaceae
38	Indian Lilac Tree	*. Melia azedarach*	Meliaceae
39	Indian Mehoginy	*Cedrela toona*	Meliaceae
40	. Indian Rubber Tree	*Ficus elastica*	Moraceae
41	Indrajao	*Holarrhena pubescens*	Apocynaceae
	Jack Fruit	*Artocarpus heterophyllus*	Moraceae
42	Kadam	*Anthocephalus chinensis*	Rubiaceae
43	Lichi	*Litchi chinensis*	Sapindaceae
44	Longan	*Euforia longan*	Sapindaceae
45	Mango	*Mangifera indica*	Anacardiaceae
46	Neem Tree	*Azadirachta indica*	Meliaceae
47	Pomelo	*Citrus maxima*	Rutaceae
48	Pongam Tree	*Pongame Oil Tree Pongamia pinnata*	Fabaceae
49	Pride of India	*Lagerstroemia speciosa*	Lythraceae
50	Putranjiva / Lucky Bean Tree	*Putranjiva roxburghii*	Euphorbiaceae
51	Queen of the night	*Nyctanthes arbortristis*	Oleaceae
52	. Rain Tree	*Samanea saman*	Mimosaceae
53	Red Jasmine Tree	*Plumeria rubra*	Apocynaceae
54	Red Silk Cotton Tree	*Bombax ceiba*	Malvaceae
55	Sabeda	*. Manikara sapota*	Sapotaceae
56	Sand Paper Tree	*Streblus asper*	Moraceae
57	She-Oak / Indian Christmas Tree	*Casuarina equisetifolia*	Casuarinaceae
58	Small-leaved Mahogany	*Swietenia mahagoni*	Meliaceae
59	Spanish cherry / Bakul	*. Mimusops elengi*	Caesalpiniaceae
60	. Star Fruit	*Averrhoa carambola*	Averrhoaceae
61	Subabul Leucena	*leucocephela*	Mimosaceae
62	Tamarind	*Tamarindus indica*	Caesalpiniaceae
63	Vilayati Babul	*Pithecolobium dulce*	Mimosaceae
64	Water Apple Bay Cedar	*Guazuma ulmifolia*	Malvaceae
65	White Fig	*Ficus infectoria*	Moraceae
66	Wild Mango	*Spondias pinnata*	Anacardiaceae

Sl	Aquatic Plants	Scientific Name	Family
79	Alligator weed	*Alternanthera philoxeroides*	Amaranthaceae
80	Duck lettuce	*Ottelia alismoides*	Hydrocharitaceae
81	Tape grass	*Vallineria spiralis*	Hydrocharitaceae
82	Taro	*Colocasia esculenta*	Araceae
83	Water hyacinth	*Eichhornia crassipes*	Pontederiaceae
84	. Water lily	*Nymphea nouchali*	Nymphaeaceae
85	Waterthyme	*Hydrilla verticillata*	Hydrocharitaceae

Table 1b- List of Grasses in the study area

Sl	Grasses	Scientific name	Family
74	Bamboo	*Bambusa sp.*	Poaceae
75	Common Carpet grass	*Axonopus sp*	Poaceae
76	Durba	*Cynodon dactylon*	Graminae
77	Hogla Grass	*Typha elephantine, T. Latifolia*	
78	Kans Grass	*Saccharum spontaneum*	

Table 1c– List of Herbs in the study area

	Herbs	Scientific Name	Family
86	Achyranthes	*Achyranthes aspera*	Amaranthaceae
87	Ageratum	*Ageratum conyzoides*	Asteraceae
88	Alocasia	*Alocasia indica*	Arecaaceae
89	Aloe Vera	*Aloe barbadensis*	Liliaceae
90	Alternanthera	*Alternanthera philoxeroides*	Amaranthaceae
91	Alternanthera	*Alternanthera paronychioides*	Amaranthaceae
92	Alternanthera	*Alternanthera sessilis*	Amaranthaceae
93	Amaranthus	*Amaranthus viridis*	Amaranthaceae
94	Amaranthus	*Aerva javanica*	Amaranthaceae
95	American Mint	*Anisomeles indica*	Lamiaceae
96	Asian Spiderflower	*Cleome viscosa*	Cleomaceae
97	Bachelor Button Flower	*Gomphrena globosa*	Amaranthaceae
98	Ban Dhone / Mitha Pata	*Scoparia dulcis*	Scrophulariaceae
99	Banana Tree	*Musa sp.*	Musaceae
100	Bengal Arum	*Typhonium trilobatum*	Areceae
101	Bhringaraj	*Wedelia trilobata*	Asteraceae
102	Bhuin Okra	*Phyla nodiflora*	Verbenaceae
103	Black Nightshade	*Solanum*	Solanaceae
104	Bluebell	*Ruellia prostrata*	Acanthaceae
105	Boatlily,	*Moses-in-the-cradle Tradescantia spathacea*	Commelinaceae
106	Bon Tepari	*Physalis minima*	Solanaceae
107	Bon Tulshi	*Croton bonplandianum*	Euphorbiaceae
108	Calendula,	*Common Marigold Calendula officinalis*	Asteraceae
109	Chrysanthemums	*Chrysanthemum sp.*	Asteraceae

110	Coat Buttons	*Tridax Daisy Tridex procambens Asteraceae*	Lamiaceae
111	Coleus	Coleus *sp.*	Lamiaceae
112	Commelina	*Commelina benghalensis*	Commelinaceae
113	Dahlia	*Dahlia sp.*	Asteraceae
114	Diamond Flower	*Corymbose hedyotis Hedyotis corymbosa*	Rubiaceae
115	Famine Weed	*Parthenium hysterophorus*	Asteraceae
116	Gerbera	*Gerbera jamesonii*	Asteraceae
117	Graceful Pouzalz's Bush	*Pouzalzia indica*	Urticaceae
118	Heartleaf Fanpetals	*Sida humilis*	Malvaceae
119	Holy Basil	*Tulasi Ocimum sanctum*	Lamiaceae
120	Impatiens, Touch-me-not	*Impatiens*	Balsaminaceae
121	Indian Cress	*Nasturtium indicum*	Brassicaceae
122	Indian Water Navelwort	*Centella asiatica*	Apiaceae
123	Kalmegh., Green chirayta	*Andrographis paniculata*	Acanthaceae
124	Keshut	*Eclipta alba*	Asteraceae
125	khirika	*Euphorbia hirta*	Euphorbiaceae
126	Krishna Tulsi	*Ocimum tenuiflorum*	Lamiaceae
127	Kukurshoka	*Blumea laciniata*	Asteraceae
128	Kulekhara	*Hygrophila schulli*	Acanthaceae
129	Lobster claw Hanging heliconia	*Strelitzia reginae*	Musaceae
130	Marigold Flower	*Tagetes sp.*	Asteraceae

131	Agave sp.	*Agave sp.*	Asparagaccac
132	Ban jamir	*Glycosmis pentaphyla*	Ruraceae
133	Bleeding Heart	*Clerodendrum thomsoniae*	Lamiaceae
134	Castor Oil Plant	*Ricinus communis*	Euphorbiaceae
135	China Rose	*Hibiscus rosa*	Malvaceae
136	Chitrak , Plumbago,White leadwort	*Plumbago zeylanica*	Plumbaginaceae
137	Citrus	*Citrus acida*	Rutaceae
138	Citrus/	*Citron Citrus medica*	Rutaceae
139	Clerodendrum	*Clerodendrum viscosum*	Verbenaceae
140	Common Wireweed	*Sida acuta*	Malvaceae
141	Croton	*Codiaeum sp var.*	Euphorbiaceae
142	Devil’s cotton	*Abroma augustum*	Sterculiaceae
143	Devil's Trumpets	*Datura sp.*	Solanaceae
144	Dracacna	*Pleomele reflexa 'Variegata'*	Asparagaceae
145	Duranta	*Duranta repens*	Verbenaceae
146	Fever tea	*Lemon Bush Lippia javanica*	Verbenaceae
147	Fever tea/	*Lemon Bush Lippia javanica*	Verbenaceae
148	Garden Cosmos	*Cosmos bipinnatus*	Asteraceae
149	Giant Milkweed	*Calotropis gigantea*	Asclepiadaceae
150	Green Chili	*Capsicum sp.*	Solanaceae
151	Ground Fig	*Ficus heterophylla*	Moraceae
152	Heliconia	*Strelitzia. sp.*	Musaceae
153	Indian heliotrope	*Heliotropium indicum*	Boraginaceae
154	Ixora	*Ixora sp*	Rubiaceae
155	Jasmine	*Jusminum pubescens*	Oleaceae

156	Karipata	*Murraya koenigii*	Rutaceae
157	Kasunda	*Baner Cassia sophera*	Fabaceae
158	. Lagerstroemia	*Lagerstroemia indica*	Lythraceae
159	Lantana	*camara*	Verbenaceae
160	Lime	*Citrus acida*	Rutaceae
161	Milk Flower (Double)	*Tabernaemontana coronaria Apocynaceae*	Apocynaceae
162	Milk Flower (Dwarf)	*Tabernaemontana divaricata Apocynaceae*	Apocynaceae
163	Milk Flower (Plain)	*Tabernaemontana divaricata Apocynaceae*	Apocynaceae
164	Milli	*Euphorbia milli Ericaceae*	Ericaceae
165	Muktojhuri	*Acalypha indica*	Euphorbiaceae
166	Musaenda	*Mussaenda sp.*	Rubiaceae
167	Oleander	*Nerium oleander*	Apocynaceae
168	Orange Jasmine	*Murraya paniculata*	Rutaceae
169	Philippine Violet	*Barleria strigosa Acanthaceae*	Acanthaceae
170	Plumed Cockscomb	*Woolflower Celosia argentea*	Amaranthaceae
171	Poinsettia	*Euphorbia pulcherrima*	Euphorbiaceae
172	Powder Puff	*Calliendra sp.*	Euphorbiaceae
173	Ravenia Pink	*Lemonia Ravenia spectabilis*	Fabaceae
174	Roast Potato	*Phyllanthus reticulatus*	Rutaceae
175	Plant Poir.	*Euphorbiaceae*	Euphorbiaceae
176	Rose	*Rosa*	Rosaceae
177	Salparni	*Desmodium gangeticum*	Fabaceae
178	Scarlet Sage	*Salvia splendens*	Lamiaceae
179	Shooting Star Star Flower	*Pseuderanthemum sp*	Acanthaceae
180	. Siam Weed	*Bitter bush Eupatorium odoratum*	Asteraceae
181	Slipper Plant	*Pedilanthus tithymaloides*	Euphorbiaceae
182	Spicy Jatropha	*Jatropha panduraefolia*	Euphorbiaceae
183	Stinking Cassia	*Cassia tora Fabaceae*	Fabaceae
184	Tecoma	*Tecoma gaudichaudi*	Bignoniaceae
185	Thuja	*Thuja orientalis*	Cupressaceae
186	Wild Eggplant	*Solanum torvum*	Solanaceae
187	Bridal Bouquet	*Plumeria pudica*	Apocynaceae
188	Yellow Cosmos	*Cosmos sulphureus*	Asteraceae
189	Yellow oleander	*Cascabela thevetia*	Apocynaceae

Table 1d : List of Creepers in the Study Area

	Creepers	Scientific Name	Family
189	Allamanda	*Allamanda* sp.	Apocynaceae
190	Aparajita	*Clitoria ternatea*	Fabaceae
191	Bengal Trumpet Vine,	*Thunbergia grandiflora*	Acanthaceae
192	Birdfoot Grape	*Cayratia pedata*	Vitaceae
193	Birdfoot Grape-	*Cayratia* sp.	Vitaceae
194	Bougainvillea	*Bougainvillea* sp.	Nyctaginaceae
195	Cayratia	*Cayratia trifolia*	Vitaceae
196	Chinese creeper	*Micania micrantha*	Asteraceae
197	Climbing Mallotus	*Mallotus repandus*	Euphorbiaceae
198	Coral Creeper / Antigonum	*Antigonon leptopus*	Polygonaceae
199	Corkystem Passionflower	*Passiflora suberosa*	Passifloraceae
200	Gulanchalata	*Tinospora cordifolia*	Menispermaceae
201	Hemigraphis	*Hemigraphis hirta*	Acanthaceae
202	Indian Stinging Nettle	*Tragia involucrata*	Euphorbiaceae

203	Ipomoea	*Ipomoea aquatica*	Convolvulaceae
204	Justicia	*Justicia simplex*	Acanthaceae
205	Money Plant, Ivy A	*Epipremnum aureum*	Areceae
206	Passion Flower	*Passiflora suberosa*	Passifloraceae
207	Philodendron	*Philodendron* sp.	Areceae
208	Rangoon Creeper	*Combretum indicum*	Combretaceae
209	Roundleaf Bindweed	*Evolvulus nummularius*	Convolvulaceae
210	Small White Morning Glory	*Ipomoea obscura*	Convolvulaceae
211	Snake Vine	*Stephania japonica*	Menispermaceae
212	Telakuchu	*Coccinia grandis*	Cucurbitaceae
213	Tiliacora	*Tiliacora racemosa*	Menispermaceae

Table 2– Different Species of animals in our study area

Sl.no	**Mammals**	**Scientific Names**
1	Asian Palm Civet	*Paradoxurus hermaphroditus*
2	Common Pipistrelle	*Pipistrellus pipistrellus*
3	Five-striped Palm Squirrel	*Funambulus pennantii*
4	Fruit Bat	*Pteropus sp.*
5	Gray Langur	*Semnopithecus sp.*
6	Indian Flying Fox	*Pteropus giganteus*
7	Indian Grey Mongoose	*Herpestes edwardsi*
	Birds	**Scientific Names**
1	Alexandrine Parakeet	*Psittacula eupatria*
2	Asian Koel	*Eudynamys scolopaceus*
3	Asian Openbill	*Anastomus oscitans*
4	Asian Palm Swift	*Cypsiurus balasiensis*
5	Asian Pied Starling	*Gracupica contra*
6	Black Drongo	*Dicrurus macrocercus*
7	Black Kite	*Milvus migrans*
8	Black-hooded Oriole	*Oriolus xanthornus*
9	Black-naped Monarch	*Hypothymis azurea*
10	Indian Pond Heron	
11	Jungle Babbler	*Turdoides striatus*
12	Jungle Myna	*Acridotheres fuscus*
13	Lesser Goldenback	*Dinopium benghalense*
14	Lineated Barbet	*Megalaima lineata*
15	Marsh Sandpiper	*Tringa stagnatilis*
16	. Oriental Magpie Robin	*Copsychus saularis*
17	Pale-billed Flowerpecker	*Dicaeum erythrorynchos*
18	Purple Heron	*Ardea purpurea*
19	Purple Sunbird	*Nectarinia asiatica*
20	Purple-rumped Sunbird	*Nectarinia zeylonica*
21	Indian Cormorant	*Phalacrocorax fuscicollis*
22	House Sparrow	*Passer domesticus*
23	House Crow	*Corvus splendens*
24	Green Bee-Eater	*Merops orientalis*
25	Fulvous-breasted Woodpecker	*Centropus sinensis*
26	Greater Coucal	*Dendrocopos macei*
27	Eurasian Collared Dove	*Streptopelia decaocto*

28	Eastern Jungle Crow	*Corvus levaillantii*
29	Coppersmith Barbet	*Megalaima haemacephala*
30	Common Tailorbird	*Orthotomus sutorius*
31	Common Sandpiper	*Actitis hypoleucos*
32	. Common Pigeon	*Columba livia*
33	Common Myna	*Acridotheres tristis*
34	Common Kingfisher	*Alcedo atthis*
35	Common Iora	*Aegithina tiphia*
36	. Common Hoopoe	*Upupa epops*
37	Common Hawk Cuckoo	*Hierococcyx varius*
38	Cattle Egret	*Bubulcus ibis*
39	Blue-throated Barbet	*Megalaima asiatica*
40	Black-naped Oriole	*Oriolus chinensis*
41	Red-vented Bulbul	*Pycnonotus cafer*
42	Red-whiskered Bulbul	*Pycnonotus jocosus*
43	Rose-ringed Parakeet	*Psittacula krameri*
44	Rufous Treepie	*Dendrocitta vagabunda*
45	Shikra	*Accipiter badius Accipitridae*
46	Spotted Dove	*Stigmatopelia chinensis*
47	Spotted Owlet	*Athene brama*
48	Stork-billed kingfisher	*Pelargopsis capensis*
49	White Wagtail	*Motacilla alba*
50	Taiga Flycatcher	*Ficedula albicilla*
51	White-breasted Waterhen	*Amaurornis phoenicurus*
52	White-throated Kingfisher	*Halcyon smyrnensis*
53	Yellow-footed Green Pigeon	*Treron phoenicoptera*
	Reptiles	***Scientific Names***
1	Bengal Monitor Lizard	*Varanus bengalensis*
2	Buff Striped Keelback	*Amphiesma stolatum*
3	. Checkered Keelback	*Xenochrophis piscator*
4	Common House Gecko	*Hemidactylus frenatus*
5	Oriental Garden Lizard	*Calotes versicolor*
6	Rat Snake	*Zamenis longissimus*
7	Russell's Viper	*Daboia russelii*
8	Skink	*Lampropholis sp.*
	Butterflies	***Scientific Names***
1	Angled Castor	*Ariadne ariadne*
2	Blue Mormon	*Papilio polymnestor*
3	Brown Awl	*Badamia exclamationis*
4	Blue Tiger	*Tirumala limniace*
5	Chestnut Palm	*Bob Iambrix salsala*
6	Chestnut-streaked	*Sailer Neptis jumbah*
7	Commander	*Moduza procris*
8	Common Banded Awl	*Hasora chromus*
9	Common Baron	*Euthalia aconthea*
10	Common Bushbrown	*. Mycalesis perseus*
11	Common Castor	*Ariadne merione*
12	. Common Cerulean	*Jamides celeno*
13	Common Crow	*Euploea core*
14	Common Evening Brown	*Melanitis leda*
15	Common Five-ring	*Ypthima baldus*

16	Common Four-ring	*Ypthima huebneri*
17	Common Grass Yellow	*Eurema hecabe*
18	Common Guava Blue	*Virachola isocrates*
19	Common Gull	*Cepora nerissa*
20	Common Jay	*Graphium doson*
21	Common Jezebel	*Delias eucharis*
22	Common Leopard	*Phalanta phalantha*
23	Common Lineblue	*Prosotas nora*
24	Common Mime	*Papilo clytia*
25	Common Mormon	*Papilo polytes*
26	Common Palmfly	*Elymnias hypermnestra*
27	Common Pierrot	*Castalius rosimon*
28	Common Quaker	*Neopithecops zalmora*
	Odonates	**Scientific Names**
1	Black Marsh Dart	*Onychargia atrocyana*
2	Black Marsh Trotter	*Tramea limbata*
3	. Common Picturewing	*Rhyothemis variegata*
4	Coral Tailed Cloud-wing	*Tholymis tillarga*
5	Coromandel Marsh Dart	*Ceriagrion coromandelianum*
6	. Crimson-tailed Marsh Hawk	*Orthetrum pruinosum*
7	Ditch Jewel	*Brachythemis contaminata*
8	Estuarine Skimmer	*Macrodiplax cora*
9	Fulvous Forest Skimmer	*Neurothemis fulvia*
10	Granite Ghost	*Bradinopyga geminata*
11	Green Darner	*Anax junius*
12	Green Marsh Hawk	*Orthetrum sabina*
13	Ground Skimmer	*Diplacodes trivialis*
14	Little Blue Marsh Hawk	*Brachydiplax sobrina*
15	Orange Tailed Marsh Dart	*Ceriagrion cerinorubellum*
16	Pied Paddy Skimmer	*Neurothemis tullia*
17	Pygmy Dartlet	*Agriocnemis pygmaea*
18	Ruddy Marsh Skimmer	*Crocothemis servilia*
19	Rufous Marsh Glider	*Rhudothemis rufa*
20	Faced Blue Dart	*Saffron Pseudagrion*
21	Scarlet Marsh Hawk	*Aethriamanta brevipennis*
22	Senegal Golden Dartlet	*Ischnura senegalensis*
23	Three lined Dart	*Pseudagrion decorum*
24	Tiny Hooded Dartlet	*Agriocnemis kalinga*
25	Wondering Glider	*Pantala flavescens*
26	Yellow-tailed Ashy Skimmer	*Potamarcha congener*

Plate 4a : Rose Ring Parakeet , Chinsurah

Plate 4b. Collard Owlet , Sabujdweep, Somra , Hugli

Plate 4c : Pied Kingfisher , Balagarh Char , Hugli

Plate 4d : Baya Weaver , Chandannagar outskirts

CHAPTER 4 – DOCUMENTING NATURE & PROPERTIES OF NATURAL HERITAGE

4.1. Drainage

The Hugli river, or, as it should be more correctly described, the Bhagirathi branch of the Ganges, has three distinct sections, the upper section from the point of bifurcation to its confluence with the Jalangi at Nadia, the central section from Nadia to its confluence with the Rupnarayan at Hugli Point, and the lower section from Hugli Point to the sea. The central section is a little more than 120 miles long, of which 50 miles lie along the eastern boundary of Hugli district. The river first touches the district opposite Santipur, below which it turns to the south-east past Guptipara, Balagarh, Jiret and Sukhsagar (in the Nadia district), forming several large *chars* as it swings from one side to the other.

Plate 5 : Kuntighat , Nayasarai , 23° 0.734'N 88° 25.093'E

From **Sukhsagar** it runs south-west to Tribeni and then nearly south up to Hugli town and Chinsura, after which it follows a southerly course, winding alternately from west to east, until Mahesh is touched. The river then flows nearly south up to the outfall of the Bally Khal, which is part of the southern boundary of Hugli. The channel narrows from south to north, being in the winter months about three-quarters of a mile wide opposite Uttarpara, half that width at Hugli and Bansberia, and a little less than half of it at Guptipara. In the rains, when the chars and islands are submerged, it becomes more than a mile wide and as much as a mile and half at Uttarpara. In the summer the river shrinks much in breadth, and the height of water falls considerably. It is navigable by large boats and river steamers throughout the year ; but in the hot weather navigation is precarious for river Br.e9.mers in the northern reaches, as the depth of water falls to 6 feet, and the channel, winding rapidly from east to west through the c/tars and islands, is very tortuous.

Plate 6: Saraswati River outfall , Tribeni , 22° 58.996'N 88° 24.098'E

The mean level of the water is affected not only by floods, but also by **tides and bores**. During the freshet months, July to September, such a volume of water is brought down that no tide is felt, and the current is known as ek-tana or one-sided. In the dry season the upward tidal stream and the tidal rise and fall are felt distinctly throughout this portion of its course. The high water of the spring tides comes up to Chinsura between three and four in the afternoon. Its velocity, which at Calcutta is 18 miles an hour, diminishes as it advances northwards. The difference between low and high water is 7 to 8 feet at Chinsura, the difference between neap and spring tides being 3 to 4 feet. Further up, the rise becomes smaller and smaller. Bores occur in the hot months (March to May) at perigee springs, with more or less violence according as tidal conditions are favourable or not and the southerly breezes are strong or feeble. The bore diminishes in force in its passage up from Calcutta, and at its highest may be 2 feet high at Chinsura.

Plate 7 : Effect of tidal bore in the Kotrang Municipality area , 22° 40.192'N 88° 21.100'E

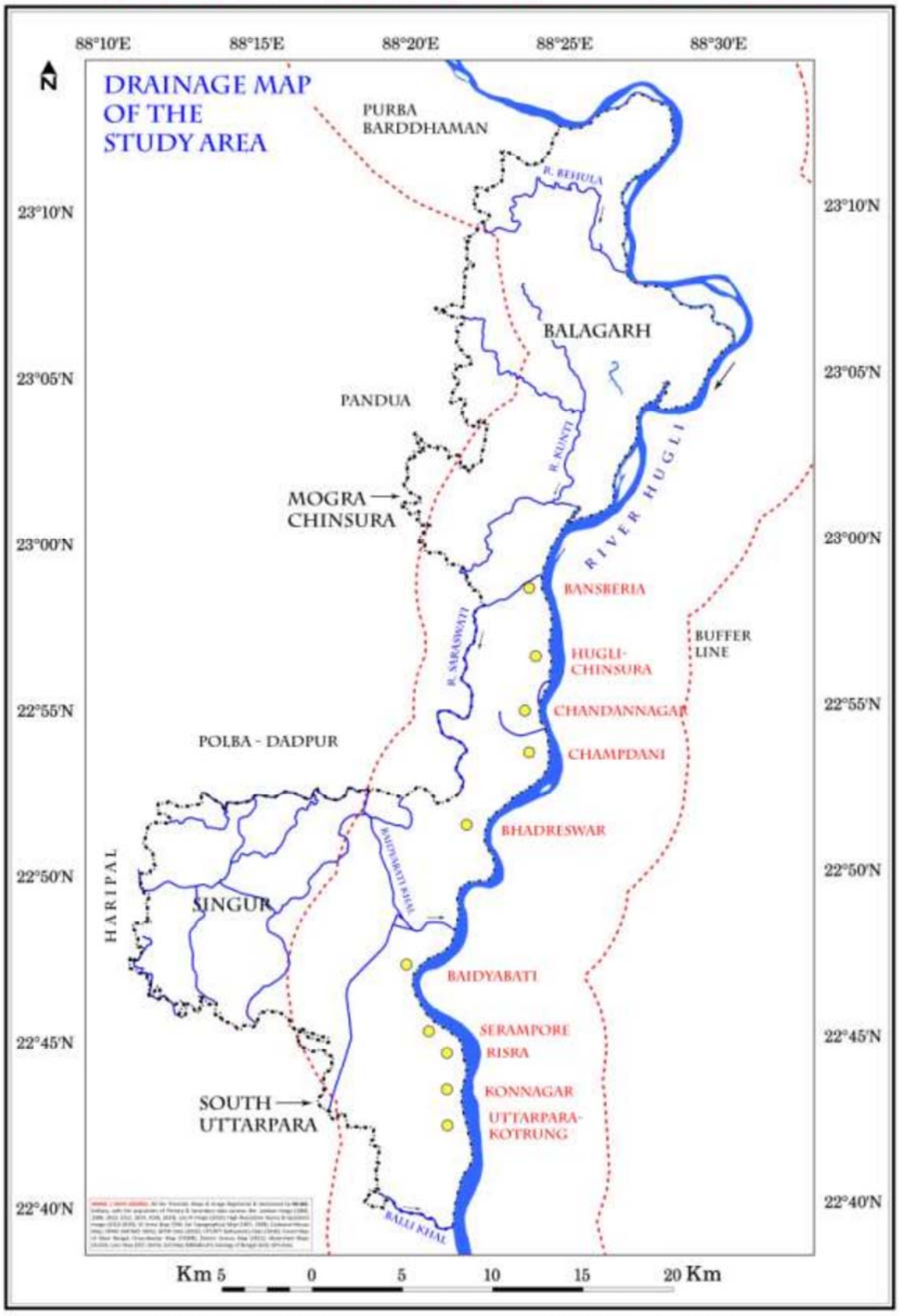
Minor Streams : The following streams join the river Hugli from the west, viz., **(1) the Behula, (2) Kana Nadi, (3) Kunti Nadi or Magra Khal, (4) Baidyabati Khal, (5) Serampore Khal, and (6) Bally Khal.** The **Saraswati** branches off from it below Tribeni and rejoins it lower down at Sankrail in the Howrah district. These are now small streams and add little to the body of water in the Hugli.

Sl.No.	Name of the tributaries	Confluence point	Source	Condition
1.	**Behula**	Sukuria , Somra 23° 8.070'N 88° 26.947'E	**Bardhaman District**	**Clogged at certain areas**
2.	**Kunti Nadi**	Nayasarai 23° 0.569'N 88° 24.912'E	**Bardhaman District**	**Clogged at certain areas**
3.	**Saraswati**	Tribeni 22° 58.991'N 88° 24.054'E	**Bhagirathi-Hugli (distributary)**	**Clogged at certain areas**
4.	**Baidyabati Khal**	Baidyabati 22° 48.391'N 88° 21.148'E	**Bardhaman District**	**Clogged at certain areas**
5.	**Serampur Khal**	Serampur 22° 46.831'N 88° 19.758'E	**Hugli**	**Clogged in most of the areas**
6.	**Bally Khal**	North of Bally Bridge 22° 39.314'N 88° 20.962'E	**Dankuni**	**Clogged at certain areas**

a. Behula River : Among the smaller streams several may be mentioned. The Gangan Gangan or Behula rises in the Burdwan district, touches this district below Baddipur (in the Kalna subdivision), and then divides into two branches, both called **Behula**. The northern branch after a circuitous course falls into the Hugli near **Somra**. The southern branch cuts across the district and falls into the

Map 13: Outfall of Behula River , Somra , Balagarh Block

DISTRICT HUGLI - NATURAL HERITAGE DOCUMENTATION



Magra Khal half-a mile west of Nayasarai. This stream has a muddy bed and is probably a remnant of one of the old courses of the Damodar.

Plate 8 : Behula River joining with Hugli River , 23° 8.072'N 88° 26.946'E , Plate 9 : Clogged path of Behula river near Abdulpur , 23° 9.826'N 88° 26.189'E

b. The **Kunti Nadi, 23° 1.101'N 88° 25.298'E** branches off from the Damodar just below Kunti or Salimabad in the Bardhaman district, and flows south-east Bandipur and then east to Gopalnagar. Then, curionsly enough, it turns north-east, running nearly parallel to the Saraswati, till it falls into the Hugli at Nayasarai after describing a complete semicircle. The upper part is known as the **Kana Nadi**, and is flushed annually from the Eden Canal ; the central part is known as the **Kunti Nadi** ; and the lower reach for a few miles as the **Magra Khal**. It has some flow of water all the year round, and large country boats go up from Nayasarai to Rajhat, a distance of 8 miles. In old days this stream apparently formed a main channel of the Damodar for some time. It is joined near Ukli in its north-eastward journey by the Ghia, which is fed from the north by the Kantul and Gopalnagar streams, and from the south by the Julka, all three draining thana Dhaniakhali. The stream has altogether a length of 50 miles, of which 44 miles are in the Hugli district.

Plate 10 : Kunti Nadi , 23° 1.101'N 88° 25.298'E opening up near Kuntighat

Plate 11 : Nayasarai Marshes 23° 0.558'N 88° 24.922'E

Plate 12 : Confluence of Kunti River with Hugli River 23° 0.679'N 88° 25.255'E

C. Saraswati branches out from the Hugli below Tribeni. It flows at first south-east for a mile and a half, and then runs south, parallel to and within three miles of the main river. Behind Chandannagar . It curves to the south-west up to the village of **Burai,** west of **Serampore town**, and then goes south- east till it enters Howrah district, rejoining the Hugli above Sankrail Below Tribeni the river is only 10 or 12 feet wide and a foot deep in the hot weather, but in the rains its width increases to a quarter of a mile and its depth to about 10 feet. Half a century ago it was a dead river, represented merely by a chain of pools ; but water

Plate 13 : Along River Saraswati , Chinsurah

was let into it in connection with the Eden Canal scheme, by a cut from the Kana Nadi near Gopalnagar ; and it is now even in the summer a running, though tiny, stream. Though much silted up, its banks are fairly high (10 to 15 feet) and are still densely populated, specially in the south, where there are several large villages, such as Burai, Baksa, Janai, Chanditala and Kalipur.

D. **Bali Khal:** Below Tribeni several creeks fall into the Hugli after draining the interior. The southernmost of them is the Bali (Bally) Khal, which forms the southern boundary of the district for several miles. It drains the Dankuni marsh, and is now used as the outfall of the Dankuni drainage channel. In its lower reaches it is navigable throughout the year by boats of fair size, and is not fordable. Both the bed and banks are clayey, and furnish excellent material for the manufacture of bricks.

Plate 14 : Bally Khal Outfall bordering the districts of Haora and Hugli 22° 39.308'N 88° 20.962'E

E. Kana Damodar : The western part of the Hugli and Serampore subdivisions Damodar.It is drained by several streams, apparently old offshoots of the Damodar. 'One of these, the Kana Damodar, was apparently once a large channel. It branched off from the Damodar a few miles below Salimabad in the Burdwan district, but its mouth is now more or less silted up. It is flushed yearly, however, from the Eden Canal. Flowing south, it is joined south-east of Kristanagar by the Kausiki, the reclamation of which has recently been taken up by Giovemment nith the help of private cool ributions. The combined stream then passes into the Howrah district past Jagatballabhpur, and falls into the Hugli at Sijberia, a mile above Uluberia. In this portion of its course the stream, which is known as the Kalsapa or Kansona Khal, has been converted into the outfall of the **Rajapur Drainage Channel.**

F. The **Madaria Khal** rises north of Champadanga and passing into the Howrah district falls into the Damodar above Amta town. In its course through Hugli it is called the Eanabanda. Decently, its overflow having caused much damage to crops near Amta, the embankment along it has been raised and strengthened. Originally this stream appears to have debouched from the Damodar, but its intake has been closed by the embankment along its western bank..

II . Lakes and Marshes: There are no lakes in the district, but a number of large catchment basins are found in which water accumulates during the rains, forming long meres and marshes. Towards the close of the rains the lower lands are converted into swamps suitable for the cultivation of winter rice; and the lowest lands lying between the raised banks of rivers become *jheels* or extensive swamps. These jheels are partly drained by rivulets, but generally contain water in the dry months. The largest number of marshes is found in thanas Pandua and Polba in the Hugli subdivision, in thanas Chanditala and Krishnagar in the Serampore subdivision, and in thana Khanakul in the Arambagh subdivision. Several marshes are of considerable size, e.g., the Khanyan marsh between the old silted-up channels of the Damodar in thana Pandua . maxsh between the Grhia and the Kana Nadi the Dankuni marsh between the Hugli and the Saraswati, which is now drained by the Dankuni drainage channel, and the marsh between the Damodar Khal and the Kana Dwarakeswar in thana Khanakul. The reeds grown on their banks are sold for matting; and their water is used to some extent for irrigating crops of sugarcane and spring rice.

In our study area mostly 3 types of Waterbodies are identified. They are mostly river marshes /old scars (in the northern part of Balagarh Block) , ponds/jheels (in the municipality area) and Brick kiln Waterbodies (river bank area). We have plotted some of these Waterbodies in

the following paragraphs. Here is a table showing the Blockwise list of waterbodies in the district of Hugli.

SL.NO	BLOCK	LATITUDE	LONGITUDE	TYPE/ CONDITION
1	BALAGARH	23° 11.406'N	88° 26.506'E	MARSHES (CLOGGED)
2		23° 11.367'N	88° 26.520'E	
3		23° 11.568'N	88° 26.394'E	
4		23° 11.553'N	88° 26.208'E	
5		23° 11.403'N	88° 26.117'E	
6		23° 10.690'N	88° 25.955'E	
7		23° 10.994'N	88° 25.759'E	
8		23° 10.642'N	88° 26.020'E	
9		23° 10.232'N	88° 25.938'E	
10		23° 9.947'N	88° 25.957'E	
11		23° 9.760'N	88° 25.967'E	
12		23° 9.598'N	88° 25.901'E	
13		23° 9.421'N	88° 25.874'E	PONDS
14		23° 9.274'N	88° 25.851'E	PONDS
15		23° 9.015'N	88° 25.883'E	PONDS
16		23° 8.731'N	88° 25.925'E	PONDS
17		23° 8.721'N	23° 8.721'N	PONDS
18		23° 8.526'N	88° 25.768'E	PONDS
19		23° 8.150'N	88° 26.082'E	PONDS
20		23° 8.300'N	88° 26.080'E	PONDS
21		23° 8.129'N	88° 26.180'E	PONDS
22		23° 7.965'N	88° 26.552'E	PONDS
23		23° 7.656'N	88° 26.512'E	PONDS
24		23° 7.705'N	88° 26.665'E	PONDS
25		23° 7.898'N	88° 26.741'E	PONDS
26		23° 7.946'N	88° 26.862'E	PONDS
27		23° 7.766'N	88° 27.117'E	PONDS
28		23° 7.686'N	88° 27.281'E	MARSHES

29		23° 7.581'N	88° 27.320'E	MARSHES
30		23° 7.350'N	88° 27.285'E	MARSHES
31		23° 7.329'N	88° 27.453'E	MARSHES
32		23° 7.160'N	88° 27.723'E	MARSHES
33		23° 6.957'N	88° 27.855'E	MARSHES
34		23° 7.084'N	88° 28.045'E	MARSHES
35		23° 6.963'N	88° 28.222'E	PONDS
36		23° 5.493'N	88° 28.476'E	PONDS
37	MAGRA - CHUNCHURA	23° 5.208'N	88° 28.282'E	PONDS
38		23° 5.255'N	88° 28.034'E	PONDS
39		23° 5.073'N	88° 28.430'E	PONDS
40		23° 5.279'N	88° 28.472'E	PONDS
41		23° 5.367'N	88° 28.790'E	PONDS
42		23° 5.708'N	88° 28.806'E	MARSHES
43		23° 6.293'N	88° 28.874'E	MARSHES
44		23° 4.460'N	88° 28.462'E	MARSHES
45		23° 4.104'N	88° 28.391'E	MARSHES
46		23° 3.491'N	88° 27.086'E	MARSHES
47		23° 3.524'N	88° 26.941'E	MARSHES
48		23° 3.224'N	88° 26.914'E	MARSHES
49		23° 3.148'N	88° 27.072'E	MARSHES
50		23° 3.059'N	88° 26.866'E	MARSHES
51		23° 2.811'N	88° 26.814'E	PONDS
52		23° 2.721'N	88° 26.716'E	PONDS
53		23° 2.626'N	88° 26.530'E	PONDS
54		23° 2.626'N	88° 26.530'E	PONDS
55		23° 2.098'N	88° 26.125'E	PONDS
56		23° 2.567'N	88° 25.629'E	PONDS
57		23° 2.385'N	88° 25.781'E	PONDS
58		23° 2.161'N	88° 25.845'E	PONDS
59		23° 2.231'N	88° 25.716'E	PONDS
60		23° 1.946'N	88° 25.432'E	PONDS

61		23° 1.845'N	88° 25.380'E	PONDS
62	MAGRA - CHUNCHURA	23° 1.493'N	88° 24.704'E	PONDS
63		23° 1.345'N	88° 24.708'E	PONDS
64		23° 0.970'N	88° 24.496'E	PONDS
65		23° 0.541'N	88° 24.467'E	PONDS
66		23° 0.311'N	88° 24.430'E	PONDS
67		23° 0.183'N	88° 24.396'E	PONDS
68		23° 0.149'N	88° 24.265'E	PONDS
69		23° 0.264'N	88° 24.215'E	PONDS
70		23° 0.145'N	88° 24.049'E	PONDS
71		22° 59.958'N	88° 24.014'E	PONDS
72		22° 59.692'N	88° 23.870'E	PONDS
73		22° 59.601'N	88° 23.824'E	PONDS
74		22° 59.615'N	88° 23.604'E	PONDS
75		22° 59.418'N	88° 23.530'E	PONDS
76		22° 59.312'N	88° 23.373'E	PONDS
77		22° 59.198'N	88° 23.356'E	PONDS
78		22° 59.151'N	88° 23.350'E	PONDS
79		22° 59.004'N	88° 23.231'E	PONDS
80		22° 58.916'N	88° 23.171'E	PONDS
81		22° 58.645'N	88° 23.045'E	PONDS
82		22° 58.623'N	88° 22.903'E	PONDS
83		22° 58.625'N	88° 22.797'E	PONDS
84		22° 58.487'N	88° 22.752'E	PONDS
85		22° 58.421'N	88° 22.700'E	PONDS
86		22° 58.372'N	88° 22.566'E	PONDS
87		22° 58.346'N	88° 22.406'E	PONDS
88		22° 58.050'N	88° 22.354'E	PONDS
89		22° 57.819'N	88° 22.776'E	PONDS
90		22° 57.834'N	88° 22.920'E	PONDS
91		22° 57.968'N	88° 22.853'E	PONDS
92		22° 57.997'N	88° 22.606'E	PONDS

93		22° 57.737'N	88° 22.358'E	
94		22° 57.323'N	88° 22.255'E	PONDS
95		22° 55.297'N	88° 22.425'E	PONDS
96		22° 55.197'N	88° 22.406'E	PONDS
97		22° 55.737'N	88° 22.918'E	PONDS
98		22° 55.439'N	88° 23.201'E	PONDS
99		22° 55.712'N	88° 23.426'E	PONDS
100		22° 55.872'N	88° 23.532'E	PONDS
101		22° 55.702'N	88° 23.603'E	PONDS
102		22° 55.389'N	88° 23.615'E	PONDS
103		22° 55.256'N	88° 23.823'E	PONDS
104		22° 55.229'N	88° 23.629'E	PONDS
105		22° 55.021'N	88° 23.706'E	PONDS
106		22° 54.860'N	88° 23.790'E	PONDS
107		22° 54.799'N	88° 23.867'E	PONDS
108		22° 54.661'N	88° 23.858'E	BRICK KILNS
109	BANSBERIA	22° 54.659'N	88° 23.730'E	BRICK KILNS
110		22° 54.601'N	88° 23.692'E	BRICK KILNS
111		22° 54.500'N	88° 23.579'E	BRICK KILNS
112		22° 54.403'N	88° 23.531'E	BRICK KILNS
113		22° 54.349'N	88° 23.511'E	BRICK KILNS
114		22° 54.279'N	88° 23.384'E	BRICK KILNS
115		22° 54.212'N	88° 23.277'E	BRICK KILNS
116		22° 54.233'N	88° 23.163'E	BRICK KILNS
117		22° 54.137'N	88° 23.073'E	BRICK KILNS
118		22° 54.122'N	88° 22.984'E	BRICK KILNS
119		22° 53.900'N	88° 23.002'E	BRICK KILNS
120		22° 53.879'N	88° 22.845'E	BRICK KILNS
121		22° 57.251'N	88° 22.305'E	BRICK KILNS
122		22° 56.900'N	88° 22.029'E	BRICK KILNS
123		22° 56.554'N	88° 22.088'E	BRICK KILNS
124		22° 56.167'N	88° 22.024'E	BRICK KILNS

125		22° 57.329'N	88° 22.455'E	PONDS
126		22° 53.797'N	88° 22.815'E	PONDS
127		22° 53.720'N	88° 22.694'E	PONDS
128		22° 53.656'N	88° 22.838'E	PONDS
12		22° 53.598'N	88° 22.857'E	PONDS
130		22° 53.437'N	88° 22.806'E	PONDS
131		22° 53.348'N	88° 22.796'E	PONDS
132		22° 53.232'N	88° 22.840'E	PONDS
133		22° 53.224'N	88° 22.892'E	PONDS
134		22° 53.330'N	88° 22.953'E	PONDS
135		22° 53.271'N	88° 23.004'E	PONDS
136		22° 53.149'N	88° 23.038'E	PONDS
137		22° 53.113'N	88° 23.020'E	PONDS
138		22° 53.083'N	88° 22.977'E	PONDS
139		22° 52.994'N	88° 22.944'E	PONDS
140		22° 52.957'N	88° 23.020'E	PONDS
141	HUGLI-CHINSURAH	22° 52.921'N	88° 23.096'E	BRICK KILNS
142		22° 52.865'N	88° 22.980'E	BRICK KILNS
143		22° 52.828'N	88° 22.987'E	BRICK KILNS
144		22° 52.686'N	88° 22.929'E	BRICK KILNS
145		22° 52.679'N	88° 23.130'E	BRICK KILNS
146		22° 52.713'N	88° 23.188'E	BRICK KILNS
147		22° 52.743'N	88° 23.259'E	PONDS
148		22° 52.828'N	88° 23.344'E	PONDS
149		22° 52.843'N	88° 23.475'E	PONDS
150		22° 52.709'N	88° 23.521'E	PONDS
151		22° 52.533'N	88° 23.322'E	PONDS
152		22° 52.440'N	88° 23.015'E	PONDS
153		22° 52.377'N	88° 22.737'E	PONDS
154		22° 52.167'N	88° 22.562'E	PONDS
155		22° 52.133'N	88° 22.549'E	PONDS
156		22° 52.044'N	88° 22.436'E	PONDS

157	CHANDANNAGAR	22° 51.984'N	88° 22.380'E	PONDS
158		22° 51.906'N	88° 22.148'E	PONDS
159		22° 51.671'N	88° 21.959'E	PONDS
160		22° 51.514'N	88° 22.020'E	PONDS
161		22° 51.740'N	88° 21.644'E	PONDS
162		22° 51.645'N	88° 21.634'E	PONDS
163		22° 51.278'N	88° 21.550'E	PONDS
164		22° 51.233'N	88° 21.648'E	PONDS
165		22° 51.068'N	88° 21.383'E	PONDS
166		22° 51.016'N	88° 21.444'E	PONDS
167		22° 51.084'N	88° 21.347'E	PONDS
168		22° 51.332'N	88° 21.092'E	PONDS
169		22° 51.633'N	88° 20.947'E	PONDS
170		22° 51.549'N	88° 21.018'E	PONDS
171		22° 51.750'N	88° 20.823'E	PONDS
172		22° 51.223'N	88° 20.559'E	PONDS
173		22° 50.917'N	88° 20.517'E	PONDS
174		22° 50.884'N	88° 20.750'E	PONDS
175		22° 50.579'N	88° 20.202'E	PONDS
176		22° 50.209'N	88° 20.874'E	PONDS
177	BHADRESWAR	22° 50.172'N	88° 21.403'E	PONDS
178		22° 50.220'N	88° 21.310'E	PONDS
179		22° 50.231'N	88° 21.473'E	PONDS
180		22° 50.428'N	88° 21.544'E	PONDS
181		22° 50.256'N	88° 21.566'E	PONDS
182		22° 49.990'N	88° 21.584'E	PONDS
183		22° 49.981'N	88° 21.886'E	PONDS
184		22° 49.562'N	88° 21.189'E	PONDS
185		22° 49.505'N	88° 21.224'E	PONDS
186		22° 49.573'N	88° 21.091'E	PONDS
187		22° 49.521'N	88° 20.907'E	PONDS
188		22° 49.626'N	88° 21.076'E	BRICK KILNS

189		22° 49.577'N	88° 20.759'E	BRICK KILNS
190		22° 49.443'N	88° 20.750'E	BRICK KILNS
191		22° 49.595'N	88° 20.745'E	BRICK KILNS
192		22° 49.715'N	88° 20.536'E	BRICK KILNS
193	BHADRESWAR	22° 49.817'N	88° 20.477'E	PONDS
194		22° 49.295'N	88° 20.878'E	PONDS
195		22° 49.058'N	88° 20.758'E	PONDS
196		22° 48.976'N	88° 20.809'E	PONDS
197		22° 48.921'N	88° 20.634'E	PONDS
198		22° 48.865'N	88° 20.413'E	PONDS
199		22° 48.826'N	88° 20.339'E	PONDS
200		22° 48.774'N	88° 20.257'E	PONDS
201		22° 48.571'N	88° 20.392'E	PONDS
202		22° 48.677'N	88° 20.532'E	PONDS
203		22° 48.420'N	88° 20.609'E	PONDS
204		22° 48.351'N	88° 20.558'E	PONDS
205		22° 48.102'N	88° 20.730'E	PONDS
206		22° 48.003'N	88° 20.548'E	PONDS
207		22° 47.714'N	88° 20.572'E	PONDS
208		22° 47.519'N	88° 20.331'E	PONDS
209		22° 47.545'N	88° 20.091'E	PONDS
210		22° 47.644'N	88° 20.085'E	PONDS
211	BAIDYABATI	22° 47.626'N	88° 19.704'E	BRICK KILNS
212		22° 47.694'N	88° 19.592'E	BRICK KILNS
213		22° 47.550'N	88° 19.239'E	BRICK KILNS
214		22° 47.359'N	88° 19.202'E	BRICK KILNS
215		22° 47.625'N	88° 19.171'E	PONDS
216		22° 47.400'N	88° 18.929'E	PONDS
217		22° 47.238'N	88° 18.752'E	PONDS
218		22° 47.086'N	22° 47.086'N	PONDS
219		22° 47.177'N	88° 18.289'E	PONDS
220		22° 47.294'N	88° 17.965'E	PONDS

221		22° 47.381'N	88° 17.726'E	PONDS
222		22° 47.079'N	88° 17.683'E	PONDS
223		22° 47.390'N	88° 17.731'E	PONDS
224		22° 46.796'N	88° 17.871'E	PONDS
225		22° 46.680'N	88° 17.745'E	PONDS
226		22° 46.527'N	88° 17.766'E	PONDS
227	CHAMPADANI	22° 46.177'N	88° 19.336'E	PONDS
228		22° 46.192'N	88° 19.468'E	PONDS
229		22° 46.012'N	88° 19.512'E	PONDS
230		22° 46.181'N	88° 19.326'E	PONDS
231		22° 46.022'N	88° 19.487'E	PONDS
232		22° 45.788'N	88° 19.203'E	PONDS
233		22° 45.748'N	88° 19.256'E	PONDS
234		22° 45.712'N	88° 19.290'E	PONDS
235		22° 45.711'N	88° 19.201'E	PONDS
236		22° 45.810'N	88° 19.143'E	PONDS
237		22° 46.014'N	88° 19.508'E	PONDS
238		22° 45.696'N	88° 19.669'E	PONDS
239		22° 45.660'N	88° 19.589'E	BRICK KILNS
240		22° 45.445'N	88° 19.670'E	BRICK KILNS
241		22° 45.266'N	88° 19.746'E	BRICK KILNS
242		22° 45.298'N	88° 19.834'E	BRICK KILNS
243		22° 45.270'N	88° 20.008'E	PONDS
244		22° 45.249'N	88° 20.063'E	PONDS
245		22° 45.150'N	22° 45.150'N	PONDS
246		22° 45.116'N	88° 20.239'E	PONDS
247	SERAMPUR	22° 45.027'N	88° 20.200'E	PONDS
248		88° 20.200'E	88° 20.409'E	PONDS
249		22° 45.014'N	88° 20.421'E	PONDS
250		22° 45.107'N	88° 20.230'E	PONDS
251		22° 45.145'N	88° 20.051'E	PONDS
252		22° 45.193'N	88° 19.997'E	PONDS

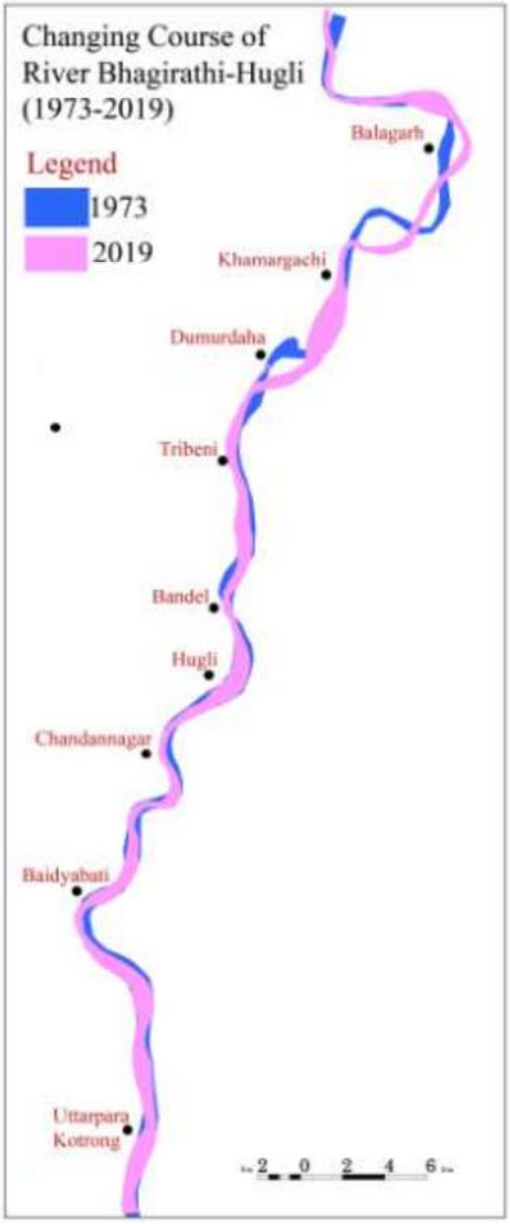
253		22° 44.843'N	88° 19.997'E	PONDS
254		22° 44.909'N	88° 19.897'E	PONDS
255		22° 44.877'N	88° 19.748'E	PONDS
256		22° 44.740'N	88° 19.772'E	BRICK KILNS
257		22° 44.657'N	88° 19.853'E	BRICK KILNS
258		22° 44.587'N	88° 19.962'E	BRICK KILNS
258		22° 44.333'N	88° 19.897'E	PONDS
260		22° 44.215'N	88° 19.950'E	PONDS
261		22° 44.090'N	88° 19.815'E	PONDS
262		22° 44.145'N	88° 19.640'E	PONDS
263		22° 44.165'N	88° 19.585'E	PONDS
264		22° 44.147'N	88° 19.440'E	PONDS
265		22° 43.892'N	88° 19.406'E	PONDS
266	RISHRA	22° 43.799'N	88° 19.506'E	PONDS
267		22° 43.581'N	88° 19.587'E	PONDS
268		22° 43.458'N	88° 19.471'E	PONDS
269		22° 43.794'N	88° 19.334'E	BRICK KILNS
270		22° 43.810'N	88° 19.222'E	BRICK KILNS
271		22° 43.680'N	88° 19.078'E	BRICK KILNS
272		22° 43.801'N	88° 19.040'E	PONDS
273		22° 43.460'N	88° 19.225'E	PONDS
274		22° 43.471'N	88° 21.095'E	PONDS
275		22° 43.416'N	88° 20.989'E	PONDS
276		22° 43.497'N	88° 20.943'E	PONDS
277		22° 43.354'N	88° 20.943'E	PONDS
278		22° 43.423'N	88° 20.994'E	PONDS
279		22° 43.473'N	88° 21.109'E	PONDS
280		22° 43.410'N	88° 21.239'E	PONDS
281		22° 43.466'N	88° 21.102'E	PONDS
282		22° 43.459'N	88° 21.013'E	PONDS
283		22° 43.372'N	88° 20.924'E	PONDS
284		22° 43.330'N	88° 20.827'E	PONDS

285		22° 43.617'N	88° 20.952'E	PONDS
286		22° 43.721'N	88° 20.916'E	BRICK KILNS
287		22° 43.766'N	88° 20.885'E	BRICK KILNS
288		22° 43.788'N	88° 20.853'E	BRICK KILNS
289		22° 43.673'N	88° 20.795'E	PONDS
290		22° 43.773'N	88° 20.852'E	PONDS
291		22° 43.723'N	88° 20.965'E	PONDS
292		22° 43.914'N	88° 21.152'E	PONDS
293		22° 44.039'N	88° 21.111'E	PONDS
293		22° 44.134'N	88° 21.017'E	PONDS
295		22° 44.227'N	88° 20.901'E	PONDS
296		22° 44.167'N	88° 20.874'E	PONDS
297	KONNAGAR	22° 44.078'N	88° 20.908'E	PONDS
298		22° 44.391'N	88° 20.904'E	PONDS
299		22° 44.612'N	88° 20.938'E	PONDS
300		22° 44.662'N	88° 20.842'E	BRICK KILNS
301		22° 44.797'N	88° 20.984'E	BRICK KILNS
302		22° 45.002'N	88° 21.029'E	BRICK KILNS
303		22° 45.041'N	88° 20.923'E	PONDS
304		22° 45.035'N	88° 20.731'E	PONDS
305		22° 45.106'N	88° 20.657'E	PONDS
306		22° 45.204'N	88° 20.579'E	PONDS
307		22° 45.225'N	88° 20.478'E	PONDS
308		22° 45.207'N	88° 20.583'E	PONDS
309		22° 45.228'N	88° 20.462'E	PONDS
310		22° 45.308'N	88° 20.334'E	PONDS
311		22° 45.392'N	88° 20.558'E	PONDS
312		22° 45.420'N	88° 20.689'E	PONDS
313		22° 45.307'N	88° 20.804'E	PONDS
314		22° 45.359'N	88° 20.797'E	PONDS
315		22° 45.422'N	88° 20.664'E	PONDS
316		22° 45.471'N	88° 20.616'E	PONDS

317		22° 45.304'N	88° 20.342'E	PONDS
318	UTTARPARA-KOTRANG	22° 45.213'N	88° 20.255'E	PONDS
319		22° 45.507'N	88° 20.226'E	PONDS
320		22° 45.289'N	88° 20.358'E	PONDS
321		22° 45.484'N	88° 20.217'E	PONDS
322		22° 45.124'N	88° 20.223'E	PONDS
323		22° 43.651'N	88° 20.809'E	BRICK KILNS
324		22° 43.896'N	88° 20.542'E	BRICK KILNS
325		22° 43.416'N	88° 20.992'E	BRICK KILNS
326		22° 43.460'N	88° 20.822'E	BRICK KILNS
327		22° 43.300'N	88° 20.895'E	BRICK KILNS
328		22° 43.104'N	88° 20.901'E	PONDS
329		22° 43.096'N	88° 20.813'E	PONDS
330		22° 43.123'N	88° 20.872'E	PONDS
331		22° 43.701'N	88° 20.756'E	PONDS
332		22° 43.320'N	88° 20.511'E	PONDS
333		22° 43.588'N	88° 20.837'E	PONDS

Plate 15 : Lal Dighi , Chandannagar , one of the oldest dighi / lake of Chandannagar

4.3. CHANGE IN RIVER COURSES: Even during the few centuries for which records are available, there have been many great changes in the courses of the rivers in this riverain district. In the river Hugli the north-eastern portion of its course has been specially affected. Here several chars have formed, and the channel has shifted eastwards and become more and more tortuous.

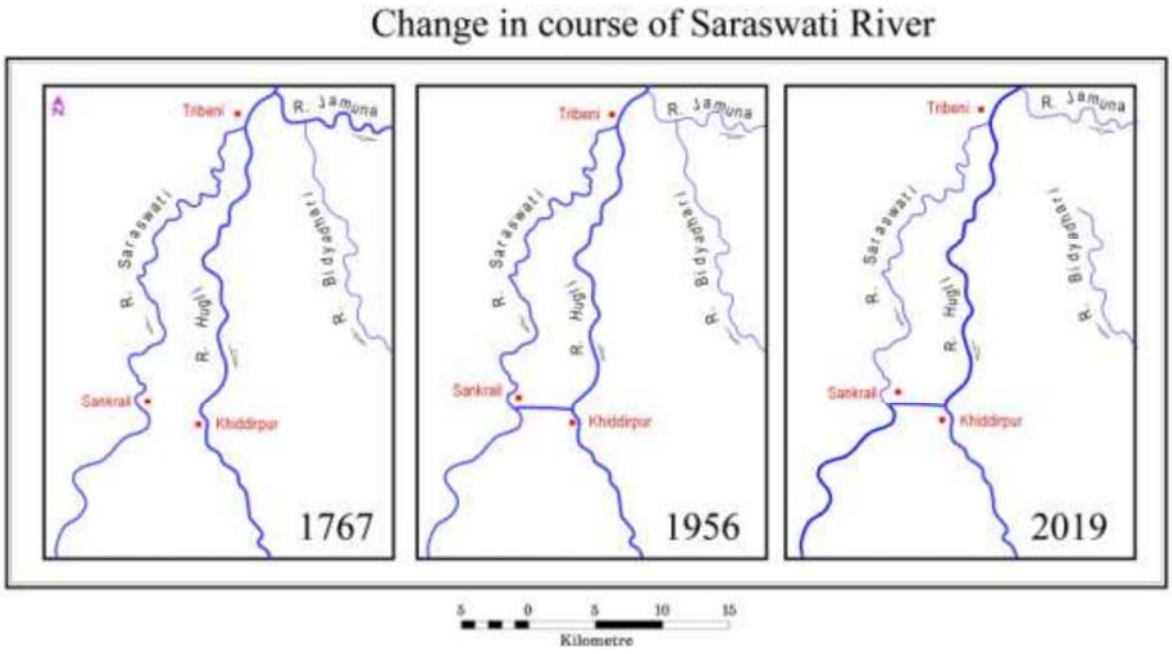


The map of **Stavorinus (1769),** for example, showed Guptipara to the east of the Ganges, whereas it now lies west of the main channel, the river, which apparently once flowed just below this village, having receded a mile eastwards. One main cause of this diversion to the east was the shrinkage of the Jalangi which once a large river which discharged a large volume of water into the Hugli and so kept its course fairly well to the south. Now that the Jalangi or Khari has diminished in size and volume, the Hugli is tracking more and more to the east, and is encroaching steadily on the Nadia side. Lower down there have been some changes in the chars, of which one may specially be noticed. In the seventies of last centuries an island was formed opposite Sandeshwartala below the college at Chinsura. It grew in size, and trees also sprang up on it, bat it was swept away one night in the rainy season of 1898.

The earliest mention of its depth by an European appears to be that of Cesare Federici, who remarked (1580 A. D.):—"From thence Bator upwards the ships does not go, because that upwards the river is very shallow and little water"; but, he adds -"In the port of Satagaon every year lade thirtie or five and thirtie ships great and small". According to a Muhammadan account, the Portuguese in 1632 had a large vessel with nearly two thousand persons on board moored in the river off Hugli town. Again, in a letter of the Court of Directors to Fort St.

George, Madras, dated 31st December 1662, it is stated: — "We take notice that Captain Elliott hath left a writeing with you that it is hazardless to goes up for Hugely and that the Dutch have shipps of 600 tons that Tyde it up thither." Besides this, we know that in the latter half of the 17th century, ships, hke the Falcon, and large sloops, like the Arricall and the Ganges, came up to the English factory at the same place. Bowrey's Chart and the Pilot Ch^ (1688 and 1703) shew 4 fathoms of water at Hugli gradually increasing to 5^ or 6 fathoms opposite Baranagar. In March 1757, the three largest ships of the Company's navy, with 50 to 70 guns, sailed up to Chandernagore, though on a high tide All these facts go to show that the depth of water has really been decreasing. This decrease may he partly due to the silting up of the bed and partly to the diminished supply of water which it receives from its own intake and also from its tributaries, like (he Jalangi and the Damodar.

Saraswati River : The changes in the Saraswati are still more marked. The Saraswati place where the three streams branch off (Tribeni, i.e., three braided) is described in a Sanskrit poem, Pavanadutam, as far back as the 12th century A. D. ; it is also mentioned, with a slight change of name, in Muhammadan inscriptions and books of the 13th century and later ; and it is shown as a large stream in maps as late as that of Valentijn (based on information gathered in 1660-70). It is a mistake, however, to suppose that it formed the main channel of the Hugli, though country boats and small sloops undoubtedly used it for inland traffic, as on its banks



lay, and still lie, populous villages. Apparently, it formerly received water from the Kana Nadi through a small branch taking off near IJkli, but it gradually silted up, until inRennell's

time (1779-81) it hfld dwindled down to a small stream, and, except for a few miles, had become a dead river and navigable after the rains. Lately, some water has been let in by a cut from the Kana Nadi, but not enough to permit the passage of cargo boats throughout its length.

Plate 16 & 17 : Saraswati River near Tribeni

4.4. FLOOD PLAINS OF HUGLI DISTRICT :

From the very early days , the district of Hugli has been under European traders like P

Plate 17 & 18 : Saraswati River confluence near Tribeni.

Hooghly port attracted all of them from the ancient times. Thus the adjoining areas developed more as a industrial and trading centres. From Tribeni till Uttarpara in south the banks of the river had been paved restricting the normal flooding and oscillation of the river flow. However in the north of Tribeni till south of Kalna of Purba Barddhaman we find the natural floodplain of the river with distinct geomorphological features.

Map 14 : Major Chars of Hugli

The 2 major chars, near Guptipara – Char Krishnabati and at Balagarh in the Balagarh Block of our study area shows significant deposition of alluvial . The fresh deposits are very much suitable for agriculture purpose. Besides , Balagarh has the largest boat making industry of West Bengal.

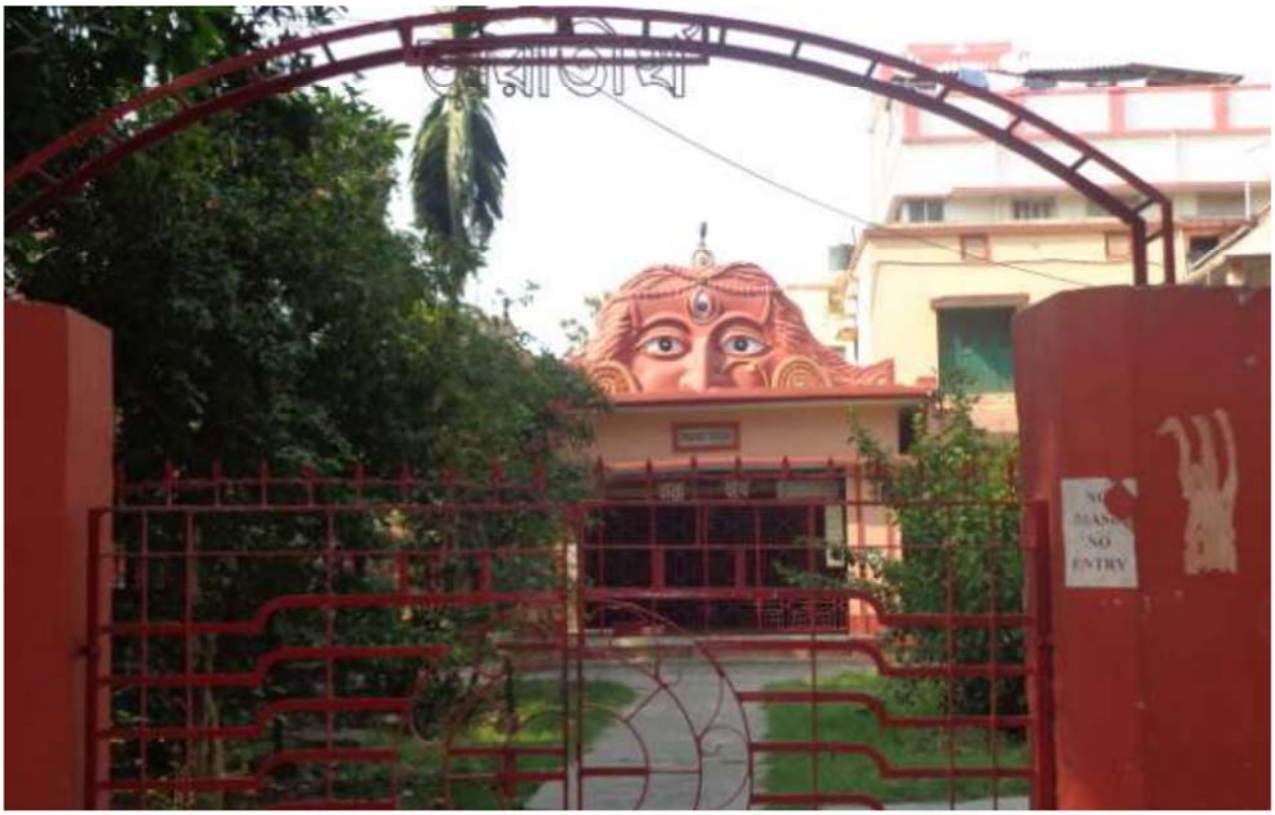
4.5. SACRED TREES & THEIR HISTORICAL IMPORTANCE

Kalpavriksha and Chaityavriksha scriptures mention that worshipping trees have been an ancient Indian practice. Considering trees as sacred entities, dates back to the era of the Aryans who worshiped nature. Plants and trees are associated with several Indian rituals and tree worshiping continues to be an aspect of modern Indian traditions. These trees are an important storehouse of biodiversity, having remained largely undisturbed by human interference and these are the last remnants of natural forests which should be preserved for conserve the local biodiversity.

With this background the present study was undertaken along the bank of Bhagirathi-Hugli . The plants of these sacred groves are Ficus religiosa (Aswatha), Ficus bengalensis (Bot), Opuntia dillevii (Fani Manosa), Murraya paniculata (Kamini), Ocimum sp. (Tulsi) and Catharanthus roseaus (Nayantara). Some of the major sacred places are documented below .

a. Plate 18 : Ficus religiosa (Aswatha) near Kuntighat with the Kali Temple , 23° 1.091'N 88° 25.151'E

b. Plate 19 : Ficus bengalensis (Bot) and Tara Tirtha , Kotrung Municipality , 22° 40.916'N 88° 21.312'E



c. Plate 20 : Debipukur Ghat , Battala , Hindmotor , 22° 40.817'N 88° 21.255'E

d.Plate 21: Konnagar Battala Ghat , 22° 42.054'N 88° 21.578'E

e. Plate 22 : Konnagar Baro Mandir Ghat 22° 42.414'N 88° 21.490'E

Plate 23 : Baro Mandir, Konnagar, established in 1821 on the weaster bank of the Ganges near Konnagar Ferry Ghat is beautiful creation. On the opposite of the river is Panihati Baromandir.. The Baro Mandir in Konnagar has its own brand of unique charm. In fact, countless visitors just can't stop gushing about the place. In short, rest assure that a trip to Baro Mandir Konnagar will leave you with a lifetime of fond memories.

Plate 24 & 25 : The temple called Deshkali mandir is situated at Guptipara near buro bazar. The temple is very old and famous to devotees. The very old and big banyan tree situated on the compound of the deshkali temple has created beautiful atmospheres in that area that is used to take rest for devotees.

CHAPTER 5 – DOCUMENTING STRUCTURES INTHE RIVER

5.1. MAJOR BRIDGES - There are 4 bridges on River Bhagirathi-Hugli in this stretch . They are –**A. The Jubilee Bridge (22°54'26.53"N, 88°24'18.61"E)** is a former rail bridge over the Hugli River between Naihati and Bandel in West Bengal, India. It provided an important connection between Garifa railway station and Hugli Ghat railway station. The Jubilee Bridge was opened on 16 February 1885 in the fiftieth, or jubilee, year of the reign of Queen Victoria. Construction began in 1882 and was completed in 1887. The Chief Engineer in charge of construction works was Lt Col Arthur John Barry, nephew of Sir John Wolfe-Barry, project engineer of the London Tower Bridge. The Bridge was designed by Sir Bradford Leslie, Chief Engineer in India and Alexander Meadows Rendel. Its steel was manufactured by Hawks Crawshay of Gateshead in England and James Goodwin of Motherwell in Scotland. Bradford Leslie also designed the floating pontoon bridge across the Hugli in Calcutta, which was replaced by the Howrah Bridge in 1942 and the Gorai River Railway Bridge near Kushtia in Bangladesh. He was a son of the American painter Charles Robert Leslie, ultimately Professor of Painting at the Royal Academy in London. The Jubilee Bridge is noteworthy in that it is a cantilever truss bridge, constructed entirely by riveting,

Plate 26 : The Jubilee Bridge , Hugli

Map 17- Location of Jubilee Bridge connecting Naihati with Hugli

Map 18 – Connecting 2 Districts, Vivekananda Setu and Nibedita Setu

B. Sampreeti Setu (22°54'25.77"N, 88°24'19.43"E) is a railway bridge on Hugli River. This bridge was inaugurated on 17 April 2016. It is situated between Garifa railway station and Hugli Ghat railway station in the Naihati-Bandel branch line. This bridge has been built as an alternative to the Jubilee Bridge (India). The bridge is 415 meters long. In 2000, the Indian Railway minister took the project to build this bridge, but the project got clearance in 2007 and construction commenced thereafter. The bridge was inaugurated in April, 2016. Contractor-Tantia Constructions Ltd.

Plate 27 – Sampreeti Bridge on River Hugli.

5.2. Ghats of Hugli Districts in our study area :

As almost the entire stretch of our study area has paved river bank there are many significant Ghats mostly used for ferry service and other domestic purposes. Here is a list of the ghats along with their purpose.

Sl.No.	Name of the Block /Municipality	Name of the Ghat	Latitude	Longitude	Purpose
1	**Uttrapara-Kotrang**	Uttrapara College Ghat	22° 39.378'N	88° 20.991'E	Ferry Service (occasional)
2		Doltala Ghat	22° 40.101'N	88° 21.074'E	Domestic
3		Uttarpara Sakherbazar Ganges Ghat	22° 40.317'N	88° 21.138'E	Domestic
4		Panchanontal Ghat	22° 39.870'N	88° 21.044'E	Domestic
5		Uttarpara Ferry Ghat	22° 39.646'N	88° 21.038'E	Ferry Service
6		Uttarpara Ram Ghat	22° 39.795'N	88° 21.039'E	Domestic
7		Bhadrakali Crematorium	22° 40.654'N	88° 21.258'E	Crematorium
8		Battala Ghat	22° 40.023'N	88° 21.074'E	Domestic
9		Uttarpar Jai Krishna Library Ghat	22° 39.701'N	88° 21.045'E	Domestic
10		Uttarpara Ariadaha Ferry Service	22° 39.944'N	88° 21.059'E	Ferry Service
11	**Konnagar**	Konnagar Ferryghat	22° 42.040'N	88° 21.585'E	Ferry Service
12		Baro Mandir Ghat	22° 42.418'N	88° 21.496'E	Domestic
13		Brahma samaj Ghat	22° 42.165'N	88° 21.529'E	Domestic
14		Konnagar Bata Ghat Ferry Service	22° 42.032'N	88° 21.568'E	Ferry Service
15		Konnagar launch Ghat	22° 41.996'N	88° 21.601'E	Ferry Service
18	**Serampur**	Harebabur Ghat			Domestic
19		Jugol Addhya Ferry Ghat	22° 45.545'N	88° 20.536'E	Ferry Service

20		Gargari	22° 46.134'N	88° 20.034'E	Domestic
21		Surki Tala Ghat	22° 43.937'N	88° 21.449'E	Ferry Service
22		Dey Ghat Kali Temple	22° 45.080'N	88° 21.259'E	Domestic
23		Ballavpur Ferry Ghat	22° 44.744'N	88° 21.349'E	Ferry Service
24		Roy Ghat Kali Mandir	22° 45.505'N	88° 20.586'E	Domestic
25		Sri Sri Radhaballavjiu Ganga Ghat	22° 44.746'N	88° 21.333'E	Domestic
26		Chinnyamasta Ghat	22° 44.571'N	88° 21.390'E	Domestic
27		Gour Chndra Ghat	22° 45.792'N	88° 20.229'E	Domestic
28		Anondomoyee Ghat	22° 45.324'N	88° 20.907'E	Domestic
29		Ballavpur Crematorium Ghat	22° 44.659'N	88° 21.332'E	Crematorium
30		Mahesh Jagganath Ghat	22° 44.751'N	88° 21.375'E	Ferry Service
31		Mahesh Crematorium Ghat	22° 44.071'N	88° 21.455'E	Crematorium
32		Dhobi Ghat	22° 45.580'N	88° 20.462'E	Ferry Service
33		Srirampur Ghat	22° 45.540'N	88° 20.534'E	Ferry Service
34	**Baidyabati**	Sheoraphuli Ghat	22° 46.652'N	88° 19.789'E	Ferry Service
35		Shyama Charan Chatterjee Ghat	22° 46.935'N	88° 19.796'E	Ferry Service
36		Du Paisar Ghat	22° 46.656'N	88° 19.779'E	Ferry Service
37	**Bhadreswar**	Gourhati Ghat	22° 48.997'N	88° 21.276'E	Domestic
38		Babu Ghat	22° 49.712'N	88° 21.506'E	Ferry Service
39		Shibtala Ghat	22° 49.807'N	88° 21.843'E	Domestic
40		Shyamsundar Ghat	22° 49.548'N	88° 21.299'E	Domestic
41		Telinipara Ferry Ghat	22° 50.036'N	88° 22.399'E	Ferry Service
42	**Champdani**	Champdani Ferry Ghat	22° 47.963'N	88° 21.012'E	Ferry Service
43		Nimai Tirtho Ghat	22° 47.156'N	88° 19.906'E	Domestic

44		Hatisal Ghat	22° 47.271'N	88° 19.943'E	Domestic
45		Mondol Ghat	22° 47.016'N	88° 19.830'E	Domestic
46	**Chandannagar**	Rani Ghat	22° 51.611'N	88° 22.265'E	Domestic
47		Jora Ghat	22° 51.431'N	88° 22.178'E	Domestic
48		Boraichanditala Ghat	22° 52.013'N	88° 22.714'E	Ferry Service
49		Gopinath Ghat	22° 51.735'N	88° 22.339'E	Domestic
50		Jaggadal Ghat	22° 51.529'N	88° 22.208'E	Ferry Service
51		Gondalpara Ferry Ghat	22° 50.658'N	88° 22.333'E	Ferry Service
52		Chandannagar Ferry Ghat	22° 51.632'N	88° 22.283'E	Ferry Service
54		Goswami Ghat	22° 52.001'N	88° 22.696'E	Domestic
55	**Hugli-Chinsurah**	Mayurpankhi Ghat	22° 53.831'N	88° 24.251'E	Ferry Service
56		Hooghly Ferry Ghat	22° 54.339'N	88° 24.161'E	
57		Chinsurah Launch Ghat	22° 54.339'N	88° 24.161'E	Ferry Service
58		Chandni Ferry Ghat	22° 54.748'N	88° 23.941'E	Ferry Service
59		Hooghly Ferry Ghat	22° 54.745'N	88° 23.920'E	Domestic
60		Burning Ghat	22° 54.137'N	88° 24.236'E	Crematorium
61		Itkhola Ghat	22° 55.240'N	88° 23.913'E	Domestic
62	**Bansberia**	Gandheswari Burning Ghat Ghat	22° 56.540'N	88° 24.353'E	Crematorium
63		Gandheswari Ghat	22° 56.690'N	88° 24.335'E	Domestic
		Bansberia Ganesh Ghat	22° 57.640'N	88° 24.385'E	Domestic
64		Dunlop Ferry Ghat	22° 56.450'N	88° 24.387'E	Ferry Service
65		Rashmoni Ghat	22° 57.720'N	88° 24.379'E	Domestic
66		Tribeni Burning Ghat	22° 59.103'N	88° 24.115'E	Crematorium
67		Tribeni Lorry Ghat	22° 59.176'N	88° 24.130'E	Domestic
68		Tribeni Ferry Ghat	22° 59.044'N	88° 24.096'E	Ferry Service
69	**Magra-Chinsurah**	Chaitnya Doba	23° 0.446'N	88° 24.759'E	Domestic
70		Magraghat	22° 59.035'N	88° 23.951'E	Domestic

71		Kuntighat Ferry Ghat	23° 1.147'N	88° 24.896'E	Ferry Service
72	**Balagarh Ghat**	Balagarh Burning Ghat	23° 7.623'N	88° 28.059'E	Crematorium
73		Balagarh Ferry Ghat	23° 7.624'N	88° 27.988'E	Ferry Service
74		Chaar Khyramari Ghat	23° 5.032'N	88° 29.484'E	Ferry Service
75		Sabuj dweep parapaar	23° 8.115'N	88° 26.769'E	Ferry Service

Plate 28 : Uttarpara Doltala Ghat

Plate 29: Uttarpara Ferry Ghat

Plate 30: Uttarpara – Ariadaha Ferry Ghat

Plate 31 : Uttarpara Ram Ghat , Plate 32 : Tribeni Ferry Ghat

Plate 33 & 34 : Vegetables transported through River Kunti , 23° 1.201'N 88° 24.618'E

Plate 36 : Chandannagar Ferry Ghat

Plate 37 : Tribeni Burning Ghat

Plate 38 : Chandannagar Boraichanditala Ghat , Plate39 : Konnagar Ghat

CHAPTER 6 - DOCUMENTING LIVLELIHOOD PATTERN & ACTIVITIES IN AND AROUND THE RIVER HUGLI.

6.1. LANDUSE LANDCOVER STUDY IN THE STUDY AREA

Hugli district of West Bengal, is another very fertile stretch of land . However , our study area includes the heavily urban sector of the district mostly covering the municipalities starting from Uttarpara-Kotrung, Serampur ,Chamdannagar & Chinsura. The northern portion of the study area that includes Balagarh exhibits the rural traits where agriculture predominates. The rainfall is regular and copious, the soil is fertile, and it is periodically enriched by fresh deposits of silt from the overflow of the rivers. The latter are constantly carrying on the work of erosion and accretion, of soil denudation and formation, but the process of soil formation is the more active of the two. The manner in which a large river with a steady slow current acts as a land-builder is best seen in thana Balagarh, where every year the Hugli (Bhagirathi) throws up chars after the rams, either in its bed or along its bank. If not swept away in a year or two, the chars, when sufficiently raised above flood-level, are eagerly sought after by the ryots. Being renovated annually by deposits of silt, they require no-manure, and they grow splendid rabi crops of pulses, mustard, tobacco or - vegetables. The lands along the river are similarly raised by accretion, and are also made to yield rabi crops, if high, and rice, if low-lying ; but a large proportion, not receiving fresh silt deposits, remains waste, and are covered either with coarse grass or wild undergrowth.

A third aspect of an alluvial plain is seen in the Serampore subdivision and the rest of the Sadar subdivision. This tract is protected from river floods by high banks or artificial embankments, but is liable to be submerged by excessive rain. The lands, whether high or low, are extremely fertile. The uplands yield fine crops of vegetables, and land at a slightly lower level dus rice or jute alternating with fftbi. The lovdands, enriched by the drainage and refuse of the villages, are eminently adapted for the cultivation of winter rice. Southwards, in the Serampore subdivision, the lowest lands receive the drainage from the whole of the northern tract, which is unable to find an outlet into the rivers. They are consequently converted into extensive marshes covered with reeds, sedges and coarse grasses, but winter rice grows well on their borders.

On an average in our study area about 38 percent of the total population belongs to the agricultural population while the non-agricultural sector accounts for the remaining 62 percent. The eastern, northern, southern and central areas of the district are extensively cultivated. Rice is the staple food of the district. Paddy covers maximum of the gross cropped area. Generally, three crops of paddy are taken as Aus, Aman and Boro in a year if irrigation water is available covering about 85 per cent of the total gross cropped area. Among commercial crops, jute, sugarcane, potato and oilseeds are major crops. Vegetables are also grown abundantly.

Our Study area comprises of 666.59sq.km with about 123.62 sq.km under agriculture. Out of this area almost 190.68 sq.km area is under double or multiple crops. Rest of the 90.77 sq.km area remains clogged during monsoon while some vegetables are grown in the winters. Heavy urbanisation can be observed along the banks of Hugli River with very ancient agglomeration of Portuguese, Dutch, French, Danes and English. The settlement area occupies about 234.64 sq.km covering 35% of land.

Potato is a very important vegetable produced and cultivated all along the river banks with oilseeds like mustard. As regard crop diversification it has been observed that the southern part is comparatively less diversified than the north-western part because of the variation in

A general landuse and cropping pattern map is prepared with the help of Landsat FCC Image , 2019 shows spatial distribution of Mono Crop Land (low lying areas), Double Crop Land , Settlement Areas , Water body & Homestead orchards . The major crop is rice, while the minor crop is pulse and vegetables growing areas in the district including rural-urban settlements, forest, orchard and plantation. Swamp area which is presently used as commercial fish production is also delineated in the map.

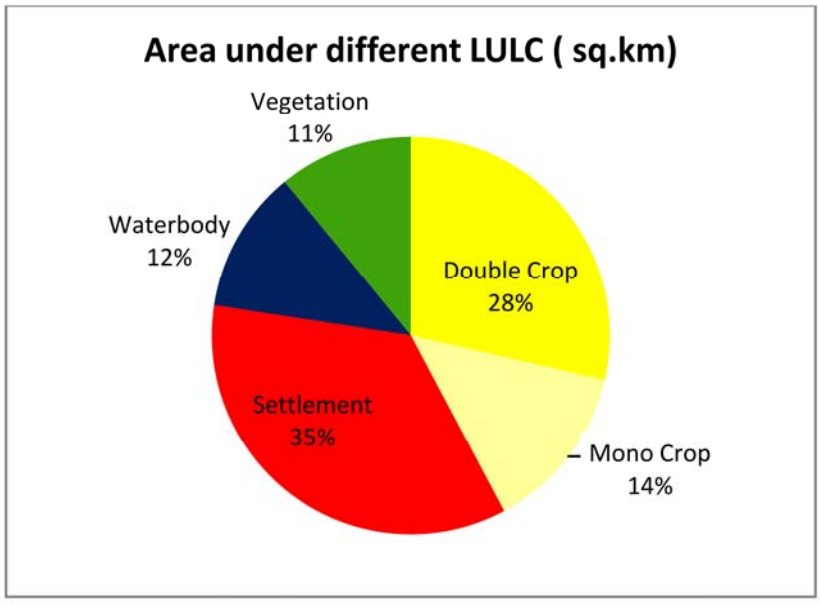
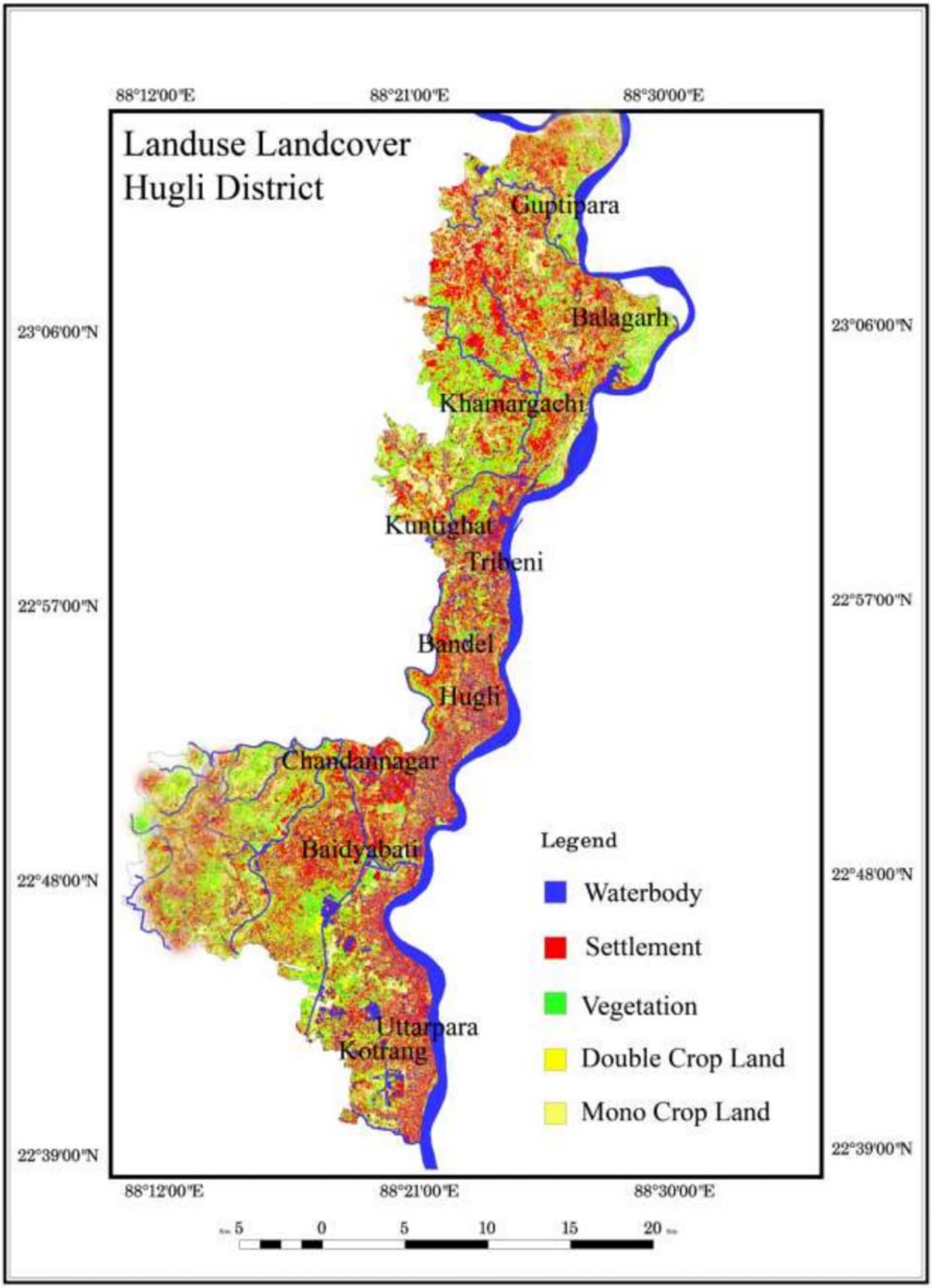


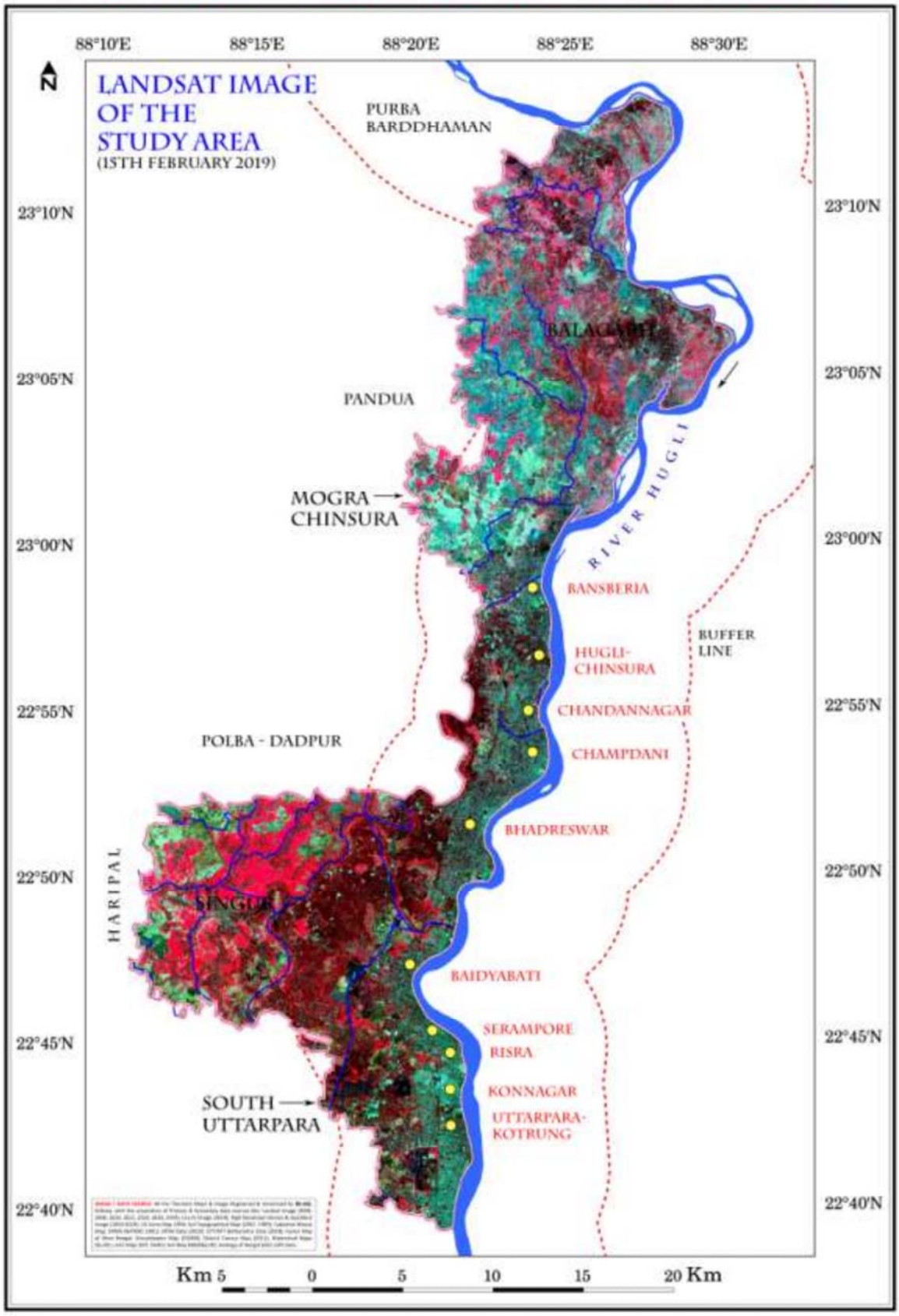
Plate 40– Paddy is the major agricultural crop of the study area, Singur 22° 44.841'N 88° 18.791'E

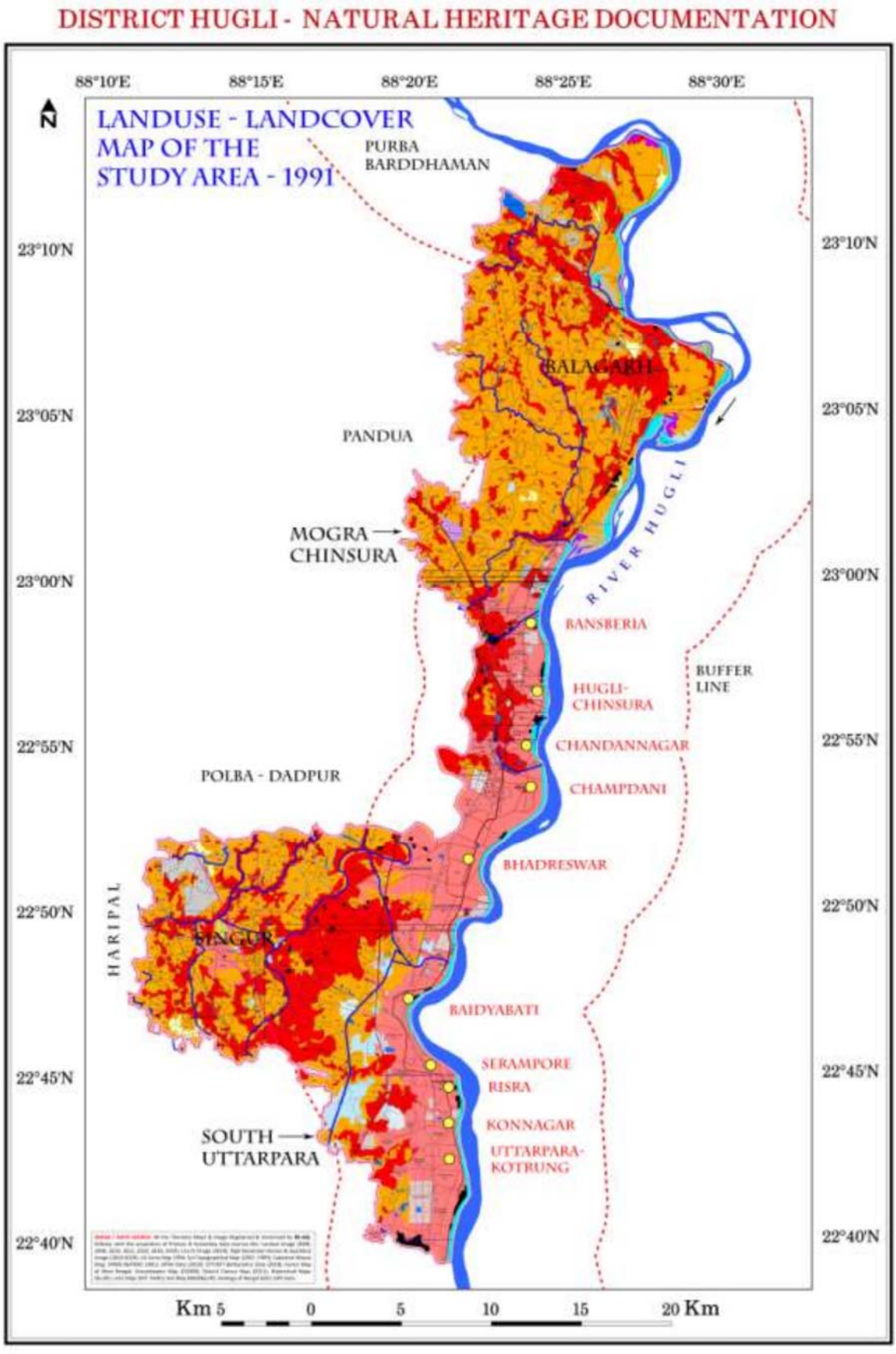
Plate 41 : Potato farming in the study area , Mogra –Chinsurah Block



Map 19 – LULC Map of the Study area , Source :
Landsat Image , 2019

DISTRICT HUGLI - NATURAL HERITAGE DOCUMENTATION




DISTRICT HUGLI - NATURAL HERITAGE DOCUMENTATION
LANDUSE - LANDCOVER MAP OF THE STUDY AREA - 1991
N
88°10'E
88°15'E
88°20'E
88°25'E
88°30'E
23°10'N
23°05'N
23°00'N
22°55'N
22°50'N
22°45'N
22°40'N
PURBA BARDDHAMAN
BALAGARH
PANDUA
MOGRA
CHINSURA
RIVER HUGLI
BANSBERIA
BUFFER LINE
HUGLI-CHINSURA
CHANDANNAGAR
CHAMPDANI
POLBA - DADPUR
BHADRESWAR
HARIPAL
SINGUR
BAIDYABATI
SERAMPORE
RISRA
KONNAGAR
UTTARPARA-KOTRUNG
SOUTH UTTARPARA
Km 5 0 5 10 15 20 Km

6.2. River / Channel bank using for various Economic activities

6.2A. Agriculture

Hugli lies within the biggest agro-climatic zone in West Bengal – the new Alluvium Zone. The alluvium zone spreads southward approximately from the head of the delta formed by the succession of rivers. This district has the highest cropping intensity and crop diversity. The district is about 10 m -15 m above MSL and criss-crossed by the Bhagirathi and its tributaries. Soil of this agro-climatic zone is deep, well drained, texturally fine, loamy, and neutral in reaction with high base saturation and medium to medium low NPK status. The area is humid and with high precipitation. Summer is hot and humid and winter is moderate which facilitates higher crop production and yield. The district has a tendency of high rainfall and also occurrence of flood.

PRINCIPAL CROPS

Rice forms the staple crop of district, and is particularly well suited to the low damp lands, receiving an abundant rainfall. Many varieties are grown, but the crops may be grouped under three main heads according to the harvest seasons, viz., boro or spring rice, aus or autumn rice, and aman or winter rice.

Boro rice is ordinarily transplanted along the banks of Boro marshes, or in very low lands which remain wet till well into summer. Ploughing is not required if the ground is of soft mud otherwise one or two ploughings are given. It is sown in the nursery in November, transplanted in December, and reaped in April and May. This class of rice includes only coarse varieties and the area of land which can be profitably reservecl for its

cultivation is small, Only newly threshed grain will germinate properly, and the grain has to be prepared carefully before sowing in the nursery.

The crop of next importance to the district is the winter rice or aman. It is in this class that the most varieties occur, and it furnishes all the finest qualities of rice. The preparation of the land for this crop begins early in the year. In April or May the seed is sown very thick in a nursery, and when the seedlings make their appearance another field is prepared into which to transplant them. For this purpose it is necessary to repair the embankments round the field so that it shall retain all the rain which it receives. It is then repeatedly ploughed up until the surface

Plate 42 : Aman Paddy cultivation , Gournagar , Balagarh 23° 7.259'N 88°29.303'E

is reduced to thick mud. The seedlings are then taken out of the nursery and transplanted into rows about nine inches apart, where they are left to mature, the only subsequent operation being one or two weedings in the latter part of August. The crop is harvested in November or December. The most critical period for this crop is when it begins to blossom in the latter part of October. If there is not sufficient moisture at this time, no grain will form in the ear. The soil most suited to the aman crop is one that contains a large admixture of clay.

JUTE

The cultivation of jute has been steadily increasing of late years, and this crop now occupies 9 per cent. of the normal net cropped area. Generally speaking, it does well on lands which are suitable for ours rice. But still the inundated areas of adjoining districts of Nadia and Murshidabad has more land under jute cultivation.

The preparation of the land for this crop begins as soon as sufficient rain to moisten it has fallen. It is first ploughed twice or thrice and then allowed to rest for a time, while the cultivator manures it with cow-dung and any other fertilizing agent upon which he can lay his hands. It is ploughed again in May, and the surface rendered' as fine as possible, after which the seed is sown. then the seedlings are five or six inches in height, a harrow is passed over the field with a view to thinning out the plants where they a

Plate71 : The lush green Aman Paddy fields in the Jaluidanga area, Kalna 23° 20.625'N 88°

surface of the ground. The first weeding does not take place until the plants are about a foot high ; every effort is then made to entirely eliminate the weeds, and if the work is well done no further weeding is required. The crop matures in August or September, and it is then cut and tied up in bundles about 15 inches in diameter, which are steeped in the nearest stagnant water for about a fortnight until the stalks have become sufficiently decomposed to admit of the extraction of the fibre from them. In performing this operation the stem is broken near the root, and the broken portion drawn off ; the protruding end of the fibre is then grasped, and, by gradual pulling and shaking, the rest of the fibre is extracted from the stalk. It is then well rinsed in water, and hung up on bamboos in the sun to dry. Jute is an exhausting crop to the land, and cannot be grown on the same plot for two years in succession. Some of the loss to the land is made up by scattering on the surface the leaves of the plant which are stripped from the stalks before they are steeped.

The quality of the jute grown in the Hugli district is inferior to that grown in the districts north of the Ganges. One reason for this is that in the latter districts the best lands are devoted to the crop, whereas in Hugliand other districts in the Presidency Division less care is taken in this respect .

OTHER CROPS

Crops producing oilseeds occupy, between the different varieties, about 22 per cent. of the normal net cropped area. In some parts, especially in the Chuadanga Subdivision, the cultivation of chillies *{capsicum frutescens)* and turmeric forms an important feature of the rural industry, and the peasant relies upon it to pay his rent. Indigo, the manufacture of which was once the most important industry in the district, now occupies only about J,000 acres. About 20,fi00 acres are devoted to orchards and market-gardens. Generally speaking, the quality of the mangoes is not good, and in some parts of the district, especially in the Kalantar, even the yommon mango does not do well. The cultivation of potatoes is extending especially in the south of the district near the railway line, in which parts other garden produce is freely grown (where the conditions of the soil permit) and exported to Calcutta. Different vegetables like brinjal, pointed gourd, bitter gourd , leafy vegetables etc are cultivated.

Plate 43 : Machan Crop like Gourd , Pumkins are cultivated in the homesteads . Lakshmirani in her field , Dumurdaha 23° 2.104'N 88° 26.216'E

6.2.B. Boat Making : Balagarh in our study area is the largest boat making industrial zone of Bengal. It supplies boat to almost all the districts.

Balagarh is a non-descript sleepy hamlet, situated 115 km North of Kolkata, by the river Hugli. It is the heart of Bengal's indigenous boat manufacture. The centre where the boat makers and workshops still uphold a centuries-old tradition is clustered around Sripur market. The craft is at least 500 years old, with the boat makers of Sripur getting a mention in the writings of even Abul Fazal (1551-1602). Way back in the 16th-century, rivers were the lifeline of trade and business. Adi Saptagram, on the Saraswati River, a distributary of the Hugli was connected directly with the Bay of Bengal and used to be a busy river port. It was about 20 km south of Balagarh and local merchants used the port for conducting trade with countries as far as Sri Lanka, Burma, the Indonesian archipelago and other places.

The demand for boats was immense and Balagarh's craft plied every part of the Mughal Empire's richest province, which included today's Bihar and Odisha along with the old undivided Bengal. Rajbongshi wood craftsmen from Balagarh attended to them. Over the years, these craftsmen learnt boat-making and built boats for rivers as well as for seafarers. Interestingly, The Boat Makers of Balagarh used only Salwood earlier because of its sturdy quality but now they use Babla, Camphor and Shirish too. During monsoons, some fly-by-night boat builders use inferior quality wood as they lack funds to buy good quality wood.

A boat is measured by "hands". One hand = 45 cm. Boats may be from 10 hands (15 feet) to 28 hands (42 feet) or more. They are used mainly to transport sand, coal, etc., or for fishing and ferrying people. Monsoon brings business, but also sprouts fly-by-night crooks who hammer out a dingi nouko in less than 10 days with inferior wood. Balagarh's boat-makers find it hard to compete with these cons as they traditionally use only hardwood like sal or teak but are now forced to accept cheaper varieties. The primary markets for boats from Balagarh are Bihar, Jharkhand and neighbouring Bangladesh and Bengal itself. But the trade is no longer viable as the margins are very small. A 10-foot boat takes three to four days to make with two fully dedicated craftsmen and requires an investment of Rs 7,000. The sale price is just Rs 8000. This is driving down earnings and causing plight of boatmen. But the workers continue to hope that their skill will not die out.

Plate 44 & 45 – Boat making is going on at Balagarh , 23° 7.418'N 88° 28.645'E

Plate 46 – Boat making centre , Balagarh , 23° 7.418'N 88° 28.645'E

Plate 47 – Boat making centre , Balagarh , 23° 7.418'N 88° 28.645'E

Plate 48 & 49 : Boat making centre , Balagarh , 23° 7.418'N 88° 28.645'E

6.2.C. Potteries and other clay items –

With the availability of riverine clay , many people are involved in making potteries and other useful items like Well Rims . During the time of religious festivals many of them start preparing idols also.

6.2. D.Brick Kilns –The brick industry has been highly concentrated on the sides of the river Bhagirathi-Hugli of the study area. Most of the brickfield has been developed over the year 2000 in the agricultural land of the riversides. It is a significant economic activity that is one of the principal operators of topsoil loss and environmental degradation. These activities are decimating enormous areas of agricultural land every year. It has some evil effects on the geo - environment. Indiscriminate cutting of topsoil from the fertile agricultural land, river banks and lifting of sand from the river bed by brickfields lead to a severe impact on geo-environmental such as loss of soil fertility, riverbank erosion, changes in the river channel, degradation of water quality, deterioration of land and the adverse effects on the health of the brickfield workers.

Almost 38 significant brickfields are located throughout our study area which provides economic activity to a considerable number of people. Most of the fields are located in the vicinity of the main river occupying area ranging from 0.015sq.km to 0.115 sq.km. There is only one brickfield, specifically Bengal Brick field of Hugli having an area of 0.115 km^2 and is considered as a large industry in this study area. Soil, sand, mud, and coal are very important raw materials for brick making processes. About 344632.30 m^3 mud per brick production season in a year is used for making bricks by 58 brickfields of the study area

a. Brick Field near Arabindapally , Uttarpara – Kotrang , 22° 41.262'N 88° 21.483'E
Plate 50.

Plate 51 : 22° 44.253'N 88° 21.373'E, Mahesh Bosepara , Hugli

Plate 52 : 22° 47.192'N 88° 19.933'E, Baidyapara , Hugli

Plate 53 : 22° 52.245'N 88° 22.955'E,Nikaripara , Chandannagar , Hugli

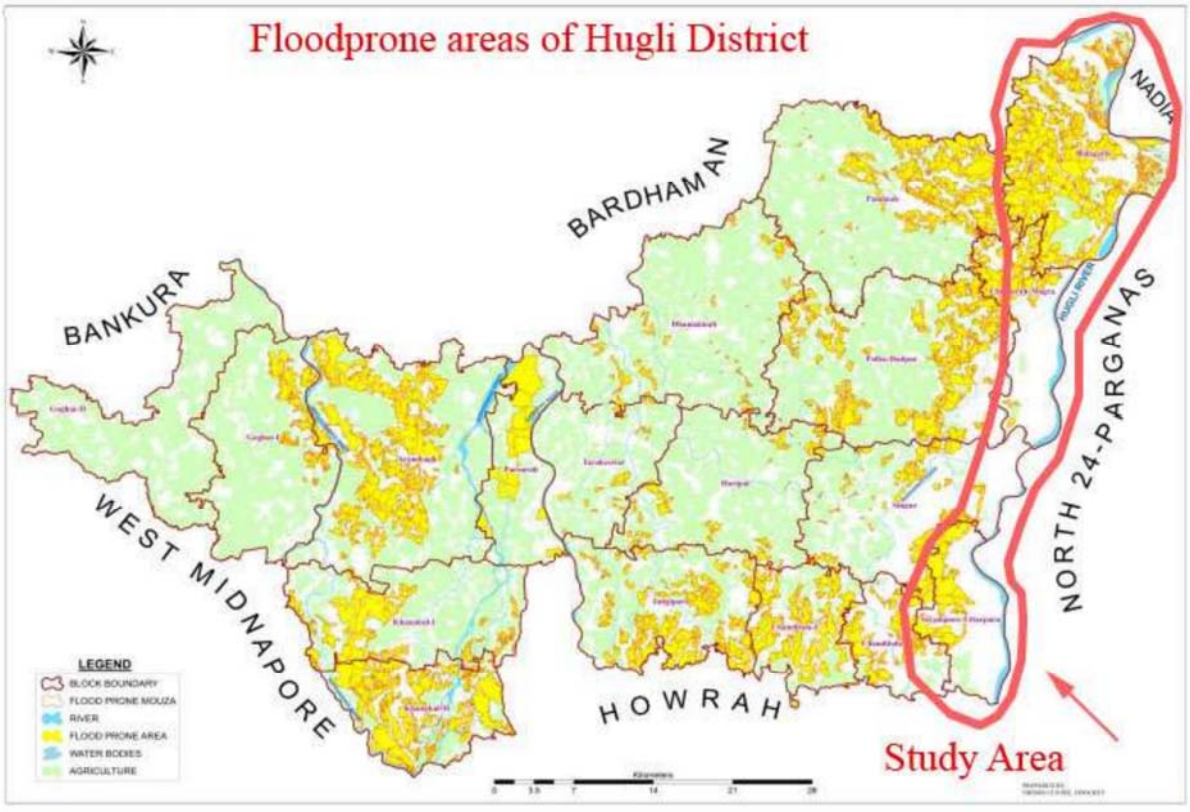
Plate 54: 22° 55.776'N 88° 24.067'E, Kuntighat , Hugli

Plate 55 : 22° 57.415'N 88° 24.326'E, Mithanpukur More , Bansberia, Hugli

Plate 56 : 23° 2.168'N 88° 26.264'E , Dumurdaha Char , Hugli

CHAPTER 7: DOCUMENTING ENVIRONMENTAL PROBLEMS

7.1. Flood - The Hugli district like any other district of West Bengal is a flood prone district of West Bengal. Every year during the rainy season large areas get inundated by flood water. However since our study area is under heavily built-up category of landuse landcover , the phenomenon of flood is not observed except for in the northern Chinsurah- Mogra and Balagarh Block. Rest of the areas suffer from Urban Flood or water logging because of the ill-maintenance of the canals. All the 08 municipalities of the study area namely;- HooghlyChinsurah, Bansberia, Chadernagore Municipal Corporation, Bhadreswar, Baidyabati, Serampore, Rishra, Uttarpara-Kotrong, are more or less affected by water logging every year, because of inadequate drainage. Bhagirathi: Hooghly (Bhagirathi) is the principal river of the district, flows the eastern part of the district for about 72.0k.m.Beside that there is Ghia-Kunti System with 59.56 km , Baidyabati Canal with 9.50 km , Dankuni Khal with 10.60 Km , Saraswati River with 31.21Km, Cut-Kunti Channel with 11 km . All the channel bank areas are prone to flooding.



Map 20 : Flood affected areas of Hugli District

Name of the Block	Type of Hazard	Rivers	Name of The GPs / Wards Affected (Vulnerable areas)	No. of People Affected
Balagarh	Flood & Cyclone	Hugli-Bhagirathi River	Char-Krishnabati G.P –Fultala ,Char-Rampur,Choraldanga,Roypara,Benalichar Saktipur,Kurmipara	Whole village
			Sripur –Balagarh GP – Rajbanshipara,Kshatriyanagar,Khalpar, Bhabanipur,Bhabanipur Char,Tinchar,Sripur Bazar Tentulia,Sripur	
			Jirat G.P – Char Khyaramari ,Khaserchar Kaligarh,Hasimpur	
			Sija-Kamalpur G.P – Gournai ,Dhakchhara , Kamalpur (Sisupara)	
			Somra-1G.P – Sundarpur , Kamardanga , Abdulpur,Joshra-Bakipur,Paigachi	
			Dumurdaha G.P – Chandigaccha , Srikanta , Dadpur , Aschitpur , Daspara , Ramnagar	
Mogra-Chinsurah	Flood	Bhagirathi	Patuli, Majida, Purbasthali, Jhowdanga, Mertala & Pilla Gram Panchayat	Whole village

Plate 57: Flooded Mogra area, Source : Telegraph , India.

7.2.Bank Erosion - Channel instability and rhythmic fluctuation through erosion-deposition sequence are very familiar phenomena in the lower course of a river in monsoon climate. A river is found to be scouring in a place and deposit at others. A live channel, therefore, evolves through channel changes. The course of river Bhagirathi-Hooghly has undergone changes during last few centuries (Chatterjee, 1989). Descriptions by various scholars viz. Rennell (1788), Colebrooke (1801), Sherwill (1858), Hirst (1915), Mukherjee (1938), Bandyopadhyay (1996), Ray (1999), Bhattacharya (2000), and Rudra (2010) have outlined frequent shifting nature of Ganga. So channel shifting of Ganga or the Bhagirathi-Hooghly system has drawn attention from time immemorial.

Every year during the time of Monsoons , Balagarh Block in our study area is highly affected by bank erosion. 09 Gram Panchayets of Balagarh Block like Chandrahati 1 & II , Dumurdaha , Nityanandapur 1 & II , Khamargacchi, Jirat , Somrabazaar ,are hugely vulnerable. Many of these Gram Panchayats have lost many of the land areas under river erosion.

Plate 58: Bank Erosion along Hugli River , Balagarh during Monsoons , Source : Anandabazar .

Causes –

a. Since the Farakka Barrage has been planted in Malda, vast parts of land downstream, gets affected by massive floods almost every year. Erosion occurs mainly through slumping and hydraulic action of the river water.

b. Impact of In-Bed and On-Bank Soil Cutting by Brick Fields on Moribund Deltaic Rivers:

Soil Cutting from bank and bed for brick fields is one of the most triggering human activities affecting the river. This illegal practice causes bank erosion leading to loss of property and life. It also multiplies silt charge (Moscrip and Montogomery, 1997) and consequently the river becomes shallow and deteriorates rapidly (Collier et al, 1996). Given the context, we seek to focus on reckless soil and sand cutting from banks and beds of River Bhagirathi and Jalangi and assess the impact of those soil and sand cutting from banks and beds on the channel morphology and inhabitants on the banks of the river. The traditional brick manufacturing needs considerable land area and top soil. The land used for top soil loses its fertility and the land erosion is accelerated. The land area near the kiln is subjected to high temperature making it unfit for uses in agricultural activities after being abandoned. The brick manufacturing uses thousands of tonnes of coal and biomass fuel (The energy use is 30-35 % of production cost). The possible pollutants from brick kilns are: 1. Carbon dioxide (CO2). 2. Carbon monoxide (CO). 3. Sulpher dioxide (SO2). 4. Nitrogen Oxides (NOx). 5. Suspended Particulate Matter (SPM). Along with these there is a problem of high volume of bottom ash as residue. It affects the agricultural productivity of the surrounding fertile tracts. The other possible environmental threat may be disturbance of flow path of natural stream, nullah, river due to establishment of the brick kiln in the vicinity in the path leading to obstruction in downstream as well as for distribution on flow of water during rainy season. The waste produced from the brick kilns of the area falls in the nearby river thus creating pollution.

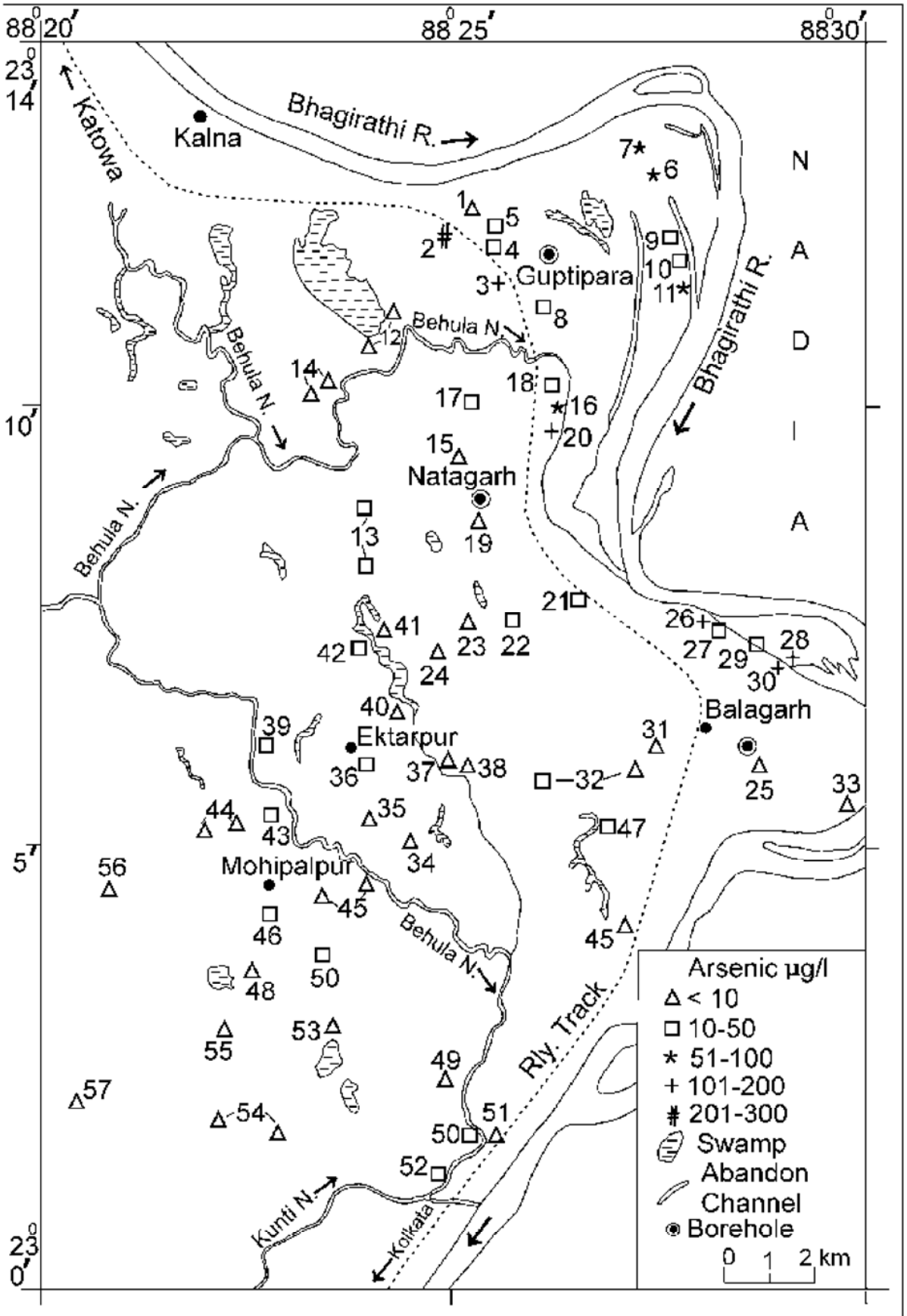
c.Absence of Vegetal cover : Soil erosion potential is increased if the soil has no or very little vegetative cover of plants and/or crop residues. Plant and residue cover protects the soil from raindrop impact and splash, tends to slow down the movement of surface runoff and allows excess surface water to infilt rate. The erosion- reducing effectiveness of plant and/or residue covers depends on the type, extent and quantity of cover. Vegetation and residue combinations that completely cover the soil, and which intercept all falling raindrops at and

close to the surface and the most efficient in controlling soil (e.g. forests, permanent grass. Partially incorporated residues and residual roots are also important as these provide channels that allow surface water to move into the soil. As we travelled by the side of the Ganges, we could see a number of deciduous trees. These trees shed their leaves in winter. Plants of low height also dominate the area. Shrubs and grasses with hard knify leaves are found scattered. Though the soil is sandy, it has a good percentage of silt and loam in it. The ground has grass but is not covered by it. The height of the shrub layer is seen to increase towards the river but as erosion proceeds, it engulfs the land areas. We heard a date palm tree falling in the river just the day before our 4th day of survey. Al these processes have a joint action on the bank materials and thus cause a substantial part of land to get detached and flow away with the running water.

7.3. Arsenic Pollution & Ground Water:

Arsenic contamination in groundwater affecting West Bengal (India) and Bangladesh is a serious environmental problem. Contamination is extensive in the low-lying areas of Bhagirathi–Ganga delta, located mainly to the east of the Bhagirathi River. A few isolated As-contaminated areas occur west of the Bhagirathi River and over the lower parts of the Damodar river fan-delta. The Damodar being a Peninsular Indian river, the arsenic problem is not restricted to Himalayan rivers alone. Arsenic contamination in the Bengal Delta is confined to the Holocene Younger Delta Plain and the alluvium that was deposited around 10,000–7,000years bp, under combined influence of the Holocene sea-level rise and rapid erosion in the Himalaya. Further, contaminated areas are often located close to distribution of abandoned or existing channels, swamps, which are areas of surface water and biomass accumulation. Extensive extraction of groundwater mainly from shallow aquifers cause recharge from nearby surface water bodies. Infiltration of recharge water enriched in dissolved organic matter derived either from recently accumulated biomass and/or from sediment organic matter enhanced reductive dissolution of hydrated iron oxide that are present mainly as sediment grain coatings in the aquifers enhancing release of sorbed arsenic to groundwater. Overuse of groundwater and consequent depletion of groundwater level has unfortunately invited arsenic pollution in groundwater through oxidation of arseno-pyrites. Arsenic occurs at 15m-60m depth and is often found along the existing or abandoned river course, bils etc. Long continued consumption of arsenic-contaminated drinking water gives rise to arsenicosis, a health hazard which may cause skin lesions to cancer. Victims are

mainly undernourished, poor people of remote villages in Balagarh & Mogra Chisurah blocks deprived of minimum transport, education, medical and marketing facilities.



Map 21 of Guptipara and Balagarh area showing Arsenic level , Source : Subhrangshu Acharya & Babar A. Shah , Arsenic-contaminated groundwater from parts of Damodar fan-delta and west of Bhagirathi River, West Bengal, India: Influence of fluvial geomorphology and Quaternary morphostratigraphy

Major Findings : i) Arsenic concentration is high in meander scars, oxbow lakes, linear lakes etc, left out by meandering Bhagirathi. So, presence of arsenic may be related to the flood behaviour of the Bhagirathi, though the hypothesis is yet to be tested by scientists. ii) Arsenic concentration is mainly conined to a speciic layer between 15m to 60m and sometimes at greater depth (100m). iii) Arsenic concentration changes over a very short distance. So, some of the tubewells are affected and some are not within a few 10s of metres. iv) People with poor nutrition are affected more. v) To the women arsenic related health hazard becomes a social hazard. vi) Arsenic is a silent killer for its longer lag period vii) Poor access to health facilities owing to poor transport system or low economic standard make the people vulnerable to this disease. ix) Measures taken to fight with arsenic pollution is still inadequate though the issue is often politicized. x) Arsenic pollution may create environmental refugees in future if the problem is not addressed with proper attention.

7.5. Impact of barge movement on fish catch and livelihood issues of fishers:

River plays an important role in supporting the livelihood of millions of impoverished communities. In the Bhagirathi-Hugli stretch of the Ganga river, a sizeable population of fishers depend on fishing for their livelihood and daily sustenance. Any disturbance including movement of vessels in the river will have direct bearing on fishing operations which may result into obstruction of the fishing activities and thereby affecting the daily livelihood of the fishermen.

7.6. Pollution : Our study area mostly covers municipality areas where Pollution is the major environmental hazard in this zone. Over 7 billion litres of raw sewerage are dumped into the Ganga every day from hundreds of towns along the river and its tributaries, and almost half comes from West Bengal, says Kalyan Rudra, chairman of the West Bengal Pollution Control Board and a hydrologist who has been tracking the state of the river for many years.

The state contributes 48% of wastewater produced in the Ganga basin and only treats 42% of this – leaving 1,779 MLD (million litres a day) of untreated waste flowing from the 54 drains throughout the state. Uttarpara – Kotrung , Serampur, Chandannagar , Chinsurah are the worst polluted areas of the study zone.

Water quality of the Bhagirathi-Hooghly river at different sampling stations (State of environment report West Bengal, 2016) shows the following result .

Sample points	DO (mg/l)		BOD (mg/l)		TCC (MPN/100ml)		FCC (MPN/100ml)	
	Apr. 2015	Oct. 2015	Apr. 2015	Oct. 2015	Apr. 2015	Oct. 2015	Apr. 2015	Oct. 2015
Tribeni	7.1	6.0	1.88	4.3	140000	110000	70000	80000
Serampore	6.5	5.6	2.68	1.15	140000	80000	110000	70000

In our survey , what we find that almost all the outlets like canals , drains and rivers in the study area adds considerable amount of municipal wastes to the main river.

Plate 59 : An outlet at Bandel , Hugli , 22° 55.133'N 88° 23.919'E with lots of municipal sewage.

Plate 60 : 23° 1.200'N 88° 24.562'E, plastic wastes along Kunti River, Kuntighat , Hugli

Plate 62 : 22° 50.114'N 88° 22.449'E, pollution along river Hugli , Gondalpara, Chandannagar , Hugli

Plate 63 : Pollution along River Sarswati , Chinsurah , 22° 58.838'N 88° 23.672'E

Plate 64 : Huge pollution at the Tribeni Ghat , Hugli , 22° 59.087'N 88° 24.118'E

7.7 .Urbanisation: Developing countries of the world encounter urbanisation and infrastructural development in or around the fertile tracts and the absence of any landuse plan for desired landuse change has led to conversion of farmlands, which is detrimental to future food security and environmental quality. Hugli district is traditionally well known as one of the most prosperous agricultural regions of West Bengal, but the district is experiencing rapid urban extension and infrastructural development towards productive agricultural land since 1991. This has caused decline in the amount of agricultural production, which may be treated as an indicator of increasing threat to the long run sustainable livelihood security of the people of the whole of West Bengal.

Blocks	**% of Urban population to total population**		**Urban area in km2**		**No. Of CT (Census towns)**	
	2001	**2011**	**2001**	**2011**	**2001**	**2011**
Balagarh	2.2	12.31	1	9.4	1	4
Chinsurah Mogra	46.83	64.87	19.9	24.43	9	15

Data- Census of India

The above mentioned data shows that in our study area there are 2 major blocks along Hugli River which shows rapid urbanisation which leads to broad-based rural to urban transformation relating population, landuse, economic activity, culture, or indeed any one of these (McGranahan et al., 2014:6). The study area has experienced rapid pace of urbanisation and infrastructural development within a span of 10 years from 2001 to 2011. Consequently, the net sown area of the selected blocks has declined and non agricultural landuse has increased simultaneously. Future projection of landuse change, loss of soil fertility, productivity decrease, and rise of population are some of the facts, which are directly consequent upon the future food security of the area.

An important consequence of urbanisation can be establishment of a new balance with the agricultural processes. This new balance necessitates direct attention to a number of problems that must include both formal and informal planning (Winfield, 1973: 73). Lower yield rate, constant increase of population, contraction of cropland by built up area and infrastructural development are the major problems in the study area. To deal with these problems, modern agricultural system becomes important. Modern agricultural process is solely dependent upon several formal and informal planning in agriculture, which requires access to resources, technology, management, investment, markets and supportive government policies. There

must be proper supply of nutrients to maintain soil fertility. Plant growth must be promoted without soil loss by new technologies and machineries. Effective irrigation system along with the use of improved genetics for crops and livestock to enhance yields and use of modern genetic and other techniques to protect plants and livestock from losses to competing plants, diseases, drought insects and other threats are necessary actions to be given attention. There must be a highly productive and efficient system that simultaneously protects the environment by means of sensitive and efficient use of natural resources (Motes, 2010: 13). Moreover, balanced urbanisation is a good sustainable urbanisation example where attainment of sustainable food security is must, which involves issues like conserving land, water, and economic growth through food production (Chambers, 1987; Jain et al., 2010 and Liu et al., 2017).