DISTRICT SURVEY REPORT
OF
MURSHIDABAD DISTRICT

(For mining of minor minerals)
As per Notification No. S.O.141 (E) New Delhi Dated 15th of January 2016 and S.O.3611 (E) New Delhi Dated 25th of July 2018 and Enforcement & Monitoring Guidelines for Sand Mining (EMGSM) January 2020, Issued by Ministry of Environment, Forest and Climate Change (MoEF& CC)

SEIAA Approval Date:

26th July 2022

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July, 2022

PREPARED BY
Department of Industry, Commerce & Enterprises
Government of West Bengal

GOVERNMENT OF WEST BENGAL
DIRECTORATE OF MINES & MINERALS
4, ABANINDRANATH TAGORE ROAD
KOLKATA-700016

No. 1333 MD

Kolkata, 6th January, 2022.

TO WHOM IT MAY CONCERN

This is to certify that DSRs of concerned districts of West Bengal have been duly validated by respective district authorities and their suggestions/inputs, if any, have been duly incorporated in the DSRs. The DSRs have been finally scrutinised and accepted by the scrutiny committee of DMM, WB and the same have been forwarded to the Dept. of Industry, Commerce and Enterprises along with respective scrutiny reports for onward transmission to SEAC for necessary action.

Director of Mines and Minerals

Govt. of West Bengal

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Abbreviations

% DEP – Departures

° C – Degree Centigrade

BGL – Below Ground Level

CD - Community Development

Cft- Cubic Feet

CGWB - Central Ground water Board

CRIS - Customized Rainfall Information System

Cum - Cubic meter

DGMS - Directorate General of Mines Safety

DGPS - Differential Global Positioning system.

DL&LRO - District Land & Land Reform officer

DSR - District Survey Report

EC – Environmental Clearance

EIA- Environment Impact Assessment

EMGSM - Enforcement and Monitoring Guideline for Sand Mining

ENVIS - Environmental Information System

ft – Feet

GIS - Geographical Information System

GMEC - Global Management and Engineering Consultant

GSI - Geological Survey of India

Ha – Hectare

hr - Hour

IMD – Indian Meteorological Department

ISRO - The Indian Space Research Organisation

KM - Kilometre

LISS - Linear Imaging Self-Scanning Sensor

LOI - Letter of Intent

LULC - Land Use Land Cover

m^2 - Square meter

Mcum – Million Cubic Meter

MMDR - Mines & Minerals (Development and Regulation) Act

MMR - Metalliferous Mines Regulation

MOEF & CC - Ministry of Environment, forest & Climate Change

Mph- miles per hour

M-Sand - Mineral Sand

MSME - Micro, Small & Medium Enterprises

Mt - Metric Ton

MT – Million Tons

NGT - National Green Tribunal

NH – National Highway

NIC - National Informatics Centre

OC - Officer In Charge

OGL - Original Ground level

PSU - Public Sector Unit

R/F – Rain Fall

SSMG - Sustainable Sand Mining Guidelines

WBMDTCL- West Bengal Mineral Development and Trading Corporation Limited

The WBMMCR 2016 – The West Bengal Minor Mineral Concession Rules, 2016

Definitions

Riverbed: A riverbed is the area between two banks of river where sediment deposited. During the normal flow period, river water is contained in and flows along the riverbed. However, during a flood, the river overflows the riverbed and flows onto the floodplain.

Sandbars: The sandbar is the ridge of sand or coarse sediment that is built over a period of time.

Pre monsoon Sandbars: Sandbars which are identified from satellite imagery of pre monsoon period.

Post monsoon Sandbars: Sandbars which are identified from satellite imagery of post monsoon period.

Restricted Area: Sandbars or part of sandbars which are falling within restricted area. As per the Enforcement & Monitoring Guidelines for Sand Mining (EMGSM) 2020 the restricted zone for mining is a distance from the bank is ¼th of river width and not be less than 7.5 meters. Also, there is a no mining zone up to a distance of 1 kilometre (1 km) from major bridges and highways on both sides, or five times (5x) of the span (x) of a bridge/public civil structure (including water intake points) on up-stream side and ten times (10x) the span of such bridge on down-stream side, subjected to a minimum of 250 meters on the upstream side and 500 meters on the downstream side. No mining zone has been marked for an area up to a width of 100 meters from the active edge of embankments.

Potential Zone: Sandbars which are falling within the central 3/4th part of the riverbed and which are not falling within the restricted area.

Potential Block: Each individual sand bars of potential zone is Potential Block.

River bed occurrence: River bed occurrence means sand, stone, boulder, pebbles, gravel accumulated in the river bed by natural phenomenon.

Replenishment: Quantum of sand deposited in a mined out void during monsoon period.

Aggradations: Aggradation (or alluviation) is the term used in geology for the increase in land elevation, typically in a river system, due to the deposition of sediment. Aggradation occurs in areas in which the supply of sediment is greater than the amount of material that the system is able to transport.

Act: It means the Mines and Minerals (Development and Regulation) Act, 1957(67 of 1957), as subsequently amended.

Mineral: It means minor minerals as defined in clause (e) of section 3 of the Act.

Sand: A natural resource, is a minor mineral as defined under S 3(e) of the Mines and Minerals (Development and Regulation) Act, 1957 (" MMDR Act").

Lease: It means a mining lease granted under West Bengal Minor Mineral Concession Rules, 2016.

Mining: Excavation of mineral by manual method or using machineries.

EXECUTIVE SUMMARY:

Murshidabad district of West Bengal covers an area of 5324 sq. km. area. Murshidabadis located in the eastern part of the state and bounded by the district Malda to the North and Rajshahi Division of Bangladesh to the East. Districts PurbaBardhaman and Nadia are in the Southern side and Birbhum and the Pakur (Jharkhand) are located at the Western side of the district.

The Murshidabad district is divided into two broad zones namely Radh and Bagri, which are situated on the Western and Eastern side of the river Bhagirathi respectively. Radh is primarily composed of laterites and clay. This region is elevated than the eastern Bagri region. Some hillocks are situated in this region, of which the most popular one is known as Dhuli Pahari. The Eastern tract or Bagri lies almost entirely between the Ganga-Bhagirathi basins and is characterized by the existence of inundation along with many swamps.

The district is characterized by humid tropical monsoonclimate. The average annual rainfall in the district is 1128mm (2016-2020).

Soil type of the district mainly divided based on active alluvial plain or flood plain soil and alluvial plain or sub-recent alluvial soil & its sub-type. The soil in the eastern part of the district is very fertile for growing aus, paddy, jute and rabi crops, whereas in the western part, soil is mostly clay and lateritic clay type. The main crops in the western part of the district are paddy, sugarcane and potato. Around 76% of the land of Murshidabad district is under cultivation.

Geologically the district is divided into Recent – alluvium, Pleistocene-recent – older alluvium and lateritic clay and Jurrassic – Rajmahal Trap. The Rajmahal trap is found in the northern part of the district. A major part of the west of the river Bhagirathi is occupied by older alluvium and lateritic clay. The rest of the district is occupied by recent alluvium mainly composed of sands and clays.

The whole district falls under Zone III as per the earthquake zonation map of India. Major earthquake does not occur in the district; however, many earthquake shocks were reported since seventeenth century. Floods are a common feature in the district of Murshidabad of West Bengal, especially, in the low-lying areas of River Bhagirathi Basin. More or less every year the area gets flooded in the form of inundations due to excessive rainfall.

Murshidabad district does not have any major mineral deposits. The district is currently generating revenue from mining of minor minerals mostly from river bed sand and other materials. The drainage system of the district is mainly controlled by River Mayurakshi, Dwarka, Bramhani, Jalangi, Bhairab, and Ganga/Padma.

As per the data received from OC, Minor Minerals, DL&LRO office, Murshidabad, total 143 blocks have been allotted for mining of river sand in the district. Out of which 118 blocks are

allotted in Mayurakshi, 10 blocks are allotted Dwarka, 8 blocks in Bramhani, 2 blocks in Jalangi, 2 blocks in Bhairab, 2 blocks in Jalangi/Bhairab and 1 block in Padma River. Total allotted area for 143 blocks comes to about 288.23 ha and estimated reserve is around 6911631 CuM.Beside this, about 44 blocks are in the process of allotment by the competent authority. Revenue generated in the district of Murshidabad from Minor minerals during April 2017 to March 2022 is Rs. 26.53 Crore. However, as observed, the sand ghats allotted in Mayurakshi Rivers are often found to be closely spaced and need to study further with cluster approach. The cumulative effect of sand mining in many patches of Mayurakshi needs to be underataken by the competent authority.

The district has some potential areas of Rajmahal Trap basalt reported from Northern part of the district. Deleniation of the Basaltic occurences perform through satellite imagery study coupled with field investigation. An area of around 12.02 sq.km has been identified as a potential mineralized zone which can be developed in subsequent years through G2 level of exploration.

1 Preface

The need for District Survey Report (DSR) have been necessitated by Ministry of Environment, Forest and Climate Change (MoEF& CC) vide there Notification No. 125 (Extraordinary, Part II Section 3, Sub-section ii), S.O. 141 (E), dated 15th January 2016. The notification was addressed to bring certain amendments with respect to the EIA notification 2006 and in order to have a better control over the legislation. District level committee's have been introduced in the system. As a part of this notification, preparation of District Survey Reports has been introduced. Subsequently, MOEF& CC has published Notification No. 3611 (E), dt. 25thJuly, 2018 regarding inclusion of the "Minerals Other than Sand" and format for preparation of the DSR has been specified. Enforcement & Monitoring Guidelines for Sand Mining (EMGSM) January 2020, Issued by MoEF& CC is prepared in consideration of various orders/directions issued by Hon'ble NGT in matters pertaining to illegal sand mining and also based on the reports submitted by expert committees and investigation teams. This DSR has been prepared in conformity with the S O 141 (E), S O 3611 (E) and other sand mining guidelines published by MOEF& CC time to time as well as the requirement specified in West Bengal Minor Mineral Concession Rule, 2016.

The purpose of District Survey Report (DSR) is to identify the mining potential areas where mining can be allowed; and also to distinguish areas where mining will not be allowed due to proximity to infrastructural structures and installations, areas of erosion. The DSR would also help to estimate the annual rate of replenishment wherever applicable.

Preparation of this DSR involved both primary and secondary data generation. The primary data generation involved the site inspection, survey, ground truthing etc. while secondary data has been acquired through various authenticated sources and satellite imagery studies.

The district survey report of Murshidabad district also describes the general geographical profile of the district, distribution of natural resources, livelihood, climatic condition and sources of revenue generation.

2 Introduction

The District Survey Report of Murshidabad District has been prepared as per the guide line of Ministry of Environment, Forests andClimate Change (MoEF& CC), Government of India vide Notification S.O.-1533(E) dated 14th Sept, 2006 and subsequent MoEF& CC Notification S.O. 141(E) dated 15th Jan, 2016. This report shall guide systematic and scientific utilization of natural resources, so that present and future generation may be benefitted at large. Further, MoEF& CC published a notification S.O. 3611(E) Dated 25th July, 2018 and recommended the format for District Survey Report.

The main objective of DSR is identification of areas of aggradations or deposition where mining can be allowed; and identification of areas of erosion and proximity to infrastructural structures and installations where mining should be prohibited and calculation of annual rate of replenishment and allowing time for replenishment after mining in that area. The DSR would also help to calculate the annual rate of replenishment wherever applicable and allow time for replenishment.Besides the sand mining, the DSR also include the potential development scope of in-situ minor minerals.

The objectives of the District Survey Report are as follows:

1. To identify and quantify minor mineral resources for its optimal utilization.
2. To regulate sand and gravel mining, identification of site specific end-use consumers and reduction in demand and supply gaps.
3. To facilitate use information technology (IT) for surveillance of the sand mining at each step.
4. To enable environmental clearance for cluster of sand and gravel mines.
5. To restrict illegal mining.
6. To reduce occurrences of flood in the area.
7. To maintain the aquatic habitats.
8. To protect ground water in the area by limiting extraction of material in riverbeds to an elevation above the base flow.
9. To maintain data records viz. details of mineral resource, potential area, lease, approved mining plan, co-ordinates of lease hold areas, and revenue generation.
10. To design a scientific mining plan and estimate ultimate pit limit.
11. To frame a comprehensive guideline for mining of sand and other minor minerals.

The District Survey report (DSR) is comprised of secondary data published and endorsed by various departments and websites about geology of the area, mineral resources, climate,

topography, land form, forest, rivers, soil, agriculture, road, transportation, irrigation etc. Data on lease and mining activities in the district, revenue etc. are collected and collatedfrom concern districtDL&LRO office and West Bengal Mineral Development Corporation Limited.

2.1 Statutory Framework

Ministry of Environment, Forest and Climate Change (MoEF& CC) has published several notifications time to time to formulate and implement the District Survey Report (DSR) for every district. Statutory Frameworkandits legal aspect with respect to DSR is tabulated in Table 2.1.

Table 2.1: Statutory Framework and guidelines on DSR with time scale

Year	Particulars
1994	The Ministry of Environment, Forest & Climate Change (MoEF&CC) published Environmental Impact Assessment Notification 1994 which is only applicable for the Major Minerals more than 5 ha.
2006	In order to cover the minor minerals also into the preview of EIA, the MoEF&CChasissued EIA Notification SO 1533 (E), dated 14th September 2006, made mandatory to obtain environmental clearance for both Major & Minor Mineral more than 5 Ha.
2012	Further, Hon'ble Supreme Court wide order dated the 27th February, 2012 in I.A. No.12- 13 of 2011 in Special Leave Petition (C) No.19628-19629 of 2009, in the matter of Deepak Kumar etc. Vs. State of Haryana and Others etc., ordered that "leases of minor minerals including their renewal for an area of less than five hectares be granted by the States/Union Territories only after getting environmental clearance from MoEF"; and Hon'ble National Green Tribunal, order dated the 13th January, 2015 in the matter regarding sand mining has directed for making a policy on environmental clearance for mining leases in cluster for minor Minerals.
2016	The MoEF&CC in compliance of above Hon'ble Supreme Court's and NGT'S order has prepared "Sustainable Sand Mining Guidelines (SSMG), 2016" in consultation with State governments, detailing the provisions on environmental clearance (EC) for cluster, creation of District Environment Impact Assessment Authority, preparation of District survey report and proper monitoring of minor mineral. There by issued Notification dated 15.01.2016 for making certain amendments in the EIA Notification, 2006, and made mandatory to obtain EC for all minor minerals. Provisions have been made for the preparation of District survey report (DSR) forRiver bed mining and other minor minerals.
2016	West Bengal Minor Minerals Concession Rules,2016 amended the Mines and Minerals (Developmentand Regulation) Act, 1957 (Act 67 of 1957), to make the rules regulating the grant of mining licenses, prospecting license-cum-mining leases and mining leases in respect of minor minerals by auction process.The rule also incorporates EIA

	2016 also includes SSMG 2016 for minor mineral mining.
2018	MoEF& CC published a notification S.O. 3611(E) Dated 25th July, 2018 and recommended the format for District Survey Report .The notification stated about the objective of DSRi.e."Identification of areas of aggradations or deposition where mining can be allowed; and identification of areas of erosion and proximity to infrastructural structures and installations where mining should be prohibited and calculation of annual rate of replenishment and allowing time for replenishment after mining in that area".
2020	Enforcement & Monitoring Guidelines for Sand Mining (EMGSM) 2020 has been published modifying Sustainable sand Mining Guidelines, 2016 by MoEF& CC for effective enforcement of regulatory provisions and their monitoring.TheEMGSM 2020 directed the states to carry out river audits, put detailed survey reports of all mining areas online and in the public domain, conduct replenishment studies of river beds, constantly monitor mining with drones, aerial surveys, ground surveys and set up dedicated task forces at district levels.The guidelines also push for online sales and purchase of sand and other riverbed materials to make the process transparent. They propose night surveillance of mining activity through night-vision drones.

Important statutory Guidelines for sand or gravel mining:

- **The West Bengal Minor Minerals Concession Rules (WBMMCR), 2016**

1) (a) No person shall undertake mining operation in any area prohibited by the 'State Government in the public interest by notification in the *Official Gazette*.

Provided that nothing in the sub-rule shall affect any mining operation undertaken in any area in accordance with the terms and conditions of a mining lease or mineral concession already granted.

(b) No person shall transport or store or cause to be transported or stored any mineral otherwise than in accordance with the provisions of these rules and the West Bengal Minerals (Prevention of Illegal Mining, Transportation and Storage) Rules, 2002.

(2) No minor mineral coming out in course of digging of wells or excavation of tanks shall be disposed of by the person digging or excavating without informing the District Authority as well as the Executive Officer of the *Panchayat Samiti* or the Executive Officer of the Municipality concerned, as the case may be, about such occurrence.

Provided that disposal of such minor mineral may be allowed on pre-payment of prices of such minor mineral at the prevailing market rate as determined on the basis of the rates published by the Public Works Department / concerned department of the State Government for the concerned area from time to time.

(3) No mining of river bed occurrences shall be allowed within 300 meters, upstream and downstream, measured from the centre line of any bridge, regulator or similar hydraulic structure and from the end point of bank protection works.

(4) No river bed mining shall be allowed beneath 3 meters of the river bed or ground water Ievel, whichever is less.

(5) No mining operation in case of river bed occurrence shall be done within a distance of three (3) kilometers of a barrage axis or dam on a river unless otherwise permitted by the concerned Executive Engineer or Revenue Officer or authorized officer and such distance shall be reckoned across an imaginary line parallel to the 'barrage, or dam axis, as the case maybe.

(6) No extraction of river bed occurrence shall 'be allowed beyond the central one third of the river bed, or keeping a distance of 100 meter from the existing bank line whichever is less, unless otherwise permitted by the concerned Executive Engineer or Revenue Officer.

(7) No extraction of minerals other than river bed occurrence shall be allowed within fifty (50) meters from any road, public structure, embankment, railway line, bridge canal, road and other public works or buildings.

(8) No mining lease shall be granted without proof of existence of mineral contents in the area for which the application for a mining lease has been made in accordance with such parameters as may be prescribed by the Government from time to time.

N.B- The aforesaid application for mining lease shall succeed the competitive bidding for mining lease for a specified mineral(s).

- **Sustainable Sand Mining Management Guidelines (SSMMG), 2016by MoEF& CC.**

  The sustainable sand Mining Management Guidelines 2016 has been prepared after extensive consultation with the States and Stakeholders over a period of one year. The main objective of the Guideline is to ensure sustainable sand mining and environment friendly management practices in order to restore and maintain the ecology of river and other sand sources.

a) Parts of the river reach that experience deposition or aggradation shall be identified first. The Lease holder/ Environmental Clearance holder may be allowed to extract the sand and gravel deposit in these locations to manage aggradation problem.

b) The distance between sites for sand and gravel mining shall depend on the replenishment rate of the river. Sediment rating curve for the potential sites shall be developed and checked against the extracted volumes of sand and gravel.

c) Sand and gravel may be extracted across the entire active channel during the dry season.

d) Abandoned stream channels on terrace and inactive flood plains be preferred rather than active channels and their deltas and flood plains. Stream should not be diverted to form inactive channel.

e) Layers of sand and gravel which could be removed from the river bed shall depend on the width of the river and replenishment rate of the river.

f) Sand and gravel shall not be allowed to be extracted where erosion may occur, such as at the concave bank.

g) Segments of braided river system should be used preferably falling within the lateral migration area of the river regime that enhances the feasibility of sediment replenishment.

h) Sand and gravel shall not be extracted within 200 to 500 meter from any crucial hydraulic structure such as pumping station, water intakes, and bridges. The exact distance should be ascertained by the local authorities based on local situation. The cross-section survey should cover a minimum distance of 1.0 km upstream and 1.0 km downstream of the potential reach for extraction. The sediment sampling should include the bed material and bed material load before, during and after extraction period. Develop a sediment rating curve at the upstream end of the potential reach using the surveyed cross- section. Using the historical or gauged flow rating curve, determine the suitable period of high flow that can replenish the extracted volume. Calculate the extraction volume based on the sediment rating curve and high flow period after determining the allowable mining depth.

h) Sand and gravel could be extracted from the downstream of the sand bar at river bends. Retaining the upstream one to two thirds of the bar and riparian vegetation is accepted as a method to promote channel stability.

Flood discharge capacity of the river could be maintained in areas where there are significant flood hazard to existing structures or infrastructure. Sand and gravel mining may be allowed to maintain the natural flow capacity based on surveyed cross- section history.

i) Alternatively, off-channel or floodplain extraction is recommended to allow rivers to replenish the quantity taken out during mining.

j) The Piedmont Zone (Bhabhar area) particularly in the Himalayan foothills, where riverbed material is mined, this sandy-gravelly track constitutes excellent conduits and holds the greater potential for ground water recharge. Mining in such areas should be preferred in locations selected away from the channel bank stretches.

k) Mining depth should be restricted to 3 meter and distance from the bank should be 3 meter or 10 percent of the river width whichever less.

The borrow area should preferably be located on the river side of the proposed embankment, because they get silted up in course of time. For low embankment less than 6 m in height, borrow area should not be selected within 25 m from the toe/heel of the embankment. In case of higher embankment the distance should not be less than 50 m. In order to obviate development of flow parallel to embankment, cross bars of width eight times the depth of borrow pits spaced 50 to 60 meters centre-to-centre should be left in the borrow pits.

l) Demarcation of mining area with pillars and geo-referencing should be done prior to start of mining.

- **Enforcement & Monitoring Guidelines for sand Mining, 2020 (MoEF& CC)**

The Ministry of Environment Forest & Climate Change formulated the Sustainable Sand Management Guidelines 2016 which focuses on the Management of Sand Mining in the Country. But in the recent past, it has been observed that apart from management and systematic mining practices there is an urgent need to have a guideline for effective enforcement of regulatory provision and their monitoring. Section 23 C of MMDR, Act 1957 empowered the State Government to make rules for preventing illegal mining, transportation and storage of minerals. But in the recent past, it has been observed that

there was large number of illegal mining cases in the Country and in some cases, many of the officers lost their lives while executing their duties for curbing illegal mining incidence. The illegal and uncontrolled illegal mining leads to loss of revenue to the State and degradation of the environment.

a) Parts of the river reach that experience deposition or aggradation shall be identified. The Leaseholder/ Environmental Clearance holder may be allowed to extract the sand and gravel deposit in these locations to manage aggradation problem.
b) The distance between sites for sand and gravel mining shall depend on the replenishment rate of the river. Sediment rating curve for the potential sites shall be developed and checked against the extracted volumes of sand and gravel.
c) Sand and gravel may be extracted across the entire active channel during the dry season.
d) Abandoned stream channels on the terrace and inactive floodplains be preferred rather than active channels and their deltas and flood plains. The stream should not be diverted to form the inactive channel.
e) Layers of sand and gravel which could be removed from the river bed shall depend on the width of the river and replenishment rate of the river.
f) Sand and gravel shall not be allowed to be extracted where erosion may occur, such as at the concave bank.
g) Segments of the braided river system should be used preferably falling within the lateral migration area of the river regime that enhances the feasibility of sediment replenishment.
h) Sand and gravel shall not be extracted up to a distance of 1kilometre (1 km) from major bridges and highways on both sides, or five times (5x) of the span (x) of a bridge/public civil structure (including water intake points) on up-stream side and ten times (10x) the span of such bridge on down-stream side, subjected to a minimum of 250 meters on the upstream side and 500 meters on the downstream side.
i) The sediment sampling should include the bed material and bed material load before, during and after the extraction period. Develop a sediment rating curve at the upstream end of the potential reach using the surveyed cross-section. Using the historical or gauged flow rating curve, determine the suitable period of high flow that can replenish the extracted volume. Calculate the extraction volume based on the sediment rating curve and high flow period after determining the allowable mining depth.
j) Sand and gravel could be extracted from the downstream of the sand bar at river bends. Retaining the upstream one to two-thirds of the bar and riparian vegetation is accepted as a method to promote channel stability.
k) The flood discharge capacity of the river could be maintained in areas where there is a significant flood hazard to existing structures or infrastructure. Sand and gravel mining may be allowed to maintain the natural flow capacity based on surveyed cross-section history. Alternatively, off-channel or floodplain extraction is recommended to allow rivers to replenish the quantity taken out during mining.
l) The Piedmont Zone (Bhabhar area) particularly in the Himalayan foothills, where riverbed material is mined, this sandy-gravelly track constitutes excellent conduits and holds the greater potential for groundwater recharge. Mining in such areas should be preferred in locations selected away from the channel bank stretches.

m) Mining depth should be restricted to 3 meters and distance from the bank should be ¼th or river width and should not be less than 7.5 meters.

n) The borrow area should preferably be located on the riverside of the proposed embankment because they get silted in the course of time. For low embankment, less than 6 m in height, borrow area should not be selected within 25 m from the toe/heel of the embankment. In the case of the higher embankment, the distance should not be less than 50 m. In order to obviate the development of flow parallels to the embankment, crossbars of width eight times the depth of borrow pits spaced 50 to 60 meter center-to-center should be left in the borrow pits.

o) Demarcation of mining area with pillars and geo-referencing should be done prior to the start of mining.

p) A buffer distance /un-mined block of 50 meters after every block of 1000 meters over which mining is undertaken or at such distance as may be the directed/prescribed by the regulatory authority shall be maintained.

q) A buffer distance /unmined block of 50 meters after every block of 1000 meters over which mining is undertaken or at such distance as may be the directed/prescribed by the regulatory authority shall be maintained.

r) River bed sand mining shall be restricted within the central 3/4th width of the river/rivulet or 7.5 meters (inward) from river banks but up to 10% of the width of the river, as the case may be and decided by regulatory authority while granting environmental clearance in consultation with irrigation department. Regulating authority while regulating the zone of river bed mining shall ensure that the objective to minimize the effects of riverbank erosion and consequential channel migration are achieved to the extent possible. In general, the area for removal of minerals shall not exceed 60% of the mine lease area, and any deviation or relaxation in this regard shall be adequately supported by the scientific report.

s) Mining Plan for the mining leases(non-government) on agricultural fields/Patta land shall only be approved if there is a possibility of replenishment of the mineral or when there is no riverbed mining possibility within 5 KM of the Patta land/Khatedari land. For government projects mining could be allowed on Patta land/Khatedari land but the mining should only be done by the Government agency and material should not be used for sale in the open market.

The minerals reserve for riverbed area is calculated on the basis of maximum depth of 3 meters and margins, width and other dimensions as mentioned in para (s) above. The area multiplied by depth gives the volume and volume multiplied with bulk density gives the quantity in Metric Ton. In case of riverbed, mineable material per hectare area available for actual mining shall not exceed the maximum quantity of 60,000 MT per annum.

Demand and Utilisation of Sand

Sand is a multi-purpose topographical material. It is known as one of the three fundamental ingredients in concrete. The composition of sand is diverse. Mostly sand is made of silica which is a common element. It can also come from another source of minerals like quartz, limestone, or gypsum.

From beds to flood plains to coastlines- we can find the sand at almost everywhere. The robustness of sand has played a significant role in everyday life. We use sand practically every other day.

Sand extraction from river beds and brick earth mining for making raw bricks are the main mining activities in the district. With a spurt in construction of real estate sectors and various govt. sponsored projects, the demand for both sand and bricks has increased manifold. The extraction of sand is carried out either manually or through semi- mechanized system. The depth of mining for both river bed sand and brick earth is restricted due to statutory provision in the regulations pertaining to conservation and development of minor minerals.

River sand mining is a common practice as habitation concentrates along the rivers and the mining locations are preferred near the markets or along the transportation route, for reducing the transportation cost.

In the real world, there are a lot of situations where we can find uses of sand. Followings are the common sand uses.

1. While bunging metal, we can mix sand with clay binder for frameworks used in the foundries.
2. Sand can be used for cleaning up oil leak or any spill by dredging sand on that spill. The material will form clumps by soaking up, and we can quickly clean the mess.
3. Sand can be used as a road base which is a protective layer underneath all roads
4. Industrial sand is used to make glass, as foundry sand and as abrasive sand.
5. One creative usage of sand is serving as a candle holder. We can try putting some sand before pouring tea light or any candle in a glass. It holds the candle still and refrain the candle from rolling by giving it an excellent decoration.
6. Adds texture and aesthetic appeal to space.
7. Sand is mostly pure to handle, promptly available and economically wise.
8. We use sand in aquariums, fabricating artificial fringing reefs, and in human-made beaches
9. Sandy soils are ideal for growing crops, fruits and vegetables like watermelon, peaches, peanuts, etc.
10. Sand can light a path by filling mason jars with sand and tea light which is another inexpensive way to make a walkway glow.
11. Sand helps to improve resistance (and thus traffic safety) in icy or snowy conditions.
12. We need sand in the beaches where tides, storms or any form of preconceived changes to the shoreline crumble the first sand.
13. Sand containing silica is used for making glass in the automobile and food industry- even household products for the kitchen.
14. Sand is a strong strand which is used for plaster, mortar, concrete, and asphalt.
15. The usual bricks formulated of clay only is way weaker and lesser in weight than blocks made of clay mixed with sand.

2.2 Methodology of DSR Preparation

The steps followed during the preparation of District Survey Report are given in Figure 2.1. The individual steps are discussed in following paragraphs.

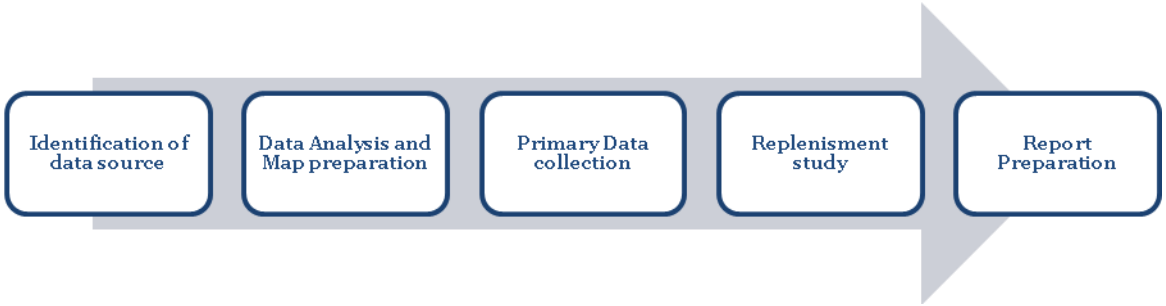


Figure 2.2.1: Steps followed in preparation of DSR

Data source Identification: District Survey Report has been prepared based on the Primary data base and secondary data base collected and collated from different sources. This is very critical to identify authentic data sources before compiling thedata set. The secondary data sources which are used in this DSR are mostly taken from public domain and or fromthe published report in reputed journal. Information related to district profile has been taken from District Census report,2011 and District Statistical Handbook published by the Govt. of West Bengal. Potential mineral resources of the district have been described based on the published report of Geological Survey of India (GSI) or any other govt. agencies like MECL etc. List of Mining lease, name of lease holder, lease/Block area, resource in already allotted mining lease, revenue from minor mineral sector etc. have been collected fromthe concern DL&LRO offices of the district. Satellite images have been used for map preparation related to physiography and land use/land cover of the district.

Data Analysis and Map preparation: Dataset which are captured during the report preparation, are gone through detail analysis work. District Survey Report involves the analytical implication of the captured dataset to prepare relevant maps.

Methodology adopted for preparation of relevant maps is explained below.

Land Use and Land Cover Map: Land Use and Land Cover classification is a complex process and requires consideration of many factors. The major steps of image classification may include determination of a suitable classification system via Visual Image Interpretation, selection of training samples, Satellite image (FCC-False Color Composite) pre-processing, selection of suitable classification approaches, postclassification processing, and accuracy assessment.

Here LISS-III satellite Imagery has been taken for Supervised Classification as supervised classification can be much more accurate than unsupervised classification, but depends heavily on the training sites, the skill of the individual processing the image, and the spectral distinctness of the classes in broader scale.

According to the Visual Image Interpretation (Tone, Pattern, Texture, Shape, Color etc.) training set of the pixel has been taken. Pictorial descriptions of Land Use classification are explained in Figure 2.2.

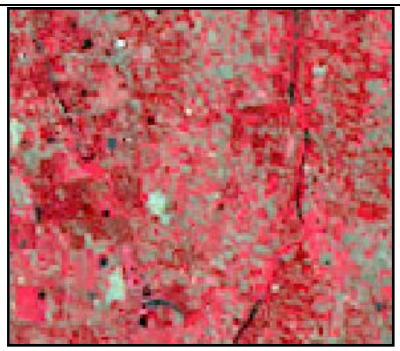
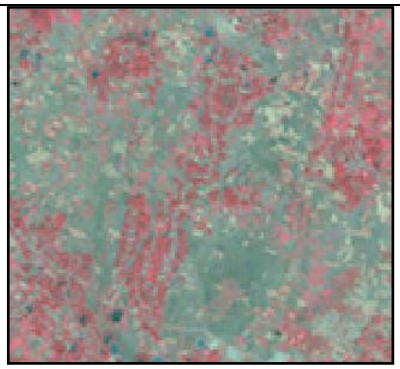
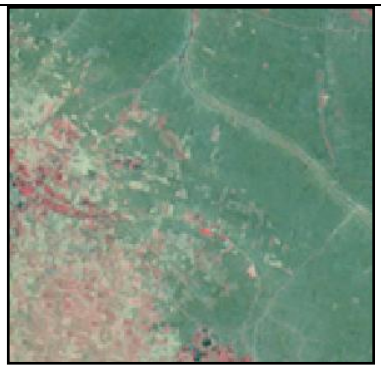
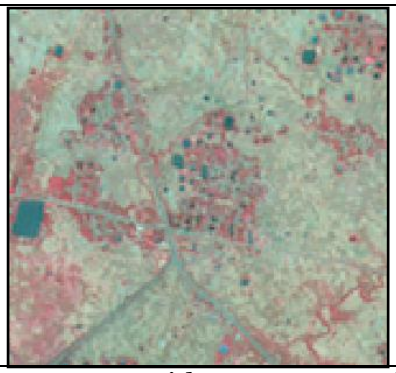
	
Agricultural Land - Based on their Geometrical shape, Red and Pink color tone, Agricultural Land has been identified.	**Vegetation Covered Area** - Area with continuous Red color tone, Vegetation Covered Area has been classified.
	
Agricultural Fallow Land - Based on their Geometrical shape, Yellowish green color tone, Agricultural Fallow Land has been identified.	**Bad Land Topography**- Area with Non geometrical shape and Yellowish green colortonehas been identified as Bad Land Topography.
	
Settlement – Area with some geometrical shape in a Linear Pattern including Light Cyan Colorhas been recognized as Settlement Area.	**Water Bodies –** Area with Blue color has been classified as Water Bodies.

Figure 2.2: Pictorial description of Land Use Classification method

Geomorphological Map: The major step of preparing Geomorphological Map is identifying features like – Alluvial Fan, Alluvial Plain, Hilly Region etc. from Satellite Imagery

(FCC-False Colour Composite) via Visual Image Interpretation and then digitisation has been taken into the consideration to prepare map including all the Geomorphological features according to their location. Pictorial descriptions of Geomorphological unit's classification are explained in Figure 2.3.

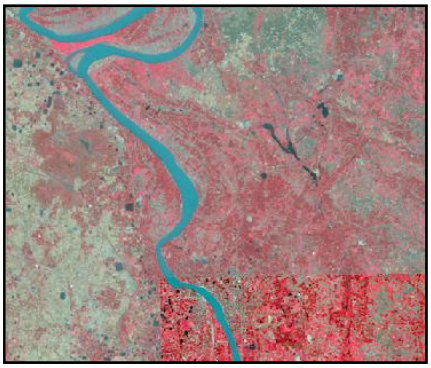
	
Flood plain-Floodplainis a generally flat area of land next to a river or stream. It stretches from the banks of the river to the outer edges of the valley. For Murshidabad District, Whole region has been classified as Flood Plain Area.	**OX-BOW Lake-** An ox-bow lake starts out as a curve, or meander, in a river. This "U" shaped body of water identified as Ox-Box Lake from Satellite Imagery.

Figure 2.3: Pictorial description of Geomorphological Units Classification methods

Physiographical Map: The major step of preparing Physiographical Map is generating contour at a specific interval to show the elevation of the area using Cartosat DEM.

Block Map/Transportation Map/Drainage Map:

- Raw Data collected from **National Informatics Centre (NIC Website) during Sept 2020.**
- Data has been geo-referenced using GIS software.
- Digitization of block boundary, district boundary, state boundary, international boundary, and district headquarter, sub–district headquarter, places, road, railway, river, nala etc.
- Road name, River name, Railway name has been filled in attribute table of the Layers
- Final layout has been prepared by giving scale, legend, north arrow, etc.

Earthquake Map:

- Raw data collected from **Ministry of Earth Science.**
- Data has been geo-referenced using GIS software.
- Digitization of Earthquake zone and superimposed it over Block Boundary.
- Zone name has been filled in attribute table of the Layers
- Final layout has been prepared by giving scale, legend, north arrow, etc.

Soil Map:

- Raw data collected from **National Bureau of Soil Survey and Land Use Planning during Sept 2020.**
- Data has been geo-referenced using GIS software.
- Digitization of Soil classification zone and superimposed it over District Boundary.
- Soil classification has been filled in attribute table of the Layers.
- Final layout has been prepared by giving scale, legend, north arrow, etc.

Wildlife Sanctuary and National Park location Map:

- Raw data obtained from **ENVIS Centre on Wildlife & Protected Areas during August 2020.**
- Data has been geo-referenced using GIS software.
- Digitization of Wildlife Sanctuary&National Park and superimposed it over Block Boundary.
- Wildlife Sanctuary & National Park name has been filled in attribute table of the Layers

Final layout has been prepared by giving scale, legend, north arrow, etc.

Primary Data Collection: To prepare DSR, primary data has been collected and field work has also been carried out for the district. Field study involves assessment of the mineral resources of the district by means of pitting / trenching in specific interval. This provides clear picture of mineral matters characterization and their distribution over the area.

Replenishment study: One of the principal causes of environmental impacts from in-stream mining is the removal of more sediment than the system can replenish. Therefore, there is a need for replenishment study for river bed sand in order to nullify the adverse impacts arising due to excess sand extraction. The annual rate of replenishment carried out on every river of the district to have proper assessment of the sand reserve for mining purposes.

Four times Physical survey has been carried out by GPS/DGPS/ Total Station to define the topography, contours and offsets of the riverbed. The surveys clearly depict the important attributes of the stretch of the river and its nearby important civil and other feature of importance. This information will provide the eligible spatial area for mining.

Report Preparation: The district survey report portrays general profile, geomorphology, land use pattern and geology of the district. The report then describes the availability and distribution of riverbed sands and other minor minerals in the district. Apart from delineation the potential mining blocks, the report also includes inventorization of the minerals, recent trends of production of minor minerals and revenue generation there from. Annual replenishment of the riverbed sand has been estimated using field observation, satellite imagery and empirical formula. The road network connecting arterial road to potential mining blocks has been identified. Potential environmental impacts of mining of these minerals, their mitigation measures along with risk assessment and disaster management plan have also been discussed. Finally the reclamation strategy for already mined out areas is also chalked out.

3 General Profile of the district

a) General Information

Murshidabad is situated on the Eastern peripheral plains of the State of West Bengal and it is the Northern-most district of Presidency Division. It forms the Eastern international boundary of State bordering Bangladesh from 1947 when India became independent. River Padma creates the Northern and Eastern boundary, separating the district from the district Maldah to the North and Rajshahi Division of Bangladesh to the East. Districts Burdwan and Nadia are in the Southern side and Birbhum and the Pakur (Jharkhand) are on the Western side of the District. (Source: https://en.wikipedia.org/wiki/Murshidabad)

Murshidabad is in the middle of West Bengal lying between 24°50'20"N and 23°43'30"N latitude and 88°46'00"E and 87°49'17"E longitude. It has a total area of 5324 sq. km. (Figure 4.1).In shape, the district resembles an isosceles triangle with its apex pointing to the North-West. (Source: https://www.murshidabadzp.in/zp_administrative_setup.php)

The district has 5 Sub-divisions, viz. BerhamporeSadar, Jangipur, Lalbag, Kandi &Domkal. There are 26 Community Development (C.D.) Blocks, 7 Municipalities and in the district (Figure 4.2).Berhamporeis the district headquarter of Murshidabad district.

BehramporeSadar Sub-division has got 5 C.D. Blocks namely, Beldanga-I, Beldanga-II, Berhampore, Hariharpara and Nawda with 2 Municipalities viz. Berhampore (M) and Beldanga (M). Jangipur Sub-division has got 7 C.D. Blocks namely, Farakka, Samserganj, Suti-I, Suti-II, Raghunathganj-I, Raghunathganj-II and Sagardighi with 2 Municipalities viz. Jangipur (M) and Dhulian (M). Lalbagh Sub-division has got 5 C.D. Blocks namely Lalgola, Bhagawangola-I, Bhagawangola-II, Murshidabad-Jiaganj and Nabagram with 2 Municipalities viz. Murshidabad (M) and Jiaganj-Azimganj (M). KandiSub-division has got 5 C.D. Blocks namely Kandi, Khargram, Burwan, Bharatpur-I and Bharatpur-II and 1 Municipality namely Kandi (M). Domkal Sub-division has got 4 C.D. Blocks namely Domkal, Jalangi, Raninagar-I, Raninagar-II.

There are 27 Police Stations (P.S.) in the district. 7 P.S. are situated in BehramporeSadar Sub-division viz. Behrampore, Daulatabad, Hariharpara, Nowda, Beldanga and Rejinagar. 5 P.S. are situated in Jangipur Sub-division viz. Raghunathganj, Farakka, Sagardighi, Suti and Samserganj. 6 P.S. are situated in the Lalbag Sub-division viz. Murshidabad, Nabagram, Jiaganj, Bhagwangola, Ranitala and Lalgola. 5 P.S. are situated in Kandi Sub-division viz. Kandi, Khargram, Salar, Bharatpur and Burwan. 4 P.S. are situated in Domkal Sub-division viz. Domkal, Jalangi, Islampur and Raninagar. (Source: https://murshidabad.gov.in/subdivision-blocks/)

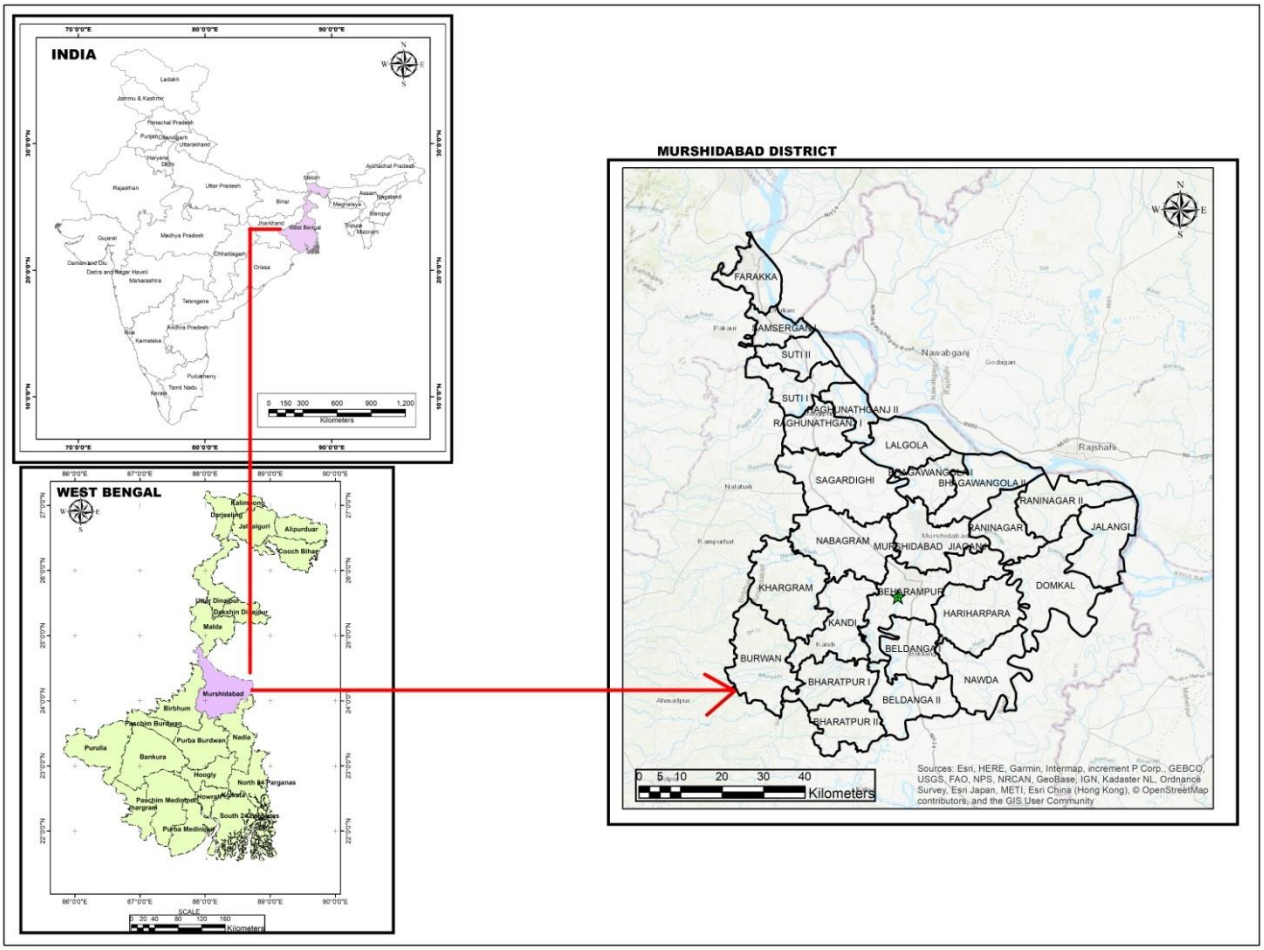


Figure 3.3.1: Location Map of Murshidabad
(Source: National Informatics Centre and ESRI Base Map)

Table 3.1: Block distribution of Murshidabad District

Sub-Division	Police Station	C.D.Block / M	Gram Panchayats	Area (Sq. Km.)
Sadar Sub-Div.	**7**	**5 / 2**	**61**	**1195.57**
	Behrampore (P) Daulatabad	Behrampore	17	314.19
	Beldanga (P)	Beldanga-I	13	168.75
	Rejinagar Shaktipur	Beldanga-II	11	207.93
	Nowda	Nowda	10	231.39
	Hariharpara	Hariharpara	10	253.14
	Behrampore (P)	Behrampore(M)	-	16.19
	Beldanga (P)	Beldanga(M)	-	3.98
Kandi Sub-Div.	**5**	**5 / 1**	**50**	**1200.76**
	Kandi (P)	Kandi	10	227.48
	Khargram	Khargram	12	318.45
	Burwan	Burwan	13	299.66
	Bharatpur	Bharatpur-I	8	183.72
	Salar	Bharatpur-II	7	158.50
	Kandi (P)	Kandi(M)	-	12.95
Jangipur Sub-Div.	**5**	**7 / 2**	**61**	**1097.82**
	Farakka	Farakka	9	132.74
	Samserganj (P)	Samserganj	9	84.21
	Suti	Suti-I	6	143.68
		Suti-II	10	111.13
	Raghunathganj (P)	Raghunathganj-I	6	140.91
		Raghunathganj-II	10	121.60
	Sagardighi	Sagardighi	11	345.42
	Raghunathganj (P)	Jangipur(M)	-	7.86
	Samserganj (P)	Dhuliyan(M)	-	10.27
Lalbagh Sub-Div.	**6**	**5 / 2**	**44**	**1019.10**
	Lalgola	Lalgola	12	184.37
	Bhagwangola	Bhagwangola-I	8	136.10
	Ranitala	Bhagwangola-II	6	175.26
	Jiaganj (P)	Murshidabad - Jiaganj	8	192.13
	Murshidabad (P)			
	Nabagram	Nabagram	10	306.63
	Murshidabad (P)	Murshidabad(M)	-	12.95
	Jiaganj (P)	Jiaganj-Azimganj(M)	-	11.66
Domkal Sub-Div.	**4**	**4 / 0**	**38**	**837.88**
	Domkal	Domkal	13	305.19

Sub-Division	Police Station	C.D.Block / M	Gram Panchayats	Area (Sq. Km.)
	Jalangi	Jalangi	10	210.63
	Islampore	Raninagar-I	6	146.93
	Raninagar	Raninagar-II	9	175.13
District Total- 5	**27**	**26 / 7**	**254**	**5324**

Figure 3.3.2: Block divisional map of Murshidabad

(Source: National Informatics Centre)

b) Climate Condition

District Murshidabad belongs to humid tropical monsoon climatic region. According to District Meteorological Department, there are very minor variation of temperature, rainfall and relative humidity in all over the district viz. north to south and west to east.

The climate of this district is characterized by an oppressive hot summer, high humidity nearly all the year round and a well distributed rainfall in the south west monsoon season. The year may be divided into four seasons. The cold season is from about the middle of November to the end of February. The period from March to May is the summer season. The south west monsoon season commences about the beginning of June and lasts till the end of September. October and the first half of November may be termed as post monsoon season. (Source: https://www.imdpune.gov.in/library/public/Climate%20of%20WestBengal.pdf)

c) Rainfall

The average annual rainfall in the district is 1179.64mm. The variations in the annual rainfall within the district and from year to year are not large. The rainfall during the monsoon season – June to September – constitutes 74 percent of the annual rainfall; July and August are the rainiest months.The district receives a mean annual rainfall varying from 815.7 mm. to 1673.5 mm.

(Source: https://hydro.imd.gov.in/hydrometweb/(S(jt2lbrak304ak5zb3yh03eaz))/DistrictRaifall.aspx)

The information on annual rainfall for the five years from 2016 to 2020 for the district Murshidabad is given in Table 3.2. Average rainfall of the district explained graphically in Figure 3.3.

Table 3.2: Annual rainfall (in milimeter) recorded in Murshidabad District

Month	2016	2017	2018	2019	2020	Average
Jan	41	2.7	0	0	18.5	12.44
Feb	7.5	0	16.1	34.5	6.5	12.92
Mar	7	16.7	2.9	18.7	17.8	12.62
Apr	24	53.6	54.3	66.3	79.1	55.46
May	89	130.3	94.9	188.6	153.3	131.22
Jun	141.7	134.4	140.9	85.4	324.4	165.36
Jul	304.3	336.7	185.5	246.3	357.9	286.14
Aug	171	224	120.4	104.7	226	169.22
Sept	203.4	163.1	99.6	198.5	227.5	178.42
Oct	57.3	108.7	72.8	184.4	48	94.24
Nov	0	0.9	2.9	3.1	1	1.58

Dec	0	16.1	25.4	0.3	0	8.36
Yearly Total	**1046.2**	**1187.2**	**815.7**	**1130.8**	**1460**	**1128**

Source: Website of Indian Meteorological Department, Govt. of India

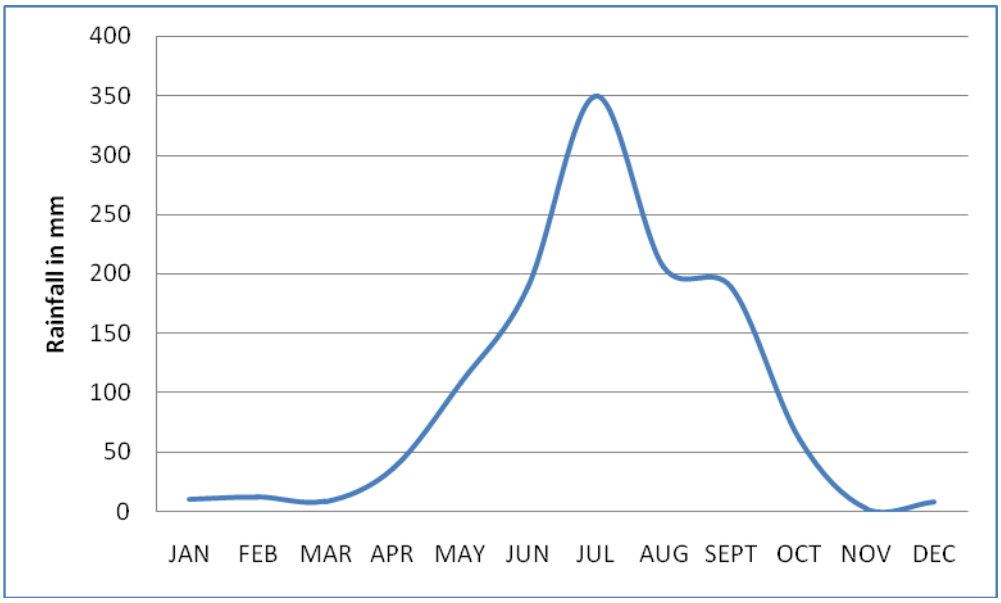


Figure 3.3.3: Graphical representation of Murshidabad District rainfall

- **Temperature:**

Temperature along with other meteorological conditions of the district is more or less uniform. The cold season commences by about the middle of November when the temperature begins to decrease.January is the coldest month with the mean daily maximum and minimum temperature at 28 ºC and 10ºC respectively. By about the end of February the temperature begins to increase and April is found as the hottest month, the mean maximum daily temperature is 38 ºC and the mean minimum daily temperature is 25 ºC. The highest temperature recorded at Berhampore was 46.1 ºC on 25th May, 1961, and the lowest minimum was 3.9 ºC on 16th January, 1933.

The average maximum and minimum temperature recorded around Murshidabad during 2010 to 2014 is as follows:

Table 3.3: Monthly mean temperature (in °C) distribution of Murshidabad District

Month	2010 (Mean)		2011 (Mean)		2012 (Mean)		2013 (Mean)		2014 (Mean)	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
January	22	10	28	10	25	11	..	..	23	12

Month	2010 (Mean)		2011 (Mean)		2012 (Mean)		2013 (Mean)		2014 (Mean)	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
February	28	15	28	14	29	14	30	16	25	14
March	35	22	37	20	34	20	33	19	..	..
April	38	25	34	22	36	23	36	23	38	24
May	35	25	34	24	38	26	34	25	37	26
June	33	25	34	25	36	26	34	27	34	27
July	33	26	..	..	32	25	..	..	33	27
August	33	25	..	..	33	26	..	..	33	27
September	32	25	..	..	..	..	33	26	33	26
October	31	23	..	..	32	22	30	24	32	24
November	30	19	29	20	..	..	..	..	29	17
December	25	13	..	..	..	..	..	..	24	12

(Source: District statistical handbook, 2014)

- **Relative Humidity, Wind speed & Wind direction**

Humidity is observed as high throughout the year, but in the summer months, March and April, the relative humidity is comparatively low, begins some 60 to 65 percent in the mornings and 35 to 40 percent in the afternoons. From May the humidity increases. Skies are moderately to heavily cloud in May. In the south-west monsoon season; the cloudiness increases and skies are mostly heavily clouded or overcast. From October the cloudiness decreases and in the next six months skies are clear or lightly clouded. Winds are generally light or moderate, with a slight increase in force in the summer seasons.

d) Topography & Terrain

Physiographically the entire district is belonging to plain region. The river Bhagirathi, flowing from north to south through the district, which divides it into two equal portions form a striking contrast to each other in their geology, their physical characteristic, their agriculture, and even the religion of their inhabitants. The Blocks Farakka, Samserganj, Suti-1, Suti-II, Raghunathganj-1, Nabagram, Khargram, Burwan, Kandi, Bharatpur-1, Bharatpur-Il, greater

part of Sagardighi, western part of Murshidabad-Jiaganj, Berhampur and Beldanga fall in the western part while the rest of the Blocks are in the side of the eastern region.

The western part of the district, that is, the Rarh represents undulating and rugged nature of terrain and intercepted by a number swamps and beds of old rivers. Elevation rises towards the Birbhum district and the Rajmahal hills, which rise a few miles beyond the North-Western boundary of the district. Some hillocksare situated in this region, of which the most popular one is known as Dhuli Pahari. The maximum height of the Rarh region rises of 45 meters passing through the northern part the Farakka Block. The Eastern tract or Bagri lies almost entirely between the Ganga-Bhagirathi basin and is characterized by the existence of inundation along with many swamps. The eastern part, as has been already mentioned is a flat plain, the height of which varies between 12.5 meters to 24 meters. The average slop of the region is from the west and northwestern sides towards the east and southeastern sides.

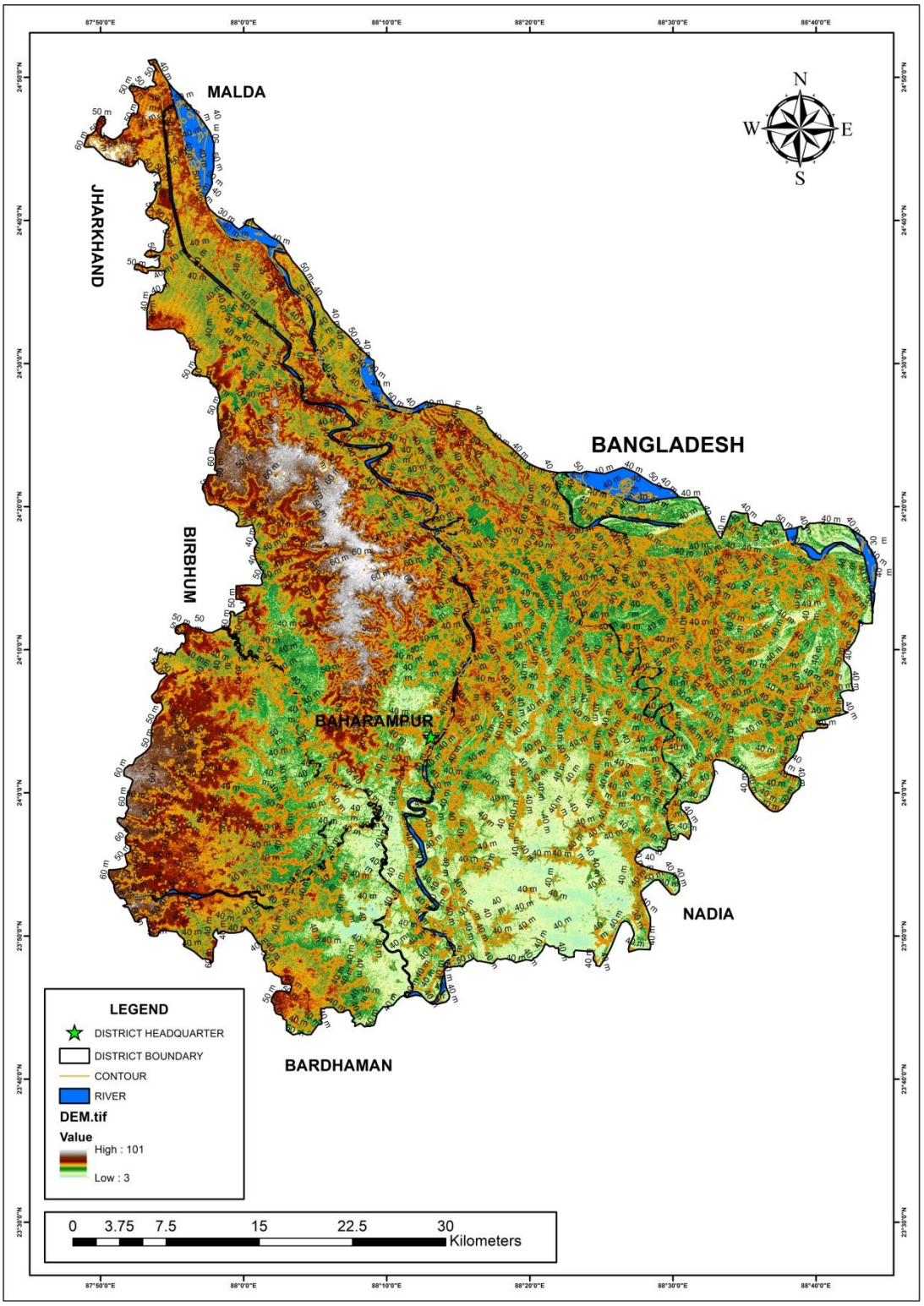


Figure 3.4: Physiographic map of Murshidabad District

(Source: Cartosat-1,Bhuvan India)

e) Water Course &Hydrology

Ground water in the district occurs in a thick zone of alluvium deposited by the river system. The aquifers made up of different grades of sand and gravel, extends down to a depth of 90-350m bgl in the east and 140 to 150m bgl in the west of Bhagirathi River, respectively.

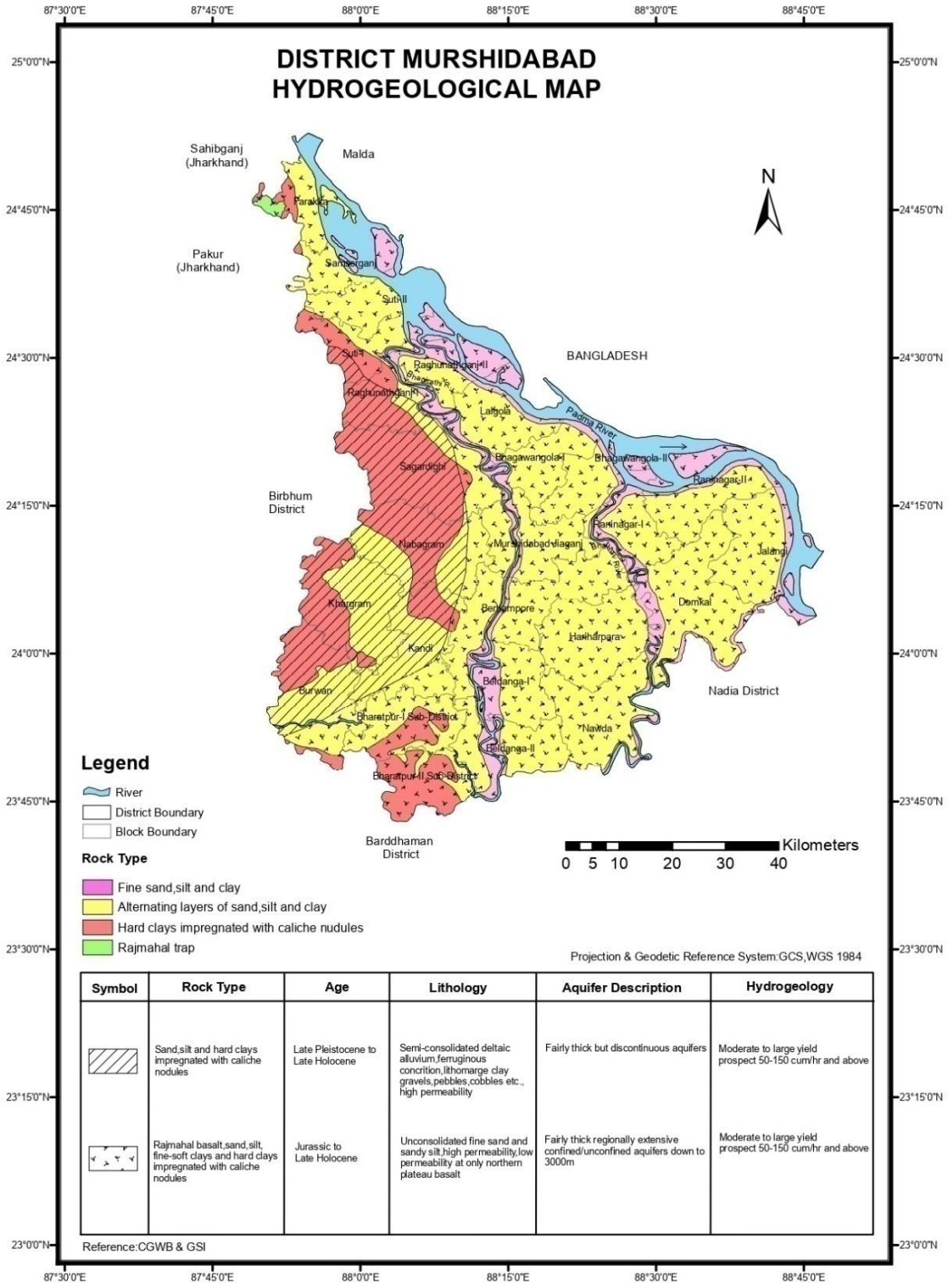
River Bhagirathi acts as a natural groundwater dividerin the district. The area east of it ischaracterized by shallow water table conditions that generally lie in between 4-7m bgl in the peaksummer. Impervious clay layers which act as confining beds are rather absent, but whereverpresent it is sandy clay or silty clay forming partially/ semi-confining conditions. Thearea comprises a mono-aquifer area having tremendous groundwater potentialities.

Groundwater in the western part of Bhagirathi River occurs under both unconfined and confined conditions. In the confined condition, the aquifers are sometimes separated by lenticular clay beds at depths and are regionally connected resulting in artesian conditions. Thick clay bed occurs particularly in the blocks of Kandi, Khargram, Nabagram, Sagardighi, Raghunathganj-I and Samserganj.

The hydro-stratigraphy of the Bhagirathi sub-basincomprises clay/sandy clay of 20-30 m thickness followed by a shallow aquifer within 60 mdepth containing sands of various grades. Below the sand impersistent clay lenses occur which isfollowed by sand and then by a thick clay. The shallow aquifer at places contains high Arsenic groundwater.

(Source: http://wbwridd.gov.in/swid/mapimages/MURSHIDABAD.pdf)

Figure 3.5 is the district hydrogeological map prepared by CGWB. District rock type has been divided into LatePleistocene to Late Holocene deposit of Sand,silt and hard clays impregnated with caliche nodules and Jurassic to Late Holocenedeposits of Rajmahalbasalt,sand,silt, fine-soft clays and hard clays impregnated with caliche nodules. Bothe the aquifers are fairly thick regionally extensive confined to unconfined aquifers having yield prospect of50-150 cum/hr and above.



Symbol	Rock Type	Age	Lithology	Aquifer Description	Hydrogeology
	Sand,silt and hard clays impregnated with caliche nodules	Late Pleistocene to Late Holocene	Semi-consolidated deltaic alluvium,ferruginous concrition,lithomarge clay gravels,pebbles,cobbles etc., high permeability	Fairly thick but discontinuous aquifers	Moderate to large yield prospect 50-150 cum/hr and above
	Rajmahal basalt,sand,silt, fine-soft clays and hard clays impregnated with caliche nodules	Jurassic to Late Holocene	Unconsolidated fine sand and sandy silt,high permeability,low permeability at only northern plateau basalt	Fairly thick regionally extensive confined/unconfined aquifers down to 3000m	Moderate to large yield prospect 50-150 cum/hr and above

Figure3.3.5: Hydrogeological map of Murshidabad district.

f) Ground Water Development

Central Groundwater Board (CGWB) has carried out hydrogeological investigation in the Murshidabad district. The present report incorporates data published by CGWB. Water level data has been collected from222locations which include both dug-wells and tube-wells.

Depth of water level in Dug-wells measured by CGWB varied from 0.81m to 17.78m bgl during pre-monsoon period with an average depth of 5. 22m.During post-monsoon period, water level varies from 0.08m to 15.38m bglwith an average of 3.2m in the year 1996 to 2018. Depth of water level in Tube-wells varied from 2.15m to 26.9m bgl during pre-monsoon period with an average depth of 10.1m. During post-monsoon period, water level in tube-wells in the district varies from 1.02m to 32.54m bglwith an average of 7.24m in the year 1996 to 2018 (Source: CGWB Website). Figure 3.6represents water level graph for two CGWBTube wells, one from Farakka block located Northern part of the district and another from Beldanga-II block situated Southern part of the district. Fluctuation in water level is higher in the Farakka region.

(***Source:*** ***https://indiawris.gov.in/wris/#/groundWater%20(CGWB%20website%20for%20Ground%20water%20data)***)

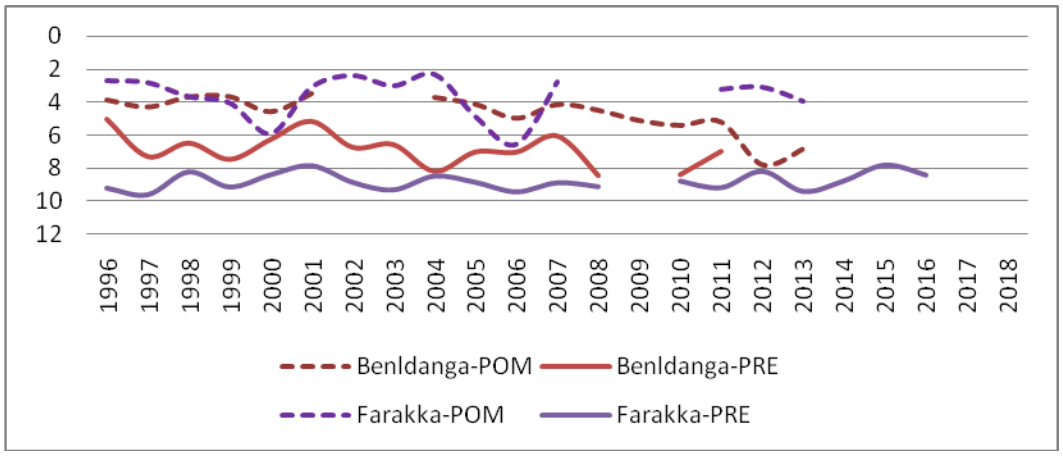
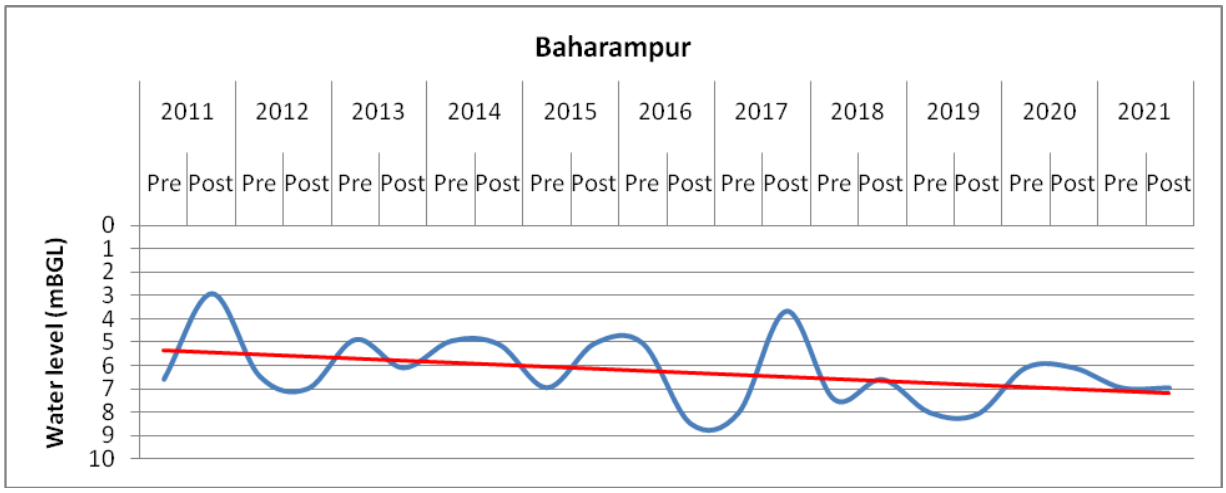
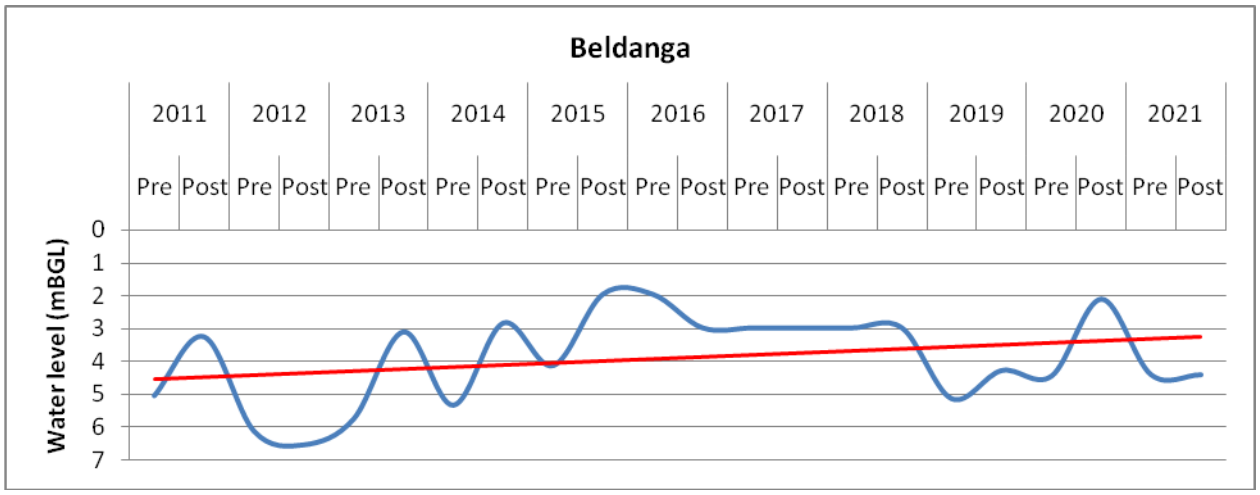


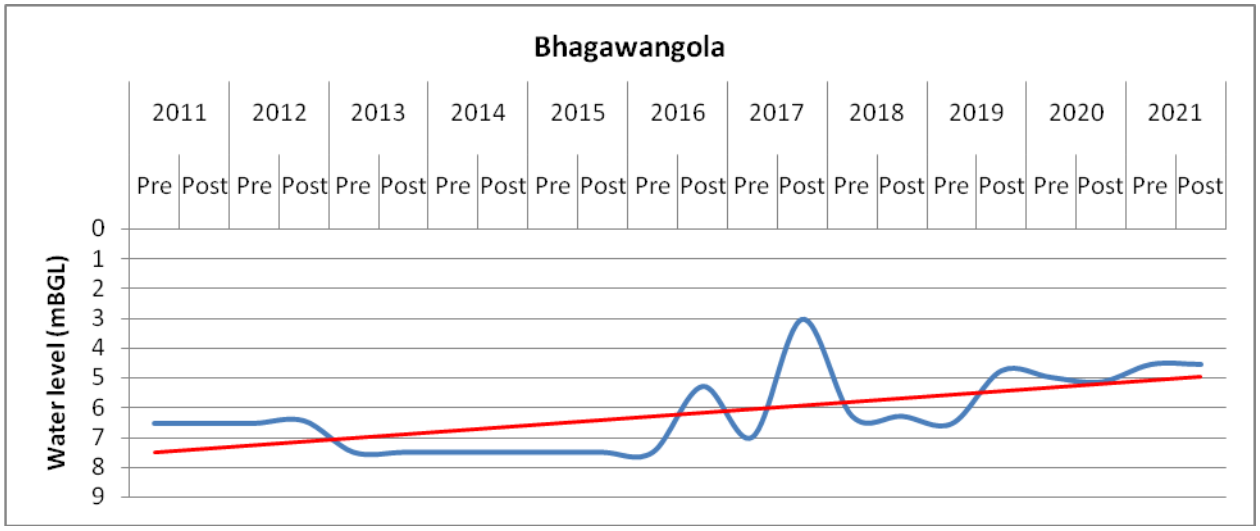
Figure 3.3.6: Graphical representation of pre-monsoon and post-monsoon water level data

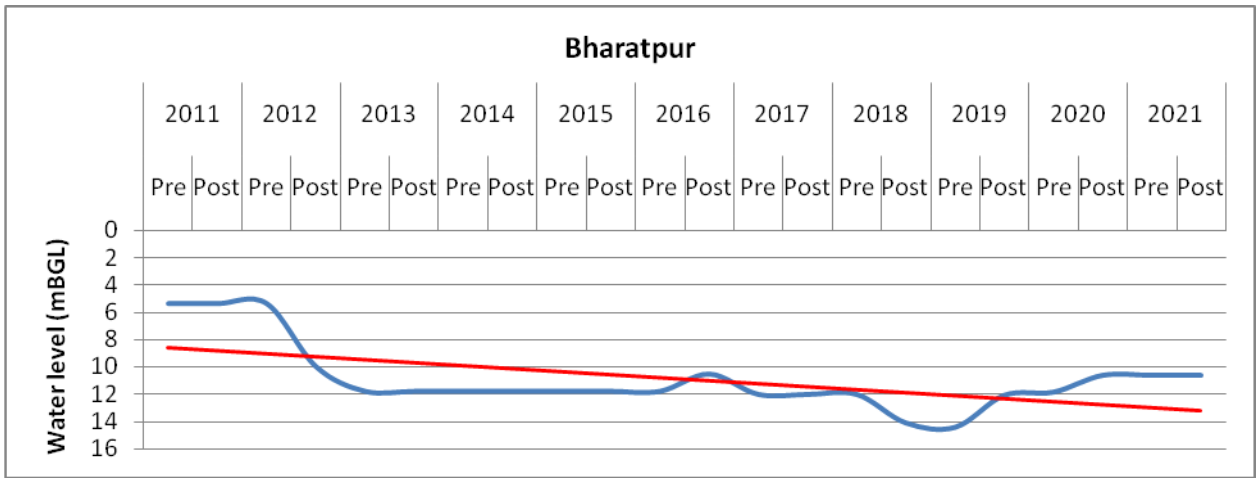
Over all stage of ground water development is 87% in the Murshidabad district which implies semi-critical stage (Source: Dynamic Groundwater Resources Assessment of India – 2017, CGWB). Ground water Resources Estimation 2013 (calculated using GEC 1997 Methodology) has been considered in case of Murshidabad, West Bengal. However, the groundwater development status is not uniform throughout the district. It is extensive in the Bagri region. Whereas the stage of groundwater development is comparatively lower in the blocks lying on the Rarh region. As per the guideline of GEC 1997, 10 numbers of blocks of the district are categorized under safe and 17 blocks are under semi-critical stage.

Hydrographs showing variation in water level observed in between 2011 to 2021 in the district is given below.








Bharatpur
2011
2012
2013
2014
2015
2016
2017
2018
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2020
2021
Pre
Post
Water level (mBGL)
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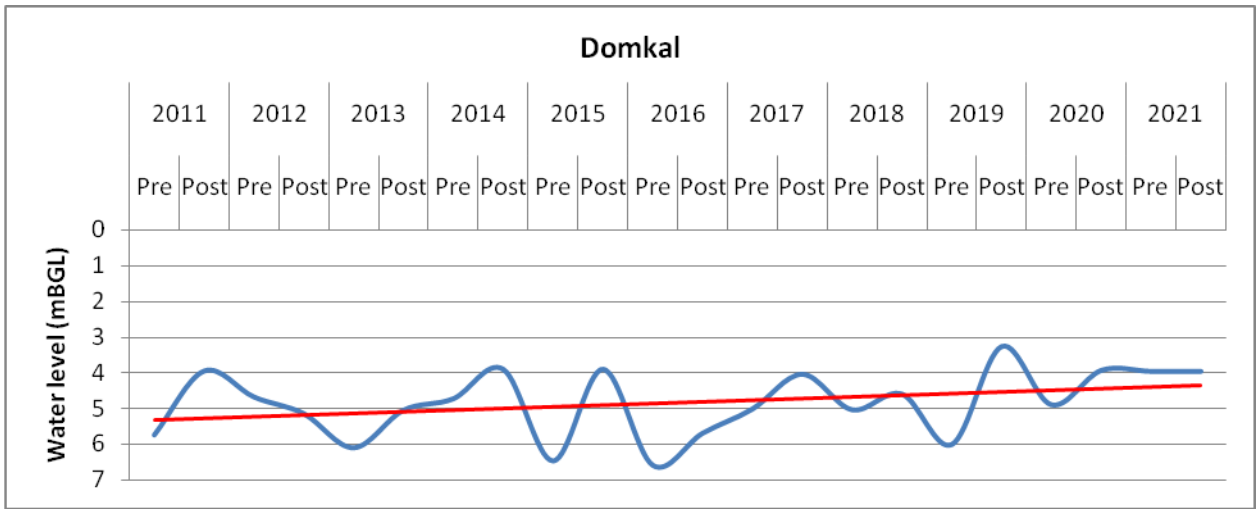
10
12
14
16


Domkal
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Water level (mBGL)
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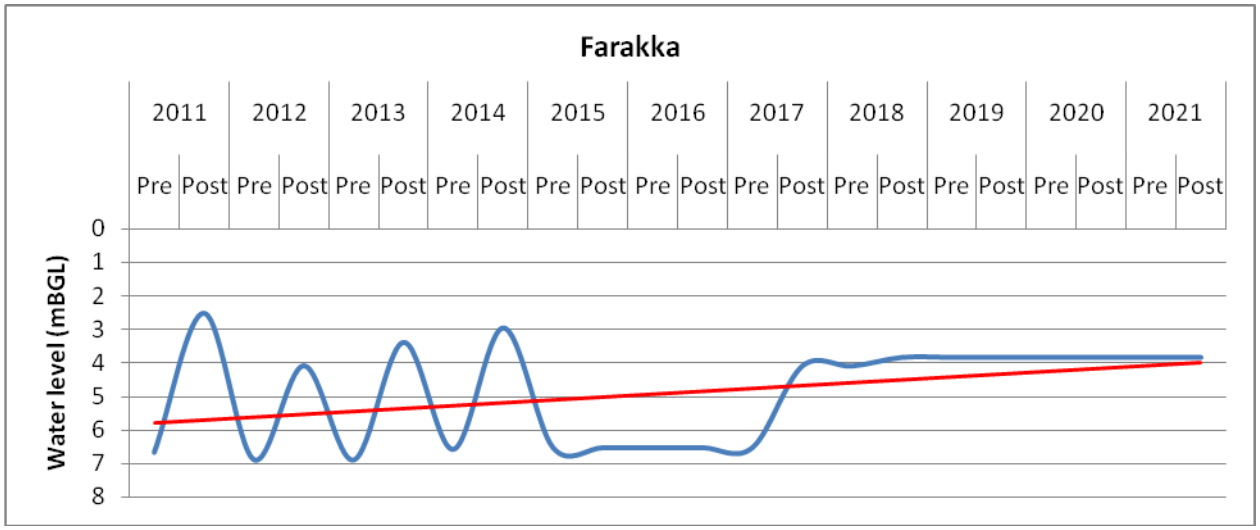
Farakka
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Water level (mBGL)
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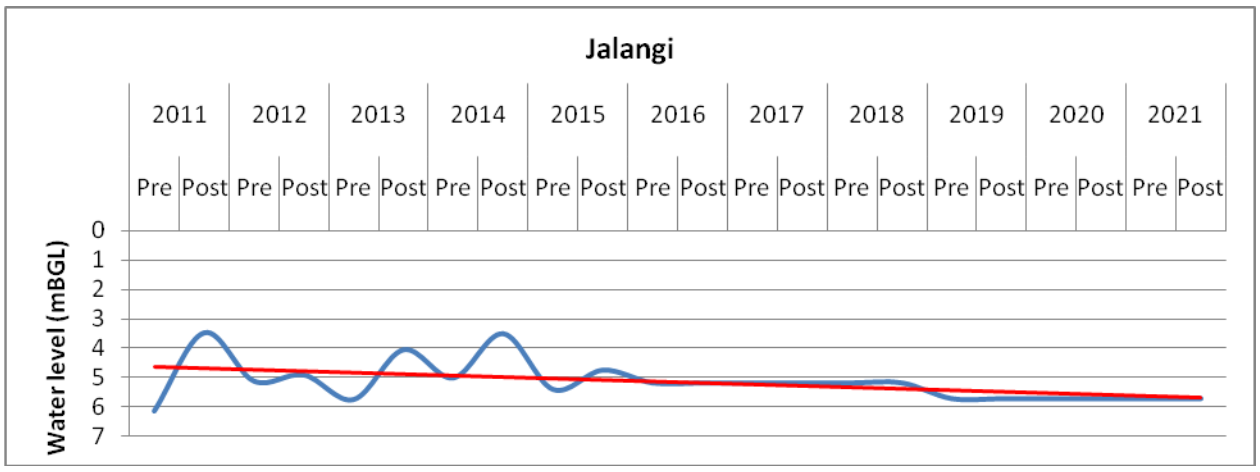
Jalangi
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Water level (mBGL)
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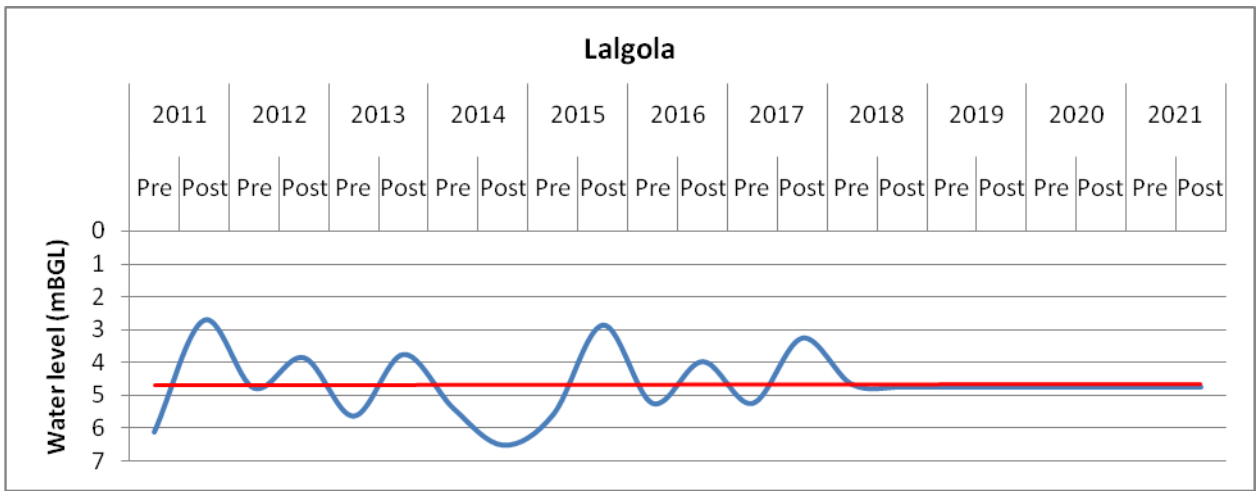
Lalgola
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Water level (mBGL)
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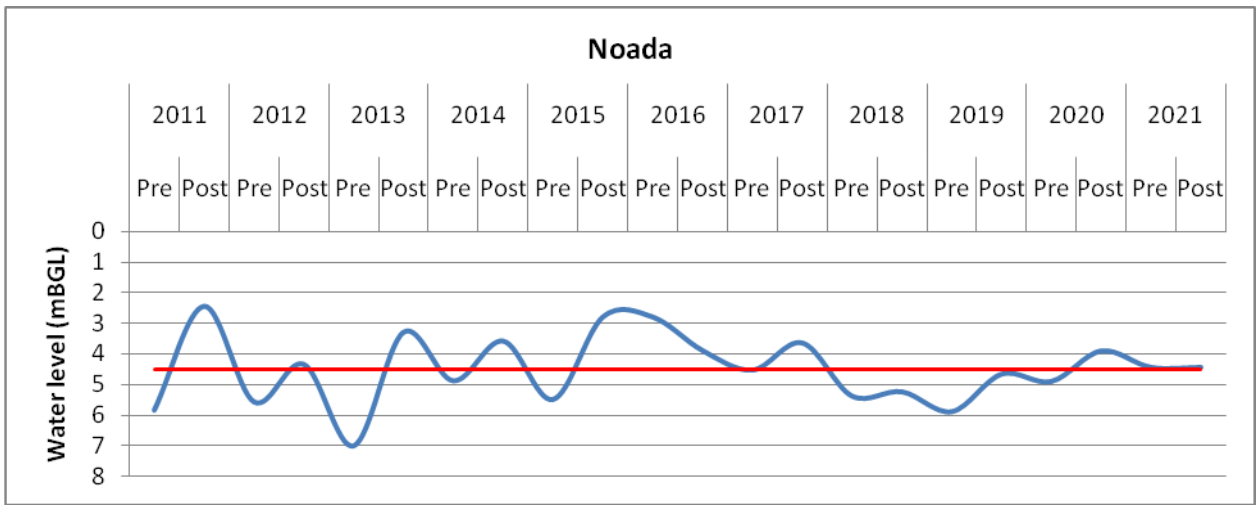
Noada
2011
2012
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Water level (mBGL)
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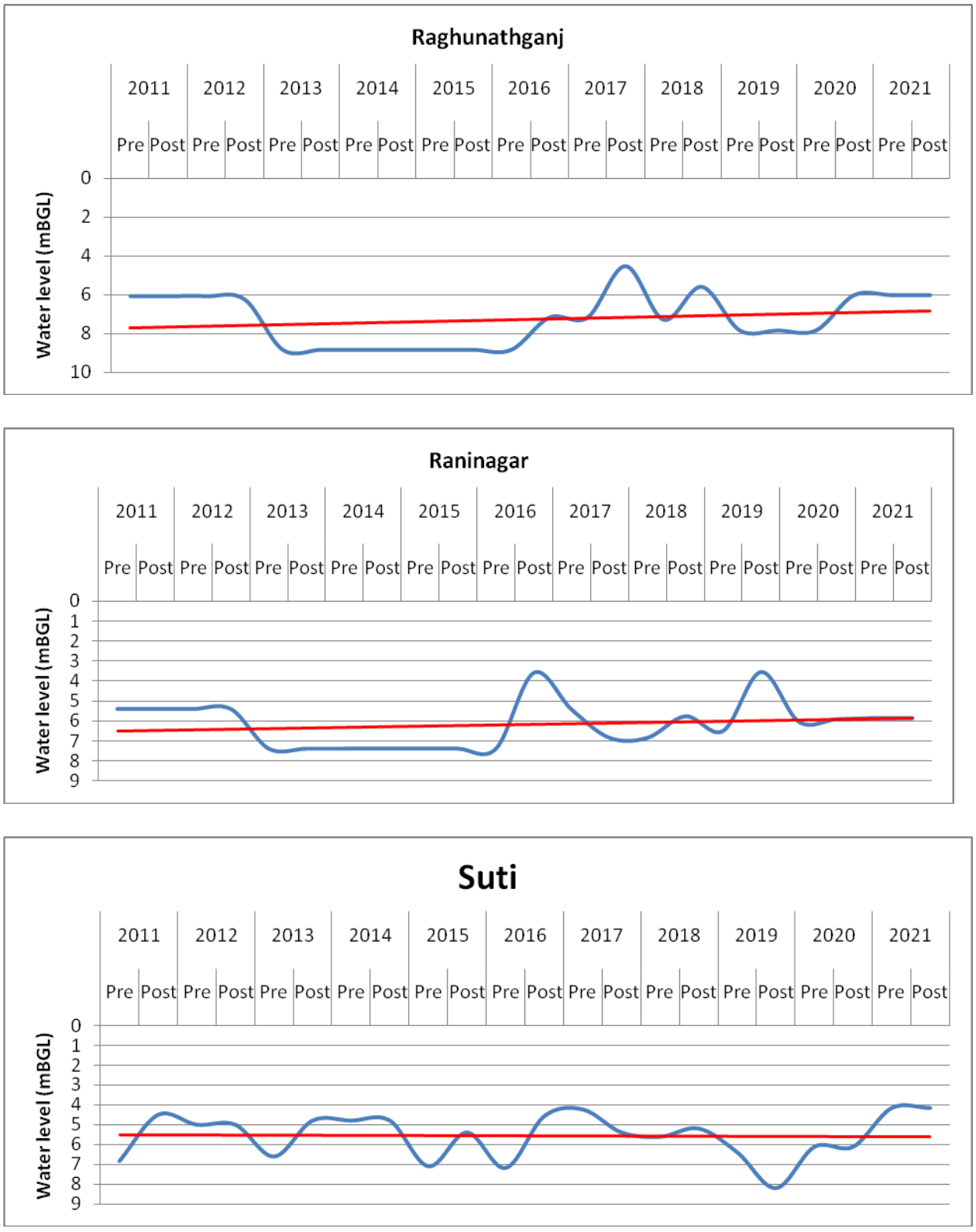


Figure 3.7: Block wise Hydrograph showing variation of water level during 2011 to 2021

g) Drainage System

The river system of district Murshidabad primarily consists of Ganga (Padma) and the course of its distributaries of which the most important are the Bhagirathi, Jalangi and Bhairab. Due to typical geographical characteristics, most of the rivers of district Murshidabad being connected to the mighty flow of Gangaandaremostlyrain-fed. The streams are incapable of carrying large quantity of silt which they receive during the upper course and as a result this leads to shoal formation and thereby hampering navigation. The rivers situated in the East of the district are filled upto a certain extent during the dry season because of downward flow from the river Ganga. However, subsequent to the erection of Farakka Barrage at the Northern part of the district, there has been considerable shift in the river paths during last few decades. Added with the heavy rainfall during the Monsoons, flush floods and destruction of habitation and agriculture owing to the shift of the river streams have become common phenomena.

From the Figure 3.8, it can be seen that the district is traversed by the two rivers channels; these are Ganga- Padma River channel and Mayurashki river channels. The Ganga-Padma River and Bhagirathi, Jalangi and itsdistributaries like Sialmari and Bhairab these rivers flow throughout the 'bagri' regionof Murshidabad. These distributaries carry water during the monsoon and remain dry inother seasons of the year.

The western Rarh block is mainly drained byMayurakshi - Dwarka- Brahmani River in the south and River Basloi, RiverPagla and River Gumaniinthenorth westernpart. These channels of 'rarh' blocks of Murshidabad, accumulates sand andsiltduring monsoon and form a deltaic plain.

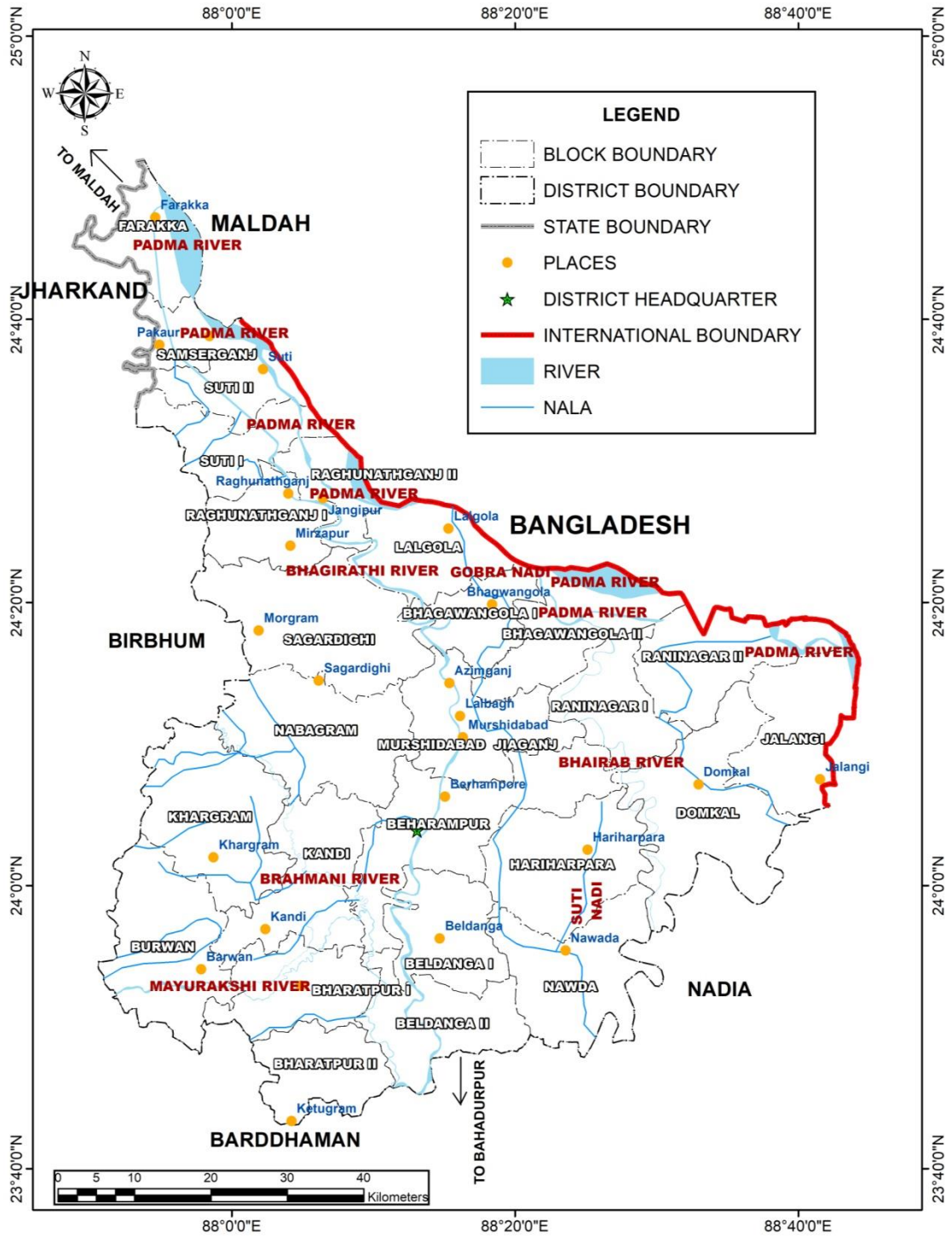


Figure 3.8: Drainage map of Murshidabad District

(Source: National Informatics Centre)

h) Demography

According to the 2011Census, Murshidabad district encompasses a geographical area of 5324sq km and has a population of 71,03,807 (persons) including 36,27,564 males and 34,76,243females.The majority of the population belongs to Muslim Community with a population share of 66% followed by Hindu (33.21%).The highest sex ratio (female per thousand male) among the C.D. Blocks is observed in Samserganj C.D. Block with 1000 and the lowest with 936 is recorded in Murshidabad-Jiaganj C.D. Block.Figure3.9representing block wise population distribution and literacy rate respectively for Murshidabad district.

Table 3.4showstheMurshidabad district demographic profile based on 2011 census. The total literacy rate of the district is 66.59and the male and female literacy rates in the district are 69.95 and 63.09 respectively with a male-female literacy rate gap of 6.85. Block-wise literacy rate of the population is described as the percentage of literates in the age group of seven years and above in Figure 3.10. Literacy rate in the municipality area is higher than the district literacy rate. Behramporemunicipality is having highest rate of 90.06%. Sadar sub-division also having higher rate of literacy and Jangipur Sub-Division is having lower literacy rate. ***(Census, 2011)***

Table 3.4: Demographic distribution of Murshidabad District

Sub-Division /C.D.Block / MT	Area (Sq. Km.)	No. of Households	Male	Female	Total Population	Literacy %	% of population to district population
Sadar Sub - Division	**1195.57**	**395951**	**884857**	**840668**	**1725525**	**72.6**	**24.29**
Behrampore	314.19	105958	228650	218237	446887	73.51	6.29
Beldanga-I	168.75	68499	164147	155175	319322	70.06	4.49
Beldanga-II	207.93	55268	129144	121314	250458	67.86	3.53
Nowda	231.39	53962	116341	110518	226859	66.09	3.19
Hariharpara	253.14	62609	131634	125937	257571	69.2	3.63
Behrampore(M)	16.19	43075	100247	94976	195223	90.06	2.75
Beldanga(M)	3.98	6580	14694	14511	29205	82.56	0.41
Kandi Sub - Division	**1200.76**	**267446**	**592322**	**563323**	**1155645**	**66.28**	**16.27**
Kandi	227.48	48963	112789	107356	220145	65.13	3.10
Khargram	318.45	65580	139533	133799	273332	63.56	3.85
Burwan	299.66	60732	132439	125027	257466	68.96	3.63
Bharatpur-I	183.72	40102	89088	83614	172702	62.93	2.43
Bharatpur-II	158.5	39832	90031	86337	176368	66.07	2.48
Kandi(M)	12.95	12237	28442	27190	55632	82.05	0.78
Jangipur Sub - Division	**1097.82**	**386666**	**1000403**	**971905**	**1972308**	**60.95**	**27.76**
Farakka	132.74	54005	139226	134885	274111	59.75	3.86

Sub-Division /C.D.Block / MT	Area (Sq. Km.)	No. of Households	Male	Female	Total Population	Literacy %	% of population to district population
Samserganj	84.21	51412	142034	142038	284072	54.98	4.00
Suti-I	143.68	36628	91905	88003	179908	58.06	2.53
Suti-II	111.13	53619	139995	138927	278922	55.23	3.93
Raghunathganj-I	140.91	39021	100295	95332	195627	64.49	2.75
Raghunathganj-II	121.6	50129	135723	129613	265336	61.17	3.73
Sagardighi	345.42	67889	158641	151820	310461	65.26	4.37
Jangipur(M)	7.86	17418	44949	43216	88165	79.24	1.24
Dhuliyan(M)	10.27	16545	47635	48071	95706	63.03	1.35
Lalbagh Sub - Division	**1019.1**	**281596**	**640763**	**613123**	**1253886**	**68**	**17.65**
Lalgola	184.37	70216	170997	164834	335831	64.32	4.73
Bhagwangola-I	136.1	45336	103419	98652	202071	66.79	2.85
Bhagwangola-II	175.26	37445	80699	77325	158024	62.82	2.22
Murshidabad-Jiaganj	192.13	54029	121187	113378	234565	69.12	3.30
Nabagram	306.63	52954	116134	111452	227586	70.83	3.20
Murshidabad(M)	12.95	9829	22177	21842	44019	81.94	0.62
Jiaganj-Azimganj(M)	11.66	11787	26150	25640	51790	80.75	0.73
Domkal Sub - Division	**837.88**	**239100**	**509219**	**487224**	**996443**	**65.35**	**14.03**
Domkal	305.19	88520	186182	177794	363976	63.9	5.12
Jalangi	210.63	60928	129430	123047	252477	67.35	3.56
Raninagar-I	146.93	45147	96248	92857	189105	67.25	2.66
Raninagar-II	175.13	44505	97359	93526	190885	63.6	2.69
District Total	**5324**	**1570759**	**3627564**	**3476243**	**7103807**	**66.59**	**100.00**

(Source: Census book of Murshidabad, 2011)

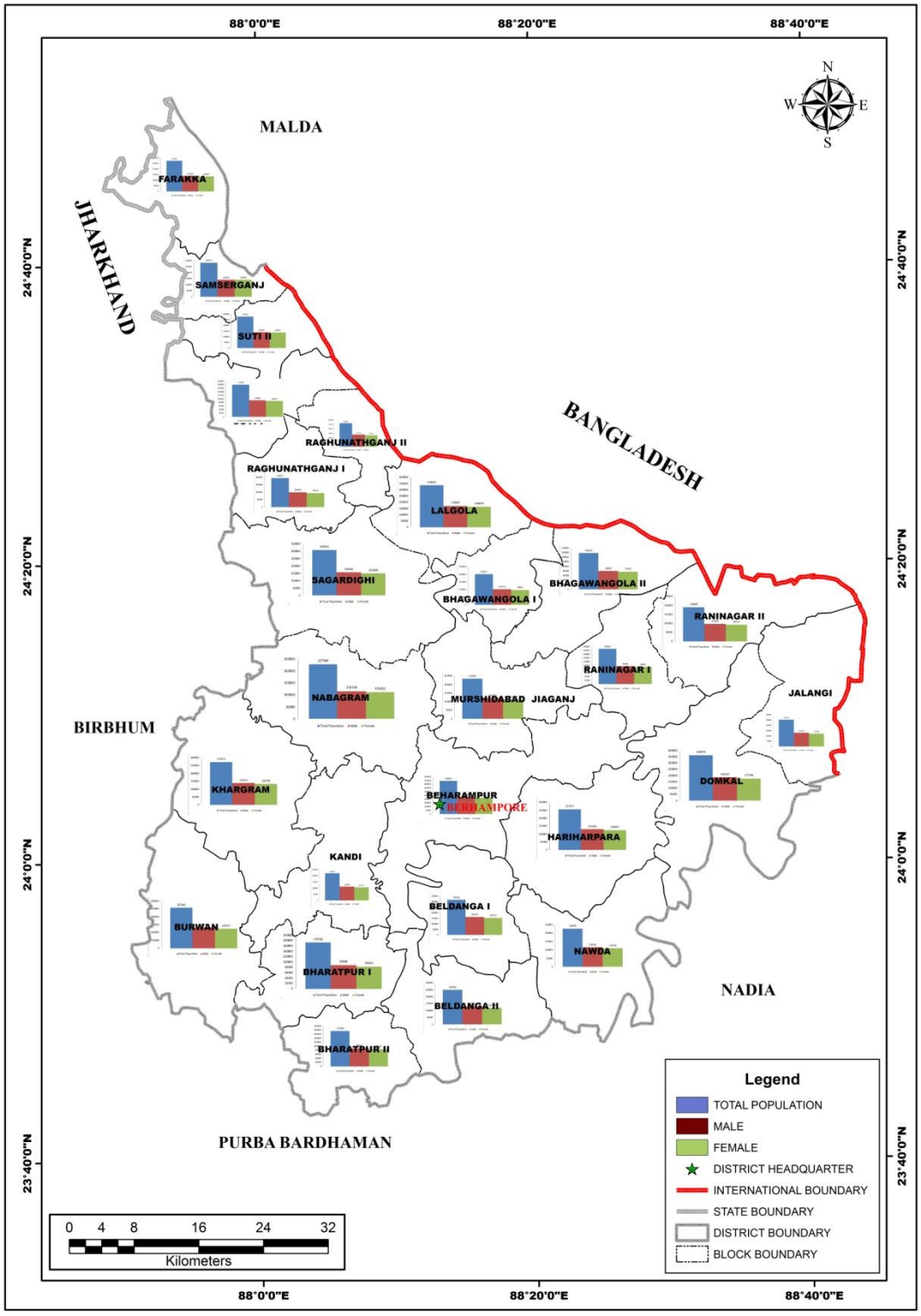


Figure 3.3.9: Block-wise population distribution in Murshidabad District

(Source: Census, 2011)

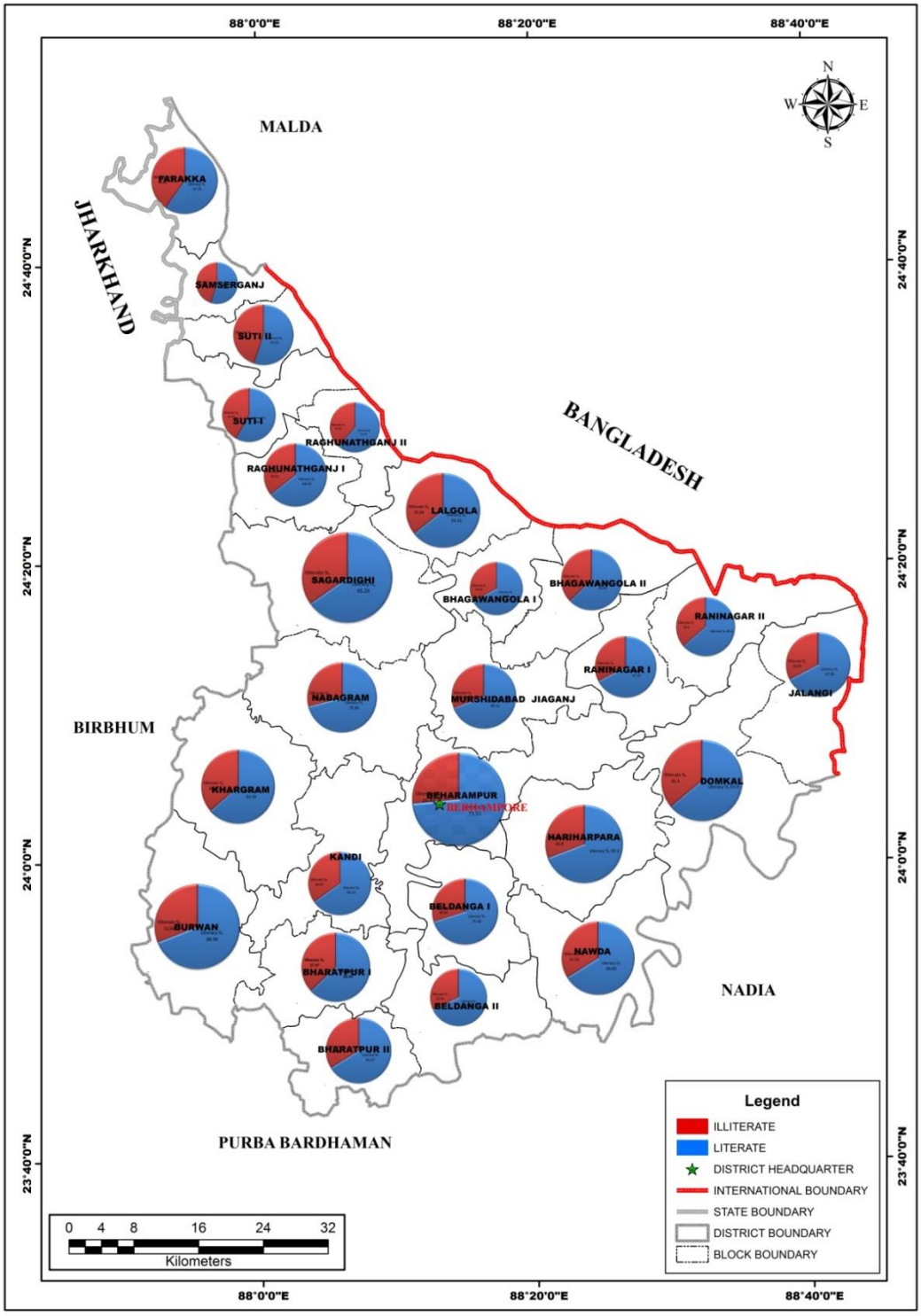


Figure 3.3.10: Demographic map showing Block-wise Literacy rate of Murshidabad District

(Source: Census of India, 2011)

i) Cropping pattern

The economy of Murshidabad district is primarily based on agriculture. Cultivation constitutes the main source of livelihood for the people in the district. The line of low-lying area in the North upto the basin of the river Bhagirathi in the Nabagram Plain is very fertile and suitable for growing of paddy, wheat and gram etc. The Mayurakshi-Dwarka Plain is also very fertile and more suited for winter paddy crop. The climate here is drier than the Eastern tract and apart from paddy, wheat; gram, sugarcane, pulses, mustard are also cultivated in this region. Ganga-Bhagirathi Basin is actually a long and narrow strip of river-valley area and more suitable for cultivation of paddy, jute and other rabi crops. Paddy is the main crop of this region. Paddy is the principal crop of Jalangi-Bhagirathi interfluves also. Besides, potato, pulses and oilseeds are grown abundantly. Soil of Raninagar Plain is alluvial and fertile and very much suitable for cultivation of paddy, jute and other rabi crops. The principal agricultural crops of the district are Rice, Wheat, Pulses, Oilseeds, potato andjute. Sugarcane, Cabbage, Cauliflower and Brinjal are produced in considerable quantity throughout the district **(Census, 2011)**.

The total cultivable land in the district amounts to 3,95,980 hectares. With the provision of good irrigation facilities, multiple crop cultivation has become feasible in certain areas of the district. In the district, the total irrigated area in the year 2013-2014 amounted to 2,20,090 hectares. The main sources of irrigation in the district are Government canals, deep and shallow tube wells along with river lift irrigation.

j) Land Form and Seismicity

Murshidabad district is dominated by almost flat topography. The district is divided into two broad zones namely Radh and Bagri, which are situated on the Western and Eastern side of the river Bhagirathi respectively. The Eastern tract or Bagri lies almost entirely between the Ganga-Bhagirathi basin and is characterized by the existence of inundation along with many swamps.The Western tract or Radh is slightly high and undulating region of the district. It is interspersed with numerous swamps along with beds of Old River.

The seismic hazard map of India was updated in 2000 (Figure 3.11) by the Bureau of Indian Standards (BIS). There are no major changes in the zones in West Bengal with the exception of the merging of Zones I and II in the 1984 BIS map. Western sections of the northern districts of Jalpaiguri and Coochbehar lie in Zone V. The remaining parts of these two districts, along with the districts of Darjeeling, Uttar Dinajpur, Dakshin Dinajpur, Maldah, 24 North Parganas and 24 South Parganas lie in Zone IV. The rest of the state along with the city of Kolkata lies in Zone III.

The district falls under theSeismic Zone III, indicatingthedistrict Murshidabad under safe earthquake–prone zone and but it cannot ignore the future possibility of a vulnerable and disastrous earthquake because the neighbor district—Malda is the earthquake-prone district and the Lower Ganga Fault line just touched the northern portion of this district (**Source: Halder S, 2012**).

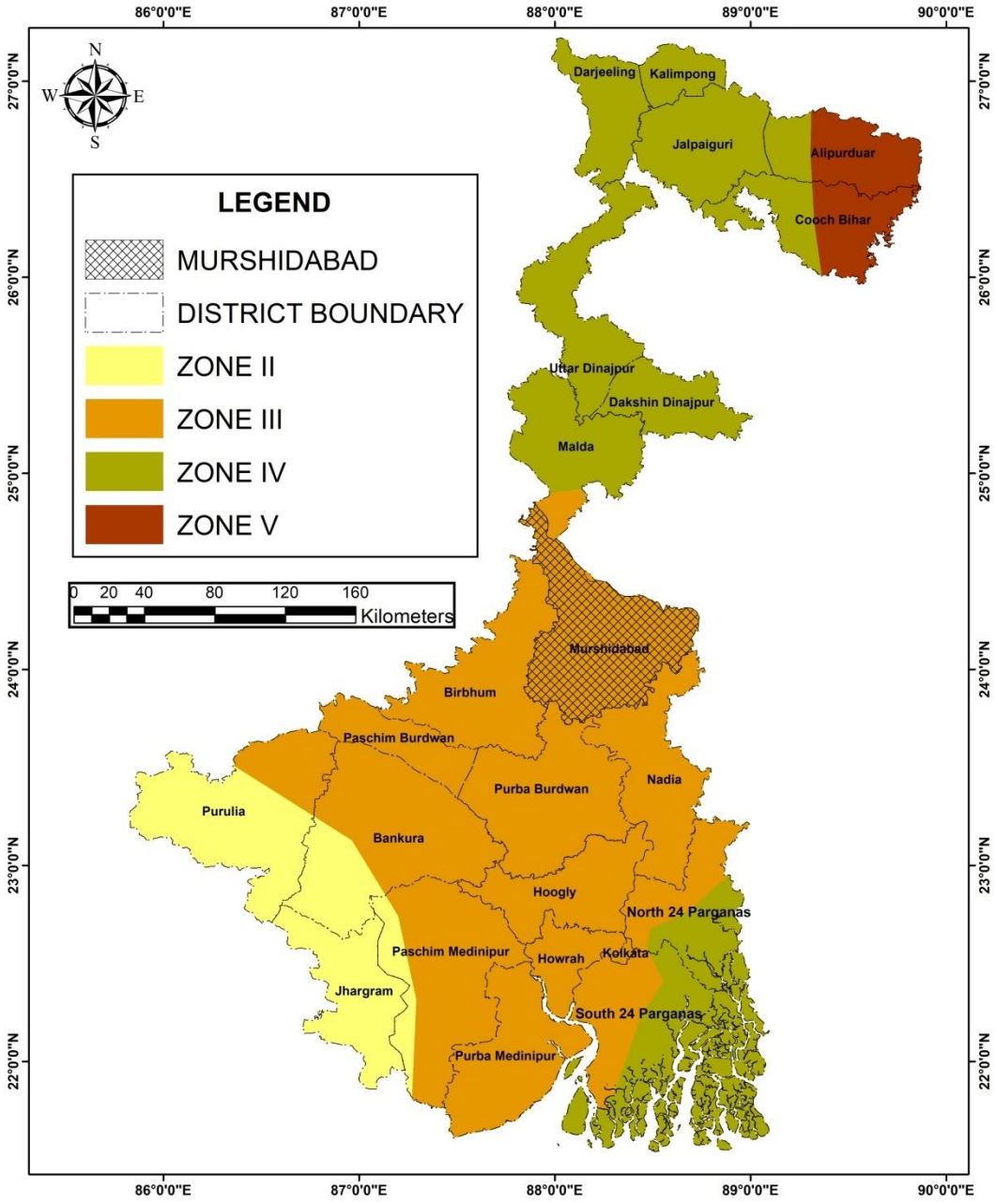


Figure 3.3.11: Earthquake zonation map of West Bengal highlighting the Murshidabad district position

(Source: Ministry of Earth Science)

- **Earthquake:**

Historical evidence of seismic hazard reveals the fact that starting from the seventeenth century there were enormous earthquake strike on Murshidabad District. According to previous record in 1762 there was a devastating earthquake. This earthquake cast its effect all over the independent West Bengal, as well as in Murshidabad.

In the year 1766 another earthquake was occurred but its shock wave was realized in north-eastern part of this district or along the Ganga River tract. According to Asiatic Annual Register, in Murshidabad district there was two earthquakes occurred in the year 1810 and 1811. Among the two, the earthquake of 1811 was more vulnerable. In 1822 an earthquake has been realized all over West Bengal, including Murshidabad district, and the epicenter was Assam-Himalayan region. in Murshidabad District as well as in West Bengal earthquake occurred eleven times in various years with irregular interval, i.e., in 1834, 1835, 1839, 1842, 1843, 1845, 1846, 1847, 1849, 1852 and 1858. But all these earthquakes having lesser intensity, did not affect too much on its civilization on district level. In 1885 on 14th July an earthquake had shaken the entire West Bengal. As per record, the affected area was Lower Ganga Plain and it was evident that the eastern part of Murshidabad district was highly affected, especially densely settled area and agricultural field, but no death reports were observed. On 12th June, 1897 a violent earthquake occurred which was having epicenter at Shilong, Maghalaya and adjacent Goalpara region. The intensity of this seismic hazard as recorded through Richter scale was 8.7 Richter or in other words it was the highest massive earthquake in India till 1897. This earthquake in Murshidabad felt at moderate magnitude and after 12th June next two days after shock was also realized, the numbers of deaths were very minor in this regard. The most hazardous condition was observed mainly in four areas like Berhampur Town, former Murshidabad (Lalbag town), former Baluchar (Jiaganj) and Azimganj.

In 15th January, 1934 another earthquake occurred and the magnitude of this earthquake was 8.4 Richter. The epicenter was the border area of India-Nepal boundary or foothills of Siwalik Himalaya. The total numbers of death recorded in Murshidabad District were 105. In 15th August, 1950 a vulnerable earthquake was realized first in Assam Plain Region and district Murshidabad was also affected by this seismic hazard. The magnitude of this was 8.5 Richter. Almost 65 people were died all over the district. After 1950 again on 6th August, 1988 an earthquake with lesser intensity were realized, although there was no evidence of big disaster but few cracks found on the big walls of Krishnanath Collegiate School, Berhampur. In the same year, on 21st August an earthquake was realized, all over the district 32 people were died 77 were injured. On 18th September, 2011 an earthquake was realized all over the district, as well as, in West Bengal. The magnitude of this earthquake was recorded as 3.9-4.3 Richter and the epicenter was Sikkim. There was no death reported in Murshidabad (**Source: Halder S, 2012**).

On 25th April and 12th May 2015, Nepal and its surrounding area were hit by earthquakes which are considered to be the most devastating in the living memory of the inhabitants of these affected areas. The 7.9 magnitude quake was the strongest to hit Nepal for

81 years. It was the most horrible natural disaster to hit Nepal since the 1934 Nepal–Bihar border earthquake. Earthquakes are often followed by landslides and rock avalanches and glacier avalanches in Himalayan hilly areas. Tremors were felt in several parts of West Bengal, including state capital Kolkata, which were felt in Murshidabad, Durgapur, Siliguri and other places of the state.

- **Floods:**

Floods are a common feature in the district of Murshidabad of West Bengal, especially, in the low-lying areas of River Bhagirathi Basin. More or less every year the area gets flooded in the form of inundations due to excessive rainfall coupled with discharge from the Dams and Barrages in the upper catchment's regions. The severe floods occurred in the year 1823, 1834, 1838, 1847, 1866, 1870, 1885, 1890, 1931, 1956, 1959, 1968, 1978, 1984, 1997 and one of the most severe one in the year 2000. There were floods reported in year 2002, 2006, 2014, 2016 and 2017 though of less severity. In the eighties the floods of 1823 are still considered the most destructive on record causing large scale destruction of crops, property and loss of human lives. Such flood recurred in the year 1870 when the embankment at Lalitakuri on River Bhagirathi gave way and flood waters swept across the district into Nadia leading to large scale destruction of crops. Severe floods have been recorded in 1885 and 1890 when the embankment again at Lalitakuri gave way leading to discharge to the extent of 50,000 cusecs. In the year 1931-32 Kandi Sub-division was severely affected and large-scale damage to standing crops was reported. In 1968 the River Mayurakshi, Dwarka, Brahmani and Gambhira flooded low lying area of Kandi Sub-division. The 1978 flood is still fresh in the memory of the district when heavy downpour in the upper reaches of Ganges and local rainfall resulted into mass destruction of crops, loss of lives and property. The flood of the year 2000 crossed all geographical and geo-hydrological barriers and the losses occurred were irrecoverable and unprecedented.

The following Table shows the nature of flood and percentage of area affected in floods in Murshidabad in from 1978 to 2004.It appears that the maximum area was flooded in year 2000, while the maximum number of years witnessed low to moderate floods affecting up to 20 % of the area only.

Table 3.5: Percentage of flood area of Murshidabad district in different years

Area affected in Floods in %	Year of Occurrences	Total number of years
0-20	1979,81,82,83,89,90,91,95,97,99, 2001,02,03,04	14
20-40	1980,86,87,98	4
40-60	1978,85	2
60-80	1993,94	2
80-100	2000	1

(Source: Census 2011)

k) Flora

The flora of the district bears resemblance with those of the other deltaic districts of West Bengal. Only in Northernmost part of the district some plants which thrive well in drier regions can also be found. In the swampy areas numerous marshy species of plantsare available. Bamboo plantations are found to be scattered all over the district. Similarly, mangos, jackfruit, Segun, Sisoo trees along with Babla, Pitali, Tentul etc. are also spreadover the district. Bot, Aswattha, Sal, Mahua, Khend and Palas trees are also found insome parts of the district. Kul mainly for the purpose of lac cultivation can be foundpredominantly in the Jangipur Sub-division of the district. Mulberry cultivation is popularin the areas famous for sericulture activities namely in Berhampore, IslampurandBeldanga areas. The district boasts of its varieties of mango delicacies. Many varieties available are unique to the district and trace their origin to the days of the Nawabs.Shadulla, Himsagar, Ranipasand (favorite to the queen), Begumpasand (favorite to theBegum), Sharanga, Mulayamjam, Kohitur (the king of mangoes) are among the varieties cherished by the mango connoisseurs (**Census, 2011**).

Within this district there are about 153 "Sacred Groves" which are small forest patches harboring many trees, bushes, shrubs, herbs, insects, amphibians, reptiles, birds and mammals. Sacred groves provide the inextricable link between present society to the past in terms of biodiversity, culture, religious and ethnic heritage. Sacred Groves are the ideal centre for biodiversity conservation preserving the local flora and fauna. 30 (Thirty) medicinal plants found in these sacred groves were commonly used by the traditional healers. These sacred groves which are repositories of great biodiversity are now faced with grave threats. The impact of modernization and education and growing disbelief in the traditional value systems among the local communities has impacted the preservation of the sacred groves (Source: **Bandyopadhyay et.al. 2019**).

l) Fauna

Wild animals of bigger type have disappeared. Antelopes and deer, which were once found, have completely disappeared. The Revenue Surveyor reported in 1857 that he found tigers, rhinoceroses and a few wild buffaloes, but none of them exists now. Wild boars, however, still abound and pig-sticking was a common pastime in and about Patkabari till lately. Leopards were sometimes found in and about Murshidabad in Hariharpara and wild cats are occasionally found. Monkeys, Jackals, Snipes, wild Duck, Pigeons, Teals, Geese etc. are found in the district. Among the Ducks, Pintail, Pochard and Brahminy are very common. Snakes like Cobra, Darrash, Karait etc. are found to be in existence all over the district and they mostly appear in more numbers at the aftermath of floods. The black-faced monkey is however found in abundance. The water bodies attract many water birds like the dabchick / little grebe, cormorants of different types, Indian shag, darter, ibis, herons, egrets, storks, teals along with various varieties of ducks. Kites, pheasants, fowls & partridges, owls, vultures, pigeons, doves, woodpeckers, cuckoos, swifts, larks, ioras (Fotik Jal), orioles and shrikes are also visible in the district. Among the household birds commonly visible are drongoes (Fingey), mynas, babblers,

pigeons, doves, and crows. Of the smaller birds the tailorbird, wagtails, sunbirds and weaverbirds are common. The area attracts the bird-lovers. (**Census, 2011**).

The more valuable fish caught in the river, bils and tanks belong to the carp family (Cyprinidoe), such as ruhi, katla, mirgal, etc., or are Siluridoe, such as boail and magur. Large catches of hilsa (Clupea ilisha) are made in the Padma or Ganges during the rainy season, when they ascend in shoals. They are also caught in the Bhagirathi and in the KhayaraBil, when it is flooded by the Bhagirathi, and are exported in considerable quantities (**Source: Bhattacharya, 1979**).

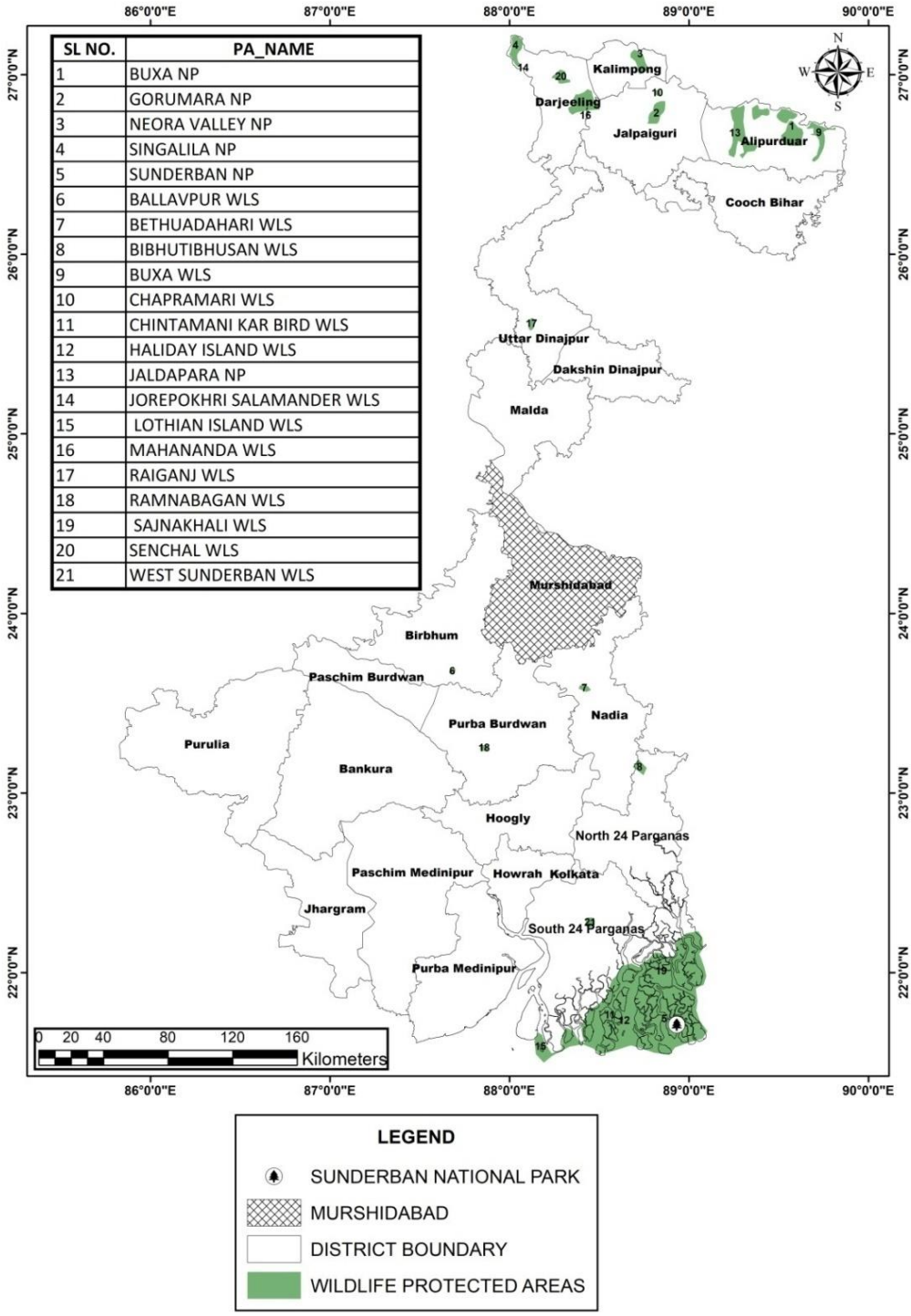
Ahiran Lake, a wetland of Murshidabad district, West Bengal, (approximately 400 hectare, 24° 26’ N to 24° 30’ S and 87° 58’ E to 88° 02’ W) serves as a habitat of large populations of resident and migrant water birds, fish, amphibian, reptiles and mammals. Two species of mammals Canis aureus (Sheal) and Herpestesjavanicus (Beji) are frequently found in Ahiran. Besides there are 40 species of fishes, 56 species of birds, 6 species of amphibian and 8 species of reptiles (**Source: Chattorajet.al. 2016**).

Bishnupur Bill a horse shoe lake derived from Holy River the Ganges. This natural lake and its surrounded area have lots of Flora and Fauna from algae to mammalians. The inventory records a total of 168 species and 64 genera (Source: Bhattacharyya et.al. 2017).

Patanbeel, a relatively unexplored wetland of North-West Murshidabad, is located between latitude 24° 2' 4" North and 24° 3' 20" North and longitude 88° 1' 18" East and 88° 0' 15" East. This approximately 500 acres wetland contains forested area, some human habitation and low but cultivable land. The area is unique in floral and faunal composition. This study has revealed that 'Patanbeel' contains 47 species of plants, 64 species of indigenous fish, 3 species of amphibians, 7 species of reptiles and 21 species of birds. Some of the birds are totally aquatic, some are migratory in nature. The seasonal occurrence of some plants and their associated fauna is also noted from Patan wetland.

Around Berhampore, a district town of Murshidabad has 64 species of birds belonging to 34 families. Among the recorded species, 71.87% were resident, 15.62% were local migrant and 12.50% were winter migrant species. The order Passeriformes represented by 15 families and 22 species, dominated the bird’s community of the study area. It accounted for 34.37% of the total number of bird species in study area. In order Passeriformes, family Sturnidae has five species. In which common myna (Acridotherestristis) are most abundant in the study area (Source: Mistry J, 2015).

Location of Wild Life Sanctuary and National Parks are shown in the Map of West Bengal (Figure 3.12). As per the map of ENVIS Centre on Wildlife and Protected Areas, there is no National Park or Sanctuary situated within the Murshidabad district. Hence, mining of river bed can be promoted in the district.



SL NO.	PA_NAME
1	BUXA NP
2	GORUMARA NP
3	NEORA VALLEY NP
4	SINGALILA NP
5	SUNDERBAN NP
6	BALLAVPUR WLS
7	BETHUADAHARI WLS
8	BIBHUTIBHUSAN WLS
9	BUXA WLS
10	CHAPRAMARI WLS
11	CHINTAMANI KAR BIRD WLS
12	HALIDAY ISLAND WLS
13	JALDAPARA NP
14	JOREPOKHRI SALAMANDER WLS
15	LOTHIAN ISLAND WLS
16	MAHANANDA WLS
17	RAIGANJ WLS
18	RAMNABAGAN WLS
19	SAJNAKHALI WLS
20	SENCHAL WLS
21	WEST SUNDERBAN WLS

Figure 3.3.12: District location with respect to Wild LifeSanctuary of West Bengal

(Source: ENVIS Centre on Wildlife and Protected Areas)

4 Geomorphology

4.1 General Landforms

The Murshidabad district is divided into two broad zones namely Radh and Bagri, which are situated on the Western and Eastern side of the river Bhagirathi respectively. Topographically the district can be divided into 5 sub-micro regions, these are as follows:

Nabagram Plain: The region is situated on the Western tract of the Bhagirathi River. As the Rajmahal hill slopes gently down in this region the plain lies at the bottom of its elevation. The Eastern slope of the region is characterised by the existence of numerous cliffs and bluffs. There exists a substantial amount of low-lying area in the North up to the basin of the river Bhagirathi situated within Samserganj, RaghunathganjalongwithSuti-I and Suti-II C.D. Blocks.

Mayurakshi-Dwarka Plain: This region is situated in the South-Western corner of the district and exhibits the characteristic features of the Sub-Vindhyan region of Radh.

Ganga-Bhagirathi Basin: This basin is a long and narrow river valley which extends along the Ganga and Bhagirathi rivers. The Bhagirathi divides the region into almost two equal parts. The soil of this region is very much fertile and suitable for cultivation.

Jalangi -Bhagirathi Interfluve: This region is a low-lying area having alluvial soil pattern with humid climate. It originates from the Bhagirathi plain in the West and culminates into the BhairabRiver in the East while the river Jalangi is situated in the South-Western region.

Raninagar Plain: This region is a low-lying area of "Bagri Tract" and is characterized by the nature of inundation along with many swamps. This region lies in the North-Eastern portion of the district situated between the Bhairab and JalangiRiver.

There are no significant hills within the districtand no-significant forest tract; although at the oscillation areas ofthe Rivers there are a number of waste-lands covered mostly with heavy grass and reeds. Along the large number of abundant channels left bythe shifting rivers lie lakes or marshes, some of which establish aconnection with the rivers during the monsoon while others are completely insular accumulations of water. These ox-bowlakesprovide catchments for a heavy rainfall in the district and are of economic importance in that they serve as fisheries besides providing water to the cultivators for the steeping of the jute.

4.2 Soil and rock pattern

The Bhagirathi River divides the district into two almost equal portions; Eastern part Bagri and the Western part Radh. These two divisions except the South-Eastern portion are in sharp contrast so far as soil is concerned. The right portion is an alluvial tract formed by inundation. The soil is very fertile for growing aus, paddy, jute and rabi crops. In the South

Eastern portion of the district lies the Kalantartract. It is a low-lying area. The surface soil is stiff dark clay and supports mainly cultivation of aman paddy, which depends on flood for successful cultivation.

The soil of Rarh, at left flank of Bhagirathi, is mostly clay and lateritic clay type, comparatively heavy, gray or reddish in colour. The land is high and slightly undulating having gentle slope from West to East. The soil of the area is generally low in carbon content and acidic to neutral in reaction. The main crops are paddy, sugarcane, potato but oil seed and vegetables are cultivated successfully in all the three seasons. Mulberry grows well and hence sericulture has developed here.

Several types of soil are found in the district of Murshidabad. Mathal or methalisclayey soil and dark in colour but BaghaMethal is brown and RangaMethal is reddish incolour. Loamy soils are known as do-ansh soil which are very much fertile and canproduce good crops while sandy loam or metebali and higher sand contained domabaliare not good for cultivation.

In Murshidabad Gazateer 2003, the soil of the district is broadly classified into two: A) Sub- Vindhyan category of alluvial andB) The alluvial flood plain of the Ganges.

Further minor classes of the soil are:

Flood plain just near the Ganga-Padma-Bhagirathi River: This region is found in the adjacent to the banks of the Ganga- Padma River.

Ganga Flat land: This land lies between Ganga riverine and Ganga lowland. The nitrogen content is moderate and the buffering capacity is very high. Water permeability and water retention capacity is very high. The percentage of sand decreases and the percentage of clay increases with the depth of the soil.

Ganga Lowland: This zone is associated with heavy clay horizon followed by subsoils of sandy material, coarse sand and some concretions. During rainy season the soil is sticky and during winter the soil dried up and cracks. The percentage of silt, moisture, carbon and nitrogen decreases with the depth of the soil.

Ganga Uplands: The area has comparatively higher topography. The Bhagirathi rarely swings to the right and erode the land due to the stable and stiff nature of this soil. The soil profile is clayey in nature with the presence of lime horizon. The sesquioxide present is immobile. In the third- and fourth-layer lime accumulation is noted due to leaching of calcium carbonate from the surface layer. Phosphate and nitrogen content is low and potash content is average.

Other types are: Rajmahal flood plain area, Rajmahal plain land and Rajmahal upper plain land. These are occurred at the northern part of the Murshidabad district (blocks like Farakka, Suti-I, Suti-II and Samsherganj) which consists of basaltic lava flows with intercalated

carbonaceous shale and clays. This part of the district has very low soil fertility. Basloi River and other hill streams from the west Rajmahal hill flood the area every year.

Figure 4.1 is showing soil pattern of the Murshidabad district. Soil type of the district mainly divided based on active alluvial plain or flood plain soil and alluvial plain or sub-recent alluvial soil as explained below table (Table 4.1).

Figure 4.4.1: Soil Map of Murshidabad District
(Source: National Bureau of Soil Survey and Land Planning)

Table 4.1: Description of District soil type

MAP SYMBOL	DESCRIPTION	TAXONOMIC NAME
ACTIVE ALLUVAIL PLAIN (Flood plain soil)		
W012	Very deep, poorly drained, fine loamy soils occurring on level to nearly level active alluvial plain with loamy surface and moderate flooding.	Fine Loamy, Typic Haplaquepts
W015	Very deep, moderately well drained, coarse loamy soils occurring on very gently sloping active alluvial plain with loamy surface associated with very deep, imperfectlydrained, fine loamy soils.	Coarse Loamy,Typic Ustifluvents; Fine Loamy, Fluventic ustochrepts
W016	Very deep, moderately well drained, fine silty soils occurring on very gently sloping active alluvial plain with loamy surface and moderate erosion associated with very deep, moderately well drained, fine loamy soils.	Fine Silty,Typic Ustifluvents; Fine Loamy, Fluventic ustochrepts
ALLUVAIL PLAIN (Sub Recent alluvial soil)		
W037	Very deep, poorly drained, fine soils occurring on level to nearly level low lying alluvial plain with clayey surface associated with very deep, imperfectly drained, fine soils.	Fine,AericHaplaquepts; Fine, Typic ustochrepts
W040	Very deep, poorly drained, fine cracking soils occurring on level to nearly level, low lying alluvial plain with loamy surface associated with very deep, poorly drained, fine soils.	Fine,VerticOchraqualfs; Fine, AericHaplaquepts
W042	Very deep, poorly drained, fine soils occurring on level to nearly level, low lying alluvial plain with clayey surface associated with very deep, poorly drained, fine cracking soils.	Fine, AericHaplaquepts; Fine,VerticOchraqualfs
W044	Very deep, poorly drained, fine cracking soils occurring on level to nearly level, low lying alluvial plain with clayey surface and moderate flooding associated with very deep, poorlydrained, fine soils	Fine, VerticHaplaquepts ; Fine AericHaplaquepts
W045	Very deep, poorly drained, fine cracking soils occurring on level to nearly level, low lying alluvial plain with clayey surface and moderate flooding associated with very deep, poorlydrained, fine soils	Fine, VerticHaplaquepts ; Fine AericOchraqualfs
W047	Very deep, poorly drained, fine soils occurring on level to nearly level low lying alluvial plain with clayey surface and severe flooding associated with very deep, moderately well drained, fine loamy soils	Very Fine, AericHaplaquepts; Fine Loamy, Typic ustochrepts
W051	Very deep, poorly drained, fine loamy soils occurring on level to nearly level meander plain with loamy surface and moderate flooding associated with very deep, imperfectlydrained, fine loamy soils	Fine Loamy, AericHaplaquepts; Fine Loamy, Fluventic ustochrepts

MAP SYMBOL	DESCRIPTION	TAXONOMIC NAME
W053	Very deep, imperfectly drained, fine soils occurring on level to nearly level meander plain with clayey surface and moderate flooding associated with very deep, poorlydrained, fine soils	Fine Loamy, Fluventic ustochrepts; Fine silty, Typic Ustifluvents
W055	Very deep, poorly drained, fine soils occurring on level to nearly level meander plain with clayey surface and severe flooding associated with very deep, moderately well drained, fine loamy soils	Fine,AericHaplaquepts; Fine Loamy, Fluventic ustochrepts;
W058	Very deep, poorly drained, fine soils occurring on level to nearly level meander plain with clayey surface and severe flooding associated with very deep, moderately well drained, fine loamy soils	Fine,AericHaplaquepts; Fine Loamy,Typic Ustifluvents
W059	Very deep, poorly drained, fine loamy soils occurring on nearly level meander plain with loamy surface and moderate flooding associated with very deep, moderately well drained, coarse loamy soils	Fine Loamy, AericHaplaquepts; Coarse Loamy,Typic Ustifluvents
W060	Very deep, moderately well drained, Coarse loamy soils occurring on level to nearly level meander plain with loamy surface and moderate flooding associated with very deep, imperfectly drained, fine loamy soils	Coarse Loamy,Typic Fluvaquents; Fine Loamy,Typic Ustifluvents
W065	Very deep, moderately well drained, Fine loamy soils occurring on very gentle sloping flood plain with loamy surface and moderate flooding associated with very deep, well drained, sandy soils	Fine Loamy,Typic Ustifluvents Typic Ustipsamments

The entire district forms a part of the great alluvial plain of the Ganges-Padmasystem.The alluvial deposits in this district have been laid down as flood-plains deposits by the rivers Bhagiratho, Dwaraka and Mayurakshi. The sediments comprise boulder, pebbles, and gravels and coarse to medium sand intercalated with lenses of clay. The sands are coarse to fine, sub-rounded and micaceous (muscovite).

4.3 Different geomorphologic units

AsisBhatacharya and S.N. Banerjee in 1979 had classified the Ajay Bhagirathi valley in to four geomorphic plain. A) Lateritic Upland or Ilambazar plain, b) Older Deltaic Plain or Rampurhat Plain, c) Younger Deltaic Plain or Kandi Plain and d) Bhagirathi recent surface. The District Murshidabad lies generally within the Younger Deltaic Plain or Kandi Plain and the Bhagirathi Recent Surface.

The Young Deltaic Plain or Kandi Plain is a terrace like plain. This plain varies from 6 kilometers in the north to 38 kilometers in the south and the average slope is 0.6 meters per kilometers. The plain becomes narrower near Jangipur and widens towards Berhampore. In the east of Kandi, the patches of Older Deltaic Plain blended into YoungDeltaic Plain and in few areas the Older Deltaic Plain underlies the Young DeltaicPlain. The fan like younger delta of Mayurakshi forms terraces. The radiating channelpattern with natural levees on each bank is well preserved. Interestingly large filledvalley-cuts are found near the junction of Older Deltaic Plain and the Bhagirathi recentsurface. The sedimentary structures are common in Young Deltaic Plain. The fluviatileland forms are like ox-bow lakes, levees, meanders, etc. also preserved.

The Bhagirathi recent surface is confined into the present-day channels and their immediate vicinity. The belt of terrace is 3-5 kilometers in width with slope 0.2 meters per kilometers. The land is very low in some places and there is a sharp break present between Young Deltaic Plain and the Bhagirathi recent surface (e.g. flood plain between Bhagirathi and Dwarka River). The surface is composed of loose and completely unconsolidated sediments structures. The river Bhagirathi meanders strongly between Jangipur and Berhampore.

Figure 4.2 below represent the Geomorphological variation of Murshidabad district. Geomorphologically the district is dominated by alluvial flood plain. Another geomorphological unit of this area is marshy land and ox-bow lakes.

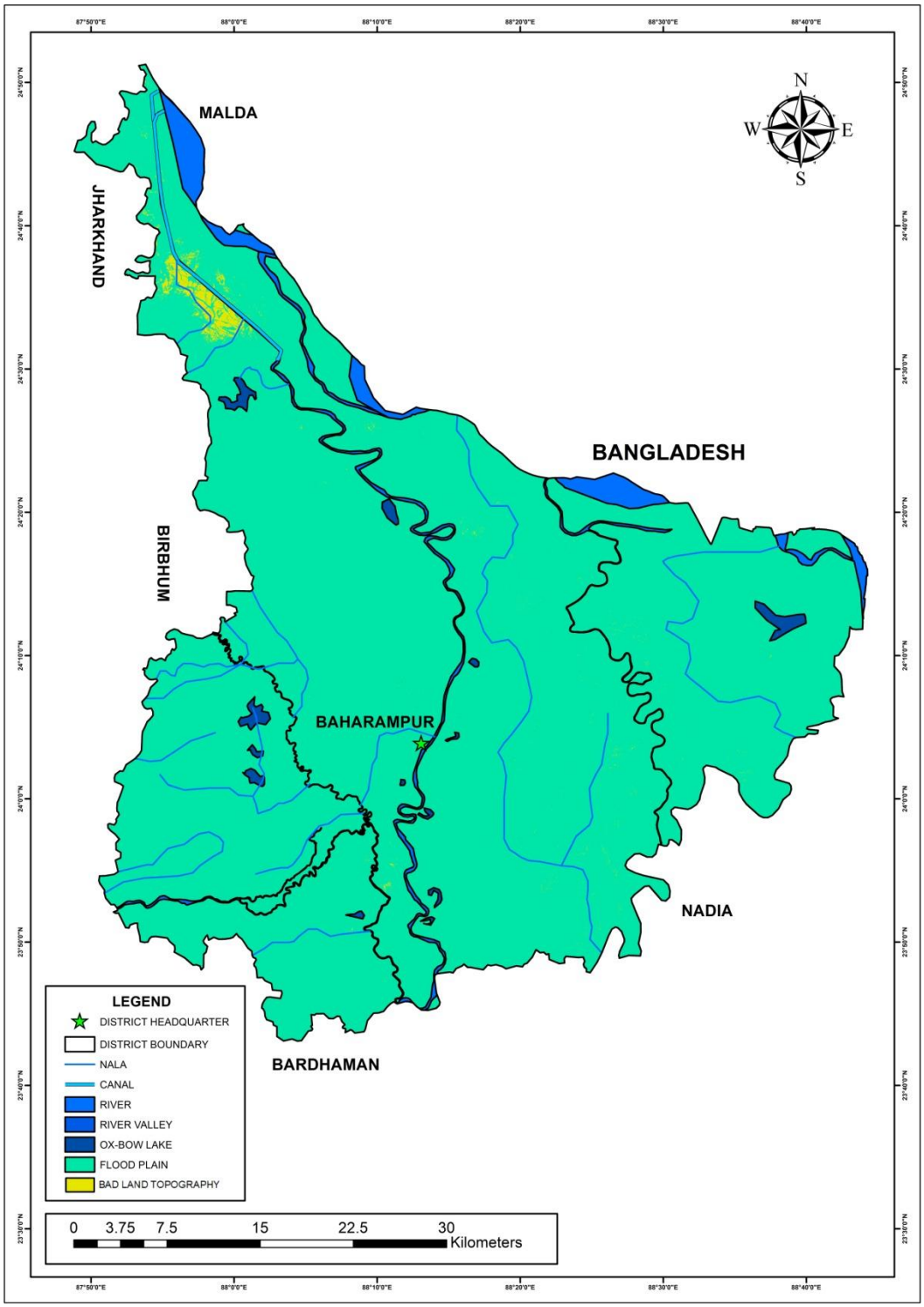


Figure 4.4.2: Geomorphological map of Murshidabad District

(Source: Resourcesat-1&2 – Liss-3,Bhuvan India)

5 Land use pattern of the district

The land situated in the extreme Western boundary slopes gently upwards towards the Birbhum district and the Rajmahal hills, which rise a few miles beyond the North-Western boundary of the district. Some hillocks are situated in this region, of which the most popular one is known as Dhuli Pahari.

The river Bhagirathi, flowing from north to south through the district, broadly divides the district into two almost equal portions, which form a striking contrast in their geology, their physical characteristics and agriculture form among each other. The western "rarh" region lies at an elevation as the range of Rajmahal hills slopes gently down in this tract. The north of the district is an area of about 390 sq. km is a strip of low-lying region which becomes a vast lake in the monsoon. South of this narrow strip of land is a plain almost tree-less at the confluence of the Mor and the Dwaraka popularly known as 'hijal'. The eastern "bagri" is low area, exposed to inundations during monsoon and is a tract of fertile soil. Here in the south eastern corner of the district about 130 sq. km of area is swampy tract of dark clay and is popularly known as 'Kalantar'. It receives the drainage of the swampy rivers in some part of the district.

Data from district statistical hand book shows that the total forest land is 770ha.Total land for agricultural use is 397thousand hectares in 2013-14. Table 5.1 gives land utilization status of Murshidabad district. Figure 5.1 is pie diagram representing broad land use pattern of the district.

Table 5.1: Classification of Land Utilisation Statistics in the district

(In thousand hectares)

Year	2009-10	2010-11	2011-12	2012-13	2013-14
Reporting Area (In Thousand Hectares)	532.50	532.50	532.50	532.50	532.50
Forest Area	0.77	0.77	0.77	0.77	0.77
Area under Non-agricultural use	129.41	130.76	130.94	131.02	131.34
Barren & unculturable land	1.96	1.98	1.68	1.58	1.52
Permanent pastures & other grazing land	0.01	0.01	0.01	-	-
Land under Misc. tree groves not included in Net area sown	1.19	1.08	1.16	1.08	1.13
Culturable waste land	1.02	1.37	1.53	1.32	0.81
Fallow land other than Current fallow	0.16	0.24	0.20	0.11	0.11
Current fallow	0.51	0.33	0.94	0.50	0.84
Net area sown	397.47	395.96	395.27	396.12	395.98

Source: Directorate of Agriculture (Evaluation), Govt. of W.B.

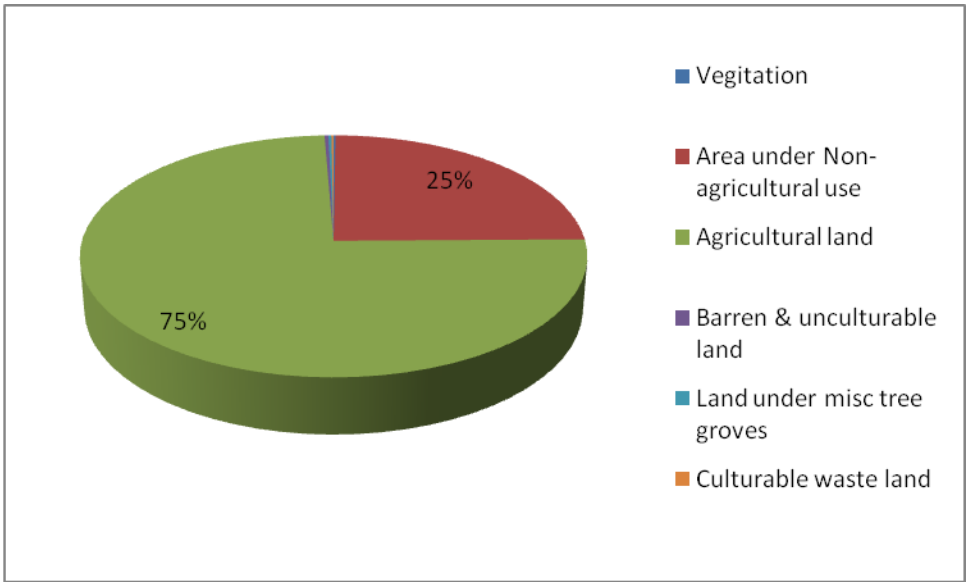


Figure 5.5.1: Land use pattern of Murshidabad District

Table 5.2: Distribution of Villages according to Agricultural Land Use, 2011

Name of C.D. Block	Total area (in Hectares)	Percentage of cultivable area to total area	Percentage of irrigated area to cultivable area
Farakka	8819.61	48.23	25.55
Samserganj	4242.52	52.48	27.83
Suti-I	12645.64	50.98	67.13
Suti-II	6629.2	72.22	46.24
Raghunathganj-I	11931.11	76.38	73.58
Raghunathganj-II	6493.36	53.12	40.15
Lalgola	15686.25	67.03	52.49
Sagardighi	33240.93	85.97	65.45
Bhagawangola-I	13397.71	75.55	81.92
Bhagawangola-II	13839.97	61.21	69.15
Raninagar-II	16192.58	68.44	54.73
Jalangi	19698.38	84.57	57.67
Domkal	29999.67	77.35	69.48
Raninagar-I	13793.79	75.29	71.68
Murshidabad-Jiaganj	18843.1	81.31	89.5
Nabagram	29036.68	86.92	51.2
Khargram	29744.98	81.19	68.02
Kandi	21849.7	75.07	43.1
Berhampore	27200.85	82.11	58.81
Hariharpara	24526.11	79.53	68.76

Name of C.D. Block	Total area (in Hectares)	Percentage of cultivable area to total area	Percentage of irrigated area to cultivable area
Nawda	22348.76	66.12	33.94
Beldanga-I	15801.96	83.83	53.31
Beldanga-II	19385.87	72.3	89.43
Bharatpur-II	15135.53	83.81	92.36
Bharatpur-I	17661.65	80.86	72.02
Burwan	29418.71	76.55	78.91
Total	**477564.62**	**76.17**	**64.61**

Table 5.2 shows the distribution of agricultural land, both irrigated and un-irrigated land, among the villages of Murshidabad district. In the district around 76.17 percent land area of the total land of the district is available for cultivation. Irrigation is considered as an important factor for cultivation. As per the census 2011 dataset,64.61 percent of the cultivable land is under irrigation. The proportions of cultivable area in the block Farakka and Suti-I are lowest to its total area. FarakkaandSamserganj are recorded having less proportion of irrigated area.

Figure 5.2 is Land Use Land Cover map of the district which shows eastern part of the district, mainly east of Bhagirathi River dominated by agricultural land. Vegetation cover in the district is very limited. Settlements are dominated in the elevated part of the district that is the Rarh region.

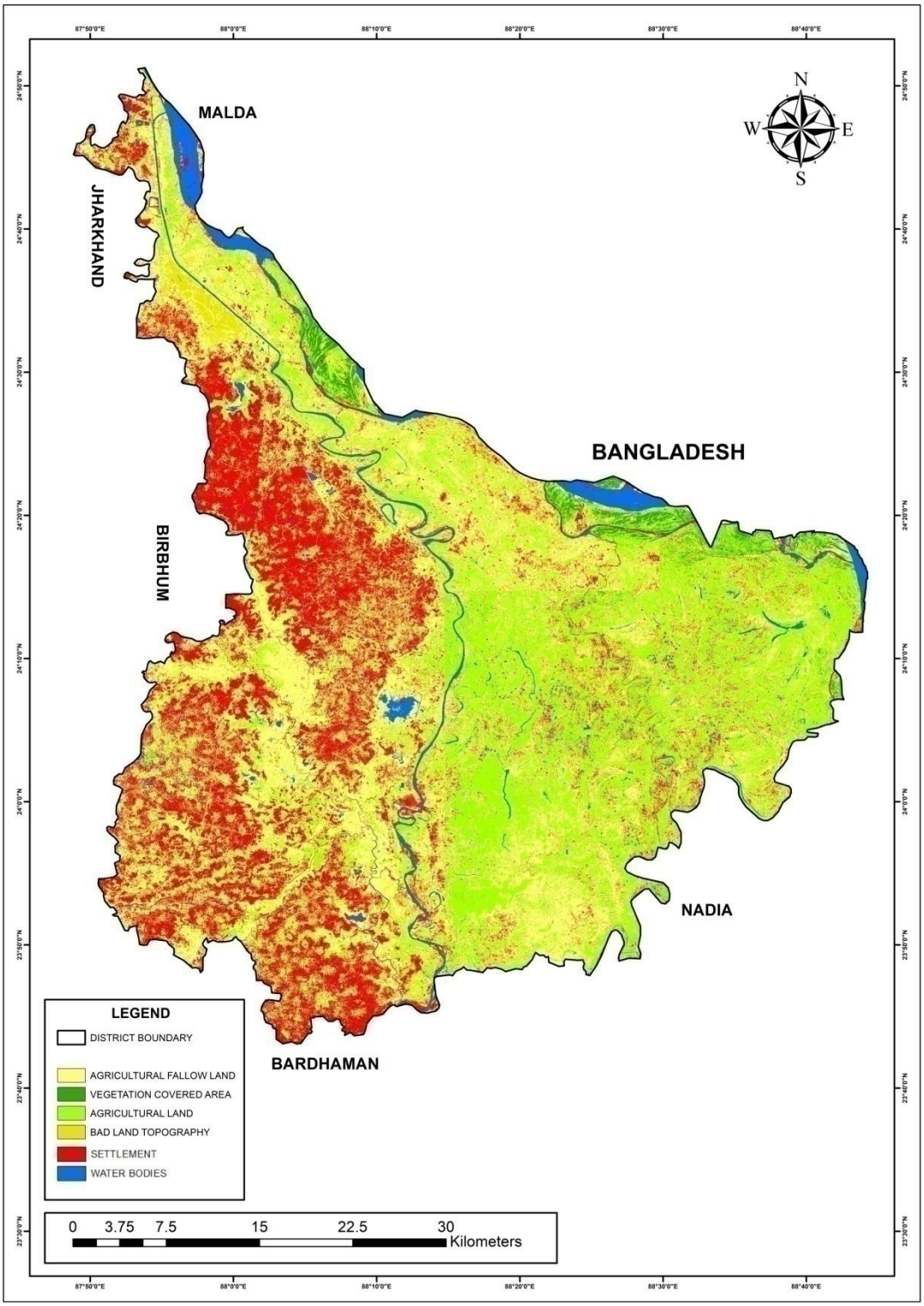


Figure 5.5.2: Land Use Land Cover map of Murshidabad District
(Source: Resourcesat-1&2 – Liss-3, Bhuvan India)

5.1 Forest -detail of thedistrict

The existence of forest is very limited in the districtof Murshidabad, exceptinthe areas near lakes. The district has only about 770Ha of forests, which covers only 0.14% of the geographical area of the district. Plum and Babla trees are visible extensively in the district.

The biological spectrum of Bahadurpur forest, a tropical deciduous forest of Nadia-Murshidabad Forest Division (West Bengal, India), reveals that out of a total of 158 species of vascular plants (154 species of angiosperms and 4 species of pteridophytes), phanerophytes occupy 57.59%, chamaephytes 6.33%, hemicryptophytes 8.23%, cryptophytes 5.7% and therophytes 22.15%. Thus, phanerophytes top the list in respect of numerical strength and cryptophytes the bottom. The phytoclimate appears to be phanero-therophytic which indicates that the tropical community, although dominated by trees, tends to be xeric. Conservation of the site has contributed to the dominance of trees and shrubs.

Jitpur forest in Dumkol block is a notable area of natural vegetation. The natural vegetation was quite rich in Murshidabad. With time all forest areas and orchard are converted into either agricultural land or used for non- agricultural purposes in sub-divisional towns.

Table 5.3: Classification of Forest Area, Out-turn of Forest Produce, Revenue and Expenditure of Forest Department

Item	Unit	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**
1. Area by class of forest:	-	-	-	-	-	
Reserved forest	hectare	90.11	90.11	90.11	90.11	90.11
Protected forest	"	561.15	561.15	561.15	561.15	561.15
Unclassed state forest	"	118.80	118.80	118.80	118.80	118.80
Khas forest	"	-	-	-	-	-
Vested waste land	"	-	-	-	-	-
Forest owned by Corporate Bodies	"	-	-	-	-	-
Forest owned by Private Individuals	"	-	-	-	-	-
Total		-	-	-	-	-
2. Forest Produce:	-	**770.06**	**770.06**	**770.06**	**770.06**	**770.06**
Timber	thousand cu. metre					
Fuel	"	73.06	1474.65	125.54	0.46	0.48
Pole	Number	1.50	1.60	294.00	0.33	0.56

Item	Unit	2008-09	2009-10	2010-11	2011-12	2012-13
3. Revenue & Expenditure:	-	154	8810	663	585	500
Revenue	Rs. in thousand					
Expenditure	"	1478	24654	1624	4562	1116

(Source: Divisional Forest Officer, Nadia-Murshidabad)

5.2 Agriculture & Irrigation

The economy of Murshidabad district is primarily based on agriculture. Cultivation constitutes the main source of livelihood for the people in the district. The line of low-lying area in the North upto the basin of the river Bhagirathi in the Nabagram Plain is very fertile and suitable for growing of paddy, wheat and gram etc. The Mayurakshi-Dwarka Plain is also very fertile and more suited for winter paddy crop. The climate here is drier than the Eastern tract and apart from paddy, wheat; gram, sugarcane, pulses, mustard are also cultivated in this region. Ganga-Bhagirathi Basin is actually a long and narrow strip of river-valley area and more suitable for cultivation of paddy, jute and other rabi crops. Paddy is the main crop of this region. Paddy is the principal crop of Jalangi-Bhagirathi interfluves also. Besides, potato, pulses and oilseeds are grown abundantly. Soil of Raninagar Plain is alluvial and fertile and very much suitable for cultivation of paddy, jute and other rabi crops. The principal agricultural crops of the district are Rice, Wheat, Pulses, Oilseeds, potatoandjute. Sugarcane, Cabbage, Cauliflower and Brinjal are produced in considerable quantity throughout the district (Census, 2011).

The total cultivable land in the district amounts to 3,95,980 ha. With the provision of good irrigation facilities, multiple crop cultivation has become feasible in certain areas of the district. In the district, the total irrigated area in the year 2013-2014 amounted to 2,20,090 hectares. The main sources of irrigation in the district are Government canals, deep and shallow tube wells along with river lift irrigation.

Agriculture is a way of life to the people of Murshidabad district as it is the source of livelihood, employment and raw materials to leading industries. In 2011, cultivators formed 14.72%among all the class of workers of Murshidabad district along with32.52% workers belong to agricultural labourers. In the Mekhligunj sub-division, 41.39% of total workers are cultivators and agricultural labourers are 35.63%. In KandiandDomkalsub-division cultivators formed 22% each, agricultural labourers formed 46% and 47% respectively of total workers. Jangipur sub-division is having lowest cultivators of 5.58% to total workers (Source: District Statistical handbook 2014).

Table 5.4 shows the crop production capacity of the Murshidabad district.

Table 5.4: Production of Principal Crops in the MurshidabadDistrict

(In thousand tonnes)

Crops		2009-10	2010-11	2011-12	2012-13	2013-14
Foodgrains:						
1.	**Rice**	**1040.4**	**861.7**	**957.3**	**973.7**	**1116.7**
	Aus	35.2	23.4	26.4	26.9	30.0
	Aman	593.9	439.3	556.0	554.7	674.8
	Boro	411.3	399.0	374.9	392.1	411.9
2.	Wheat	284.6	286.4	275.7	285.3	288.3
3.	Barley	0.5	0.4	0.6	0.6	0.5
4.	Maize	18.1	16.9	17.5	19.2	27.0
5.	Other Cereals	0.6	-	-	-	-
	Total Cereals	**1344.2**	**1165.4**	**1251.1**	**1278.8**	**1432.5**
6.	Gram	4.9	4.4	4.7	6.9	6.7
7.	Tur	0.2	0.2	(b)	(b)	0.1
8.	Other Pulses	31.8	41.1	33.8	36.1	46.8
	Total Pulses	**36.9**	**45.7**	**38.5**	**43.0**	**53.6**
Total Foodgrains		**1381.1**	**1211.1**	**1289.6**	**1321.8**	**1486.1**
Oil Seeds:						
1.	Rapeseed & Mustard	111.0	97.7	81.2	94.7	95.9
2.	Linseed	(b)	(b)	(b)	(b)	(b)
3.	Other Oil seeds	17.1	14.8	15.6	14.7	18.9
	Total Oil seeds	**128.1**	**112.5**	**96.8**	**109.4**	**114.8**
Fibres* :						
1.	Jute	2589.6	2343.3	2195.5	2176.8	2286.4
2.	Mesta	2.3	1.0	-	8.8	9.5
3.	Other Fibres	-	-	-	-	-
	Total Fibres	**2591.9**	**2344.3**	**2195.5**	**2185.6**	**2295.9**
Miscellaneous crops:						
1.	Sugarcane	335.1	399.3	214.9	302.4	271.6
2.	Potato	370.7	368.0	291.7	364.7	298.9
3.	Tobacco	-	-	-	-	-

Crops		2009-10	2010-11	2011-12	2012-13	2013-14
4.	Tea	-	-	-	-	-
5.	Chillies (dry)	7.3	7.3	7.4	7.4	7.4
6.	Ginger	0.5	0.6	0.6	0.6	0.7
Total Miscellaneous crops		**713.6**	**775.2**	**514.6**	**675.1**	**578.6**

(Source: Directorate of Agriculture, Govt. of W.B.; B.A.E.& S., Govt. of W.B.)

5.3 Horticulture

Murshidabad district is famous for cultivating various types of fruits and vegetables. According to statistics 2013-14, this district covered an areas fruits and vegetables are 28.34 and 87.84 thousand hectares respectively.

As an individual fruit crop, mango has an important place in the district and heavy concentrations of mango trees are found in areas, like Lalgola and Bhagabangola. While jack fruit is another popular fruit crop, litchi, guava, black berry, rose berry, lemon, tamarind and such other fruits are also extensively grown. According to statistics 2013-14, the production of fruits is 215.42 thousand tones.

The floriculture means the cultivation of various types of orchids, decorative plants, temperate and tropical flowers, etc. Flowers like Gladiolus, Tuberose, Marigold, Roseandseasonal flowers are famous of Murshidabad district. In this district the most popular flower is marigold. According to statistics 2013-14, the areas and productions of Marigold are found in 164 hectares and 1470.0 metric tones of Marigold is produced during that year. Production of Marigold is more than others flower of Murshidabad district (Source: District Statistical handbook 2014).

Table 5.5: Production of Fruits and Vegetables in the district

Name of Fruits / Vegetables		Production (Thousand tonnes)				
		2009-10	2010-11	2011-12	2012-13	2013-14
A.	**Fruits:**					
	Mango	120.00	135.00	141.50	168.06	50.00
	Banana	53.52	57.52	63.52	66.80	66.95
	Pineapple	0.40	0.40	0.35	0.36	0.37
	Papaya	27.35	27.54	27.94	28.00	26.28
	Guava	7.89	7.90	8.00	9.50	10.40
	Jackfruit	20.40	20.40	20.41	19.41	19.45
	Litchi	31.06	33.26	33.00	33.20	33.90
	Mandarin Orange	-	-	-	-	-
	Other Citrus	3.06	3.06	3.56	3.70	3.80

Name of Fruits / Vegetables		Production (Thousand tonnes)				
		2009-10	**2010-11**	**2011-12**	**2012-13**	**2013-14**
	Sapota	1.02	1.02	0.88	1.00	1.05
	Others	3.40	3.43	3.02	3.21	3.22
	Total	**268.10**	**289.53**	**302.18**	**333.24**	**215.42**
B.	**Vegetables:**					
	Tomato	70.89	71.81	73.81	74.10	75.10
	Cabbage	307.00	311.30	315.40	316.75	326.69
	Cauliflower	289.28	293.10	297.50	302.45	303.69
	Peas	6.89	7.10	7.12	7.25	6.30
	Brinjal	296.83	259.73	314.94	315.40	328.20
	Onion	28.91	29.71	30.71	30.90	43.56
	Cucurbits	131.49	135.90	138.90	140.12	142.17
	Ladies Finger	47.99	49.33	49.45	50.90	52.20
	Radish	49.81	18.75	51.95	52.30	55.40
	Others	159.20	240.88	167.81	168.51	166.06
	Total	**1388.29**	**1417.61**	**1447.59**	**1458.68**	**1499.37**

(Source: Directorate of Food Processing Industries and Horticulture, Govt. of W.B.)

Table 5.6: Production of Flowers in the district

Name of Flowers	Production					
	Unit	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**
Rose	Crore Cut Flower	-	-	-	-	-
Chrysanthemum	"	-	-	-	-	-
Gladiolus	"	0.018	0.018	0.018	0.035	0.091
Tuberose	"	0.065	0.075	0.076	0.205	0.430
Marigold	' 000 MT	0.650	0.659	1.259	1.420	1.470
Jasmine	"	-	-	-	-	-
Seasonal Flower	"	0.017	0.017	0.017	0.020	0.021
Misc.Flower	"	0.031	0.031	0.021	0.023	0.023

(Source: Directorate of Food Processing Industries and Horticulture, Govt. of W.B.)

5.4 Mining

The district is not very rich in mineral resources andthere are no large mines in the district. However, collection of sand, stone and gravelsfrom the river-bed of the hilly torrents are the minor mineral sources. These materials areprimarily utilized for construction purpose.

6 Geology

The geological formations of the district are divided into three categories (O'Malley, 1997). These are i) Recent – alluvium of Bhagirathi formation, ii) Pleistocene-recent – older alluvium and lateritic clay and iii) Jurassic – Rajmahal Trap. The district is completely blanketed by a sequence of Quaternary sediments of Bengal delta except few areas in the northern side where the area is occupied by Rajmahal trap.

Jurassic: The Rajmahal trap is found in the northern part of the district. It is the oldest rock of the district belongs to Jurassic to Cretaceous age. It consists of basaltic lava flows with intercalated carbonaceous shales and clays. The basalt is a black-coloured, fine grained amygdaloidal rock; when somewhat more coarsely crystalline, it resembles a dolerite. The amygdales are filled with chalcedony, calcite, zeolite and other secondary minerals.

Pleistocene-recent: A major part of the west of the river Bhagirathi is occupied by older alluvium and lateritic clay of Rampurhat formation. It is suggested to be the continuation of the sub-Vindhyan region of lateritic clay and nodular limestone. The beds of nodular limestone (kankar) are scattered in the western part. The lateritic clay is hard, grey or raddish brown in colour, and mixed with lime and oxide of iron. Because of intense leaching low base-exchange capacity, typical lateritic soil is lacking in the elements of fertility and is of little value for crop production, but secondary changes may produce fair soil.

The Kandi formation comprises an alternation of feebly oxidized to unoxidised fine sand and silt with clay. The sediments are absolutely devoid of any ferruginous and calcareous concretions and it occupies mainly in the eastern part of the Bhagirathi River.

Recent: The rest of the district is occupied by recent alluvium of Bhagirathi formation which is composed of sands and clays brought by the rivers. Bhagirathi formation is characterized by alluvial soils of present-day river flood plains consisting of unoxidized fine to very fine silver grey micaceous sand, silt and dark grey clay. This formation occupies the lowest relief in the area on the river bank.

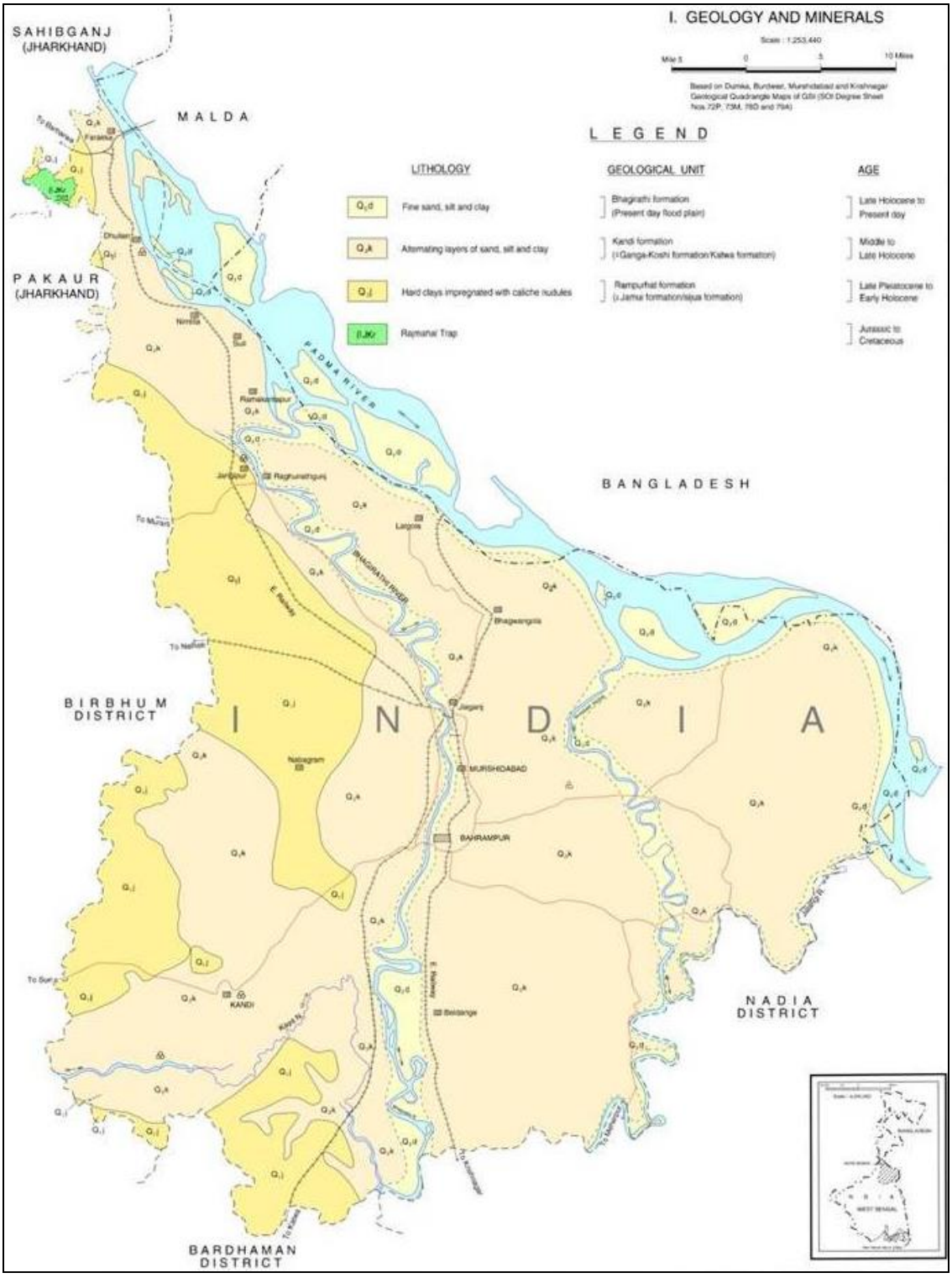


Figure 6.6.1: Geological map of Murshidabad district
(Source: GSI, 2008)

7 Mineral wealth

7.1 Overview of mineral resources:

Occurrence of major minerals in the district of Murshidabad is not established so far. Main mineable mineral of the district issand and gravel from theriverbed, however, existence of In-situ hard basalt is reported in the Rajamahal trap in the northern part of Murshidabad District, Bahadurpurgrampanchayatwhich should be sufficiently explored for development.

7.2 Details of Resources:

The mineral resources of the district whose categorization and estimation have been done are furnished in this section.

7.2.1. Sand and other riverbed minerals:

I. Drainage System (Description of main rivers/streams, Salient features of important rivers and streams, list of villages, which the river pass through)

Drainage system of the district is controlled by following river courses:

The Ganges or Padma River: The rivercoursefirst touches Murshidabad district at its extreme northern point, and then flows almost due south east, forming the eastern boundary of the district, and dividing it from Malda district of West Bengal and Rajshahi district of Bangladesh.

The only tributary of any importance which is received from west is the Singa, which affects a junction with it about ten miles from the spot where it first touches the district. The Singa enters the district from the Sonthal Parganas at Adwaitapur, and just below Ankura divides in to two branches; one falls into the Ganges near NayanSukh, and the other at Dhulian.

Bhagirathi River: The Bhagirathi which branches off from the Ganges at Nurpur about 25 km below Farakka and runs almost parallel to it for about 2 kmuptoBiswanathpur. After leaving Biswanathpur, its course, which is very winding, is running due south and divides the district into two almost equal portions; Eastern part 'Bagri' and the Western part 'Radh'. Near Jangipur it received united water fromBansloi and Pagla rivers from the West. Near Saktipur, the ChoraDekra, a part of Dwarka River flows into Bhagirathi from the West. It is a full-fledged river for about four months of the year but for the remaining eight months, it resembles an attenuated stream wandering through a wide expanse of sand. During the rainy season fresh spill from the Ganga flows through the Bhagirathi. Bhagirathi River leaves the district at the Northern portion of Plassey.

Bhairab River: The Bhairab is an old river and only a section of its earlier flows can be traced as of now. During the rainy season it receives water from Padma also. Bhairab originates from Ganga in Lalgola and after a short journey across this district meets Jalangi in the North of

Nadia district and thereafter loses its separate identity. At present Bhairab run through number of blocks of the 'bagri' region of Murshidabad district.

Jalangi River: The Jalangi is another important branch of the Ganges. The river originates from the Ganga and flows along West of the Hangordaobah and later flows East-wards close to the international boundary of Bangladesh. Then it flows South-wards along the boundary of the districts Nadia with Murshidabad. It finally leaves the district with an abrupt turn near the village of Bali. The Jalangi River is one of the important rivers in the "bagri" region of Murshidabad.

Sialmari River: This river originating from River Padma moving in between Jalangi River and the Bhairab river. After traveling shortly, the river meets Jalangi with a zig- zag way like Bhairab River. In the lower stage of journey, it is also known as the Kharia.

Bansloi River: The Bansloi is another tributary of Bhagirathi. It enters the district from Birbhum near the village Husainpur and flows eastwards and thereafter falls into the Bhagirathi at the North of Jangipur.

Dwaraka and Babla Rivers: The Dwaraka and Babla are two streams entering the district from the Birbhum district near Morgram and flows East-ward and then in the South-East direction forming the Eastern boundary of Kandi Sub-division and thereafter leaving the district at Raghupur. They are joined on the right bank by the Mayurakshi (or Mor) and the Kuiya respectively which also flow down from Birbhum district. Though moderate in size, these rivers have many names along with a number of tributaries and estuaries. The numerous backwaters and side channels connect them with the river Bhagirathi.

Rivers Brahmani, Mayurakshi and Kuiya: The Brahmani, Mayurakshi and Kuiya rivers originate from the hills of Birbhum district and thereafter flow in the Westward direction and ultimately merge with the river Dwaraka. These rivers meet at the HizalBeel located at the Kandi Sub-division. Mayurakshi and Kuiya receive rivers Dwaraka and Babla. These rivers are originated from hill streams consisting of beds of pebbles and yellow clay and their depths have been reduced to a substantial extent owing to silt deposition inside district Murshidabad.

(Census, 2011)

a) Drainage System with description of main rivers

Table 7.1: Drainage system with description of main rivers

Sl.No.	Name of the River	Area drained (Sq.km)	% Area drained in the district
1	Padma	125.89	2.36
2	Bhagirathi	48.56	0.91
3	Bhairab	5.51	0.10
4	Mayurakhsi	7.01	0.13

Sl.No.	Name of the River	Area drained (Sq.km)	% Area drained in the district
5	Brahmni	7.23	0.14

b) Salient Features of important rivers and streams

Table 7.2: Salient Features of important rivers and streams

S.No.	Name of the River or Stream	Total Length in District (in Km)	Place of origin	Altitude at Origin
1	Padma	88	Gangotri Glacier of the Himalaya	3100m
2	Bhagirathi	171	Branches off from the Ganges at Nurpur, Malda	28m
3	Bhairab	73.87	Originates from Ganga in Lalgola, Murshidabad	26m
4	Mayurakhsi	65	Originates from Trikut Hill. Jharkhand	260m
5	Brahmani	110	Originates in Santhal Parganas in Jharkhand	230m

II. Annual deposition of riverbed minerals

Annual deposition of riverbed minerals is dependent on various factors which are explained below.

A) Geomorphological studies

Geomorphological characteristic of a river is foremost factor for annual deposition of sedimentary load. The study includes following parameter:

i) Place of Origin

Details of origin of rivers of Murshidabad District is furnished in Table 7.3.

Table No. 7.3: Place of Origin of important rivers and streams

S.No.	Name of the River or Stream	Place of origin
1	Padma	Gangotri Glacier of the Himalaya
2	Bhagirathi	Branches off from the Ganges at Nurpur, Malda
3	Bhairab	Originates from Ganga in Lalgola, Murshidabad
4	Mayurakhsi	Originates from Trikut Hill. Jharkhand
5	Brahmani	Originates in Santhal Parganas in Jharkhand

ii) Catchment Area

The Murshidabad district is mainly drained by the Padma, Bhagirathi, Bhairab, Mayurakhsi and Brahmani. These rivers and its tributary rivers are forming the main catchment area.

iii) General profile of river stream

River profile has been studied along the cross-section lines which was chosen based on the drastic variation of the river widths, proximity of the operating sand Ghats and the position of the sand bars.

Relative disposition of rivers in Murshidabad district along with the distribution of the section lines are shown in figure 7.1.

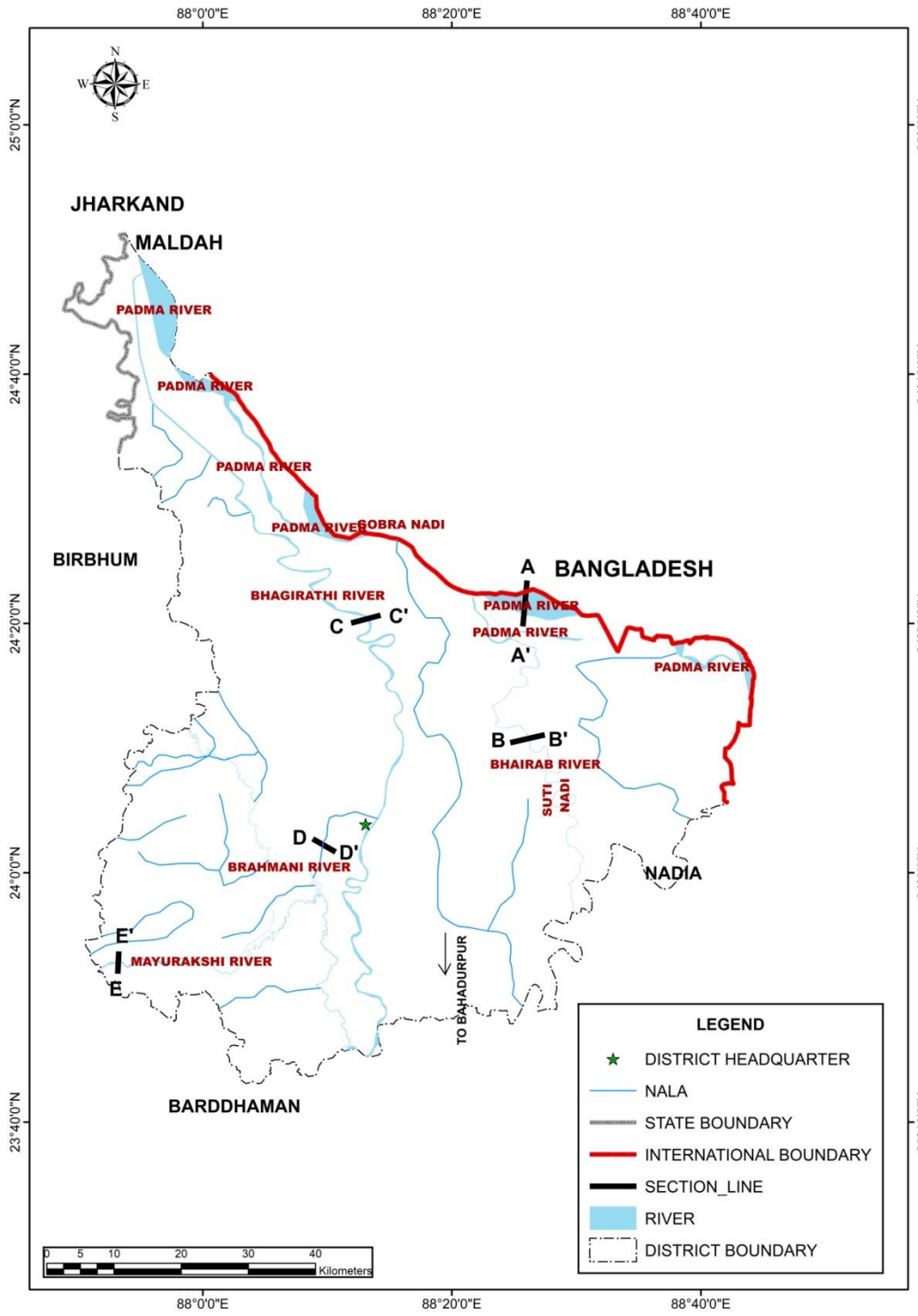


Figure 7.1: Plan showing the major rivers along with the distribution of Section Lines

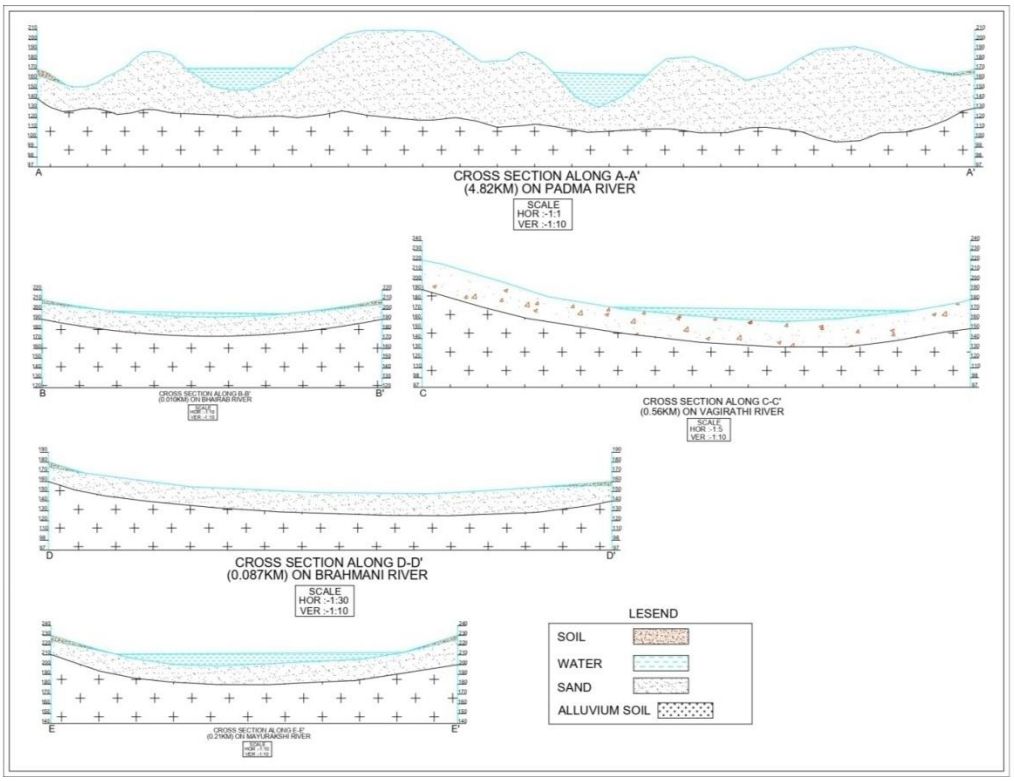


Figure 7.2: River Cross sections during pre monsoon period

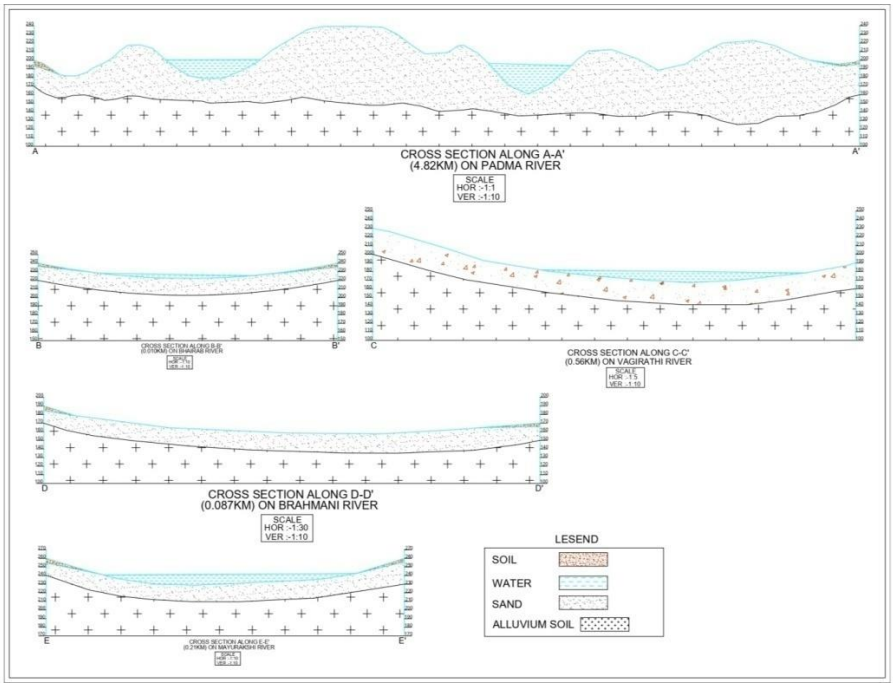


Figure 7.3: River cross sections during post monsoon period

iv) Annual deposition factor

Annual deposition of riverbed materials depends on various factors, such as process of deposition, mode of sediment transport, sediment transportrate, and sediment yield of the river.

1. Process of deposition

Deposition is the processes where material being transported by a river is deposited. Deposition occurs when the forces responsible for sediment transportation are no longer sufficient to overcome the forces of gravity and friction, creating a resistance to motion; this is known as the null-point hypothesis. This can be when a river enters a shallow area or towards its mouth where it meets another body of water.

The principle underlying the null point theory is due to the gravitational force; finer sediments remain in the water column for longer durations allowing transportation outside the surf zone to deposit under calmer conditions. The gravitational effect or settling velocity determines the location of deposition for finer sediments, whereas a grain's internal angle of friction determines the deposition of larger grains on a shore profile.

Deposition of non-cohesive sediments: Large-grain sediments transported by either bedload or suspended load. In case of bedload, when there is insufficient bed shear stress and fluid turbulence are insufficient to keep the sediment moving, the grain cease horizontal movement and rapidly come to rest. In case of suspended load, the grain settle longer distance vertically through the fluid before coming to rest.

Deposition of cohesive sediments: The cohesion of sediment occurs with the small grain sizes associated with silts and clays, or particles smaller than 4Φ or 62.5 μm. If these fine particles remain dispersed in the water column, Stokes law applies to the settling velocity of the individual grains. The face of a clay platelet has a slight negative charge where the edge has a slight positive charge when two platelets come into close proximity with each other the face of one particle and the edge of the other are electrostatically attracted, and then have a higher combined mass which leads to quicker deposition through a higher fall velocity.

2. Mode of sediment transport in rivers

Sediment transport in rivers provides a dynamic linkage between flow and channel form. Mainly there are three processes by which sediment load is transported and these are (i) rolling or traction, in which the particle moves along a sedimentary bed but is too heavy to be lifted from it; (ii) saltation; and (iii) suspension, in which particles remain permanently above the bed, sustained there by the turbulent flow of the water.

Another name for sediment transport is sediment load. The total load includes all particles moving as bedload, suspended load, and wash load.

Bed load: Bedload is the portion of sediment transport that rolls, slides or bounces along the bottom of a waterway. This sediment is not truly suspended, as it sustains intermittent contact with the streambed, and the movement is neither uniform nor continuous. Bedload occurs when the force of the water flow is strong enough to overcome the weight and cohesion of the sediment. While the particles are pushed along, they typically do not move as fast as the water around them, as the flow rate is not great enough to fully suspend them. Bedload transport can occur during low flows (smaller particles) or at high flows (for larger particles). Approximately 5-20% of total sediment transport is bedload. In situations where the flow rate is

strong enough, some of the smaller bedload particles can be pushed up into the water column and become suspended.

Suspended load: While there is often overlap, the suspended load and suspended sediment are not the same thing. Suspended sediment are any particles found in the water column, whether the water is flowing or not. The suspended load, on the other hand, is the amount of sediment carried downstream within the water column by the water flow. Suspended loads require moving water, as the water flow creates small upward currents (turbulence) that keep the particles above the bed. The size of the particles that can be carried as suspended load is dependent on the flow rate. Larger particles are more likely to fall through the upward currents to the bottom, unless the flow rate increases, increasing the turbulence at the streambed. In addition, suspended sediment will not necessarily remain suspended if the flow rate slows.

Wash load: The wash load is a subset of the suspended load. This load is comprised of the finest suspended sediment (typically less than 0.00195 mm in diameter). The wash load is differentiated from the suspended load because it will not settle to the bottom of a waterway during a low or no flow period. Instead, these particles remain in permanent suspension as they are small enough to bounce off water molecules and stay afloat. However, during flow periods, the wash load and suspended load are indistinguishable.

3. Sediment Transport Rate

The rate at which sediment is moved past a cross section of the flow is called either the sediment transport rate or the sediment discharge. It‘s related to the sediment load, but it‘s different, just because different fractions of the sediment load are transported at different rates. It can be measured in mass per unit time, or in weight per unit time, or in volume per unit time. The sediment transport rate is commonly denoted by Qs.

4. Estimation of Sedimentation

There are two approaches to obtaining values describing sediment loads in streams. One is based on direct measurement of the quantities of interest, and the other on relations developed between hydraulic parameters and sedimenttransport potential.

The total bed material load is equal to the sum of the bedload and the bed material part of the suspended load; in terms of volume transport per unit width, qt = qb + qs. Here wash load, i.e., that part of the suspended load that is too fine to be contained in measurable quantities in the river bed, is excluded from qs.

There are number of equations to compute the total sediment load. Most of these equations have some theoretical and empirical bases.

In 1973, Ackers and White developed a general theory for sediment transport which was calibrated against the flume-transport data then available. Their functions have been widely accepted as one of the best available procedures for estimating the total bed over the full width of the flow section.

Dendy-Bolton formula is often used to calculate the sedimentation yield. But use of these equations to predict sediment yield for a specific location would be unwise because of the wide variability caused by local factors not considered in the equation’s development. However, they may provide a quick, rough approximation of mean sediment yields on a regional basis.

Computed sediment yields normally would be low for highly erosive areas and high for well stabilized drainage basins with high plant density because the equations are derived from average values. The equations express the general relationships between sediment yield, runoff, and drainage area.

5. Sediment Yield

The water that reaches a stream and its tributaries carries sediment eroded from the entire area drained by it. The total amount of erosional debris exported from such a drainage basin is its sediment load or sediment discharge and the sediment yield is the sediment discharge divided by the total drainage area of the river upstream of the cross section at which the sediment discharge is measured or estimated. Sediment yield is generally expressed as a volume or weight per unit area of drainage basin—e.g., as tons per square kilometre. Further, sediment yield is usually measured during a period of years, and the results are thus expressed as an annual average.

v) Replenishment Study (As per EMGSM guidelines, 2020):

Replenishment study for a river solely depends on estimation of sediment load for any river system and the estimation is a time consuming and should be done over a period. The process in general is very slow and hardly measurable on season-to-season basis except otherwise the effect of flood is induced which is again a cyclic phenomenon. Usually, replenishment or sediment deposition quantities can be estimated in the following ways as given below:

A. Replenishment study based on satellite imagery involves demarcation of sand bars potential for riverbed mining. Both pre and post monsoon images need to be analysed to established potential sand bars. Volume estimation of sand is done by multiplying Depth and Area of the sand bar. The sand bars are interpreted with the help of satellite imagery. Ground truthing has been done for 100% of the total identified sand bars. During ground truthing, width and length of each segment were physically measured. It has also been observed that in few cases, sand bars have attained more than 3 meters height from the average top level of the river beds. Considerations of sand resources have been restricted within 3 meters from the average top surface of the river bed.

B. Direct field measurement of the existing leases involving estimation of the volume diference of sand during pre- and post-monsoon period. With systematic data acquisition, a model has developed for calculation of sediment yield and annual replenishment with variable components.

C. The replenishment estimation based on a theoretical empirical formula with the estimation of bed-load transport comprising of analytical models to calculate the replenishment estimation.

A. Replenishment estimation based on satellite imagery study

Sedimentation in any river is dependent on sediment yield and sediment yield depends on soil erosion in river's catchment area. Catchment yield is computed using Strange's Monsoon

runoff tables for runoff coefficient against rainfall return period. Peak flood discharge is calculated by using Dickens, Jarvis and Rational formula at 25, 50 and 100 years return period. The estimation of bed load transport using Ackers and White Equation.

Methodology Adopted: To delineate replenishment percentage in the river bed of the district, below mentioned steps have been followed.

- **Field data collation:**

Field data collations were done during June 2020 for pre monsoon period and during December 2020 for post monsoon period for the river ghats on continuous basis. However, the nonoperational areas were covered through traverses. In both the cases, relative elevation levels were captured through GPS/DGPS/ Electronic Total Station. Thickness of the sand bars was measured through sectional profiles. In few instances, sieve analysis of the sands was carried out to derive the size frequency analysis.

Figure 7.4: Figure Showing Site View of River Mayurakshi (Monsoon 2020)

- **Selection of Study profiles:**

Study profiles are selected based on the occurrence of the sand bars in the channel profiles. Aerial extents of each of the profiles are mapped from satellite imagery.

- **Data Compilation:**

  Following data were compiled for generation of this annual replenishment report:

  - Elevation levels of the different sand ghats and sand bars as measured at site.
  - Extents of the sand bars are measured from the pre monsoon satellite imagery.
  - Sand production data of the district.

- **Assessment of sediment load in the river:**

  Assessment of sediment load in a river is subjective to study of the whole catchment area, weathering index of the various rock types which acts as a source of sediments in the specific river bed, rainfall data over a period not less than 20 years, and finally the detail monitoring of the river bed upliftment with time axis. Again, the sediment load estimation is not a dependent variable of the district boundary, but it largely depends upon the aerial extents of the catchment areas, which crossed the district and state boundaries.

- **Estimation of annual sand deposition:**

  The major sand producing river of the Murshidabad district is Padma, Bhagirathi, Bhairab, Mayurakhsi and Brahmanirivers. Planning has been done for systematic sand mining in the rivers.

  While calculation of the areas of sand bar, a classification system has been adopted with three categories of land identified within the channel areas which is as followss:

a. The untapped Sand Bars.
b. The Sand bars worked in the pre-monsoon period.
c. Main channel course within the channel.

A summary of sediment load comparison between pre- and post-monsoon period for different rivers of Murshidabad district is given in Table 7.4 and details of each sand bars along with their sand resources in pre monsoon and post monsoon periods are provided in Annexure 2. Maps showing distribution of sand bars on rivers of the Murshidabad district during Pre and Post monsoon are depicted in Plate-2A & 2B respectively.

Table No. 7.4: Sediment Load comparison between Pre & Post Monsoon periods for different rivers

River Name	Pre-Monsoon no of ghats	Post-Monsoon no of ghats	Pre-Monsoon Sediment Load (Mcum)	Post Monsoon Sediment Load (Mcum)	Variance (Mcum)	Variance (%)
GANGA RIVER	33	33	98.40	112.87	14.47	14.71
BHAIRAB RIVER	6	6	0.62	0.09	-0.53	-85.61
BRAHMANI RIVER	10	10	0.22	0.57	0.35	160.82
MAYURAKSHI RIVER	21	21	1.54	1.28	-0.26	-16.60
Total =	70	70	**100.78**	**114.81**	**14.04**	**13.93**

Thus, in Murshidabad district, about 14.04Million cum of sand has been found as an incremental volume increase when compared between pre and post monsoon sand reserve data. Percentage of difference comes to about 113.93% which is replenishment and aggradation rate for the year. After reduction of 15%, percentage of replenishment and aggradation rate of the district comes to about 96.84%.

Long-term satellite imagery study has also been carried out for sand producing rivers of Murshidabad District to analyse the changes in river course. A representative map, showing long-term (from 1985-2010-to 2022) erosion-accretion areas on both the banks of Bhagirathi River, Murshidabad has been prepared and furnished as Plate No. 5B. Map shows changes in river channel through erosion and accretion of river bank and in the process of generating Ox-bow Lake as compare between 1985 and 2022 river courses.

B. Replenishment estimation based on field investigation

The study was carried out on existing mining leases. In order to assess the annual replenishment rate, an approach of direct measurement methodology has been adopted. The depth and area of the mining leases are measured through DGPS/Total station just before the closure of the mines in pre-monsoon period and the same areas are resurveyed in the post-monsoon period. The difference between the depth of the surveyed areas are accounted for the volumetric measurement of the replenished sand.

Table 7.5 represents field measurement of replenishment rate estimated for major rivers.

Table No. 7.5: Replenishment rate of the district

Location	River Name	Area	Surface RL	Thickness	Volume	After mining floor RL	Surface RL	Thickness	Volume	Difference in RL	Replenishment Rate
		m2	m	m	cum	m	m	m	cum	m	%
Ramipur-50	Jalangi	5000.00	13.00	2.80	14000.00	10.20	12.92	2.72	13580.00	0.08	97.00%
Islampur-56	Jalangi/ Bhairab	4000.00	11.00	2.80	11200.00	8.20	10.91	2.71	10841.60	0.09	96.80%
Jadavpur, 12	Bramhani	3100.00	17.00	2.50	7750.00	14.50	16.93	2.43	7533.00	0.07	97.20%
Andulia, 97	Mayurakshi	19000.00	16.00	2.90	55100.00	13.10	15.90	2.80	53171.50	0.10	96.50%
Ibrahimpur-34	Mayurakshi	20000.00	15.00	3.00	60000.00	12.00	14.90	2.90	57990.00	0.10	96.65%
Talgram, 42	Mayurakshi	9000.00	14.00	3.00	27000.00	11.00	13.91	2.91	26163.00	0.09	96.90%
Average Replenishment Rate											96.84

Based on field investigation, a replenishment rate for the year comes to about 96.84% calculated.

C. Replenishment estimation based on a empirical formula:

The river reaches with sand provide the resource and thus it is necessary to ascertain the rate of replenishment of the mineral. Regular replenishment study needs to be carried out to keep a balance between deposition and extraction.

Sediment load deposition in a river is dependent on catchment area, weathering index of the various rock types of the catchment area, land-use pattern of the area, rainfall data and grain size distribution of the sediments. Again, the sediment load estimation is not a dependent

variable of the district boundary, but it largely depends upon the aerial extents of the catchment areas, which crosses the district and state boundaries.

i. Methodology of the study:

The replenishment estimation is based on a theoretical empirical formula with the estimation of bedload transport comprising of analytical models to calculate the replenishment estimation. Sedimentation in riverbed depends on catchment yield, peak flood discharge due to rainfall, bed load transport rates and sediment yield characteristic of the river. Some of the common methods used for replenishment study are explained below.

a. Catchment Yield Calculation:

The total quantity of surface water that can be expected in a given period from a stream at the outlet of its catchment is known as yield of the catchment in that period. The annual yield from a catchment is the end product of various processes such as precipitation, infiltration and evapotranspiration operating on the catchment.

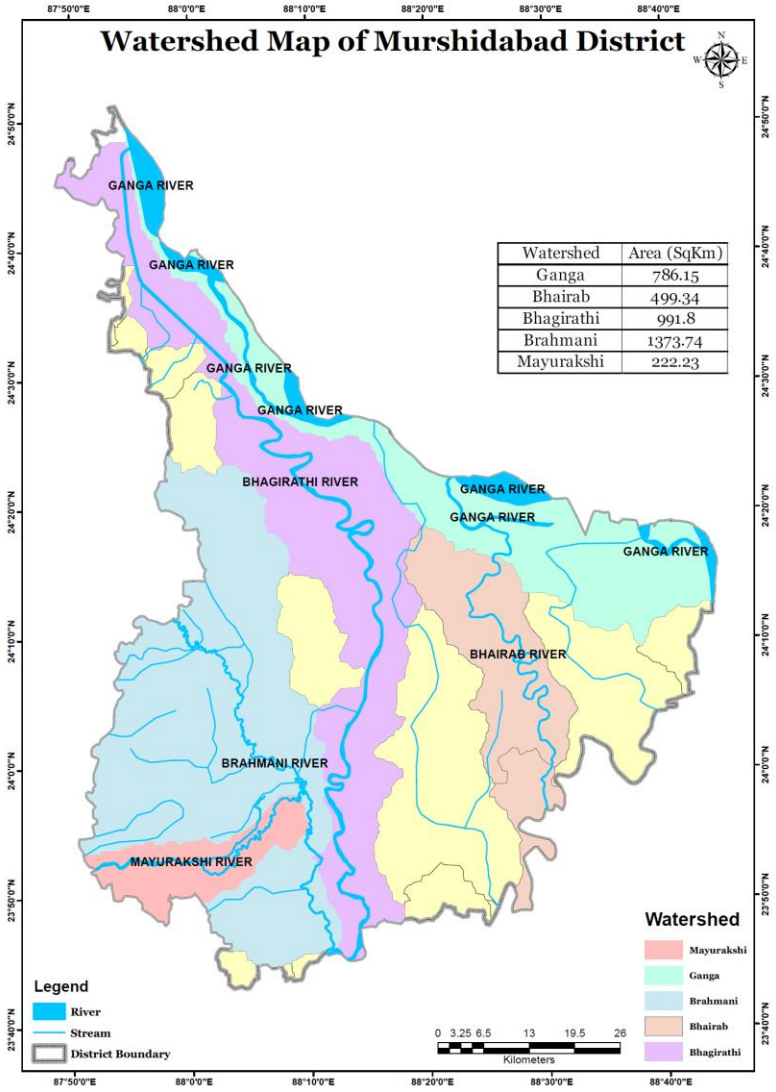


Figure 7.5: Watershed map of Murshidabad district

Catchment Yield can be estimated using following formula:

Catchment Yield (m^3) =Catchment area (m^2) × Runoff coefficient (%) × Rainfall (m)

The runoff generated from the watershed is analyzed using Strange's Tables to get the reliable yield results. Runoff from a catchment is dependent upon annual rainfall as well as catchment characteristics such as soil types and the type of groundcover / land usage. Remote sensing was used for demarcation of catchment area relevant to the drainage system. Runoff coefficient of the catchment has been established based on Strange's Table.

Strange (1892) studied the available rainfall and runoff and obtained yield ratios as functions of indicators representing catchment characleris1ics. Catchments are classified as good, average and bad according to the relative magnitudes of yield they give. For example, catchment with good forest cover and having soils of high permeability would be classified as bad, while catchment having soils of low permeability and having little or no vegetal cover is termed good. Based on the study Strange established runoff coefficient table as given in Table 7.6.

Table No. 7.6: Runoff coefficient of the catchment based on Strange's table

Total monsoon rainfall (mm)	Runoff coefficient (%)			Total monsoon rainfall (mm)	Runoff coefficient (%)		
	Good catchment	Average catchment	Bad catchment		Good catchment	Average catchment	Bad catchment
25.4	0.1	0.1	0.1	787.4	27.4	20.5	13.7
50.8	0.2	0.2	0.1	812.8	28.5	21.3	14.2
76.2	0.4	0.3	0.2	838.2	29.6	22.2	14.8
101.6	0.7	0.5	0.3	863.6	30.8	23.1	15.4
127	1	0.7	0.5	889	31.9	23.9	15.9
152.4	1.5	1.1	0.7	914.4	33	24.7	16.5
177.8	2.1	1.5	1	939.8	34.1	25.5	17
203.2	2.8	2.1	1.4	965.2	35.3	26.4	17.6
228.6	3.5	2.6	1.7	990.6	36.4	27.3	18.2
254	4.3	3.2	2.1	1016	37.5	28.1	18.7
279.4	5.2	3.9	2.6	1041.4	38.6	28.9	19.3
304.8	6.2	4.6	3.1	1066.8	39.8	29.8	19.9
330.2	7.2	5.4	3.6	1092.2	40.9	30.6	20.4
355.6	8.3	6.2	4.1	1117.6	42	31.5	21
381	9.4	7	4.7	1143	43.1	32.3	21.5
406.4	10.5	7.8	5.2	1168.4	44.3	33.2	22.1
431.8	11.6	8.7	5.8	1193.8	45.4	34	22.7
457.2	12.8	9.6	6.4	1219.2	46.5	34.8	23.2
482.6	13.9	10.4	6.9	1244.6	47.6	35.7	23.8
508	15	11.3	7.5	1270	48.8	36.6	24.4
533.4	16.1	12	8	1295.4	49.9	37.4	24.9

Total monsoon rainfall (mm)	Runoff coefficient (%)			Total monsoon rainfall (mm)	Runoff coefficient (%)		
	Good catchment	Average catchment	Bad catchment		Good catchment	Average catchment	Bad catchment
558.8	17.3	12.9	8.6	1320.8	51	38.2	25.5
584.2	18.4	13.8	9.2	1346.2	52.1	39	26
609.6	19.5	14.6	9.7	1371.6	53.3	39.9	26.6
635	20.6	15.4	10.3	1397	54.4	40.8	27.2
660.4	21.8	16.3	10.9	1422.4	55.5	41.6	27.7
685.8	22.9	17.1	11.4	1447.8	56.6	42.4	28.3
711.2	24	18	12	1473.2	57.8	43.3	28.9
736.6	25.1	18.8	12.5	1498.6	58.9	44.4	29.4
762	26.3	19.7	13.1	1524	60	45	30

Rainfall returns period for 25, 50 and 100 years calculated as below:

As per Weibull's Formula,

Return period/Recurrence interval = (n+1)/m

Where: n number of years on record;

m is the rank of observed occurrences when arranged in descending order.

b. Peak Flood Discharge Calculation:

The term "peak discharge" stands for the highest concentration of runoff from the basin area. The accurate estimation of flood discharge remains one of the major challenges as it depends upon physical characteristic of the catchment area and the flood intensity, duration and distribution pattern. There have been many different approaches for determining the peak runoff from an area. As a result many different models (equations) for peak discharge estimation have been developed. Formulas used for Peak Discharge calculation areas below:

As per Dicken's formula (Subramanya, 2008),

$$Q = CA^{3/4}$$

Where: Q is Maximum flood discharge (m^3/sec) in a river

A is Area of catchment in Sq. Km

C is Constant whose value varies widely between 2.8 to 5.6 for catchments in plains and 14 to 28 for catchments in hills

As per Jarvis formula (Subramanya, 2008),

$$Q = CA^{1/2}$$

Where: Q is Maximum flood discharge (m^3/sec) in a river

A is Area of catchment in Sq. Km

C is Constant whose value varies between 1.77 as minimum and 177 as maximum. Limiting or 100 percent chance floods are given by the value of C of 177

As per Rational formula (Subramanya, 2008),

Q = CIA

Where: Q is Maximum flood discharge (m^3/sec) in a river
A is Area of catchment in Sq. Km
C is Runoff coefficient which depends on the characteristics of the catchment area. It is a ratio of runoff: rainfall
I is Intensity of rainfall (in m/sec)

c. Bed Load Transport Calculation:

The most important problems in river engineering areto predict bed load transport rates in torrential floods flowingfrom mountainous streams. Three modes of transport namely; rolling, sliding and saltationmay occur simultaneously in bed load transport. The differentmodes of transportation are closely related and it is difficult, if not impossible, to separate them completely. There are number of equations to compute the total sediment load. Most of these equations have some theoretical and empirical bases.

Ackers and White Equation:

Ackers and White (1973) used dimensional analysis based on flow power concept and their proposedformula is as follows.

$$C_t = C_s G_s \left(d_{50}/h\right) \left(V/U_*\right)^{n'} \left[\left(F_{gr}/A_1\right) - 1\right]^{m}$$

The dimensionless particle d_{gr} is calculated by:

$$d_{gr} = d_{50} \left(g(G_s-1)/v^2\right)^{1/3}$$

The particle mobility factor $F_{gr}$is calculated by:

$$F_{gr} = \left(U_* n'/(G_s-1) g\, d_{50}\right)^{1/2} \times \left(V/(5.66 \log(10h/d_{50}))\right)^{1-n'}$$

Where,

A_1 = Critical particle mobilityfactor
C_s = Concentration coefficient in the sediment transportfunction
C_t = Total sediment concentration
d_{50} = Median grainsize
d_{gr} = Dimensionless particle diameter
F_{gr} = Particle mobilityparameter
g = Acceleration ofgravity
D_s, S_g = Specific gravity
h = Waterdepth
m = Exponent in the sediment transportfunction
n' = Manning roughnesscoefficient
U_* = Shear velocity
V = Mean flowvelocity
ν = Kinematic viscosity

Meyer – Peter's equation (Subramanya, 2008):

Meyer-Peter's equation (Ponce, 1989) is based on experimental work carried out at the Federal Institute of Technology, Zurich. Mayer-Peter gave a dimensionless equation based on

rational laws. Mayer- Peter equation gave an empirical formula of bed load transport rates in flumes and natural rivers. The simplified Meyer-Peter's equation is given below:

$$g_b = 0.417[\tau_0 (\eta'/\eta)^{1.5} - \tau c]^{1.5}$$

Where,
gb = Rate of bed load transport (by weight) in N per m width of channel per second.

η' = Manning's coefficient pertaining to grain size on an unrippled bed and Strickler formula i.e., η' = (1/24) x d1/6 where d is the median size (d_{50}) of the bed sediment in m.

η = The actual observed value of the rugosity coefficient on rippled channels. Its value is generally taken as 0.020 for discharges of more than 11cumecs, and 0.0225 for lower discharges.

τc = Critical shear stress required to move the grain in N/m2 and given by equationτc = 0.687da, where da is mean or average size of the sediment in mm. This arithmetic average size is usually found to vary between d_{50} and d_{60}.

τ0= Unit tractive force produced by flowing water i.e., γwRS. Truly speaking, its value should be taken as the unit tractive force produced by the flowing water on bed = 0.97γwRS. R is the hydraulic mean depth of the channel (depth of flow for wider channel) and S is the bed slope.

d. Sediment Yield Estimation:

Sedimentation occurred as the velocity decreases along with its abilityto carry sediment. Coarse sediments deposit first, then interfere with the channel conveyance, and may cause additional river meanders and distributaries. The area of the flowing waterexpands, the depth decreases, the velocity is reduced, and eventually even fine sediments beginto deposit. As a result, deltas may be formed in the upper portion of reservoirs. The depositedmaterial may later be moved to deeper portions of the reservoir by hydraulic processes withinthe water body.

There are many sediment transport equations which are suitable for use in the prediction of the rate of replenishment of river. Someof the famous sediment equations are:

1. Dendy – Bolton Equation
2. Yang Equations
3. Engelund-Hansen Equation
4. Modified Universal Soil Loss Equation (MUSLE) developed by Williams and Berndt (1977)

Dendy – Bolton Equation (Subramanya, 2008):
Dendy – Bolton formula is often used to calculate the sedimentation yield because: -

- The formula uses catchment area and mean annual runoff as key determinants.
- It does not differentiate in basin wide smaller streams and their characteristics.
- Dendy and Bolton equation calculates all types of sediment yield i.e. Sheet and rill Erosion gully Erosion, Channel Bed and bank erosion and mass movement etc.

Dendy-Bolton determined the combined influence of runoff and drainage area on sediment yield to compute the sediment yield. They developed two equations i.e., for run off less than 2 inch and for run off more than 2 inches, which are given below:

For run off less than 2 inch:

(Q<2in) $S=1289*(Q)^{0.46}*[1.43-0.26 \text{ Log } (A)]$

For run off more than 2 inches:

(Q > 2 in): $S= 1958\times(e^{-0.055*Q}) \times [1.43-0.26 \text{ Log } (A)]$
Where: S = Sediment yield (tons/sq miles/yr)

Q = Mean Annual runoff (inch)

A = Net drainage are in sq mile

Dendy Bolton formula is often used to calculate the sedimentation yield. But use of theseequations to predict sediment yield for a specific location would be unwise because ofthe wide variability caused by local factors not considered in the equation's development. However, they may provide a quick, rough approximation of mean sediment yields ona regional basis for preliminary watershed planning. Computed sediment yieldsnormally would be low for highly erosive areas and high for well stabilized drainagebasins with high plant density because the equations are derived from average values. The equations express the general relationships between sediment yield, runoff, and drainage area. Many variables influence sediment yield from a drainage basin. They include climate, drainage area, soils, geology, topography, vegetation and land use. The effect of any of these variables may vary greatly from one geographic location toanother, and the relative importance of controlling factors often varies within a given landresource area. Studies revealed that sediment yield per unit area generally decreases asdrainage area increases. As drainage area increases, average land slopes usually decrease; andthere is less probability of an intense rainstorm over the entire basin. Both phenomena tendto decrease sediment yield per unit area.

Modified Universal Soil Loss Equation (MUSLE) (Subramanya, 2008):

Modified universal soil loss equation (MUSLE) for estimation of sediment yield is also used widely. MUSLE is a modification of the Universal Soil Loss Equation (USLE). USLE is anestimate of sheet and rill soil movement down a uniform slope using rain- fall energyas the erosive force acting on the soil (Wischmeier and Smith 1978). Depending on soil characteristics (texture, structure, organic matter, and permeability), some soils erode easily while others are inherently moreresistant to the erosive action of rain- fall.

MUSLE is similar toUSLE except for the energy component. USLE depends strictly uponrainfall as the source of erosive energy. MUSLE uses storm-based runoff volumes andrunoff peak flows to simulate erosion and sediment yield (Williams 1995). The use ofrunoff variables rather than rainfall erosivity as the driving force enables MUSLE toestimate sediment yields for individual storm events. The generalized formula of MUSLE is as below:

$$\mathbf{Y=11.8 \times (Q \times qP).56 \times K \times Ls \times C \times P}$$

Where,
Y = sediment yield of stream (t/yr/km2),
Q = average annual runoff (m3),
K = soil erodibility factor,
qP = Highest discharge recorded (m3/s),
Ls = gradient/slope length,
C = cover management factor,
P = erosion control practice

ii. Estimation of Replenishment:

Geomorphologically the Murshidabad district is divided into two broad zones namely Radh and Bagri, which are situated on the Western and Eastern side of the river Bhagirathi respectively. Topographically the district can be divided into 5 sub-micro regions namely, Nabagram Plain (situated on the Western tract of the Bhagirathi river), Mayurakshi-Dwarka Plain (situated in the South-Western corner of the district), Ganga-Bhagirathi Basin (long and narrow river valley which extends along the Ganga and Bhagirathi rivers), Jalangi -Bhagirathi Interfluve (originates from the Bhagirathi plain in the West and culminates into the BhairabRiver in the East) and Raninagar Plain (lies in the North-Easternportion of the district situated between the Bhairab and JalangiRiver)

The entire district forms a part of the great alluvial plain of the Ganges-Padma system. The alluvial deposits in this district have been laid down as flood-plains depositsby the rivers Bhagiratho, Dwaraka and Mayurakshi.

The Murshidabad district is mainly drained by the Padma, Bhagirathi, Bhairab, Mayurakhsi and Brahmani Rivers. These rivers and its tributary rivers are forming the main catchment area.

For replenishment study, following assumption/calculation taken in to consideration:

- Catchment area (Watershed area) against each river has been calculated based on remote sensing data.
- Rainfall runoff coefficient as per Strange's table for the catchment area is consider 43%, as the rainfall in the district is in-between1447 and 1473mm and the characteristic of the catchment of the district is average in nature.
- Peak flood discharge of the river of the district calculated based on Dicken's formula which is more applicable to north Indian and central Indian catchment. Here Dicken constant C is taken as 12 in present study as per published literature by Abhijit Saha, 2002.
- Bed load transport has not been computed in the regional aspect of the district, as the values are highly dependent on local factors such as particle mobility factor, roughness coefficient, Shear velocity, Mean flow velocity, Kinematic viscosity etc.
- Sedimentation yield calculated as per Dendy Bolton formula as the equations express the general relationships between sediment yield, runoff, and drainage area.
- Computed sediment yields by Dendy Bolton formula normally would be low for highly erosive areas and high for well stabilized drainage basins with high plant density because the equations are derived from average values.
- Dendy &Boltan formula also says that actual sediments yield from individual drainage basins may vary 10-fold or even 100-fold from computed yields. Since the district river

basin comprises of sedimentary rocks with good average rainfall therefore the estimated replenishment considered as50 fold of computed results sediment yield.

The data estimated for each river in the district are tabulated in Table 7.7.

Table No. 7.7: Replenishment parameter estimated for each river in the district

Estimation parameter	Ganga	Bhairab	Brahmani	Mayurakshi
Catchment Area (m^2)	786150000	499340000	1373740000	222230000
Annual Rainfall (m) (in 2020)	1.46	1.46	1.46	1.46
Strange Runoff coefficient (%)	43%	43%	43%	43%
Annual Run-off (m) (in 2020)	0.3212	0.3212	0.3212	0.3212
Catchment Yield (m^3)	493544970	313485652	862433972	139515994
Peak Flood Discharge (m^3/sec)	56339152.56	40084688.57	85626788.17	21841540.22
Flow depth d (m)	1	0.5	0.5	0.6
Channel width b (m)	515.7	8.42	5.13	16.13
Mean velocity v (m/s)	0.1	0.06	0.07	0.07
Channel slope S_o (m/m)	0.01	0.01	0.01	0.01
Sediment Yield (Tons/year)	17993.22	12175.3	28916.17	6011.22
Estimated Annual Replenishment (in million m3)	0.33695	0.22800	0.54150	0.11257

Specific gravity of sand = 2.76tonne per m^3

Sedimentation rate of a river is dependent on the annual rainfall of the district. Sedimentation rate for last 5 years in each river has been calculated and presented in Table 7.8.

Table No. 7.8: Year-wise sedimentation rate for last 5 years of each river

Year	Ganga	Bhairab	Brahmani	Mayurakshi
2016	56.1	59.76	51.59	66.3
2017	41.34	44.04	38.02	48.85
2018	92.36	98.4	84.94	109.16
2019	46.67	49.71	42.92	55.15
2020	22.89	24.38	21.05	27.05

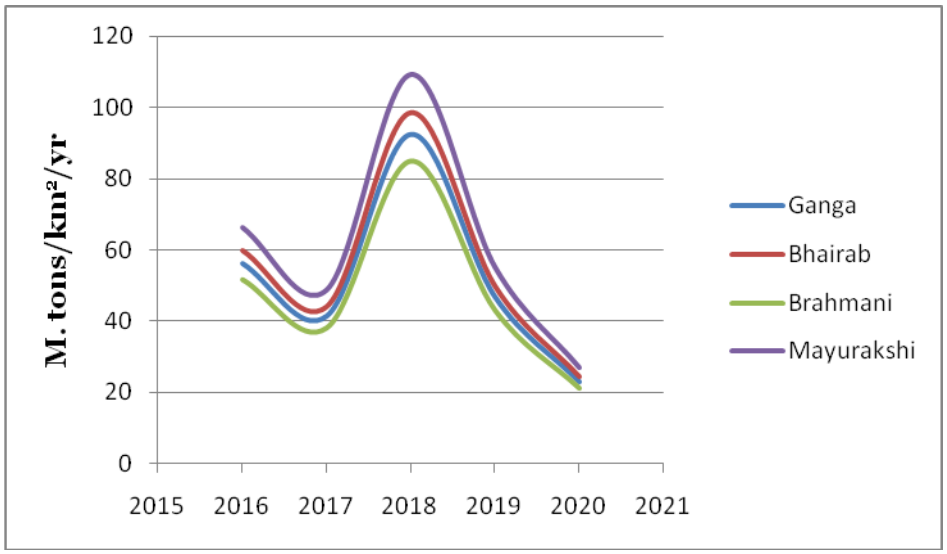


Figure 7.6: Graphical representation of year-wise sedimentation rate

The estimation of sedimentation based on empirical formula need critical analysis of different factors related to the LULC property of the catchment area, slope geometry, sediment erosion factor of catchment litho-type. This will help to assess replenishment rate more precisely.

Replenishment studies based on empirical formula for existing mining leases have also been conducted and are given in Table 7.9.

Theoretical replenishment study shows variations from 72% to 76% with an average of 74.33% of replenishment rate in the district.

Table7.9: River wise replenishment rate estimation based on empirical formula

Location	River Name	Lease Area	Surface RL Before mining	Mine out Thickness	Mine out Volume	Annual Rainfall-2020	Estimated Replenished Volume as per Dendy-Bolton	Replenishment Rate
		m2	m	m	cum	m	cum	%
Ramipur-50	Jalangi	5000.00	13.00	2.80	14000.00	1.46	9800.00	70.00%
Islampur-56	Jalangi/ Bhairab	4000.00	11.00	2.80	11200.00		8288.00	74.00%
Jadavpur, 12	Bramhani	3100.00	17.00	2.50	7750.00		5890.00	76.00%
Andulia, 97	Mayurakshi	19000.00	16.00	2.90	55100.00		39672.00	72.00%
Ibrahimpur-34	Mayurakshi	20000.00	15.00	3.00	60000.00		45000.00	75.00%
Talgram, 42	Mayurakshi	9000.00	14.00	3.00	27000.00		21330.00	79.00%
Average Replenishment Rate								74.33

Illustration of replenishment estimation is given in Table 7.10.

Table 7.10: Illustration of replenishment rate calculation based on 3 methods

Based on Satellite imageries		Based on field investigation		Based on empirical formula	
Particulars	Estimation	Particulars	Estimation	Particulars	Estimation
		River Name	Mayurakshi	River Name	Mayurakshi
River	Mayurakshi	Location	Andulia	Location	Andulia
Total Pre-monsoon Sand Bar Area	768468.4 (sq.m)	Mining Area	19000 (Sq.m)	Lease Area	19000 (Sq.m)
Average Pre monsoon Thickness	2.0 (m)	Pre monsoon RL	16.0 (m)	Surface RL Before mining	16 (m)
Total Sand Volume	1.54 (Mcum)	Sand Thickness	2.90 (m)	Mine out Thickness	2.90 (m)
Total Post-monsoon Sand Bar Area	512746.1 (sq.m)	Volume excavated (Cum)	55100.00	Mine out Volume (Cum)	55100.00
Average Post-monsoon Thickness	2.5 (m)	Post monsoon RL	15.90 (m)	Drainage area for lease block	0.037 (Sq.km)
Total Sand Volume	1.28 (M.cum)	Thickness	2.80 (m)	Monsoon Rainfall-2020	1.46 (m)
Pre and Post monsoon Volume Difference	0.26 (M.cum)	Volume deposited (Cum)	53171.50	Estimated Volume as per Dendy- Bolton ($S = 1280\ Q0.46[1.43 - 0.26 \log(A)]$) Where, Q is runoff, A is drainage area)	39672.0 (Cum)
Replenishment and Agrredation %	83.12 %	Replenishment Rate	96.50%	Replenishment Rate	72.0%

Replenishment studies have been carried out in the district based on three different methodologies as illustrated in Table 7.10. Table 7.11 explained comparison of the outcome of these three methodologies adopted for the district.

Table 7.11: Comparison of replenishment study

Replenishment Study Method	**Bhairab**	**Brahmani**	**Mayurakshi**
Estimated Annual Replenishment based on Sattelite imegaries **(*)**	86%	114%	83%
Estimated Annual Replenishment based on field investigation	96.80%	97.20%	96.68%
Estimated Annual Replenishment based on empirical formula	74.00%	76.00%	75.33%

(*) Replenishment study based on satellite imagery involves estimation of replenish volume along with aggredation/degradation volume.

vi) Total potential of minor mineral in the river bed

The major sand producing rivers of the Murshidabad district are Padma, Bhagirathi, Bhairab, Mayurakhsi and Brahmani etc. rivers.

B. Geological studies

i) Lithology of the catchment area

Asis Bhatacharya and S.N. Banerjee in 1979 had classified the Ajay Bhagirathi valley in to four geomorphic plain. A) Lateritic Upland or Ilambazar plain, b) Older Deltaic Plain or Rampurhat Plain, c) Younger Deltaic Plain or Kandi Plain and d) Bhagirathi recent surface. The District Murshidabad lies generally within the Younger Deltaic Plain or Kandi Plain and the Bhagirathi Recent Surface.

The Young Deltaic Plain or Kandi Plain is a terrace like plain. This plain varies from 6 kilometers in the north to 38 kilometers in the south and the average slope is 0.6 meters per kilometers. The plain becomes narrower near Jangipur and widens towards Berhampore. In the east of Kandi the patches of Older Deltaic Plain blended into YoungDeltaic Plain and in few areas the Older Deltaic Plain underlies the Young DeltaicPlain. The fan like younger delta of Mayurakshi forms terraces. The radiating channelpattern with natural levees on each bank is well preserved. Interestingly large filledvalley-cuts are found near the junction of Older Deltaic Plain and the Bhagirathi recentsurface. The sedimentary structures are common in Young Deltaic Plain. The fluviatileland forms are like ox-bow lakes, levees, meanders, etc. also preserved.

ii) Tectonics and structural behavior of rocks

Murshidabaddistrictis is dominatedbyalmostflattopography. The district is divided into two broad zones namely Radh and Bagri, which are situated on the Western and Eastern side of the river Bhagirathi respectively. The Eastern tract or Bagri lies almost entirely between the Ganga-Bhagirathi basin and is characterized by the existence of inundation along with many swamps.The Western tract or Radh is slightly high and undulating region of the district. It is interspersed with numerous swamps along with beds of Old River.

C. Climate Factors

i) Intensity of rainfall

The average annual rainfall in the district is 1179.64mm. The variations in the annual rainfall within the district and from year to year are not large. The rainfall during the monsoon season – June to September – constitutes 74 percent of the annual rainfall; July and August are the rainiest months. The district receives a mean annual rainfall varying from 815.7 mm. to 1673.5 mm.

ii) Climate zone

District Murshidabad belongs to humid tropical monsoon climatic region. According to District Meteorological Department, there are very minor variation of temperature, rainfall and relative humidity in all over the district viz. north to south and west to east.

The climate of this district is characterized by an oppressive hot summer, high humidity nearly all the year round and a well distributed rainfall in the south west monsoon season. The year may be divided into four seasons. The cold season is from about the middle of November

to the end of February. The period from March to May is the summer season. The south west monsoon season commences about the beginning of June and lasts till the end of September. October and the first half of November may be termed as post monsoon season.

iii) Temperature variation

Temperature along with other meteorological conditions of the district is more or less uniform. The cold season commences by about the middle of November when the temperature begins to decrease. January is the coldest month with the mean daily maximum and minimum temperature at 28 ºC and 10ºC respectively. By about the end of February the temperature begins to increase and April is found as the hottest month, the mean maximum daily temperature is 38 ºC and the mean minimum daily temperature is 25 ºC. The highest temperature recorded at Berhampore was 46.1 ºC on 25th May, 1961, and the lowest minimum was 3.9 ºC on 16th January, 1933.

Annual Deposition:

Annual deposition of riverbed minerals has been calculated on post-monsoon sand volume. The pre-monsoon sand volume of the river is the depleted resources and is replenished by the monsoon rainfall.

Sand bar area recommended for mineral concession in the table is calculated as per the Enforcement and Monitoring Guidelines for Sand Mining (EMGSM) 2020. As per guidelines, mining depth restricted to 3 meters depth and distance from the bank is ¼th of river width and not less than 7.5 meters. Also, mining is prohibitated up to a distance of 1 kilometre (1 km) from major bridges and highways on both sides, or five times (5x) of the span (x) of a bridge/public civil structure (including water intake points) on up-stream side and ten times (10x) the span of such bridge on down-stream side, subjected to a minimum of 250 meters on the upstream side and 500 meters on the downstream side.

For the purpose of estimating mineable mineral potential, the thickness of the sand bar considered extractable based on base flow level. The annual minable mineral potential is given in Table 7.12.

Table No. 7.12: Annual deposition of Riverbed minerals

Sl. No.	River or Stream	Portion of the river stream recommended for mineral concession	Length of area recommended for mineral concession (in meter)	Average width of area recommended for mineral concession (in meters)	Area recommended for mineral concession (in Sqm)	Mineable mineral potential (in Mcum) (60% of total mineral potential	Considered Thickness (m)
1	GANGA RIVER	29.65	73090.00	515.70	37692631.13	67.85	3.00
2	BHAIRAB RIVER	4.30	28150.00	8.42	236918.21	0.36	2.50
3	BRAHMANI RIVER	1.14	16000.00	5.13	82148.47	0.10	2.00
4	MAYURAKSHI RIVER	7.32	31780.00	16.13	512746.10	0.77	2.50

III. Riverbed Mineral Potential

Process of disposition etc:

Sand: Huge quantities of quality sands are found to occur in part of rivers. Smaller patches are also available locally in the other smaller rivers as well. The rivers in the north Bengal are filled by Gravels & boulders.

Table No. 7.13: Resources of Potential Riverbed Mineral

Boulder (Mcum)	Pebbles/Gravel (Mcum)	Sand/White sand (Mcum)	Total Mineable, Mineral Potential (Mcum)
13.814	20.721	34.535	69.07

Table No.7.14: Potential Zone of Riverbed Mineral

Sl. No	Rivers or Streams	Location of potential zones						Area within prohibited zone as per rule 3 of WBMMC Rules, 2016 (in sq.m)
		Administrative Block	Mouza	JL No.	Zone	Co-ordinates		
						Latitude	Longitude	
1	GANGA RIVER	FARAKKA	Baikunthapur (054), Benia gram (055), Arjunpur(096), Paranpara(093)	054, 055, 096, 093	ZONE 1	24°47'53.295"N	87°55'10.933"E	3131710.211
						24°41'36.307"N	87°57'58.03"E	
		SAMSERGANJ	Kamalpur (112)	112	ZONE 2	24°39'52.323"N	87°58'58.18"E	404527.5186
						24°38'18.602"N	88°2'17.332"E	
		SUTI II	Chaipara (067)	67	ZONE 3	24°38'0.807"N	88°1'38.226"E	485235.3218
						24°35'11.161"N	88°3'20.787"E	
		SUTI I	Paschim Nurpurnarayanpur (085), Chakbahadurpur (097), Fatellapur (083)	085, 097, 083	ZONE 4	24°34'23.952"N	88°4'12.788"E	87394.5504
						24°31'42.943"N	88°5'4.124"E	
		RAGHUNATHGANJ I	Bajitpur (044), kutubpur(073), Simultala(064), Ramdebpur(033)	044, 073, 064, 033	ZONE 5	24°31'23.47"N	88°4'49.228"E	428516.5491
						24°26'45.061"N	88°11'39.329"E	
		BHAGAWANGOLA II	Uttar Nirmal Char(128), Dakshin Char Dumuria(069),Munsarpur(106), Hasanpur(071), Nasipur(066)	128, 069, 106, 071, 066	ZONE 6	24°22'54.221"N	88°21'41.124"E	2114333.434
						24°18'25.308"N	88°30'13.996"E	
		RANINAGAR II	Char Bansgara(100), Char Rajapur(099), Ramchandrapur(092), Sibnagar(093)	100, 099, 092, 093	ZONE 7	24°18'31.964"N	88°37'47.833"E	178206.5343
						24°16'34.898"N	88°41'18.118"E	
2	BHAIRAB RIVER	BHAGAWANGOLA II, RANINAGAR I	Hasanpur(071), Harirampur(120), Gopinathpur(029), Ramipur(050), Molladanga(004)	071, 120, 029, 050, 004	ZONE 8	24°18'53.455"N	88°23'30.069"E	94837.93785
						24°10'21.851"N	88°26'53.998"E	
3	BRAHMANI RIVER	NABAGRAM, KHARGRAM	Rasulpur(025), Jurankandi(029), Dhani gram(011), Hazipur(016)	025, 029, 011, 016	ZONE 9	24°11'0.195"N	87°59'0.75"E	16574.10757
						24°8'1.189"N	88°2'48.166"E	

Sl. No	Rivers or Streams	Location of potential zones						Area within prohibited zone as per rule 3 of WBMMC Rules, 2016 (in sq.m)
		Administrative Block	Mouza	JL No.	Zone	Co-ordinates		
						Latitude	Longitude	
4	MAYURAKSHI RIVER	BEHARAMPUR, KANDI	Dakshin Hijal (037), Hijal (041), Jayrampur (099), Ranipur (101)	037, 041, 099, 101	ZONE 10	23°58'19.07"N	88°9'27.337"E	34004.22754
						23°55'57.666"N	88°6'33.42"E	
		BHARATPUR I	Chhatrapur(035), Santoshpur(040), Manoharpur(041), Alugram(069)	035, 040, 041, 069	ZONE 11	23°55'14.927"N	88°5'44.644"E	18163.15768
						23°52'15.461"N	88°2'39.846"E	
		BURWAN	Shibrambati(146), Kakra(111)	146, 111	ZONE 12	23°53'17.487"N	87°59'40.305"E	95953.78559
						23°52'47.425"N	87°54'26.412"E	

NO MINING ZONE:

As per the Enforcement & Monitoring Guidelines for Sand Mining (EMGSM) 2020 the restricted zone for mining is a distance from the bank is ¼th of river width and not be less than 7.5 meters. Also, there is a no mining zone up to a distance of 1 kilometre (1 km) from major bridges and highways on both sides, or five times (5x) of the span (x) of a bridge/public civil structure (including water intake points) on up-stream side and ten times (10x) the span of such bridge on down-stream side, subjected to a minimum of 250 meters on the upstream side and 500 meters on the downstream side.

No mining zone has been marked for an area up to a width of 100 meters from the active edge of embankments. Also, the concave side of the rive is marked as no mining zone, as mining is this area will affect the course of river in future and will erode the river bank. A representative map of no mining zone shown on River Mayurakshi of Murshidabad district is given below.

Table No.7.15: No mining zone in the district

Sl.No	Rivers or Streams	Administrative Block	No mining area (in Sq.m.)
1	GANGA RIVER	FARAKKA	3131710.211
		SAMSERGANJ	404527.5186
		SUTI II	485235.3218
		SUTI I	87394.5504
		RAGHUNATHGANJ I	428516.5491
		BHAGAWANGOLA II	2114333.434
		RANINAGAR II	178206.5343
2	BHAIRAB RIVER	BHAGAWANGOLA II, RANINAGAR I	94837.93785
3	BRAHMANI RIVER	NABAGRAM, KHARGRAM	16574.10757

Sl.No	Rivers or Streams	Administrative Block	No mining area (in Sq.m.)
4	MAYURAKSHI RIVER	BEHARAMPUR, KANDI	34004.22754
		BHARATPUR I	18163.15768
		BURWAN	95953.78559

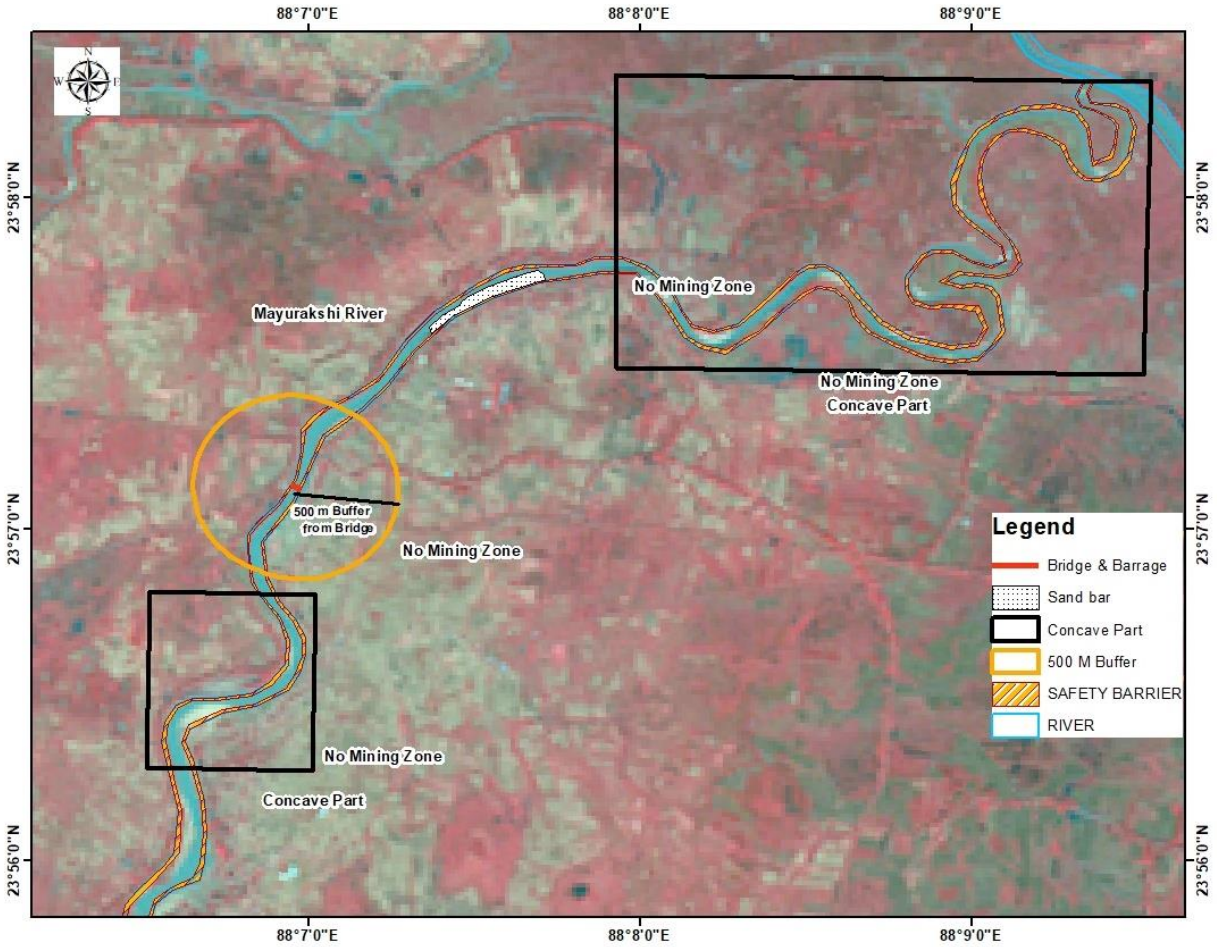


Figure No. 7.7: A representative map showing no-mining zone demarcated on Mayurakshi River

B) In-situ Minerals:

I. Mineral Reserve

Mineral resources of the district are still not well established. However, existence of some in-situ hard basalt of Rajamahal trap is reported from the northern part of the district, located in western part of Farakka block under Jangipur sub-division. These can be scientifically and economically exploited for building stone, road construction works.

II. Mineral Potential

There is no major mineral of any economic importance. The traps form a useful source for ballast and road metal. The silts and clays may find use in the manufacture of bricks and tiles.

Table 7.16: In-situ Minerals Occurrences

Name of mineral	Name of associated minerals, if any	Host rock of mineralization	Area of mineralization	Depth of mineralization	Whether virgin or partially excavated
1	2	3	4	5	6
Basalt Moorrum	Not Applicable	Not Applicable	Northern part of the district, Bahadurpur gram panchayat	>30m	Most of the area is virgin

Name of land (whether free for mining/forest/agricultural	Mineral reserve (approximate) mentioning grade	Location of potential mineralized zones				Area within prohibited zone as per rule 3(7) of WBMMC Rules, 2016	Infrastructure available near the mineralized zone
		Administrative Block	Mouza	Plot Nos.	Co-ordinates		
7	8	9				10	11
Mostly private land.	Yet to be explored	Mouza: Jibanpur, Samlapur, Kupi, Nimaitok, and Bahadurpur in Farakka block, bounded by latitudes 24°44'15" to 24°45'57" and longitudes 87°50'20" to 87°51'33"				Not studied.	Road and rail connectivity present

Basalt occurances: Mineral resources of the district are still not well established. However, existence of some in-situ hard basalt is reported in the Rajamahal trap (Northern part of the district) has been established based on satellite imegary along with field survey. An area of

around 12.02 sq.km potential area has been demarcated and same has been shown as **Annexure-4.**

The exploration needs in the northern tip of the district where occurrence of Rajmahal Basalt has been reported by GSI need in depth study for establishment of insitu mining project in the district.

A map is prepared based on occurance of insitu stone deposition, has been identified with the help of satellite imagery in the northern part of Murshidabad District, Bahadurpur grampanchayat, is furnished below.

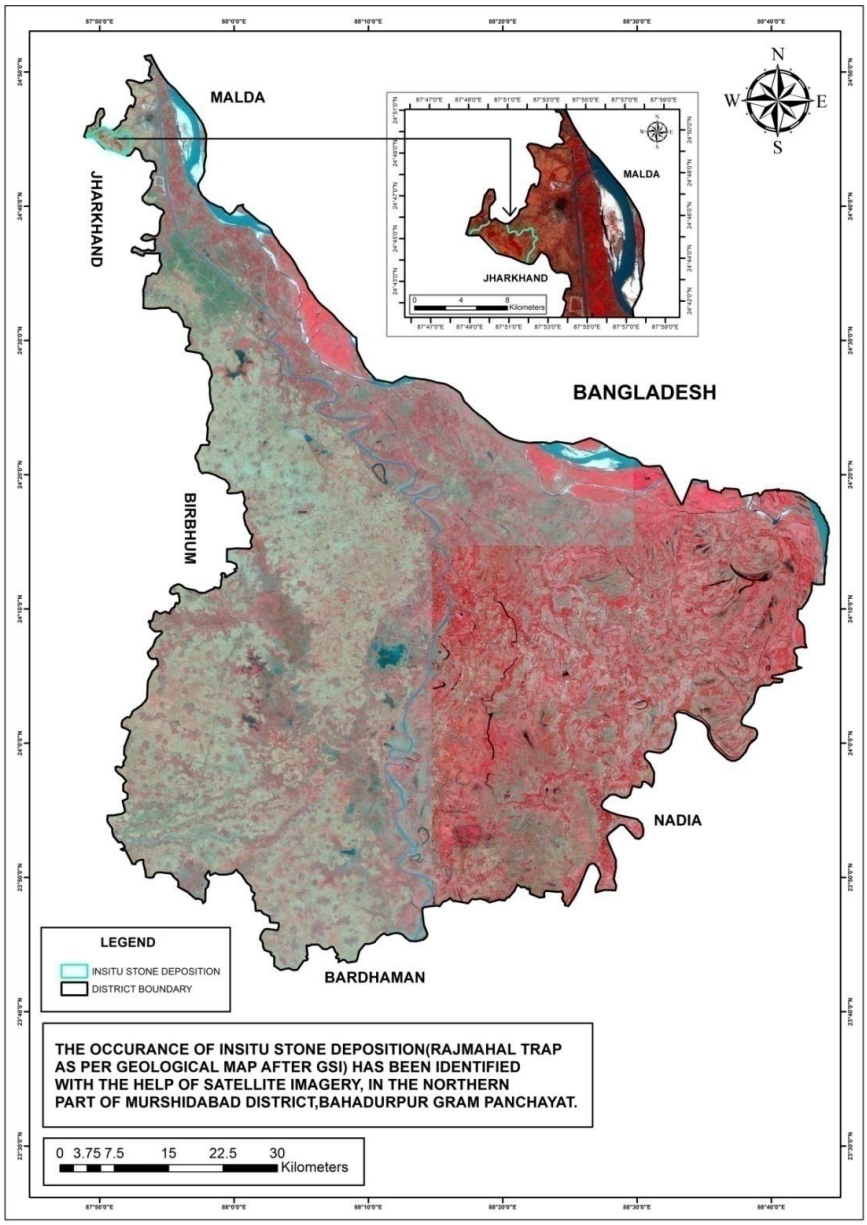


Figure No. 7.8: Occurance of insitu stone deposition (Rajmahal Trap as per Geological Map after GSI, GoI) in the northern part of Murshidabad District, Bahadurpur grampanchayat

Morrum occurances: The northwest margin of Bengal Basin, in between the western part of Bhagirathi – Hooghly River and eastern part of Chotanagpur Plateau, shows the occurances of lateritic deposits. The distribution of laterites and lateritic soils is limited to parts of western plateau fringe of West Bengal, comprising the eastern part of Bankura, west – central part of Birbhum, middle Barddhaman, part of Murshidabad, West Medinipur and eastern parts of Purulia districts, altogether covering an area of approximately 7,700 km2 (Hunday and Banerjee, 1967).

At Rajmahal Basalt-trap and its outliers of Murshidabad district, the lateritic materials directly overlie on the basaltic bed rock. The average thickness of lateritic duricrust is recorded in this area up to 9.15 metre (Chatterjee, 2008). Lateritic deposts have massive appearance (in situ weathering) relecting vermicular lateritic crust (probably Eocene – Miocene age), mottled zone with lithomarge clay and deeply weathered basalts. Below figure shows lateritic deposits of Murshidabad.

Figure No. 7.9: Occurrence of morrum deposits above Rajmahal trap

7.3 Mineral Development Prospect of the district with respect to Minor Mineral

The district does not have prospect of major mineral resources and there are no mines in the district. However, collections of sand from the river-bed of the river terrain are the major sources of revenue generation. In this district some of big rivers are flowing like Padma, Bhagirathi, Bhairab, Mayurakhsi and Brahmani Rivers, so in this region it has seen that the different geomorphic features like Alluvium Plain, Alluvial Fan etc, which are create by river deposition activity. So in this region there is huge deposition of sand has found, so the sand mining or the sand industry should the very useful for this district.

7.4 Exploration Requirement of the district

Systematic and scientific replenishement study needs to be conducted in order to ascertain the potentiality of sand/ riverbed material deposits in the district. The identified in-situ basaltic deposits also need to be studied in detail in order to estimate the mineral resources in to G2 level.

8 Overview of mining activity in the district

8.1 General overview

The district is so far exposed to sand mining activities through decades. Evidences of very small scale morrum and laterite mining/ scrapping are observed during field investigations.

8.2 List of existing mining leases of the districts

As per the data received from district authority, Murshidabad, total 143 blocks have been allotted for mining of river sand in the district. Out of which 118 blocks are allotted in Mayurakshi, 10 blocks are allotted Dwarka, 8 blocks in Bramhani, 2 blocks in Jalangi, 2 blocks in Bhairab, 2 blocks in Jalangi/Bhairab and 1 block in Padma River. Total allotted block area for 143 blocks is 288.23 Ha. and estimated reserve is around 6911631 CuM. Beside this, about 44 blocks are in the process of allotment by the competent authority.

Table 8.1: Details of Sand mining leases of the districts

ID	Mouza	JL No	River	Plot No	Area in Hectares	Latitude	Longitude	Bidder Name	Date of Issuance of Environmental Clearance (E.C.)	Date of Execution of Lease Deed	Lease Agreement Start Date (date of effect)	Lease Agreement Expiry Date	Quantum of Sand Extraction permissible	Reasons for non-execution of lease deed
159/SB2021	ARAJI BHABANIPUR	33	Mayurakshi	163 P	0.900	23° 54' 15.93"N	88° 4' 39.42"E	PRADIP AGARWAL	27/05/2017	10/12/2018	10/12/2018	10/12/2023	175040.519	
160/SB2021	ANDULIA	97	Mayurakshi	1758 P	1.900	23° 57' 7.97"N	88° 5' 18.74"E	PRADIP AGARWAL	27/05/2017	30/08/2019	30/08/2019	30/08/2024	369529.984	
1161/SB2021	SHENAI	102	Mayurakshi	1569 P, 1571 P	4.500	23° 52' 51.75"N	87° 53' 29.55"E	FALCON ABASAN PVT LTD					0	EC Awaiting
548/SB2021	BHARATPUR	68	Mayurakshi	1 P, 8111 P	3.000	23° 53' 48.03" N	88° 3' 42.01"E	SUDIP DEY					0	EC Awaiting
177/SB2021	SUNDARPUR	153	Mayurakshi	95	1.540	23° 52' 42.71"N	87° 56' 52.31"E	SUDIP DEY	14/12/2017	30/08/2019	30/08/2019	30/08/2024	167747.164	
176/SB2021	RAJHATSULI	136	Mayurakshi	2341 P	2.620	23° 52' 57.18"N	87° 54' 37.94"E	KRISHNA AGARWAL	10/08/2017	30/08/2019	30/08/2019	30/08/2024	256726.094	
151/SB2021	RAJYADHARPUR	135	Mayurakshi	59 P, 60 P	3.600	23° 58' 8.04"N	87° 55' 11.66"E	PREMI ARORA	07/11/2017	03/08/2019	03/08/2019	03/08/2024	700162.075	
154/SB2021	BHASTORE	99	Mayurakshi	294 P	4.300	23° 52' 35.68"N	87° 51' 11.31"E	MANIK SARKAR	23/03/2017	10/12/2018	10/12/2018	10/12/2023	836304.7	
157/SB2021	SUNIA	70	Mayurakshi	1P	2.450	23° 55' 13.21"N	88° 5' 36.38"E	BIKALPA TRADERS PVT LTD	07/11/2017	09/01/2019	09/01/2019	09/01/2024	476499.19	
259/SB2021	TALGRAM	42	Mayurakshi	2631 P	1.400	23° 52' 22.80" N	88° 2' 53.40"E	AMBEY NIWAS PVT LTD					0	EC Awaiting
257/SB2021	TALGRAM	42	Mayurakshi	2631 P	1.900	23° 52' 16.60"N	88° 2' 41.00"E	AMBEY NIWAS PVT LTD					0	EC Awaiting
260/SB2021	SANTOSHPUR	40	Mayurakshi	2697 P	2.300	23° 52' 35.40"N	88° 2' 59.60"E	ADYAMA TRADELINK PVT LTD					0	EC Awaiting
287/SB2021	DEWAR	98	Mayurakshi	384 P	4.840	23° 52' 27.40"N	87° 51' 33.80"E	PAWAN ARORA					0	EC Awaiting
290/SB2021	MANDRA	103	Mayurakshi	698 P, 701 P	3.350	23° 52' 42.70"N	87° 53' 0.78"E	PAWAN ARORA					0	EC Awaiting
297/SB2021	CHAITPUR	140	Mayurakshi	3915 P, 355 P, 356 P	4.400	23° 52' 57.08"N	87° 55' 43.10"E	Pradip Arora					0	EC Awaiting
299/SB2021	CHAITPUR	140	Mayurakshi	3915 P, 3916 P, 3917 P, 355 P, 357 P	4.400	23° 52' 58.66"N	87° 55' 56.74"E	AMBEY NIWAS PVT LTD					0	EC Awaiting
306/SB2021	KOGRAM	109	Mayurakshi	2290 P BATA OF 1, 2291 P BATA OF 1, 2P	4.000	23° 52' 24.99"N	87° 54' 4.21"E	SUCCESS NIRYAT PVT LTD					0	EC Awaiting
330/SB2021	PETARI	110	Mayurakshi	2715 P	3.000	23° 52' 48.58"	87° 54' 28.21"E	ABUL HASNAT					0	EC Awaiting

ID	Mouza	JL No	River	Plot No	Area in Hectares	Latitude	Longitude	Bidder Name	Date of Issuance of Environmental Clearance (E.C.)	Date of Execution of Lease Deed	Lease Agreement Start Date (date of effect)	Lease Agreement Expiry Date	Quantum of Sand Extraction permissible	Reasons for non-execution of lease deed
						N								
360/SB2021	BHASTORE	99	Mayurakshi	294 P	4.400	23° 52' 27.86"N	87° 51' 59.76"E	MANIK SARKAR					0	EC Awaiting
371/SB2021	MADANPUR DAFARPUR	73	Mayurakshi	11 P	1.800	23° 55' 48.12"N	88° 6' 26.78"E	Triumph Sales and Services					0	EC Awaiting
354/SB2021	TALBONA	100	Mayurakshi	1005 P	2.100	23° 52' 42.10"N	87° 52' 56.19"E	Sabina Nasrin					0	EC Awaiting
148/SB2021	CHAR RADHABALLAVPUR	51	Jalangi	120 P	0.400	24° 10' 12.29"N	88° 26' 15.05"E	FAZARUDDIN MONDAL	07/11/2017	22/05/2019	22/05/2019	22/05/2024	29173.42	
471/SB2021	ANDULIA	97	Mayurakshi	1758 P, 2081 P	1.900	23° 57' 1.38"N	88° 5' 36.91"E	PRADIP AGARWAL					0	EC Awaiting
1204/SB2021	ALUGRAM	69	Mayurakshi	54 P	1.770	23° 54' 37.71"N	88° 5' 39.14"E	PREMI ARORA					0	EC Awaiting
448/SB2021	SUNIA	70	Mayurakshi	1 p	0.600	23° 55' 10.61"N	88° 5' 31.58"E	TAPAN MONDAL					0	EC Awaiting
439/SB2021	ALUGRAM	69	Mayurakshi	54 P	0.500	23° 54' 38.91"N	88° 5' 35.99"E	TAPAN MONDAL					0	EC Awaiting
459/SB2021	SANKAR MARUI	30	Mayurakshi	695 P, 696 P, 136 P, 1362 P	4.120	23° 54' 21.11"N	88° 4' 40.86" E	PRADIP AGARWAL					0	EC Awaiting
182/SB2021	MANDRA	103	Mayurakshi	700 P	1.400	23° 52' 49.90" N	87° 53' 8.82"E	MITHUN GHOSH	10/02/2017	29/01/2019	29/01/2019	29/01/2024	272285.251	
186/SB2021	BHASTORE	99	Mayurakshi	1494 P, 1495 P	3.500	23° 52' 45.51"N	87° 52' 30.09" E	MOHIBUR RAHAMAN	10/02/2017	06/01/2021	06/01/2021	06/01/2026	680713.128	
191/SB2021	CHAITPUR	140	Mayurakshi	355 P, 357 P, 3917 P	4.800	23° 52' 54.03"N	87° 56' 9.33"E	AMBEY NIWAS PVT LTD	06/04/2017	09/01/2019	09/01/2019	09/01/2024	646677.472	
202/SB2021	SHENAI	102	Mayurakshi	1567 P, 1568 P, 1569 P, 1571 P	4.100	23° 52' 53.58"N	87° 53' 17.25"E	FALCON ABASAN PVT LTD	07/11/2017	23/03/2019	23/03/2019	23/03/2024	797406.807	
208/SB2021	MADDA	134	Mayurakshi	2362 P, 2363 P, 2364 P	4.490	23° 53' 13.91"N	87° 54' 56.09"E	SUCCESS NIRYAT PVT LTD	07/11/2017	09/01/2019	09/01/2019	09/01/2024	873257.699	
197/SB2021	ISLAMPUR	56	Bhairab	1701 P	0.400	24° 9' 24.86" N	88° 27' 43.45"E	HINDUSTAN CONSTRUCTION CO LTD	29/06/2017	28/05/2019	28/05/2019	28/05/2024	21880.065	
200/SB2021	ISLAMPUR	56	Bhairab	1701 P	0.500	24° 8' 53.38"N	88° 27' 39.20"E	HINDUSTAN CONSTRUC	29/06/2017	28/05/2019	28/05/2019	28/05/2024	29173.42	

ID	Mouza	JL No	River	Plot No	Area in Hectares	Latitude	Longitude	Bidder Name	Date of Issuance of Environmental Clearance (E.C.)	Date of Execution of Lease Deed	Lease Agreement Start Date (date of effect)	Lease Agreement Expiry Date	Quantum of Sand Extraction permissible	Reasons for non-execution of lease deed
								TION CO LTD						
213/SB2021	ALUGRAM	69	Mayurakshi	54 P	1.000	23° 54' 40.88" N	88° 5' 30.18"E	ADYAMA TRADELINK PVT LTD	06/04/2017	09/01/2019	09/01/2019	09/01/2024	155591.572	
591/SB2021	JADAVPUR	12	Mayurakshi	19 P	0.210	24° 10' 58.27"N	87° 59' 0.51"E	TAPAN MONDAL					0	EC Awaiting
522/SB2021	SIBARAMBATI	146	Mayurakshi	1645 P	2.710	23° 52' 58.70"N	87° 58' 37.39"E	KRISHNA AGARWAL					0	EC Awaiting
526/SB2021	SIBARAMBATI	146	Mayurakshi	1645 P	1.800	23° 52' 57.25"N	87° 58' 48.88" E	KRISHNA AGARWAL					0	EC Awaiting
560/SB2021	SUNDARPUR	153	Mayurakshi	95 P, 1688 P	2.390	23° 52' 46.76"N	87° 57' 0.56"E	SUDIP DEY					0	EC Awaiting
565/SB2021	SUNDARPUR	153	Mayurakshi	1688 P	2.150	23° 52' 49.77"N	87° 57' 7.72"E	SUDIP DEY					0	EC Awaiting
571/SB2021	SUNDARPUR	153	Mayurakshi	1688 P	2.360	23° 52' 40.14"N	87° 57' 14.75"E	SUDIP DEY					0	EC Awaiting
574/SB2021	PANCHTHUPI	149	Mayurakshi	914 P	3.720	23° 52' 48.72"N	87° 59' 21.66"E	SUDIP DEY					0	EC Awaiting
579/SB2021	PANCHTHUPI	149	Mayurakshi	914 P	1.970	23° 52' 57.04"N	87° 59' 53.59"E	SUDIP DEY					0	EC Awaiting
585/SB2021	PANCHTHUPI	149	Mayurakshi	914 P	1.200	23° 52' 58.95"N	88° 0' 19.73"E	SUDIP DEY					0	EC Awaiting
668/SB2021	BILPANCHTHUPI	43	Mayurakshi	685 P	0.900	23° 52' 13.35"N	88° 1' 2.54"E	HABIBUR RAHAMAN on behalf of RONITH ENTERPRISE					0	EC Awaiting
717/SB2021	BHASTORE	99	Mayurakshi	1494 P, 1495 P	4.000	23° 52' 45.64"N	87° 52' 30.40" E	HSJ ENTERPRISE					0	EC Awaiting
227/SB2021	TALGRAM	42	Mayurakshi	801 P	1.600	23° 51' 58.57"N	88° 1' 26.89"E	AMBEY NIWAS PVT LTD					0	EC Awaiting
683/SB2021	TALBONA	100	Mayurakshi	1003 P, 1004 P, 1005 P	4.810	23° 52' 50.64" N	87° 52' 34.99"E	FIROZ ALAM					0	EC Awaiting
703/SB2021	SHENAI	102	Mayurakshi	1569 P, 1571 P	0.300	23° 52' 38.89" N	87° 53' 40.48" E	ABUL HASNAT					0	EC Awaiting
755/SB2021	JADAVPUR	12	Mayurakshi	19 P	0.310	24° 11' 6.29"N	87° 59' 19.53"E	ABU SAHIN MONDAL					0	EC Awaiting
769/SB2021	JAYRAMPUR	99	Dwarka	309 P, 310 P, 311 P	1.250	23° 56' 27.89"N	88° 6' 45.48"E	ASHOK KUMAR JHA					0	EC Awaiting
809/SB2021	HATISALA	141	Mayurakshi	632 P, 628P	3.200	23° 52' 48.90" N	87° 56' 23.30"E	Pradip Arora					0	EC Awaiting

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817/SB2021	HATISALA	141	Mayurakshi	629 P, 628 P	3.400	23° 52' 44.60" N	87° 56' 23.20"E	Pradip Arora					0	EC Awaiting
834/SB2021	KOGRAM	109	Mayurakshi	2290 P BATA OF 1, 2291 P BATA OF 1, 2 P	4.000	23° 52' 30.51"N	87° 53' 57.64"E	SUCCESS NIRYAT PVT LTD					0	EC Awaiting
171/SB2021	PHUPRA	143	Mayurakshi	1831 P	2.670	23° 53' 10.11"N	87° 58' 10.40"E	KRISHNA AGARWAL	10/08/2017	30/08/2019	30/08/2019	30/08/2024	233387.358	
1172/SB2021	KOGRAM	109	Mayurakshi	2290 P BATA OF 1, 2291 P BATA OF 1, 2P	4.000	23° 52' 31.03"N	27° 54' 2.03"E	BIKALPA TRADERS PVT LTD					0	EC Awaiting
1176/SB2021	KOGRAM	109	Mayurakshi	2290 P BATA OF 1, 2440 P BATA OF 1, 2P	4.000	23° 52' 30.47"N	87° 53' 53.44"E	BIKALPA TRADERS PVT LTD					0	EC Awaiting
1181/SB2021	RAJYADHARPUR	135	Mayurakshi	59 P, 60 P	3.600	23° 53' 1.50"N	87° 55' 2.54"E	PREMI ARORA					0	EC Awaiting
1215/SB2021	SUNIA	70	Mayurakshi	1 p	1.950	23° 54' 45.32"N	88° 5' 42.44"E	Abhishek Arora					0	EC Awaiting
1293/SB2021	HIJAL	41	Mayurakshi	4027 P	0.600	23° 58' 4.29"N	88° 9' 23.52"E	DULAL CHANDRA BISWAS					0	EC Awaiting
1255/SB2021	MALIANDI	151	Mayurakshi	65 P, 1251 P	1.720	23° 52' 54.47"N	87° 57' 41.69"E	SUDIP DEY					0	EC Awaiting
1265/SB2021	JADAVPUR	12	Mayurakshi	19 P	0.210	24° 10' 47.46"N	87° 59' 14.69"E	TAPAN MONDAL					0	EC Awaiting
1640/SB2021	DANGAPARA	102	Bhairab	1001 P	1.200	24° 11' 46.69"N	88° 25' 2.14"E						0	
1272/SB2021	JADAVPUR	12	Mayurakshi	19 P	0.510	24° 10' 45.18"N	87° 59' 30.60" E	TAPAN MONDAL					0	EC Awaiting
1321/SB2021	HIJAL	41	Mayurakshi	4040 P, 4043 P	0.450	23° 57' 49.45"N	88° 9' 6.64"E	DULAL CHANDRA BISWAS					0	EC Awaiting
1325/SB2021	RASULPUR	25	Brahmani	5231 BATA OF 3351	1.600	24° 9' 49.86" N	87° 59' 43.75"E	DULAL CHANDRA BISWAS					0	EC Awaiting
1328/SB2021	RASULPUR	25	Brahmani	5230 BATA OF 4309	1.200	24° 9' 30.90" N	88° 0' 14.67"E	DULAL CHANDRA BISWAS					0	EC Awaiting
1311/SB2021	HIJAL	41	Mayurakshi	4027 P	0.900	23° 58' 11.44"N	88° 9' 1.24"E	DULAL CHANDRA BISWAS					0	EC Awaiting
1329/SB2021	RASULPUR	25	Brahmani	7525 BATA OF 3949	0.800	24° 9' 28.65"N	88° 0' 42.31"E	DULAL CHANDRA BISWAS					0	EC Awaiting

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1330/SB2021	JHULANPUR	28	Brahmani	2012 P BATA OF 647, 2013 P BATA OF 757, 2014 P BATA OF 1928	2.400	24° 8' 59.45"N	88° 2' 6.27"E	ASHOK KUMAR JHA					0	EC Awaiting
1352/SB2021	HIJAL	41	Mayurakshi	8749 P	0.750	23° 57' 33.28"N	88° 8' 50.86"E	TAPAN MONDAL					0	EC Awaiting
1355/SB2021	HIJAL	41	Mayurakshi	8712 P	0.550	23° 57' 37.98"N	88° 8' 41.61"E	TAPAN MONDAL					0	EC Awaiting
1359/SB2021	HIJAL	41	Mayurakshi	8515 P	1.150	23° 57' 34.64"N	88° 8' 12.58"E	ASHOK KUMAR JHA					0	EC Awaiting
1370/SB2021	GIRIA	35	Bhagirathi-Hooghly	4477 P	0.140	24° 30' 27.55"N	88° 5' 18.95"E	FAZARUDDIN MONDAL					0	EC Awaiting
1378/SB2021	HIJAL	41	Mayurakshi	8749 P	0.300	23° 57' 33.33"N	88° 9' 1.92"E	ASHOK KUMAR JHA					0	EC Awaiting
1382/SB2021	MADANPUR DAFARPUR	73	Mayurakshi	1111 P	0.410	23° 55' 27.25"N	88° 6' 7.08"E	SUDIP DEY					0	EC Awaiting
1388/SB2021	HIJAL	41	Mayurakshi	6167 P	1.000	23° 57' 38.81"N	88° 7' 25.41"E	SUDIP DEY					0	EC Awaiting
1413/SB2021	HIJAL	41	Mayurakshi	6167 P	0.450	23° 56' 58.52"N	88° 6' 51.72"E	TAPAN MONDAL					0	EC Awaiting
1416/SB2021	BHABANANDAPUR	100	Mayurakshi	478 P	2.100	23° 55' 56.48"N	88° 6' 36.92"E	SUDIP DEY					0	EC Awaiting
1421/SB2021	LAKKHIKANTAPUR	96	Mayurakshi	1821 P	0.690	23° 57' 56.42"N	88° 6' 4.49"E	TAPAN MONDAL					0	EC Awaiting
1427/SB2021	HIJAL THAKURANIRCHAK	98	Mayurakshi	370 P	1.600	23° 56' 13.28"N	88° 5' 41.99"E	SUDIP DEY					0	EC Awaiting
1435/SB2021	RAHIMANAGAR	42	Dwarka	1624 P	0.500	24° 8' 36.84" N	88° 2' 39.94"E	FAZARUDDIN MONDAL					0	EC Awaiting
1456/SB2021	CHAR MOLLADANGA	125	Bhairab	1269 P	0.520	24° 17' 15.45"N	88° 26' 46.75"E	RAKIBUL HOQUE					0	EC Awaiting
1445/SB2021	RAHIGRAM	43	Dwarka	613 P	0.800	24° 8' 4.88"N	88° 2' 42.63"E	SUDIP DEY					0	EC Awaiting
1465/SB2021	ALUGRAM	69	Mayurakshi	54 P	2.890	23° 54' 46.95"N	88° 5' 15.95"E	KRISHNA AGARWAL					0	EC Awaiting
1468/SB2021	GUNDERIA	17	Mayurakshi	3979	1.600	23° 54' 10.90"N	88° 3' 37.89"E	KRISHNA AGARWAL					0	EC Awaiting
193/SB2021	MANDRA	103	Mayurakshi	1 P	2.100	23° 52' 39.65"N	87° 52' 35.45"E	PAWAN ARORA	10/02/2017	30/07/2019	30/07/2019	30/07/2024	408427.877	
477/SB2021	ANDULIA	97	Mayurakshi	1758 P	1.450	23° 57' 17.46"N	88° 5' 17.87"E	PRADIP AGARWAL					0	EC Awaiting

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483/SB2021	RAJHATSULI	136	Mayurakshi	2341 P	3.330	23° 52' 57.48"N	87° 54' 38.23"E	KRISHNA AGARWAL					0	EC Awaiting
488/SB2021	RAJHATSULI	136	Mayurakshi	2341 P, 2342 P	3.420	23° 53' 3.17"N	87° 54' 44.21"E	KRISHNA AGARWAL					0	EC Awaiting
1470/SB2021	IBRAHIMPUR	34	Mayurakshi	36 P	1.000	23° 54' 20.52"N	88° 3' 47.57"E	KRISHNA AGARWAL					0	EC Awaiting
1473/SB2021	IBRAHIMPUR	34	Mayurakshi	36 P	1.000	23° 54' 20.55"N	88° 3' 56.52"E	KRISHNA AGARWAL					0	EC Awaiting
1474/SB2021	BELGRAM	142	Mayurakshi	1196 P	1.430	23° 52' 57.31"N	87° 57' 46.14"E	KRISHNA AGARWAL					0	EC Awaiting
537/SB2021	LAKKHIKANTAPUR	96	Mayurakshi	1994 BATA OF 1852	0.810	23° 57' 45.71"N	88° 5' 48.55"E	SUDIP DEY					0	EC Awaiting
538/SB2021	LAKKHIKANTAPUR	96	Mayurakshi	1995 BATA OF 1840	0.650	23° 57' 48.97"N	88° 5' 58.92"E	SUDIP DEY					0	EC Awaiting
1485/SB2021	MADANPUR DAFARPUR	73	Mayurakshi	1 OF 1	1.200	23° 55' 12.30"N	88° 5' 53.90"E	Triumph Sales and Services					0	EC Awaiting
1496/SB2021	CHAITPUR	140	Mayurakshi	122 P, 355 P, 3915 P	2.690	23° 52' 58.08" N	87° 55' 37.76"E	KRISHNA AGARWAL					0	EC Awaiting
228/SB2021	TALGRAM	42	Mayurakshi	540 P	0.900	23° 52' 2.57"N	88° 1' 48.15"E	AKBAR ALI					0	EC Awaiting
265/SB2021	SHENAI	102	Mayurakshi	1569 P, 1571 P	1.610	23° 52' 51.10"N	87° 53' 20.70"E	RABINDRA NATH GHOSH					0	EC Awaiting
397/SB2021	JAKHINI	36	Mayurakshi	168 P	2.500	23° 53' 25.39"N	88° 3' 5.36"E	NABIN CHANDRA CHOSH					0	EC Awaiting
383/SB2021	ALUGRAM	69	Mayurakshi	54 P	2.770	23° 54' 53.66"N	88° 5' 19.63"E	PREMI ARORA					0	EC Awaiting
389/SB2021	IBRAHIMPUR	34	Mayurakshi	1045 P	2.000	23° 54' 8.21"N	88° 4' 4.18"E	SAGAR SEKH					0	EC Awaiting
392/SB2021	IBRAHIMPUR	34	Mayurakshi	36 P	1.000	23° 54' 20.51"N	88° 3' 41.12"E	SAGAR SEKH					0	EC Awaiting
432/SB2021	SANTOSHPUR	40	Mayurakshi	2697 P	3.000	23° 53' 21.04"N	88° 3' 36.51"E	MIJANUR CHOWDHURY					0	EC Awaiting
1633/SB2021	KOGRAM	109	Mayurakshi	2441 P BATA OF 1, 2290 P BATA OF 1, 2291 P BATA OF 1, 2 P	4.000	23° 52' 38.22"N	87° 54' 13.93"E						0	
1634/SB2021	KOGRAM	109	Mayurakshi	2441 P BATA OF 1, 2290 P BATA OF 1, 2291 P BATA OF 1, 2 P	3.500	23° 52' 37.36"N	87° 54' 17.96"E						0	
1648/SB2021	CHANPUR	36	Bhairab	216 P, 235 P	0.800	24° 11' 38.27"N	88° 24' 22.62"E						0	

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1637/SB2021	KOGRAM	109	Mayurakshi	2290 P BATA OF 1, 2439 P BATA OF 2, 2 P	3.560	23° 52' 40.83" N	87° 54' 23.24"E						0	
1639/SB2021	KOGRAM	109	Mayurakshi	2290 P BATA OF 1, 2439 P BATA OF 2, 2 P	2.100	23° 52' 40.24" N	87° 54' 27.14"E						0	
1641/SB2021	DANGAPARA	102	Bhairab	1001 P	1.200	24° 11' 44.54"N	88° 24' 56.19"E						0	
1642/SB2021	HULASPUR	100	Bhairab	928 P	0.760	24° 11' 38.93"N	88° 24' 1.38"E						0	
1643/SB2021	HULASPUR	100	Bhairab	927 P, 928 P	0.950	24° 11' 37.99"N	88° 24' 7.63"E						0	
1644/SB2021	HULASPUR	100	Bhairab	927 P, 928 P	0.650	24° 11' 37.67"N	88° 24' 12.95"E						0	
1645/SB2021	SEKENDRA	14	Bhagirathi-Hooghly	3679 P	2.650	24° 30' 23.23"N	88° 5' 12.93"E						0	
1650/SB2021	CHAR HULASPUR	34	Bhairab	205 P	1.000	24° 11' 39.60" N	88° 24' 16.20"E						0	
138/SB2021	RAMIPUR	50	Jalangi	169 P	0.500	24° 11' 9.89"N	88° 25' 59.84"E	SALAM SAIKH	27/05/2017	19/12/2017	19/12/2017	19/12/2022	47722.853	
155/SB2021	HATISALA	141	Mayurakshi	1081P, 1082P, 1083P, 391P	2.500	23° 52' 47.73"N	87° 57' 10.32"E	MANIK SARKAR	06/04/2017	10/12/2018	10/12/2018	09/12/2023	328200.972	
158/SB2021	IBRAHIMPUR	34	Mayurakshi	1045 P	2.500	23° 54' 6.35"N	88° 4' 23.65"E	BIKALPA TRADERS PVT LTD	29/06/2017	23/03/2019	23/03/2019	23/03/2024	700162.075	
161/SB2021	SANKAR MARUI	30	Mayurakshi	695 P	1.800	23° 54' 33.37"N	88° 4' 49.02"E	PRADIP AGARWAL	29/06/2017	30/08/2019	30/08/2019	30/08/2024	350081.037	
178/SB2021	PANCHTHUPI	149	Mayurakshi	1107 P	2.900	23° 52' 53.06"N	87° 58' 52.58"E	SUDIP DEY	12/02/2018	30/08/2019	30/08/2019	30/08/2024	344246.353	
218/SB2021	TALGRAM	42	Mayurakshi	2769 P, 2631 P	0.900	23° 52' 8.61"N	88° 2' 37.20"E	AMBEY NIWAS PVT LTD	12/02/2018	04/09/2019	04/09/2019	04/09/2024	65640.194	
255/SB2021	TALGRAM	42	Mayurakshi	2769 P	1.200	23° 52' 4.10"N	88° 2' 30.80" E	AMBEY NIWAS PVT LTD					0	EC Awaiting
261/SB2021	SANTOSHPUR	40	Mayurakshi	2697 P	2.100	23° 52' 36.60" N	88° 3' 18.30"E	ADYAMA TRADELINK PVT LTD					0	EC Awaiting
264/SB2021	SANTOSHPUR	40	Mayurakshi	1 P	0.900	23° 52' 54.20"N	88° 3' 28.60" E	KAFARUL SHEIKH					0	EC Awaiting
272/SB2021	DEWAR	98	Mayurakshi	383 P	4.330	23° 52' 27.50"N	87° 51' 40.70"E	PAWAN ARORA					0	EC Awaiting
278/SB2021	DEWAR	98	Mayurakshi	383 P	3.580	23° 52' 27.38"N	87° 51' 47.10"E	PAWAN ARORA					0	EC Awaiting

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284/SB2021	DEWAR	98	Mayurakshi	384 P	4.850	23° 52' 28.40" N	87° 51' 25.80"E	PAWAN ARORA					0	EC Awaiting
292/SB2021	TALBONA	100	Mayurakshi	1003P, 1004 P, 1005 P	4.900	23° 52' 50.61"N	87° 52' 40.78"E	SAMIR KUMAR DEY					0	EC Awaiting
324/SB2021	JHILERA	101	Mayurakshi	677 P, 870 P	4.210	23° 52' 49.71"N	87° 52' 55.15"E	MANIK SARKAR					0	EC Awaiting
344/SB2021	MADDA	134	Mayurakshi	2362 P, 2363 P, 2364 P	4.310	23° 53' 13.39"N	87° 54' 53.74"E	Ainal Haque					0	EC Awaiting
364/SB2021	SUNIA	70	Mayurakshi	1 P	2.200	23° 55' 8.35"N	88° 5' 33.63"E	Triumph Sales and Services					0	EC Awaiting
375/SB2021	SHENAI	102	Mayurakshi	1569 P, 1571 P	0.600	23° 52' 49.44"N	87° 53' 34.81"E	REJAUL HAQUE					0	EC Awaiting
421/SB2021	SANTOSHPUR	40	Mayurakshi	2697 P	3.000	23° 52' 55.12"N	87° 3' 27.22"E	SAGAR SEKH					0	EC Awaiting
464/SB2021	ARAJI JAGADISHBATI	28	Mayurakshi	1 P	4.000	23° 54' 39.95"N	88° 4' 53.99"E	TAPAN MONDAL					0	EC Awaiting
521/SB2021	PHUPRA	143	Mayurakshi	1831 P	1.810	23° 53' 5.17"N	87° 58' 19.04"E	KRISHNA AGARWAL					0	EC Awaiting
530/SB2021	BHABANANDAPUR	100	Mayurakshi	478 P	1.100	23° 56' 10.09"N	88° 6' 37.57"E	SUDIP DEY					0	EC Awaiting
533/SB2021	LAKKHIKANTAPUR	96	Mayurakshi	1994 BATA OF 1852	0.890	23° 57' 34.71"N	88° 5' 35.77"E	SUDIP DEY					0	EC Awaiting
544/SB2021	BHARATPUR	68	Mayurakshi	1 P	3.000	23° 53' 55.79"N	88° 4' 9.14"E	TAPAN MONDAL					0	EC Awaiting
553/SB2021	BHARATPUR	68	Mayurakshi	10496 P	3.000	23° 53' 28.34" N	88° 3' 54.54"E	SUDIP DEY					0	EC Awaiting
733/SB2021	HULASPUR	100	Bhairab	928 P	0.730	24° 11' 38.97"N	88° 23' 50.41"E	FAZARUDDIN MONDAL					0	EC Awaiting
785/SB2021	MANDRA	103	Mayurakshi	699 P	2.860	23° 52' 53.56"N	87° 53' 17.21"E	BIKALPA TRADERS PVT LTD					0	EC Awaiting
1194/SB2021	RAJYADHARPUR	135	Mayurakshi	59 P, 60 P	3.600	23° 53' 5.02"N	87° 55' 14.55"E	PREMI ARORA					0	EC Awaiting
1220/SB2021	RAHIMANAGAR	42	Mayurakshi	1624 P	0.400	24° 8' 15.06"N	88° 2' 42.79"E	HUMAYUN KABIR					0	EC Awaiting
1240/SB2021	MALIANDI	151	Mayurakshi	65 P, 1250 P	1.440	23° 52' 50.46" N	87° 57' 25.45"E	SUDIP DEY					0	EC Awaiting
1260/SB2021	MALIANDI	151	Mayurakshi	121 P	1.050	23° 53' 3.20"N	87° 57' 54.85"E	SUDIP DEY					0	EC Awaiting

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1263/SB2021	MALIANDI	151	Mayurakshi	121 P	0.700	23° 52' 49.84" N	87° 58' 57.03"E	SUDIP DEY					0	EC Awaiting
1303/SB2021	HIJAL	41	Mayurakshi	4027 P	1.000	23° 58' 15.79"N	88° 9' 14.00"E	DULAL CHANDRA BISWAS					0	EC Awaiting
1317/SB2021	HIJAL	41	Mayurakshi	4027 P	0.450	23° 57' 58.73"N	88° 8' 57.65"E	DULAL CHANDRA BISWAS					0	EC Awaiting
1346/SB2021	HIJAL	41	Mayurakshi	8749 P	0.700	23° 57' 43.70"N	88° 9' 2.25"E	ASHOK KUMAR JHA					0	EC Awaiting
1357/SB2021	HIJAL	41	Mayurakshi	8515 P	0.500	23° 57' 40.69" N	88° 8' 23.42"E	DULAL CHANDRA BISWAS					0	EC Awaiting
1380/SB2021	MADANPUR DAFARPUR	73	Mayurakshi	1111 P	0.550	23° 55' 22.69"N	88° 6' 6.07"E	SUDIP DEY					0	EC Awaiting
1383/SB2021	ANDULIA	97	Mayurakshi	1758 P	0.300	23° 57' 15.99"N	88° 5' 16.62"E	SUDIP DEY					0	EC Awaiting
1389/SB2021	HIJAL	41	Mayurakshi	6167 P	0.800	23° 57' 29.92"N	88° 7' 15.23"E	TAPAN MONDAL					0	EC Awaiting
1409/SB2021	HIJAL	41	Mayurakshi	6167 P	1.000	23° 57' 19.89"N	88° 7' 4.91"E	TAPAN MONDAL					0	EC Awaiting
1489/SB2021	BELGRAM	142	Mayurakshi	1196 P	1.390	23° 52' 59.85"N	87° 57' 50.53"E	KRISHNA AGARWAL					0	EC Awaiting
1632/SB2021	RANIPUR	101	Mayurakshi	680 P	1.610	23° 56' 18.60"N	88° 6' 35.10"E						0	
1646/SB2021	SEKENDRA	14	Bhagirathi-Hooghly	3679 P	2.550	24° 30' 23.39"N	88° 5' 19.88"E						0	
1649/SB2021	PAHARPUR	37	Bhairab	543 P	1.080	24° 11' 49.56"N	88° 25' 11.61"E						0	

8.3 Detail of production of sand and other minerals during last five years

Table 8.2: Details of production of sand as per mine plan in Murshidabad district

Sl. No.	Year	Name of mineral	Total Production (inCft.)
1	2017-2018	Sand	1831450
2	2018-2019	Sand	4025942
3	2019-2020	Sand	4897456
4	2020-2021	Sand	5392003
5	2021-2022	Sand	1034761

9 Details of revenue generated from mineral sector during last five years

Revenue generation of last 5 years is furnished below.

Table No.9.1: District revenue generation from mineral sector (In cr.)

Year of Auction	Auction Amount	Royalty Received
2017-2018	19.9501400	0.2765488
2018-2019	3.7258000	0.6079173
2019-2020	0.2550000	0.7395160
2020-2021	0	0.8141926
2021-2022	0	0.1562490
TOTAL	**23.9309400**	**2.59442370**

10 Transport

The district physiography is dominated by almost flatterrain. Surface transport (road and rail) is the most important way of transport in the district.

The National Highway No-34 passes through the district along with a number of State Highways. SH-07, SH-11 and SH-11A are the state highways which connects different parts of the district. The Farakka Bridge in the district serves as vital link in both rail and road communication. The district is well managed through its extensive road & rail connections with all the important places of the State (Figure 10.1).

The major rail line runs from northtosouth and connects the district to Kolkata and North Bengal. There is another line that branches out from this line at Azimganj and connects the Sahebgunj loop at Nalhati (Birbhum). The Ajimganj-Nalhati railway line is the oldest line in the district. Sealdah-Lalgola Section is located on the Western side of the river Ganga while the Katwa- Ajimganj Section is located on the Eastern side of the river.

Murshidabad district does not have anyAirport.The nearest airport is N.S.C. Bose International Airport at Dumdum. From Kolkata Berhampore the District Capital town of Murshidabad is 195 Kms (Census, 2011).

Existing sand and gravel riverbedsof the district are connected with the state highways by blacktop or village/link roads. However, there is scope for development of infrastructural structure. Mining of riverbed sand in the potential areas can generate considerable revenue and which can be utilized for development of road network & infrastructure of the sector.

A transportation map demarcating approach road to the potential sand blocks from the nearest National Highway/ Sate Highway has been prepared and presented in Figure 10.2.

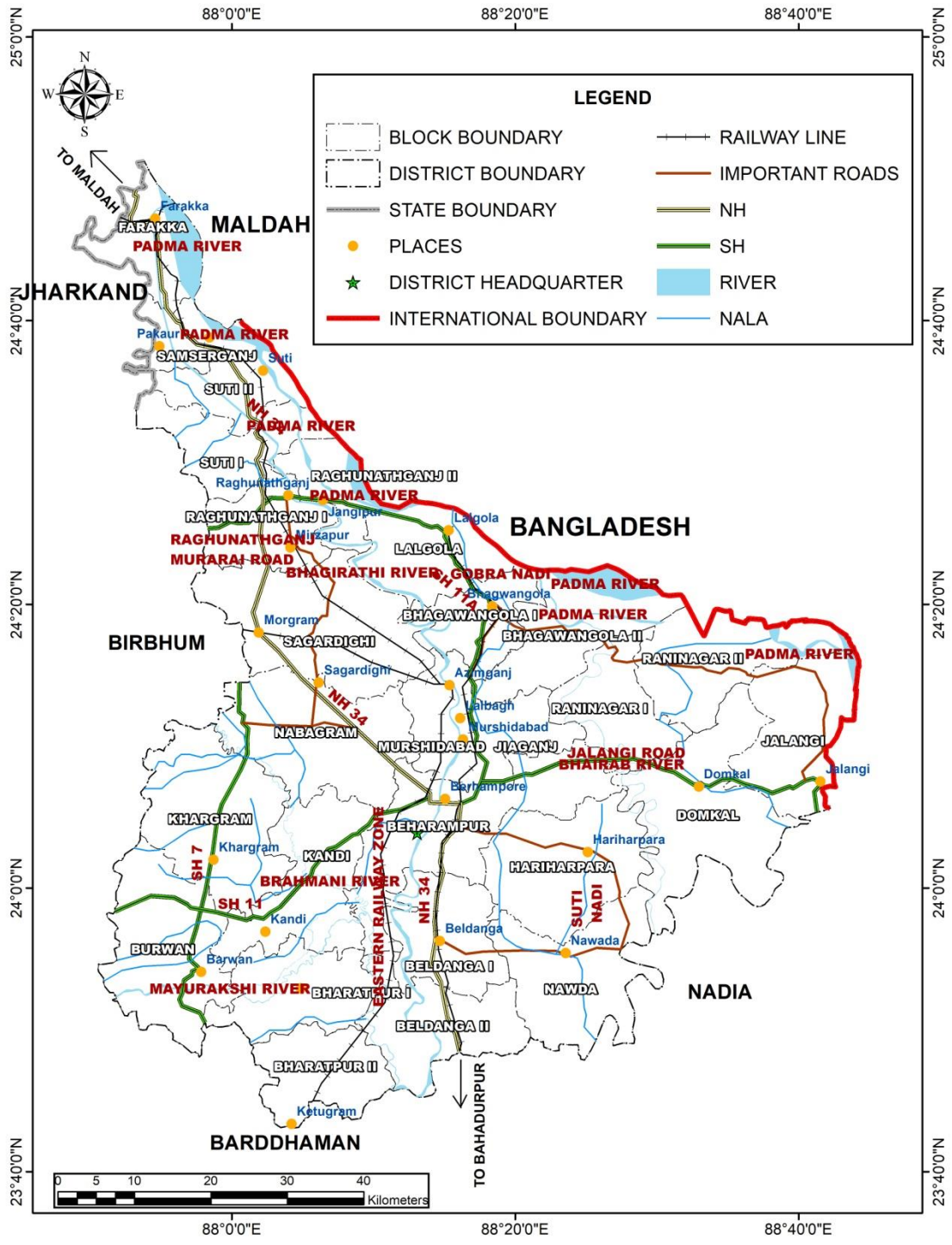

Figure 10.1: Transportation map of Murshidabad District

(Source: National Informatics Centre)

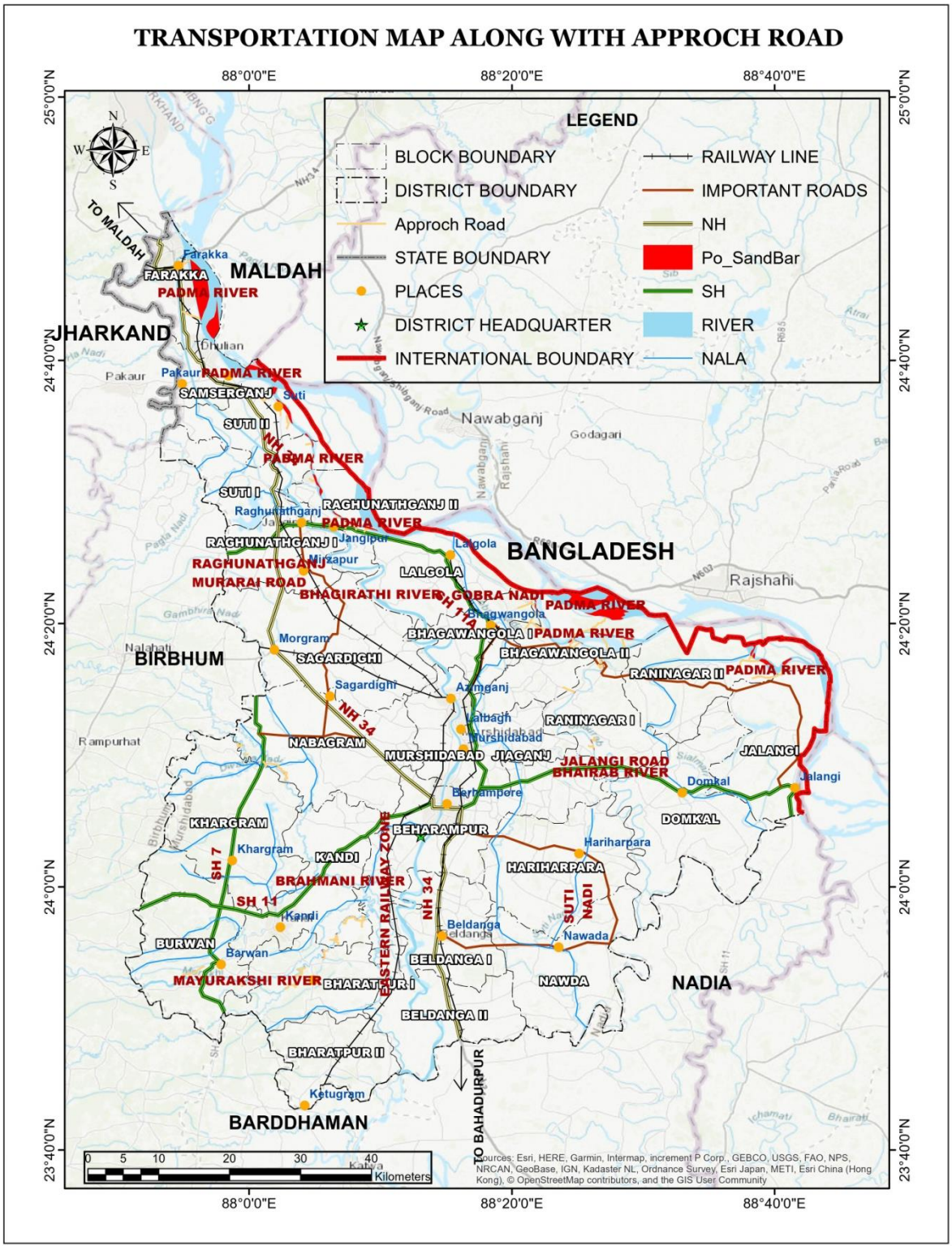

Figure 10.2: Map showing approach road to potential sand bars

11 Remedial measure to mitigate the impact of mining

11.1Environmental Sensitivity

The Murshidabad area represents a unique geo- environmental setup. As human population expands, forests are being depleted for the extension of agricultural lands, introduction of new settlements, roadways etc.

Due to unprecedented growth of population during the last few, nature has started reacting sharply to the accumulated human guilt. Soil erosion and its conservation play an important role.

The land use practices play the most important role in determining the stability factors in respect of landslide hazards. Stone quarrying from the slope is another way of human intervention that causes occasional slope failure.

11.2 Sand mining Impact

Another serious environmental problem around the globe in recent years is of Sand and gravel mining. Sand mining is a process of extraction of sand from an open pit, river bed, sea beaches, ocean floor, river banks, deltas and island dunes. The extracted sand could be utilised for various types of manufacturing, such as concrete used in the construction of building and other structures. The sand can also be used as an abrasive. The demand for sand will increase with population growth and urbanization. The high demand of sand has led to unsustainable sand mining process resulting in illegal mining.

Although most jurisdictions have legal limit on the location and volume of sand that can be mined, illegal sand extraction is taking place in many parts of the country due to rapid urbanisation and industrialisation.

Removal or extraction of too much sand from rivers leads to erosion of river banks. Deltas can recede due to sand mining. These destructive effects of sand mining ultimately result in loss of fertile land and property. It also destabilizes the ground and causes failure of engineering structures.

In-stream mining directly alters the channel geometry and bed elevation. By removing sediment from the channel, disrupts the preexisting balance between sediment supply and transporting capacity, typically inducing incision upstream and downstream of the extraction site. The resultant incision alters the frequency of floodplain inundation along the river courses, lowers valley floor water tables and frequently leads to destruction of bridges and channelization structures.

Sand Mining in beaches disturbs the ecosystem of different fauna of the beaches. The sand mining from natural barriers, made up of sand, causes flooding of the natural habitat. The sand mining activity destroys the aesthetic beauty o beaches and river bank and makes the ecosystem unstable. If there are popular tourist destination, tourism potential of such areas will decline.

It can be concluded that there has been little in-depth research on the environmental, social and political effects of land use practices and calls for urgent attention by the competent authority.

11.3 Remedial measure

11.3.1 Sustainable Mining Practices:

- The depth of mining in riverbed shall not exceed 3 meter or base flow level whichever is less, provided that where the Joint Inspection Committee certifies about excessive deposit or over accumulation of mineral in certain reaches requiring channelization, it can go above 3 meters.
- Mining shall be done in layers of 1 meter depth to avoid ponding effect and after first layer is excavated, the process will be repeated for the next layers.
- No stream should be diverted for the purpose of sand mining. No natural water course and/ or water resources are obstructed due to mining operations.
- No blasting shall be resorted to in river mining and without permission at any other place.

11.3.2 Monitoring the Mining of Mineral and its Transportation:

- For each mining lease site the access should be controlled in a way that vehicles carrying mineral from that area are tracked and accounted for.
- There should be regular monitoring of the mining activities in the State to ensure effective compliance of stipulated EC conditions and of the provisions under the Minor Mineral Concessions Rules framed by the State Government.

11.3.3 Noise Management:

- Noise arising out of mining and processing shall be abated and controlled at source to keep within permissible limit.
- Restricted sand mining operation has to be carried out between 6 am to 7 pm.

11.3.4 Air Pollution and Dust Management:

- The pollution due to transportation load on the environment will be effectively controlled and water sprinkling will also be done regularly.

- Air pollution due to dust, exhaust emission or fumes during mining and processing phase should be controlled and kept in permissible limits specified under environmental laws.
- The mineral transportation shall be carried out through covered trucks only and the vehicles carrying the mineral shall not be overloaded. Wheel washing facility should be installed and used.

11.3.5 Bio-Diversity Protection:

- Restoration of flora affected by mining should be done immediately. Five times the number of trees destroyed by mining to be planted preferably of indigenous species. Each EC holder shall have to undertake plantation of trees over at least 20% of the total area of lease in the same plot or plots utilised for such working.
- No mining lease shall be granted in the forest area without forest clearance in accordance with the provisions of the Forest Conservation Act, 1980 and the rules made there under.
- Protection of natural home of any wild animal shall have to be ensured.
- No felling of tree near quarry is allowed. For mining lease within 10km of the National Park / Sanctuary or in Eco-Sensitive Zone of the Protected Area, recommendation of Standing Committee of National Board of Wild Life (NBWL) has to be obtained as per the Hon'ble Supreme Court order in I.A. No. 460 of 2004.
- Spring sources should not be affected due to mining activities. Necessary protection measures are to be incorporated.

11.3.6 Management of Instability and Erosion:

- Removal, stacking and utilization of top soil should be ensured during mining. Where top soil cannot be used concurrently, it shall be stored separately for future use keeping in view that the bacterial organism should not die and should be spread nearby area.
- The EC should stipulate conditions for adequate steps to check soil erosion and control debris flow etc. by constructing engineering structures
- Use of oversize material to control erosion and movement of sediments
- No overhangs shall be allowed to be formed due to mining and mining shall not be allowed in area where subsidence of rocks is likely to occur due to steep angle of slope.
- No extraction of stone / boulder / sand in landslide prone areas.
- Controlled clearance of riparian vegetation to be undertaken.

11.3.7 Waste Management:

- Site clearance and tidiness is very much needed to have less visual impact of mining.

- Dumping of waste shall be done in earmarked places as approved in Mining Plan.
- Rubbish burial shall not be done in the rivers.

11.3.8 Pollution Prevention:

- Take all possible precautions for the protection of environment and control of pollution.
- Effluent discharge should be kept to the minimum and it should meet the standards prescribed.

11.3.9 Protection of Infrastructure:

- Mining activities shall not be done for mine lease where mining can cause danger to site of flood protection works, places of cultural, religious, historical, and archeological importance.
- For carrying out mining in proximity to any bridge or embankment, appropriate safety zone should be worked out on case to case basis, taking into account the structural parameters, location aspects and flow rate, and no mining should be carried out in the safety zone so worked out.

Mining shall not be undertaken in a mining lease located in 300-500 meter of bridge, 300 meter upstream and downstream of water supply / irrigation scheme, 100 meters from the edge of National Highway and railway line, 50 meters from a reservoir, canal or building, 25 meter from the edge of State Highway and 10 meters from the edge of other roads except on special exemption by the Sub-Divisional level Joint Inspection Committee.

12 Suggested reclamation plan for already mined out areas

As per statute all mines/quarries are to be properly reclaimed before finalclosure of the mine. Reclamation plans should include:

a) A baseline survey of river cross section. The study of cross section is basis for delineating channel form. Cross-sections must be surveyed between two monumented endpoints set on the river banks, and elevations should be referenced based on benchmark set in the area;

b) The proposed mining cross-section data should be plotted over the baseline data to illustrate the vertical extent of the proposed excavation;

c) The cross-section of the replenished bar should be the same as the baseline data. This illustrates that the bar elevation after the bar is replenished will be the same as the bar before extraction;

d) A planimetric map showing the aerial extent of the excavation and extent of the riparian buffers;

e) A planting plan developed by a plant ecologist familiar with the flora of the river for any areas such as roads that need to be restored;

f) Each EC holder shall have to undertake plantation of trees over at least 20% of the total area of the plot or plots of land as subject to such working in accordance with a plan approved by the concerned Divisional Forest Officer holding jurisdiction, provided further the competent authority l.e, The Divisional Forest Officer may fix up norms for plantation of trees in a particular area regarding choice of species, spacing, nos of trees and maintenance etc.;

g) A monitoring plan has to establish.

13 Risk assessment and disaster management plan

Risk analysis is the systematic study of risks encountered during various stages of miningoperation. Risk analysis seek to identify the risks involved in mining operations, tounderstand how and when they arise, and estimate the impact (financial or otherwise) ofadverse outcomes. The sand mining operation in the district is mainly done manually.

13.1 Identification of risk due to river sand mining

There is no land degradation due to mining activities as mining is done only on river beddrysurface. There will be no OB or waste generation as the sand is exposed in the river bedandis completely saleable. There will be neither any stacking of soil nor creation of OB dumps. The mining activity will carry out upto a maximum depth of 3m below the surface level. So, there is no chance of slope failure, bench failure in the mines. However, there are some identified risks in the mining activity which are as follows:

1. Accident during sand loading and transportation
2. Inundation/ Flooding
3. Quick Sand Condition

13.2 Mitigation measures

13.2.1 Measures to prevent accidents during loading and transportation:

- During the loading truck should be brought to a lower level so that the loading operation suits to the ergonomic condition of the workers.
- The workers will be provided with gloves and safety shoes during loading.
- Opening of the side covers of the truck should be done carefully and with warning to prevent injury to the loaders.
- Mining operations will be takes place during daylight only.
- The truck will be covered with tarpaulin and maintained to prevent any spillage.
- To avoid danger while reversing the trackless vehicles especially at the embankment and tipping points, all areas for reversing of lorries should be made man free as far as possible.
- All transportation within the main working will be carried out directly under the supervision and control of the management.
- Overloading should not be permitted and the maximum permissible speed limit should be ensured.
- There will be regular maintenance of the trucks and the drivers will have valid driving license.

13.2.2Measures to prevent incidents during Inundation/ Flooding:

To minimize the risk of flooding/ inundation following measures should be under taken:

- Mining will be completely closed during the monsoon months.
- Proper weather information particularly on rain should be kept during the operational period of mines so that precautionary measures will be undertaken.

13.2.3 Measures for mitigation to quick sand condition:

- Quick sand zone and deep-water zone will be clearly demarcated and all the mines' workers will be made aware of the location.
- Mining will be done strictly as per the approved mining plan.

13.3 Disaster management plan

As the depth of mining will be maximum of 3m below the surface level considering local condition, the risk related to miningactivity is much less. The mining operation will be carried out under the supervision of experienced and qualified Mines Manager having Certificate of Competency to manage themines granted by DGMS. All the provisions of Mines Act 1952, MMR 1961 and MinesRules 1955 and other laws applicable to mine will strictly be complied. During heavyrainfall and during the monsoon season the mining activities will be closed. Propercoordination with Irrigation Department should be maintained so that at the time of releasingwater, if any, from the dam suitable warning/information is given in advance. Special attention and requisite precautions shall be taken while working in areas of geologicalweakness like existence of slip, fault etc. The mining site will be supplied with first aid facilities and the entire mines worker will have access to that.

14 Conclusion and Recomendations

The District Survey Report ofMurshidabad district has been prepared as per the guidelines issued by Ministry of Environment, Forests and Climate Change (MoEF&CC) time to time. The Guideline of WBMMCR, 2016 is also taken into consideration while preparation of this report.

Potential areas where mining can be allowed are identified and discussed in this DSR. This DSR would also help to estimate the annual rate of replenishment wherever applicable.

Preparation of this DSR involved both primary and secondary data generation. The primary data generation involved the site inspection, survey, ground truthing etc. while secondary data has been acquired through various authenticated sources and satellite imagery studies.

The district survey report of Murshidabad district also describes the general geographical profile of the district, distribution of natural resources, livelihood, climatic condition and sources of revenue generation.

The Murshidabad district is divided into two broad zones namely Radh and Bagri, which are situated on the Western and Eastern side of the river Bhagirathi respectively. Radh is primarily a continuation of the sub-Vindhyan region composed of laterite clay. This region is elevated than the eastern Bagri region. Some hillocks are situated in this region, of which the most popular one is known as Dhuli Pahari. The Eastern tract or Bagri lies almost entirely between the Ganga-Bhagirathi basins and is characterized by the existence of inundation along with many swamps.

The district is characterized by humid tropical monsoon climate. The average annual rainfall in the district is 1128 4mm (2016-2020).

The whole district falls under Zone III as per the earthquake zonation map of India. Major earthquake does not occur in the district; however, many earthquake shocks were reported sinceseventeenth century. Floods are a common feature in the district of Murshidabad of West Bengal, especially, in the low-lying areas of River Bhagirathi Basin. More or less every year the area gets flooded in the form of inundations due to excessive rainfall.

Murshidabad district does not have any major mineral deposits. However, existence of some in-situ hard basalt is reported in the Rajamahal trap (Northern part of the district) has been established based on satellite imegary along with field survey. An area of around 12.02 sq.km has been identified as a potential mineralized zone which can be developed in subsequent years through G2 level of exploration. The district is currently generating revenue from mining of minor minerals such as sand from the riverbed. In-stream mining directly alters the channel geometry and bed elevation. Therefore, mining of riverbed should be carried out scientifically and based on statutory guidelines for conservation of land, river channels.

As per the data received from OC, Minor Minerals, DL&LRO office, Murshidabad, total 143 blocks have been allotted for mining of river sand in the district. Out of which 118 blocks are allotted in Mayurakshi, 10 blocks are allotted Dwarka, 8 blocks in Bramhani, 2 blocks in Jalangi, 2 blocks in Bhairab, 2 blocks in Jalangi/Bhairab and 1 block in Padma River. Total allotted block area for 143 blocks is 288.23 Ha. and estimated reserve is around 6911631 CuM. Beside this, about 44 blocks are in the process of allotment by the competent authority. Revenue generated in the district of Murshidabad from Minor minerals during April 2017 to March 2022 is Rs. 26.53 Crore.

The district has an upside potential for development of Riverbed sand. The occurrence has been reported by Directorate of Mines and Minerals, Government of West Bengal and others in previous instances. It requires further systematic and scientific approach to quantify the resource along with their grade assessment. The occurrences are mostly observed in the river Mayurakshi, Dwarka, Bramhani, Jalangi, Bhairab, and Ganga/Padma. This report also recommends undertaking detail exploration (G1 & G2 level) program to assess the mineral occurrences in the major rivers of the district and should have a proper development and production plan for the specified minerals.

As observed while preparing this DSR of Murshidabad district, mining leases on Mayurakshi River are very closely distributed. It is recommended to carry out scientific study to find the cumulative effect on the cluster of ghats. It is also recommended to redistribute the sand ghatsin the next upcoming auction process.

14.1. Conclusion

I. The river beds of the district are enriched with sand which is highly potential for mining.

II. The replenishment study has been carried out during four seasons for the preparation of this DSR.

III. Both field-based surveys coupled with satellite imagery study and empirical studies were carried out to determine the rate of replenishment in each river of the district.

IV. The determined values of various methods as adopted for replenishment study gives a comparable value and in all cases the values are found to be much more as compared to the capping limit (60%) as suggested in the Enforcement & Monitoring Guidelines for Sand Mining (EMGSM) January 2020, Issued by Ministry of Environment, Forest and Climate Change (MoEF&CC) 2020.

V. Field base study shows variation of replenishment from 96.5 to 97.2% in the district and theoretical replenishment study shows variation from 70% to 79% with an average of 74.33% of replenishment rate in the district.

14.2 Recommendation:

1. The mining lease distribution for the district must be carried out by involving a district level committee constituted with inter-disciplinary members of various departments including irrigation and waterways, DL&LRO, forest, biodiversity, wetland management, SWID or any other relevant department which the district authority may find suitable to include.
2. While recommending for Mining Leases, the District Level Committee should ensure the protection of Biodiversity Zones as recorded by relevant Government Agenesis from time to time.
3. During finalization of mining leases for the district, strict adherence of Supreme Court orders No 1501 dated 03/06/2022 should be followed.
4. Efforts should be given to restrict distribution of mining leases along the confluence zone of the rivers where rich aquatic habitats are reported.
5. Since the state of West Bengal has royalty system in volumetric measurement, specific gravity for sand and gravel has not been determined during this study. However, during the finalization of mining lease if it is found necessary to conduct such test may be initiated by the state government on case-to-case basis.
6. It is recommended to have a periodical review along with primary data collection during pre- and post-monsoon periods to record the seasonal variance of the sedimentation rate on annual basis and update replenishment rate of the district.

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PLATE 1

DRAINAGE MAP OF THE DISTRICT

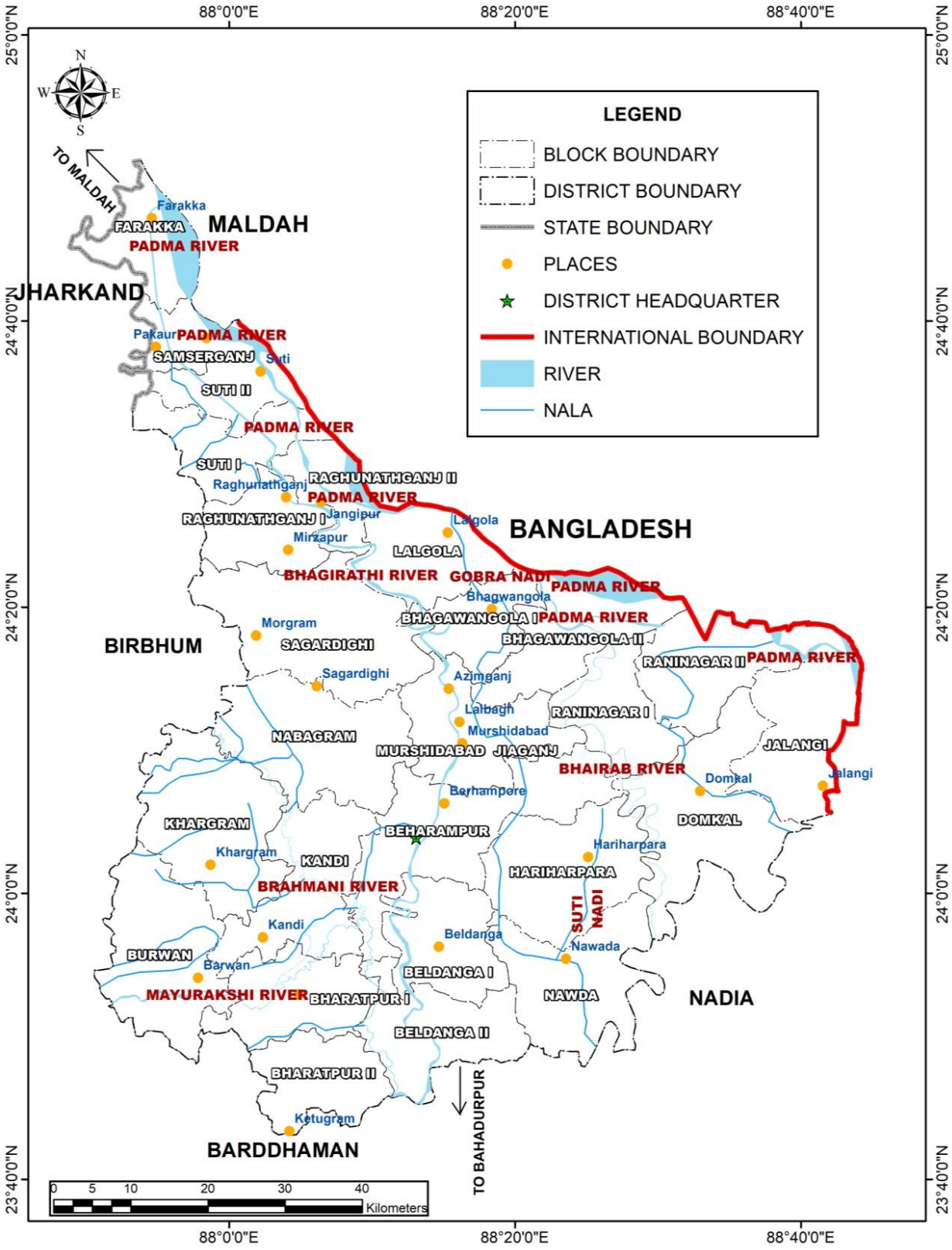
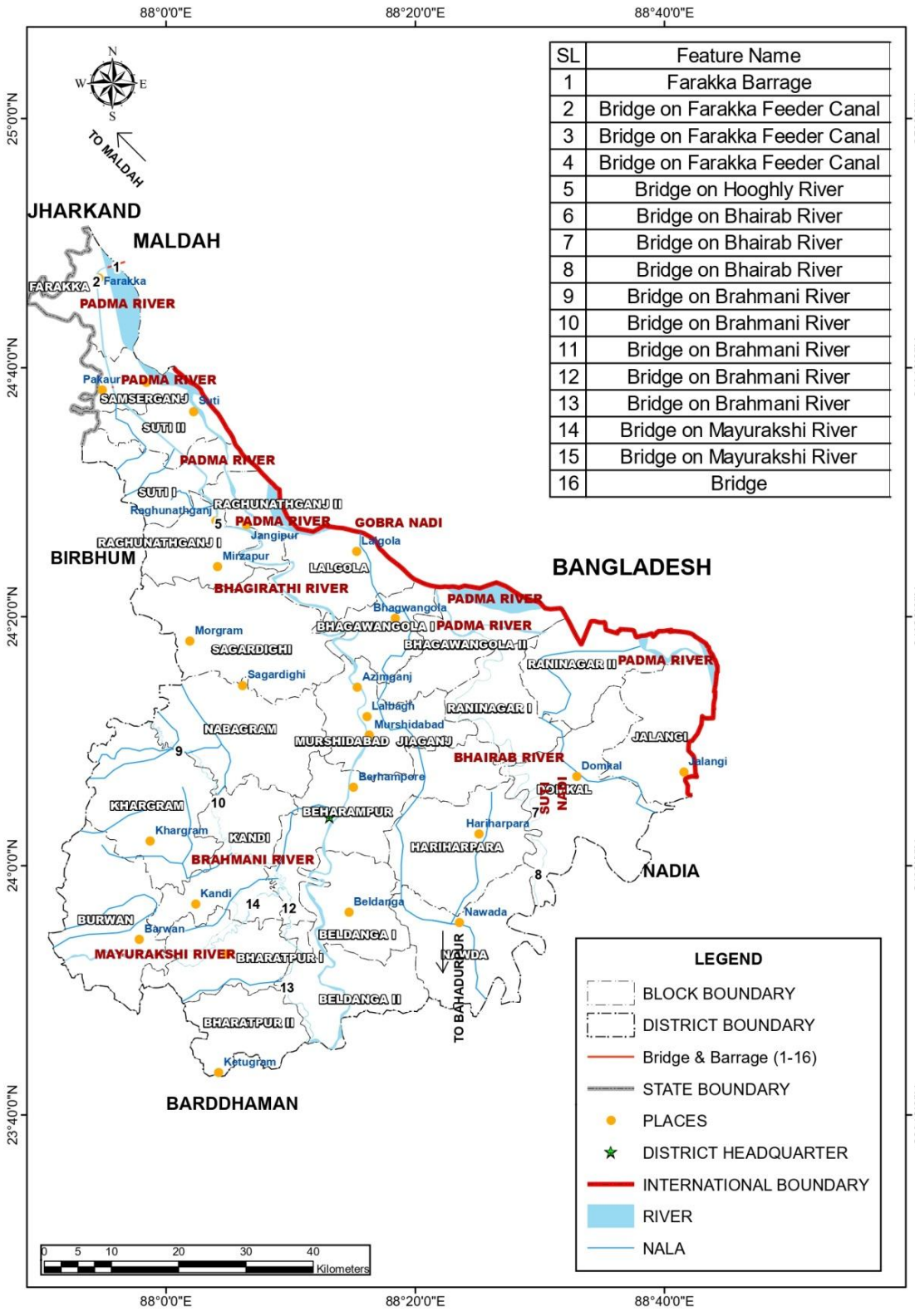


Plate 1A: Drainage Map of the District*(Source: National Informatics Centre -NIC Website, Sept 2020)*



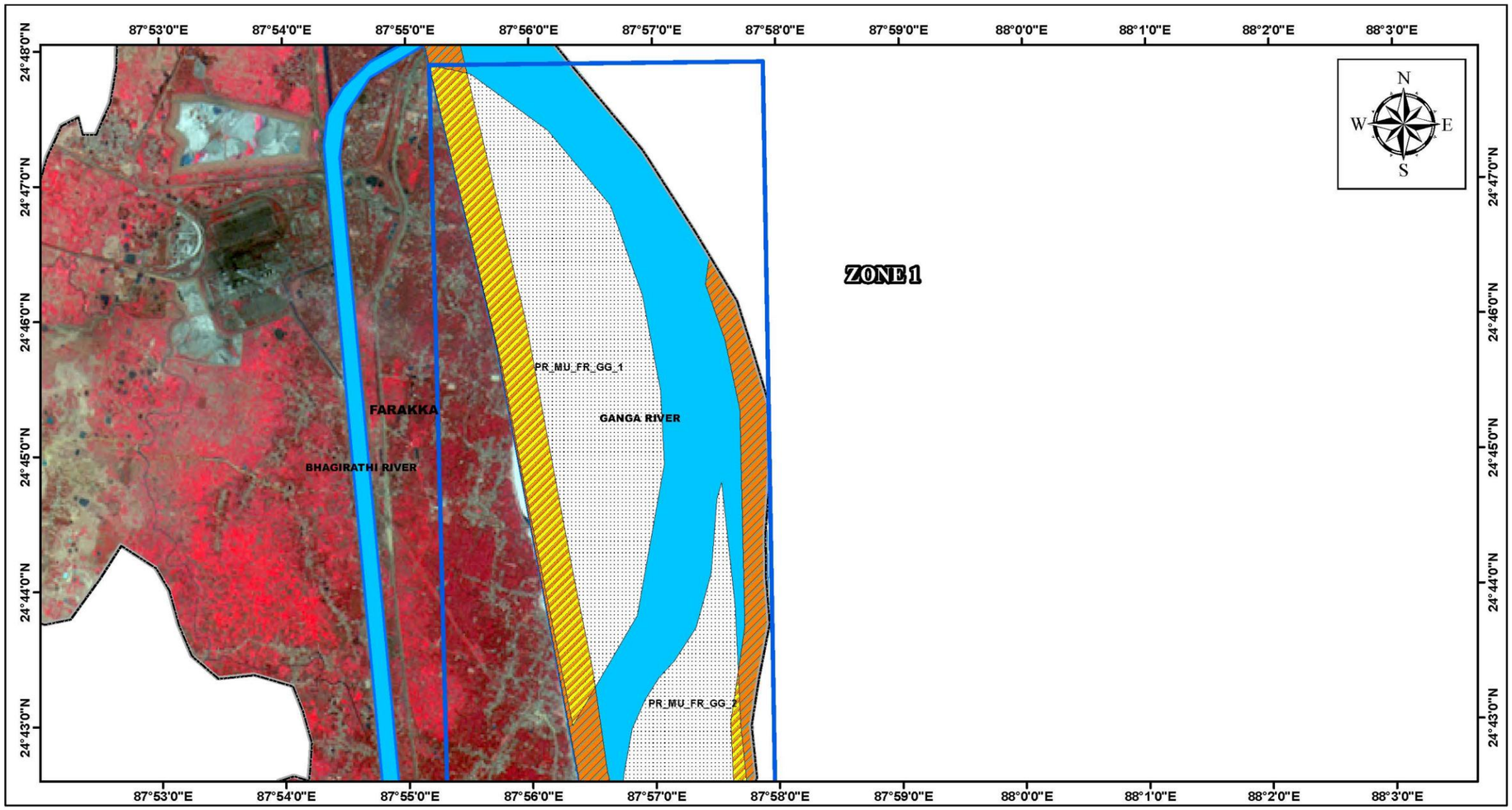
SL	Feature Name
1	Farakka Barrage
2	Bridge on Farakka Feeder Canal
3	Bridge on Farakka Feeder Canal
4	Bridge on Farakka Feeder Canal
5	Bridge on Hooghly River
6	Bridge on Bhairab River
7	Bridge on Bhairab River
8	Bridge on Bhairab River
9	Bridge on Brahmani River
10	Bridge on Brahmani River
11	Bridge on Brahmani River
12	Bridge on Brahmani River
13	Bridge on Brahmani River
14	Bridge on Mayurakshi River
15	Bridge on Mayurakshi River
16	Bridge

LEGEND
- BLOCK BOUNDARY
- DISTRICT BOUNDARY
- Bridge & Barrage (1-16)
- STATE BOUNDARY
- PLACES
- DISTRICT HEADQUARTER
- INTERNATIONAL BOUNDARY
- RIVER
- NALA

Plate No 1B: Location Map of dams, barrages, bridge showing on drainage system of the district *(Source: National Informatics Centre -NIC Website, Sept 2020)*

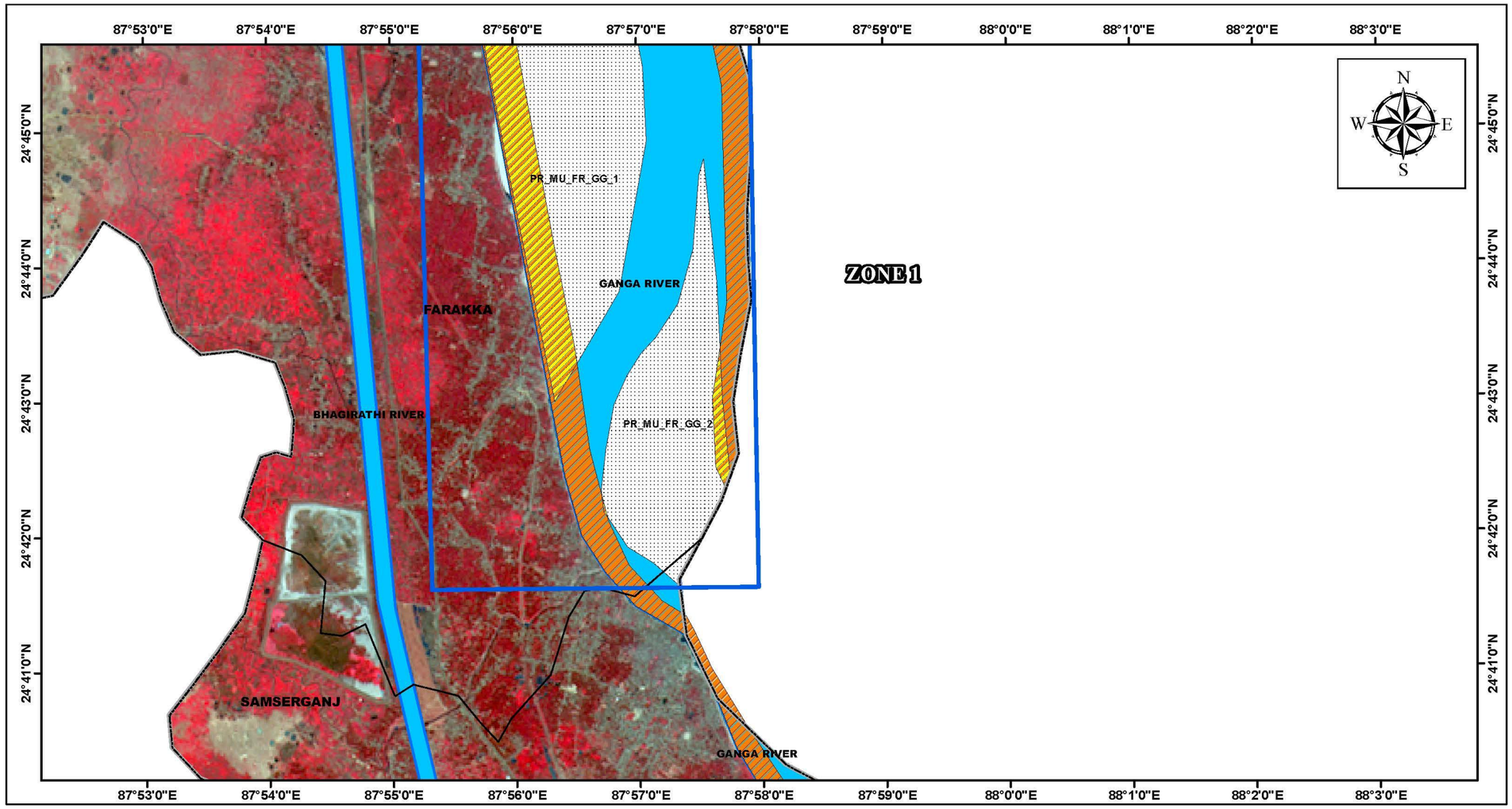
PLATE 2A

DISTRIBUTION MAP OF SAND BARS ON RIVERS DURING PRE-MONSOON PERIOD OF MURSHIDABAD DISTRICT



ABBREVIATION FORM					
PERIOD	PR	PRE MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2A1: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*



ABBREVIATION FORM					
PERIOD	PR	PRE MONSOON	BLOCK	NG	NABAGRAM
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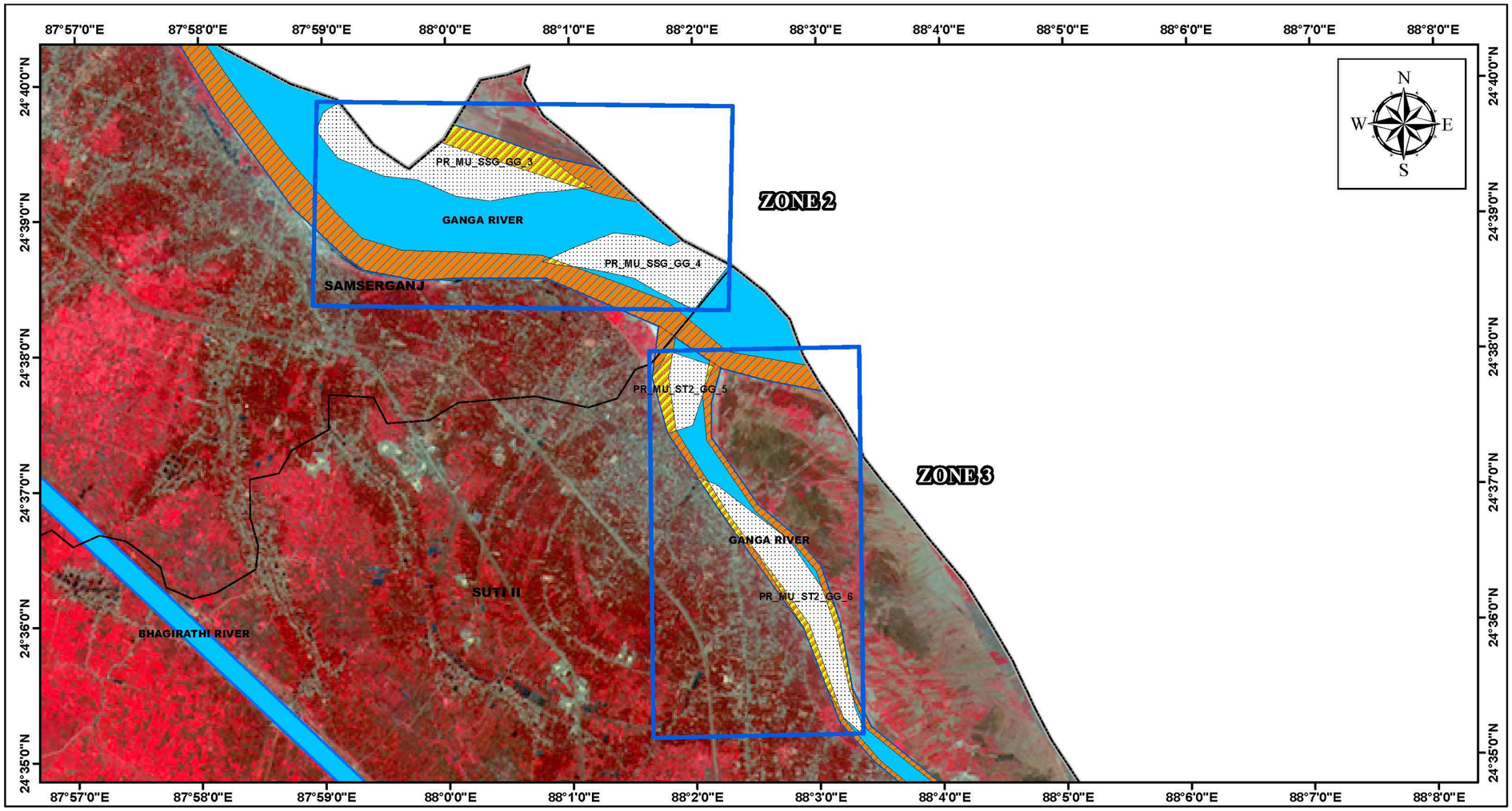
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2A2: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*



ABBREVIATION FORM					
PERIOD	PR	PRE MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
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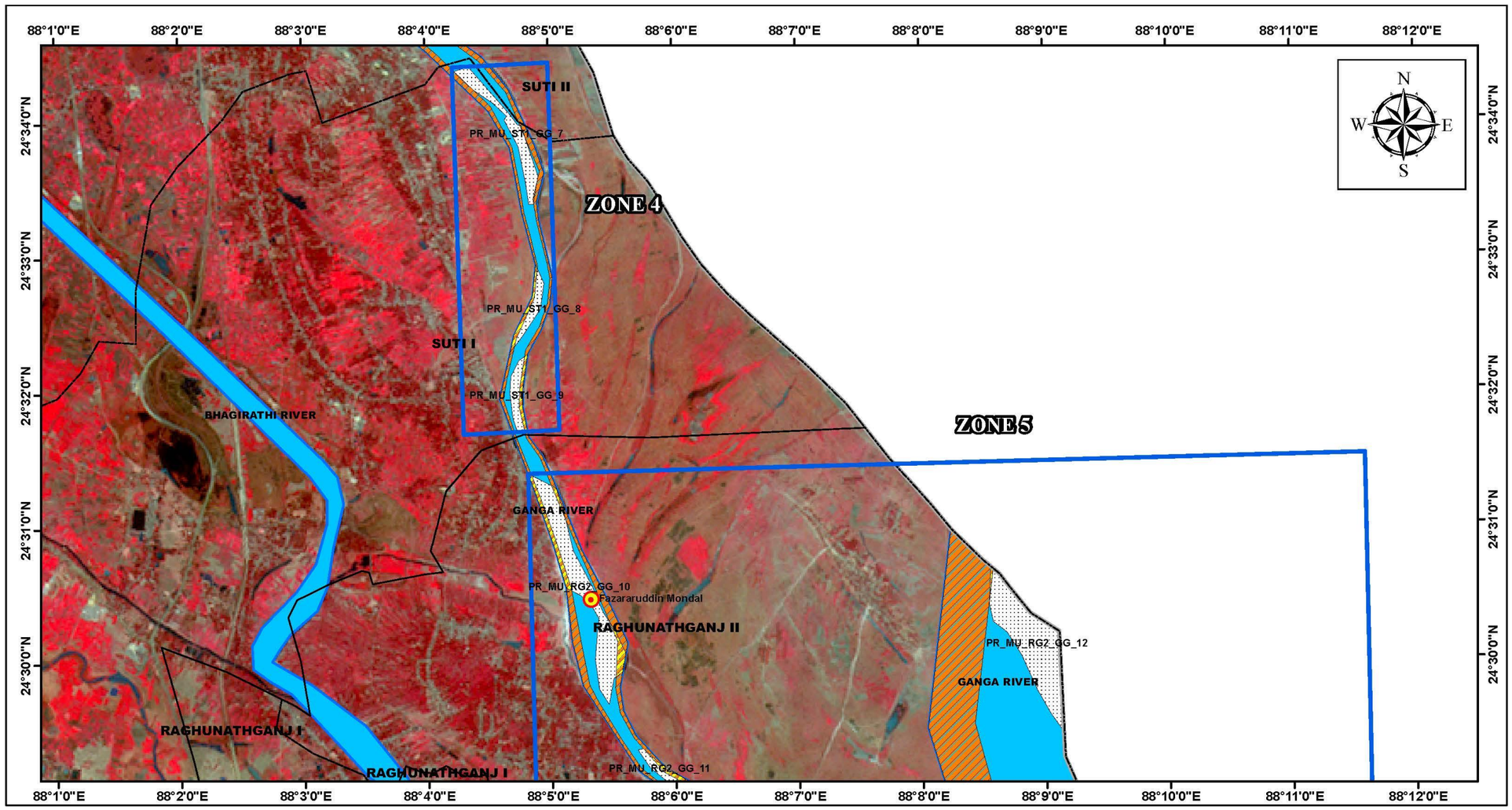
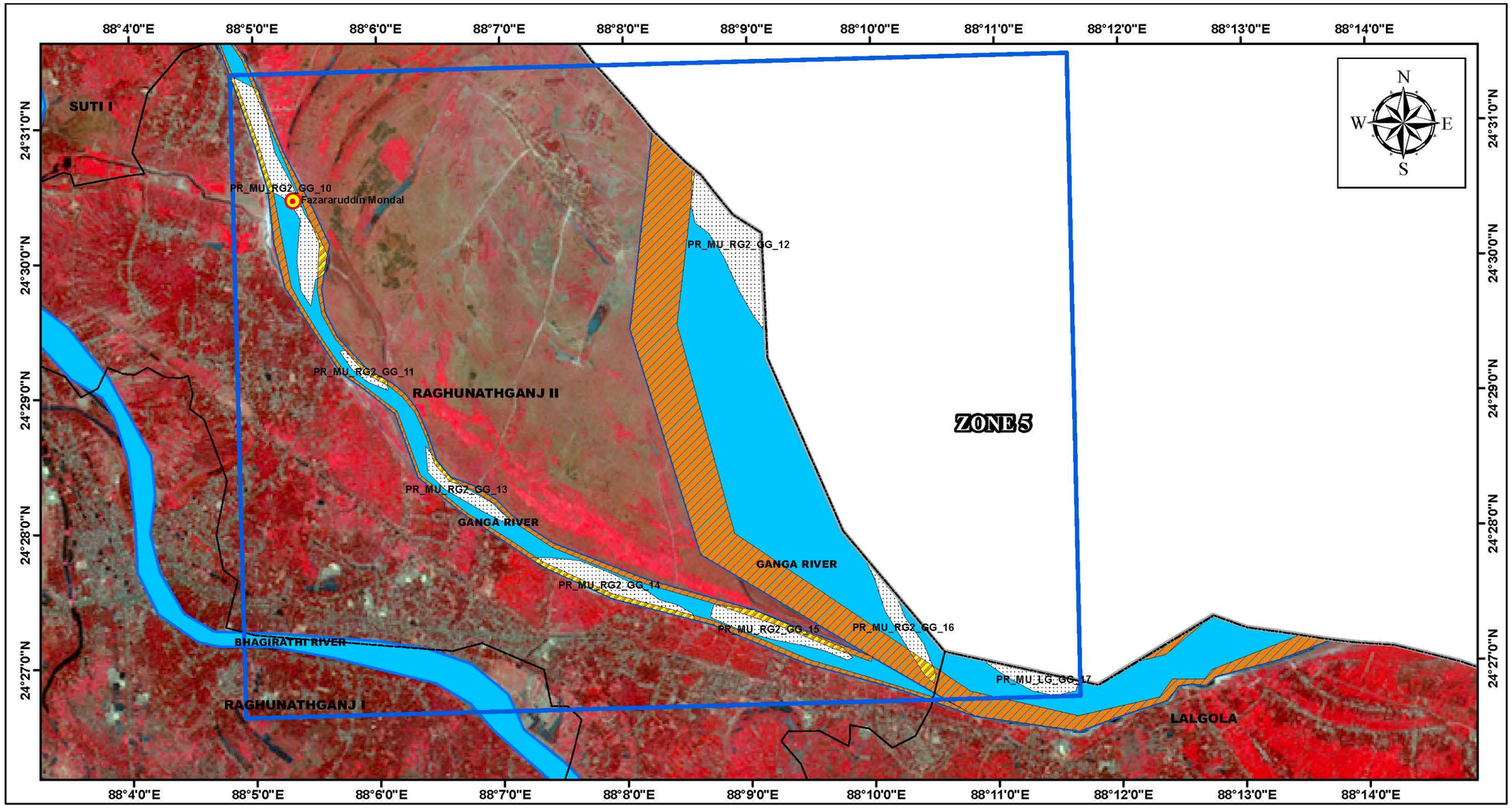
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2A3: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*



ABBREVIATION FORM					
PERIOD	PR	PRE MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2A4: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*



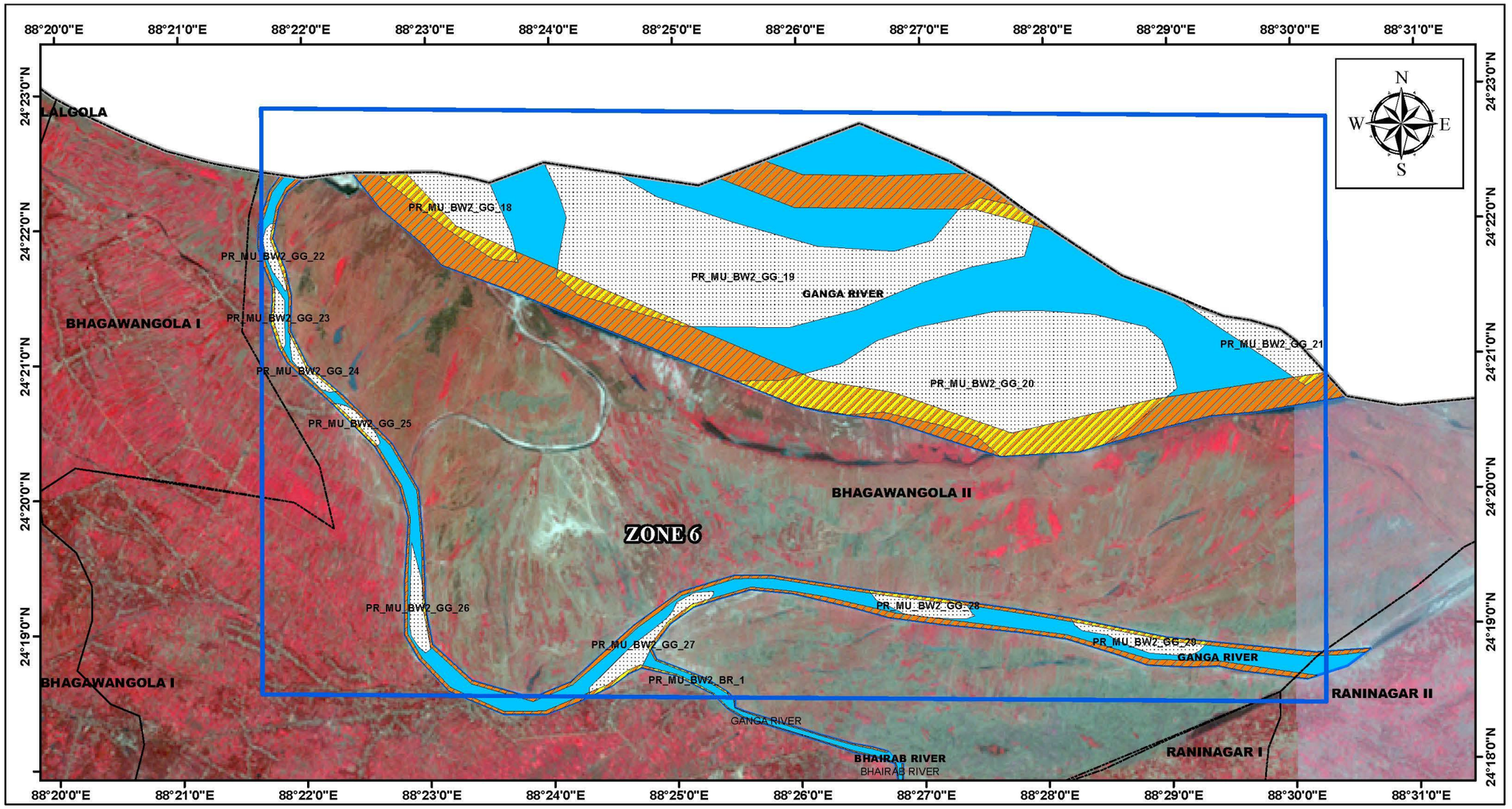
MINING LEASE
RIVER
ZONE 5
BLOCK BOUNDARY
DISTRICT BOUNDARY
RESTRICTED_AREA
SAFETY BARRIER
Pr_Sand bar

1 0.5 0 1 2 3 4
Kilometers

SCALE 1:50,000

ABBREVIATION FORM					
PERIOD	PR	PRE MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2A5: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*



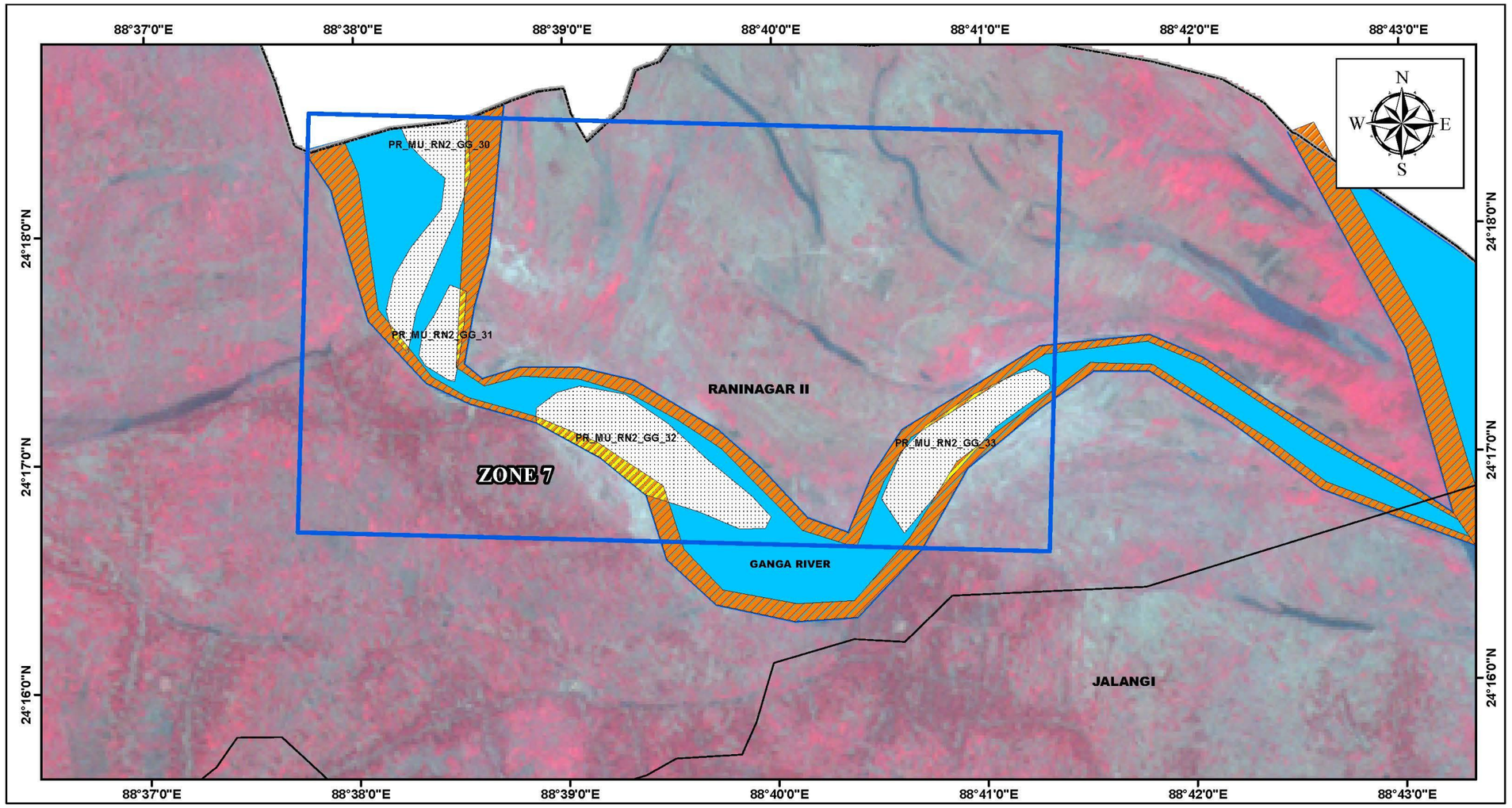
MINING LEASE
ZONE 6
BLOCK BOUNDARY
DISTRICT BOUNDARY
RESTRICTED_AREA
SAFETY BARRIER
RIVER
Pr_Sand bar
RIVER

1 0.5 0 1 2 3 4
Kilometers

SCALE 1:50,000

ABBREVIATION FORM					
PERIOD	PR	PRE MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2A6: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*



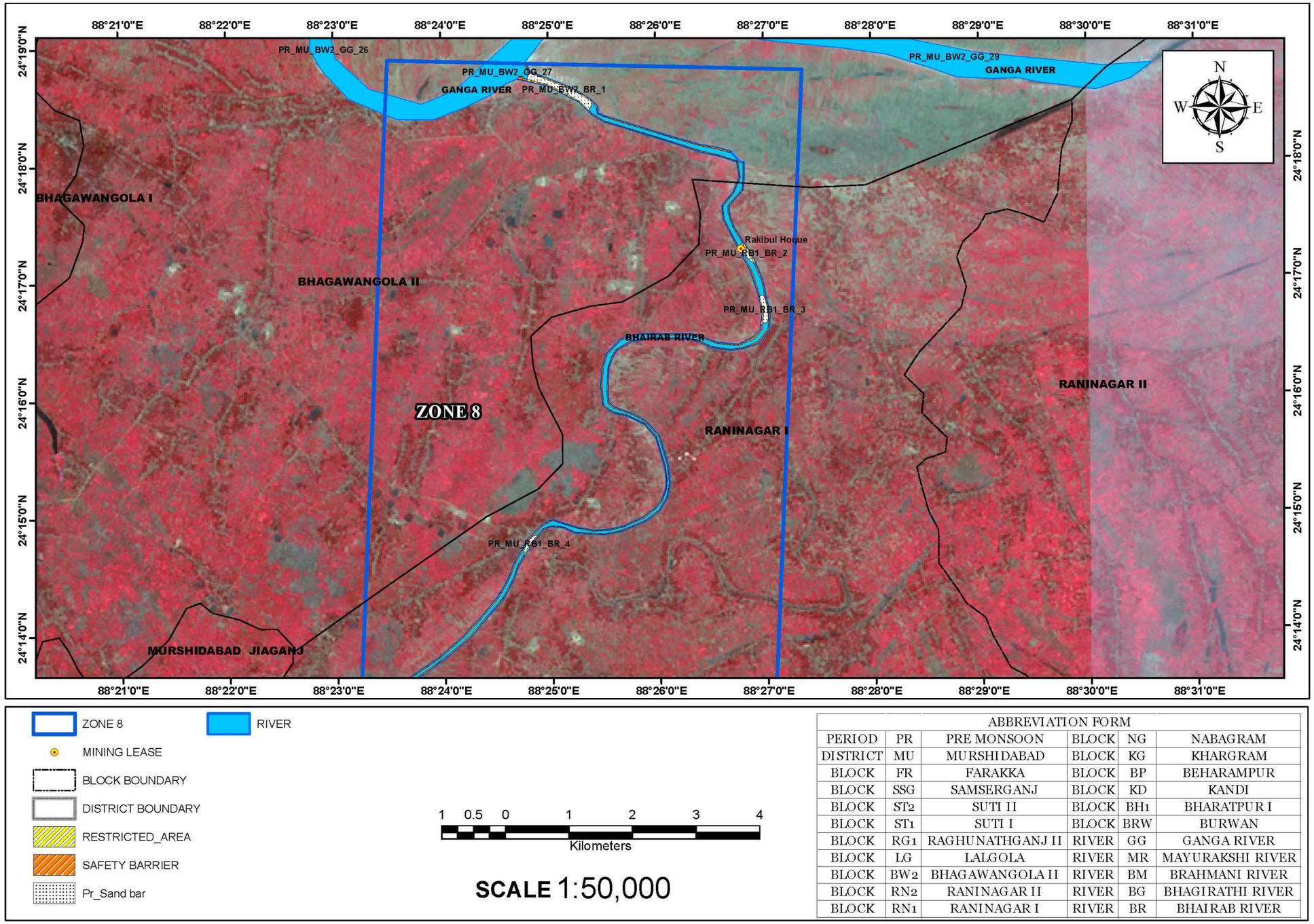
MINING LEASE
ZONE 7
BLOCK BOUNDARY
DISTRICT BOUNDARY
RESTRICTED_AREA
SAFETY BARRIER
Pr_Sand bar
RIVER

0.550.275 0 0.55 1.1 1.65 2.2
Kilometers

SCALE 1:29,525

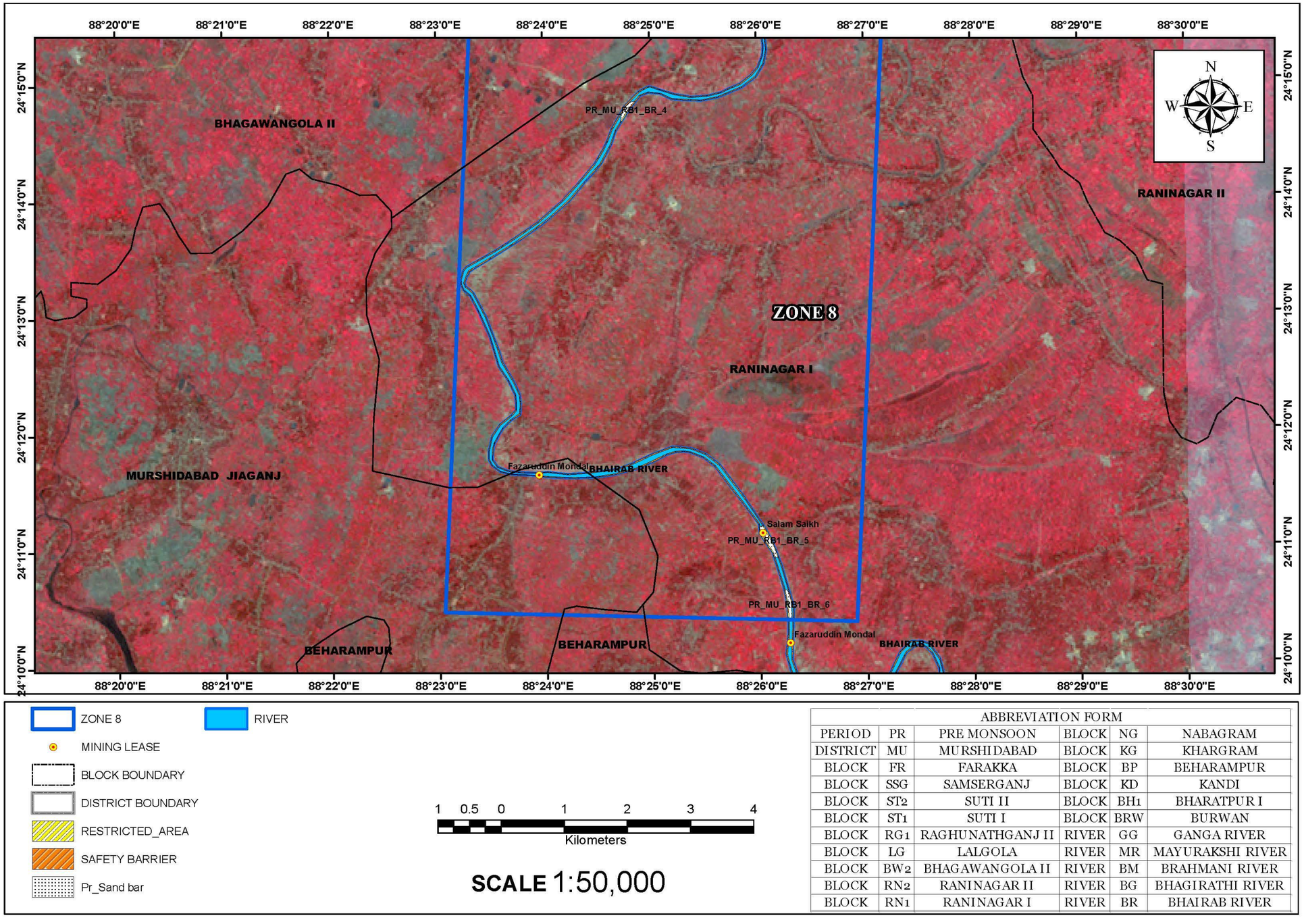
ABBREVIATION FORM					
PERIOD	PR	PRE MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2A7: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*



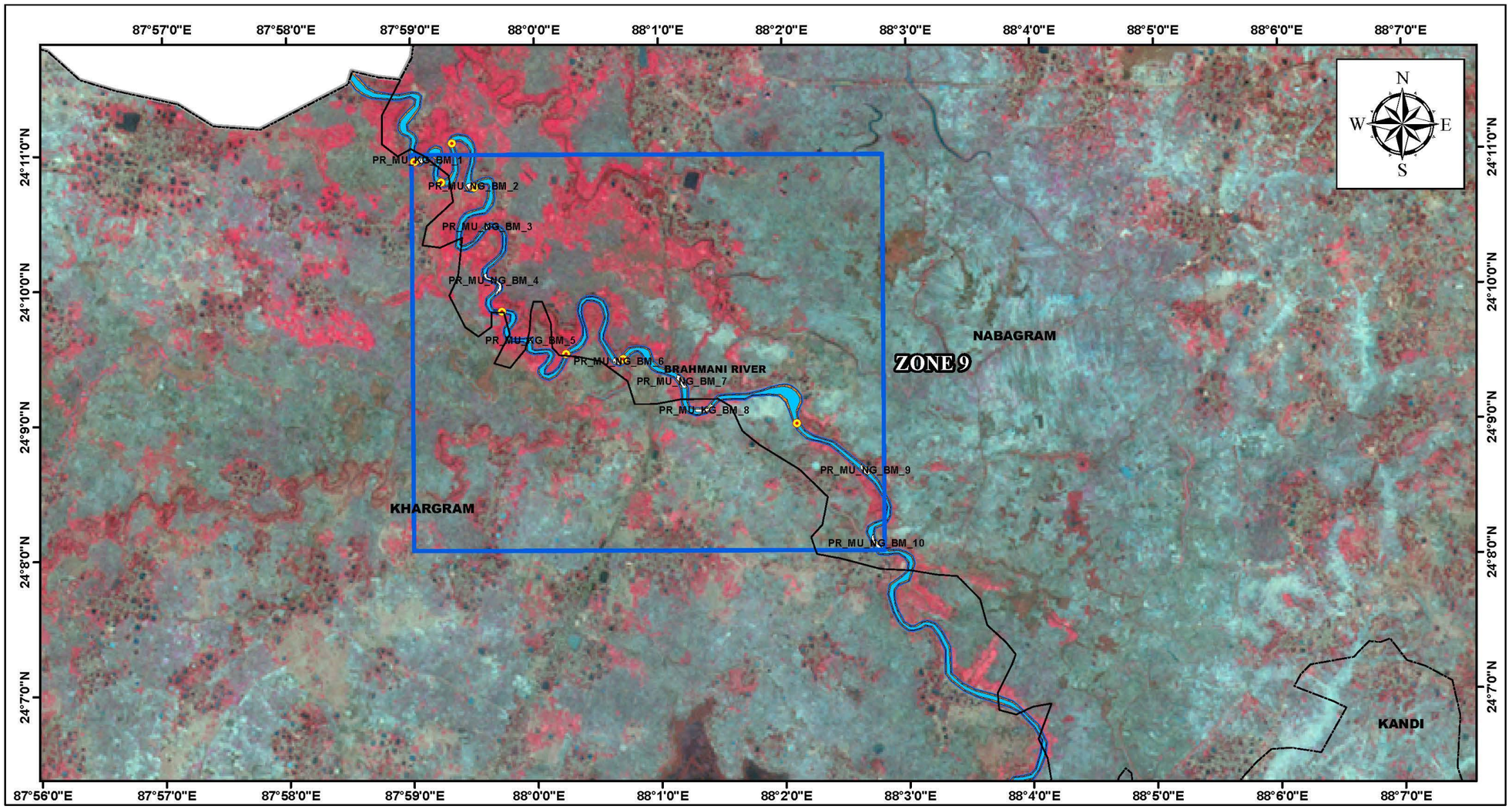
ABBREVIATION FORM					
PERIOD	PR	PRE MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2A8: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*



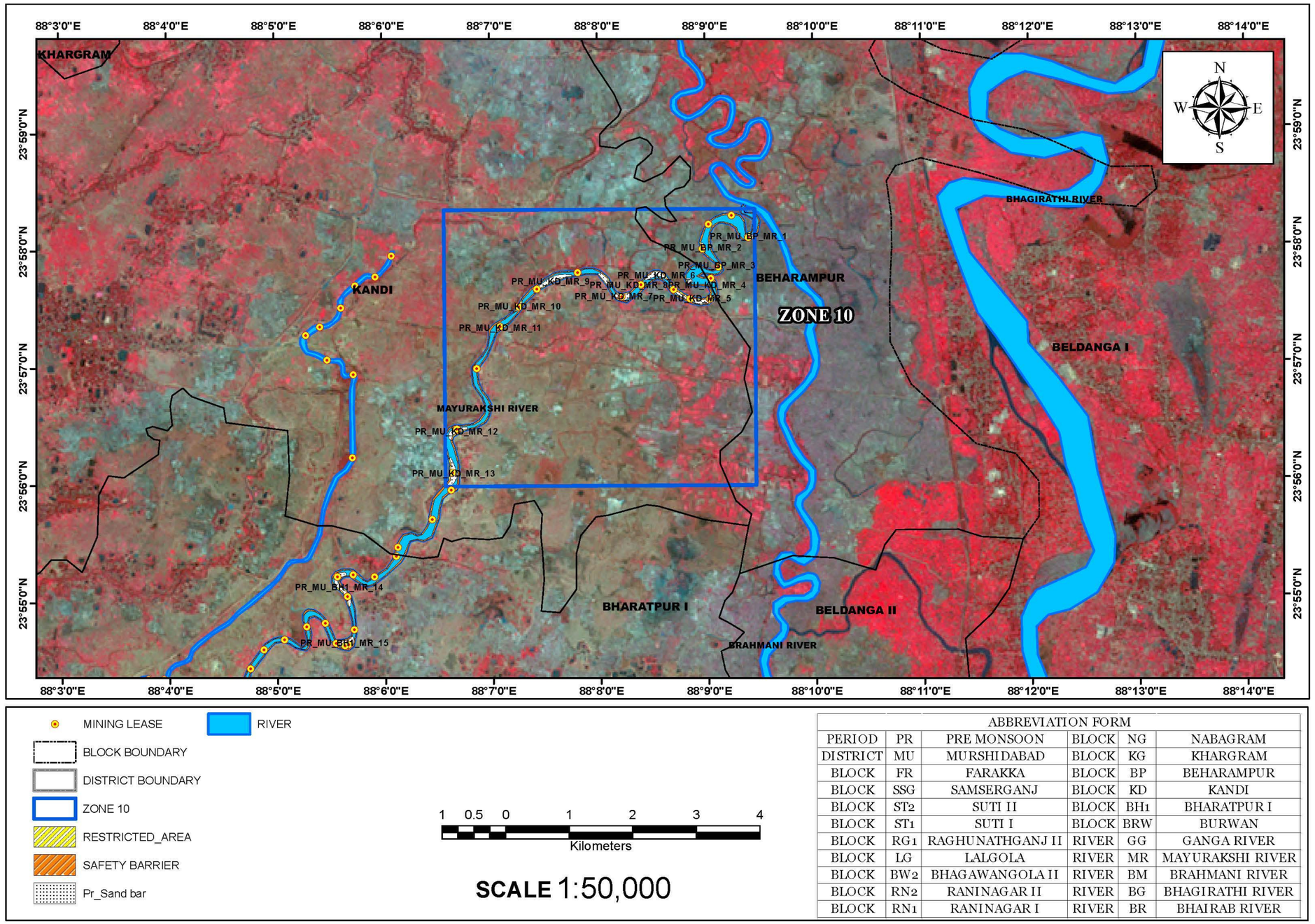
ABBREVIATION FORM					
PERIOD	PR	PRE MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2A9: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*



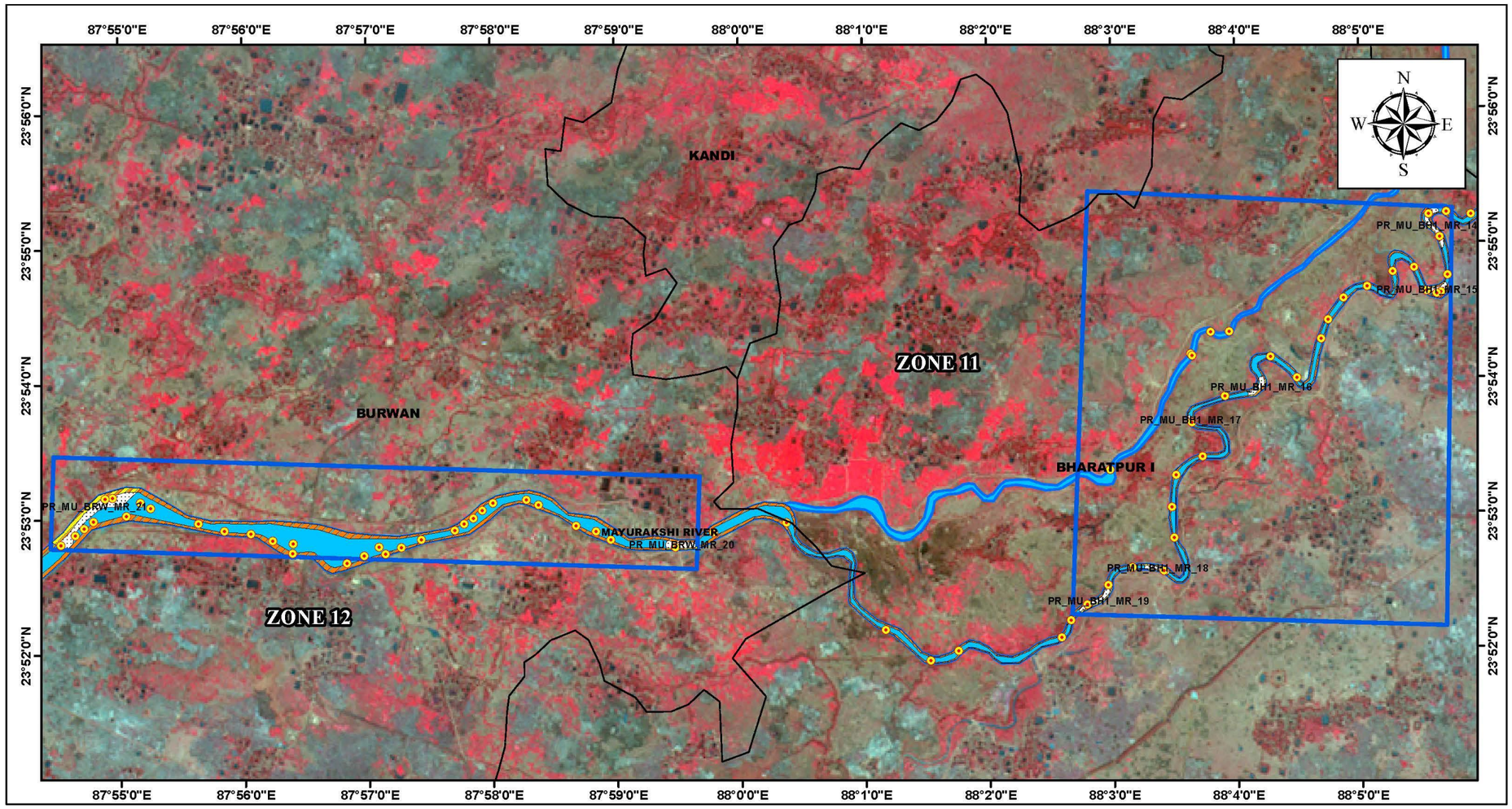
ABBREVIATION FORM					
PERIOD	PR	PRE MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2A10: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*



ABBREVIATION FORM					
PERIOD	PR	PRE MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2A11: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*

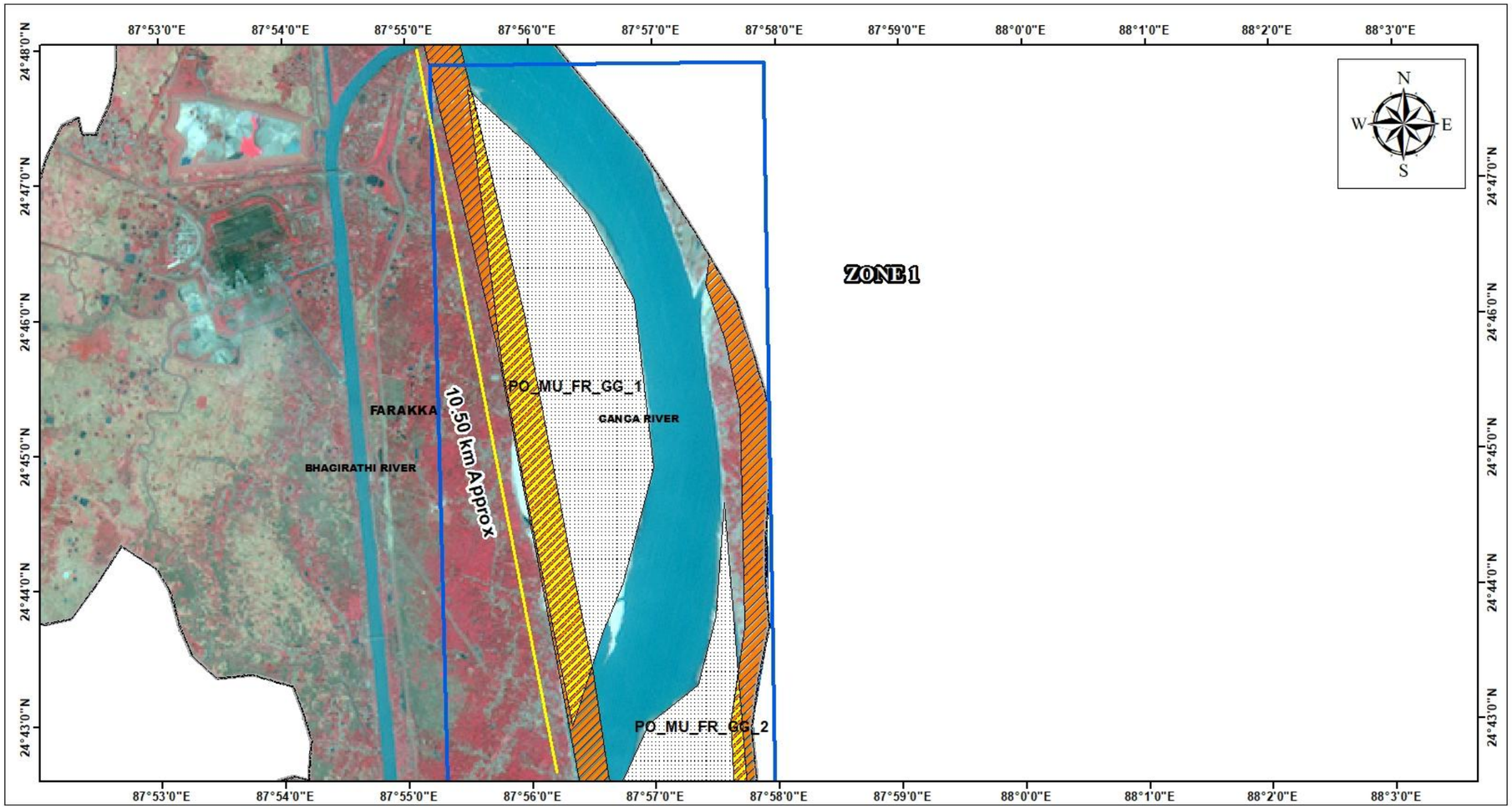


ABBREVIATION FORM					
PERIOD	PR	PRE MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2A12: Distribution Map of Sand Bars on Rivers During Pre-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, March 2020)*

ANNEXURE 2B

DISTRIBUTION MAP OF SAND BARS ON RIVERS DURING POST-MONSOON PERIOD OF MURSHIDABAD DISTRICT



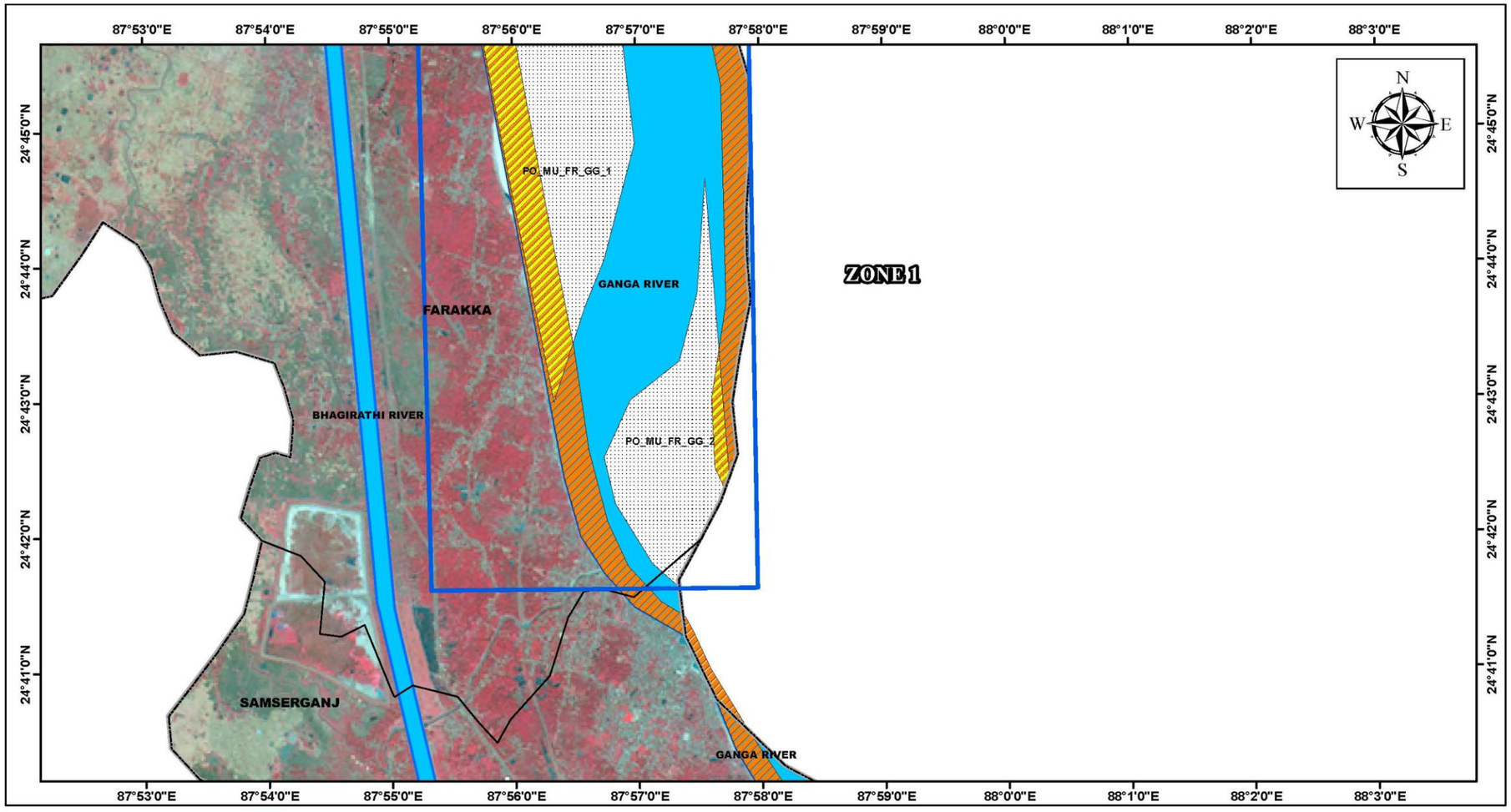
MINING LEASE
RIVER
ZONE 1
BLOCK BOUNDARY
DISTRICT BOUNDARY
RESTRICTED_AREA
SAFETY BARRIER
Po_SandBar

1 0.5 0 1 2 3 4
Kilometers

SCALE 1:50,000

ABBREVIATION FORM					
PERIOD	PO	POST MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2B1: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*



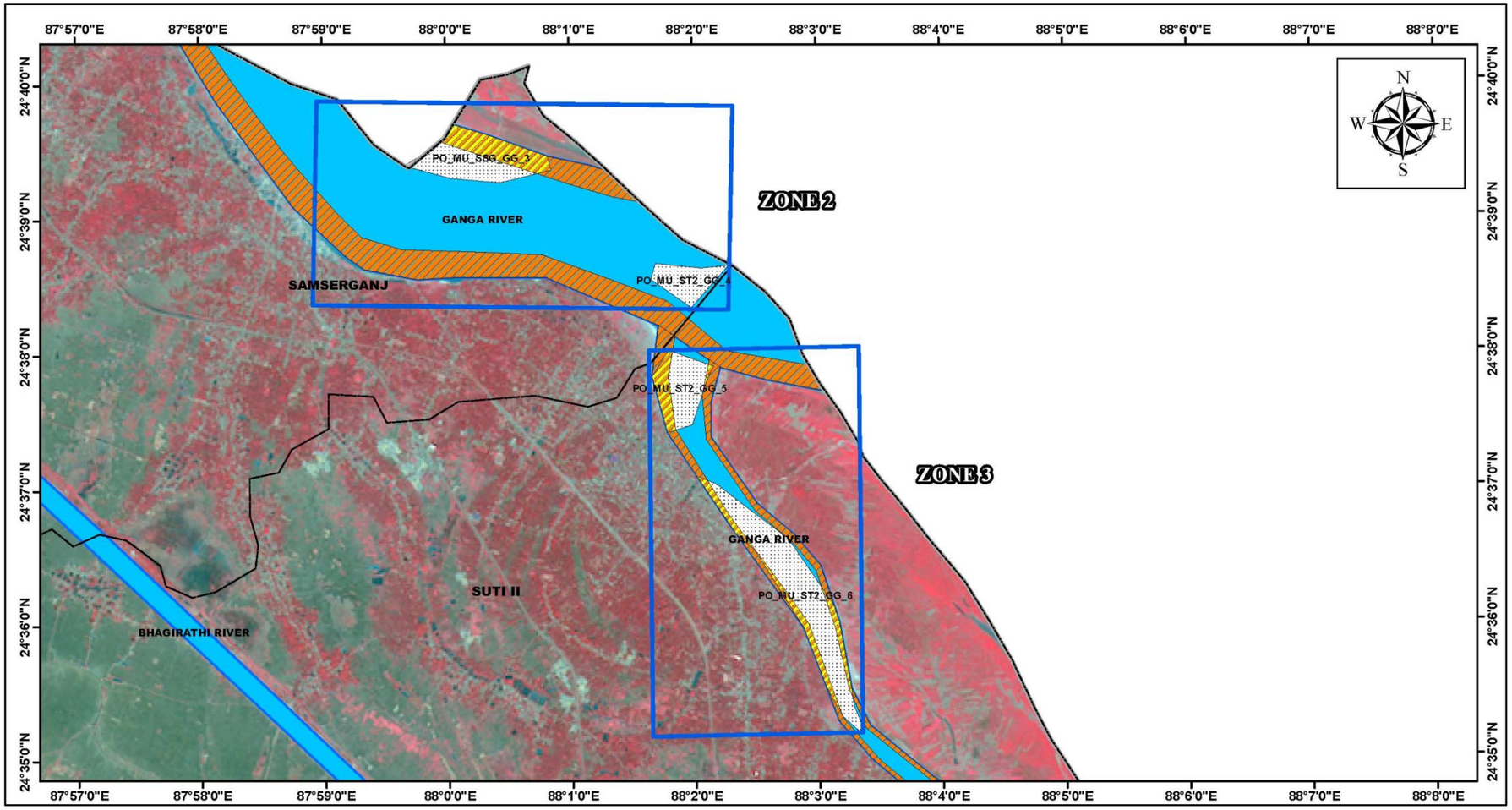
MINING LEASE
RIVER
ZONE 1
BLOCK BOUNDARY
DISTRICT BOUNDARY
RESTRICTED_AREA
SAFETY BARRIER
Po_SandBar

1 0.5 0 1 2 3 4
Kilometers

SCALE 1:50,000

ABBREVIATION FORM					
PERIOD	PO	POST MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2B2: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*



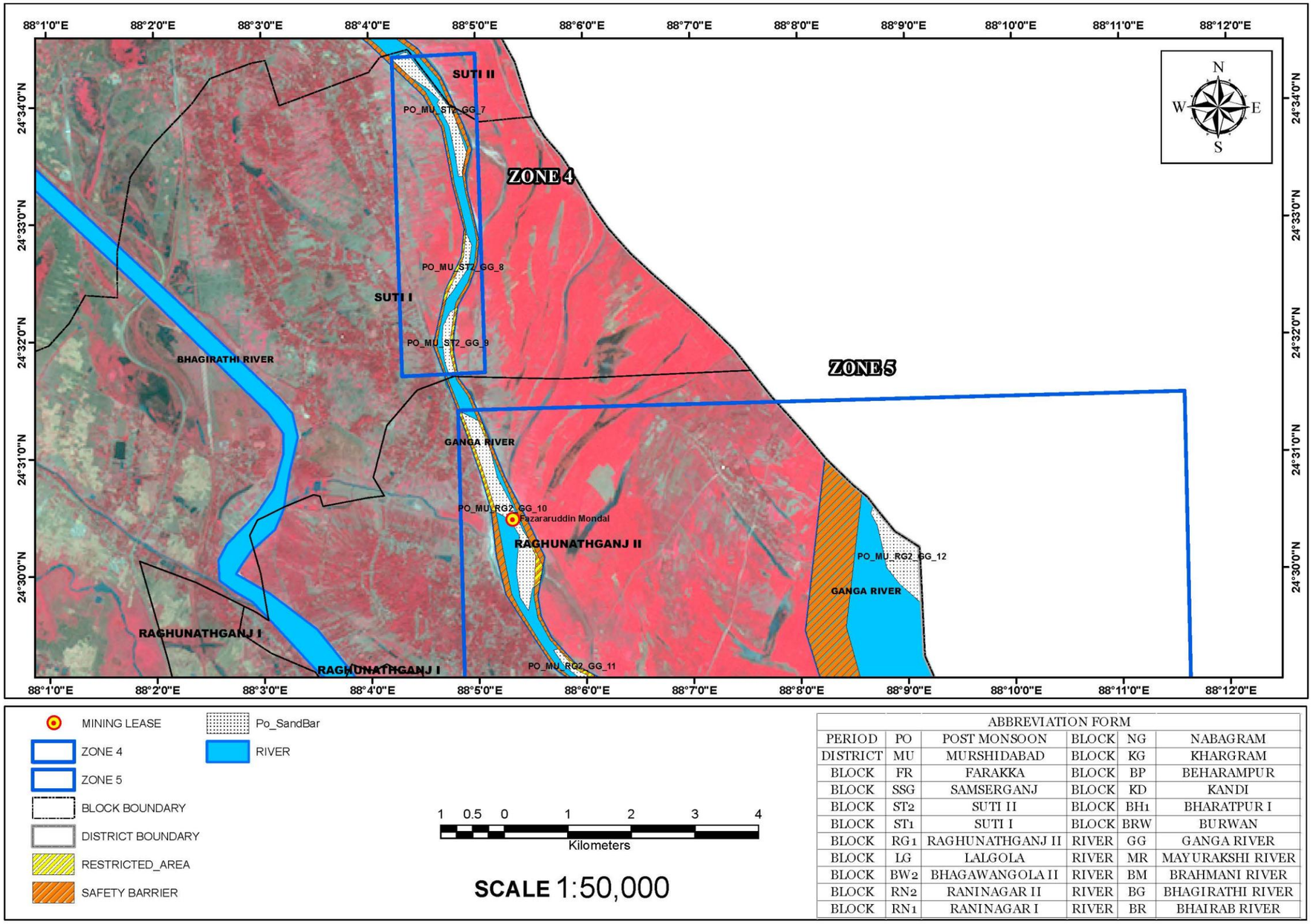
MINING LEASE
ZONE 2
ZONE 3
BLOCK BOUNDARY
DISTRICT BOUNDARY
RESTRICTED_AREA
SAFETY BARRIER
Po_SandBar
RIVER

1 0.5 0 1 2 3 4
Kilometers

SCALE 1:50,000

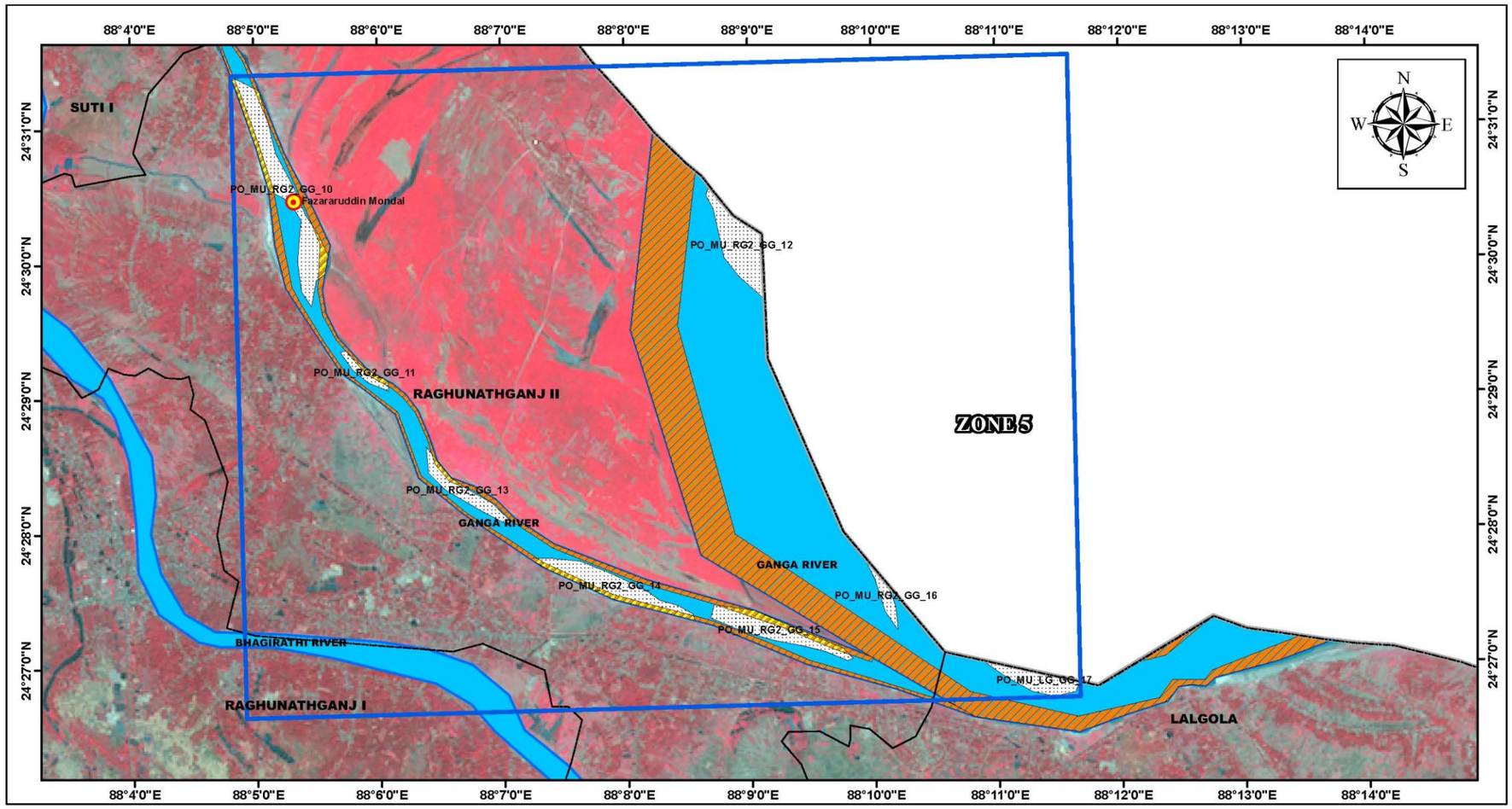
ABBREVIATION FORM					
PERIOD	PO	POST MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2B3: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Murshidabad District *(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*



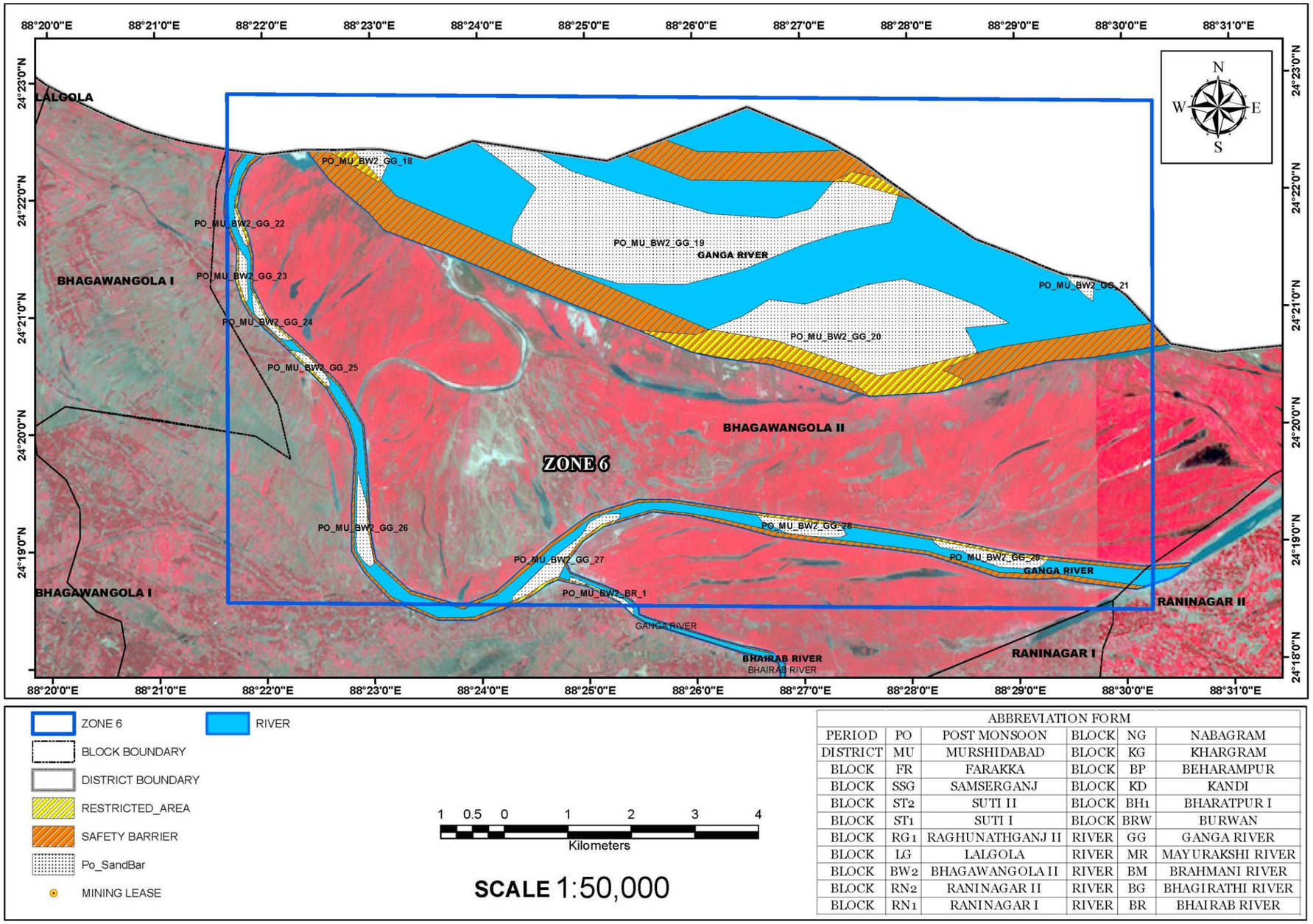
ABBREVIATION FORM					
PERIOD	PO	POST MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2B4: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*



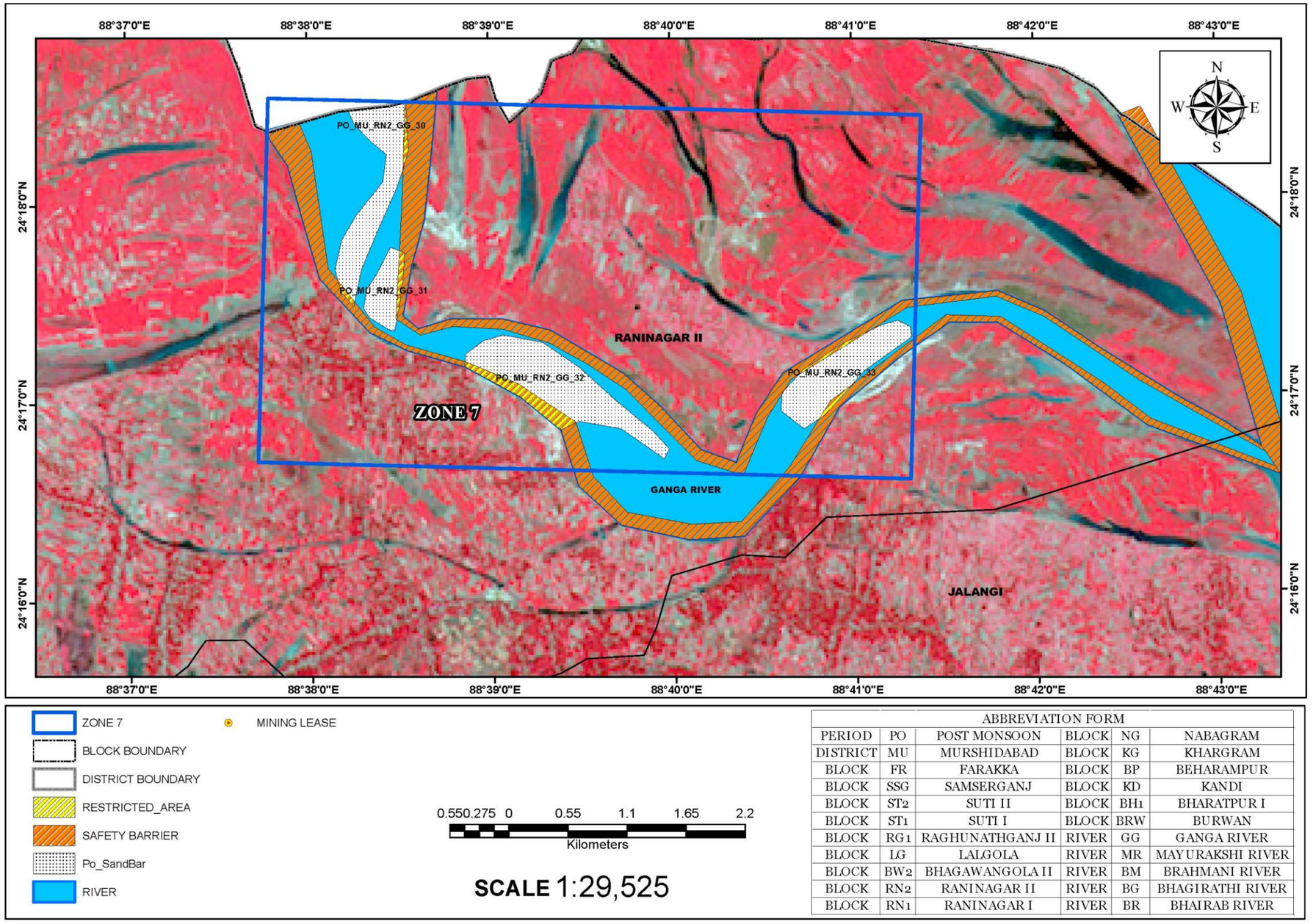
ABBREVIATION FORM					
PERIOD	PO	POST MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2B5: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*



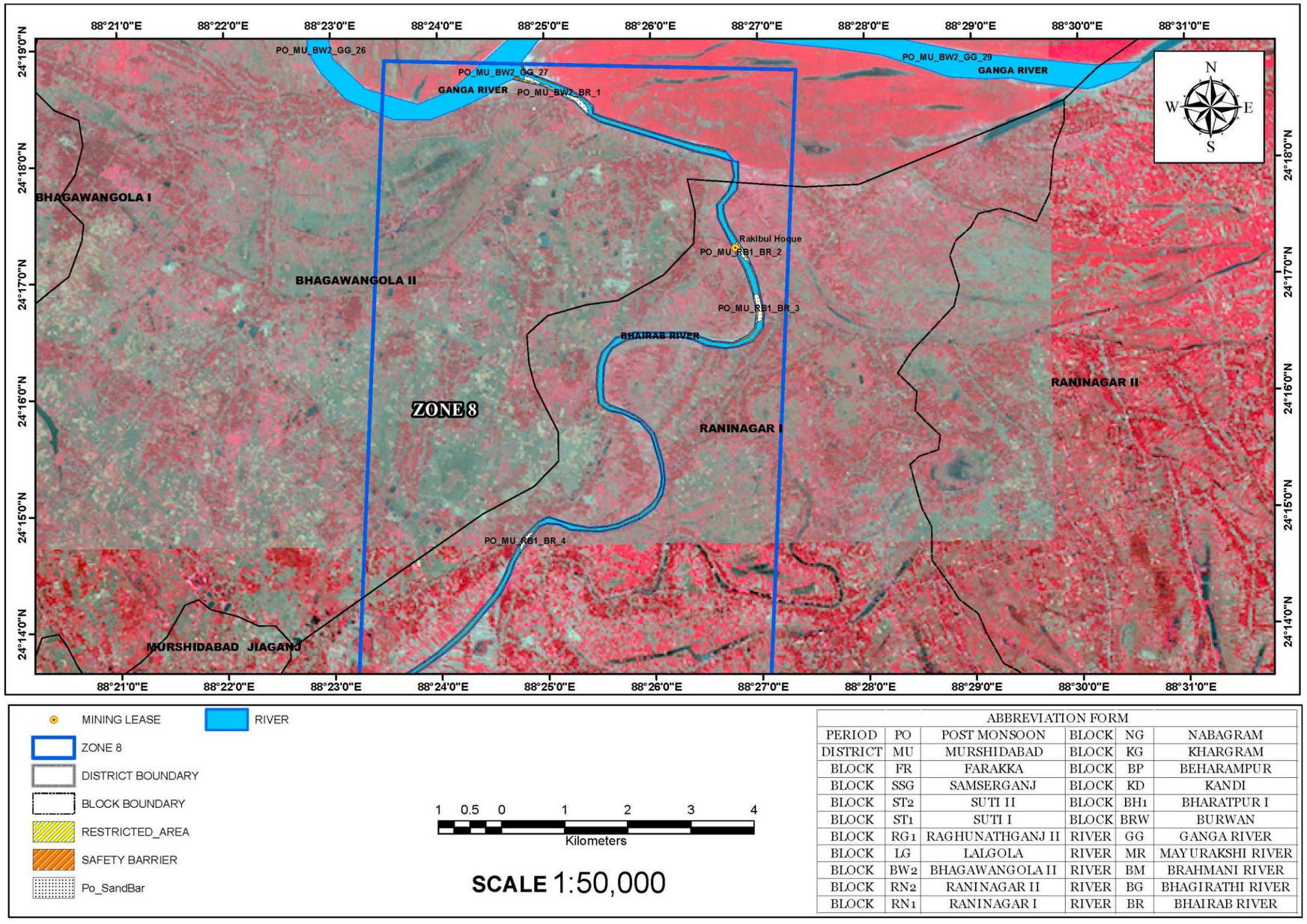
ABBREVIATION FORM					
PERIOD	PO	POST MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2B6: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*



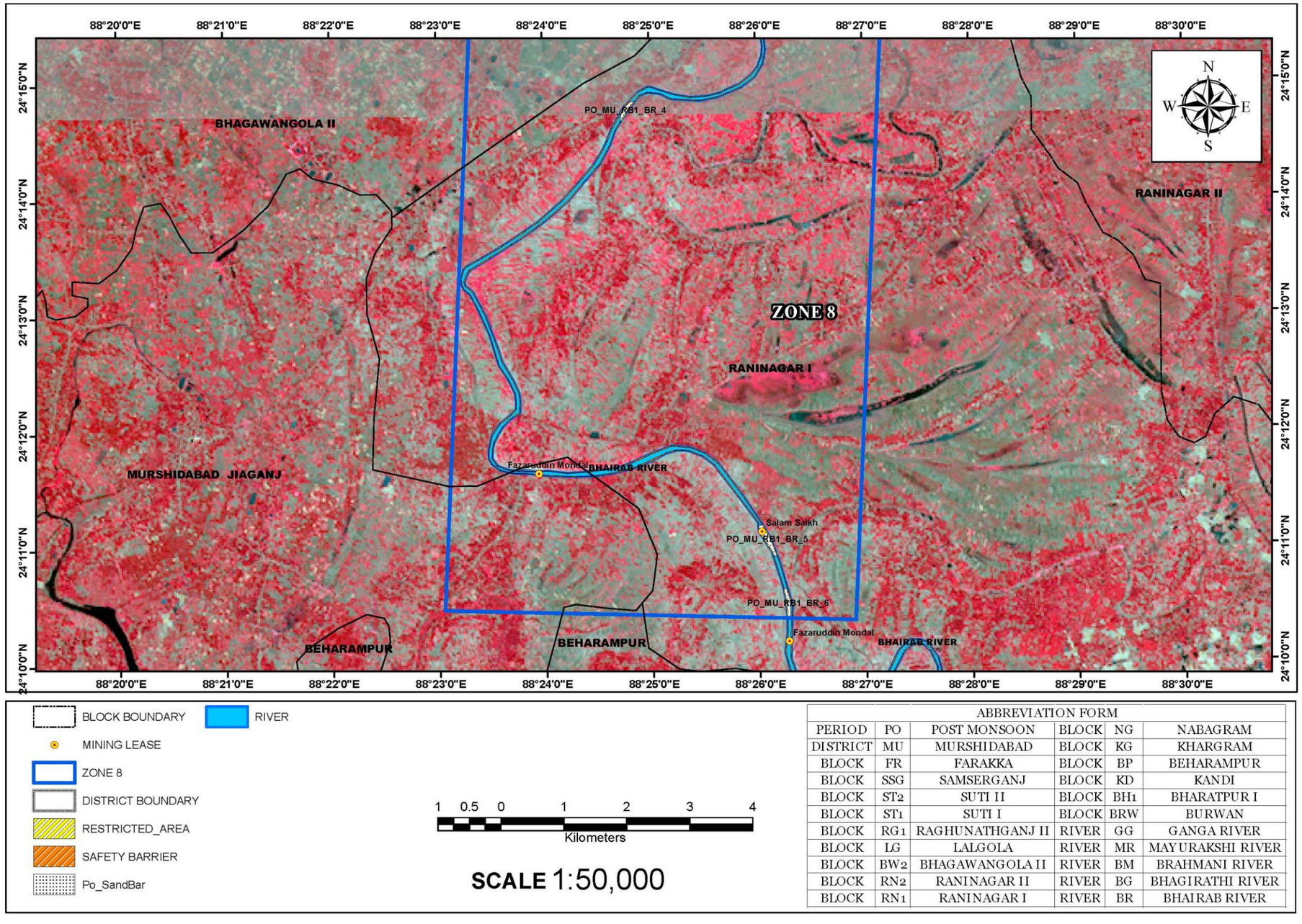
ABBREVIATION FORM					
PERIOD	PO	POST MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2B7: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*



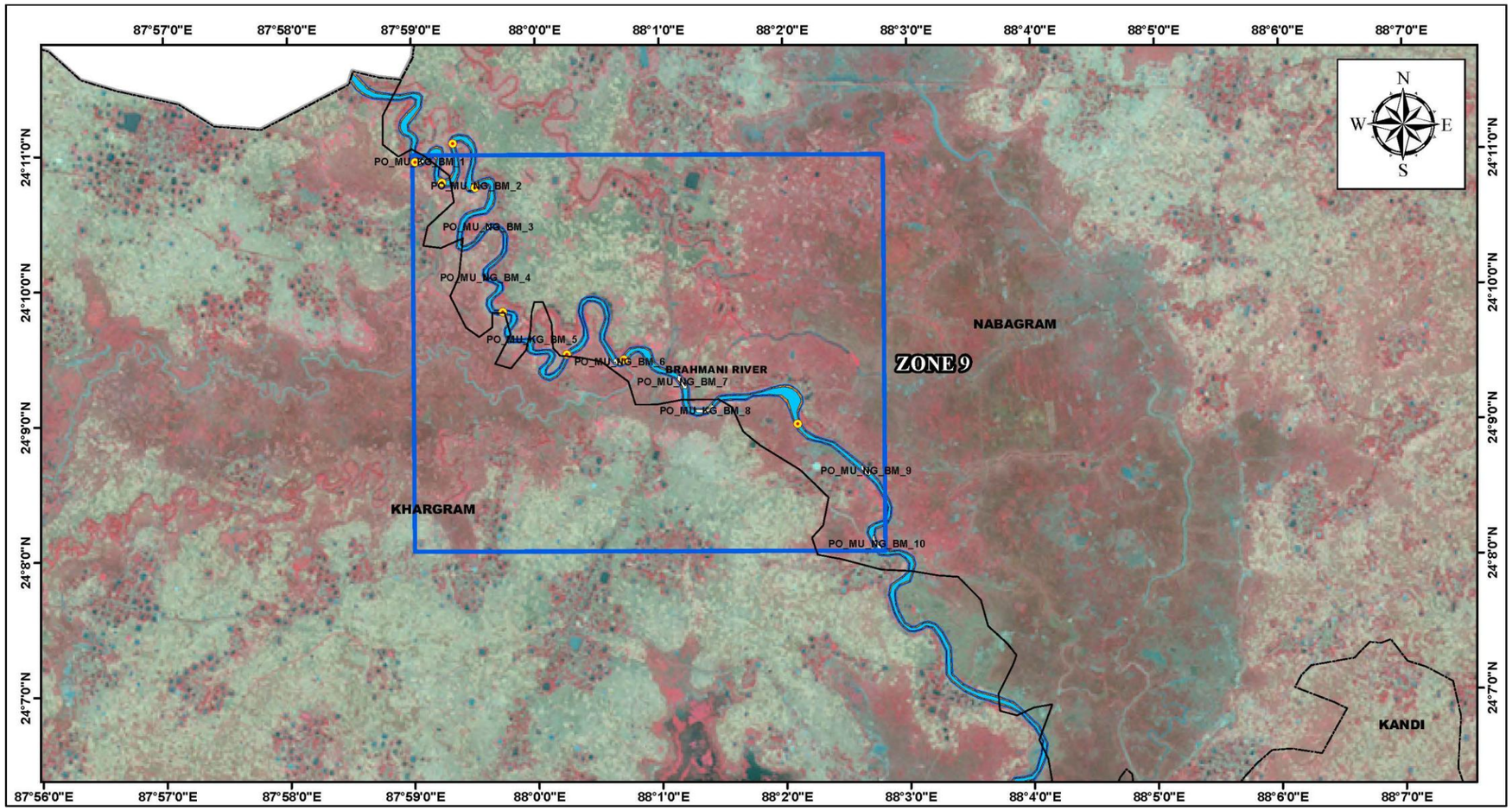
ABBREVIATION FORM					
PERIOD	PO	POST MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2B8: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*



ABBREVIATION FORM					
PERIOD	PO	POST MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2B9: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*



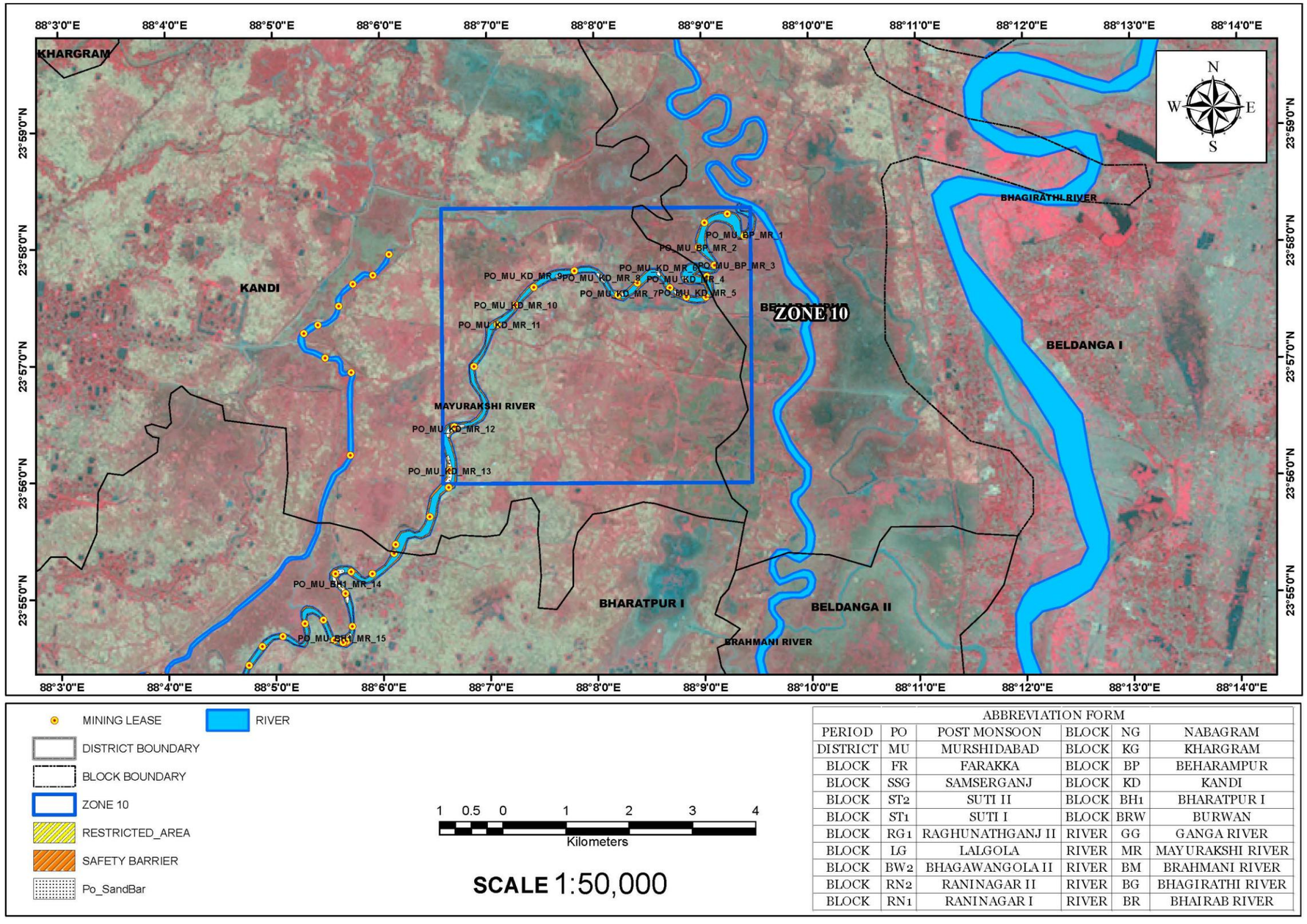
MINING LEASE
RIVER
ZONE 9
DISTRICT BOUNDARY
BLOCK BOUNDARY
RESTRICTED_AREA
SAFETY BARRIER
Po_SandBar

1 0.5 0 1 2 3 4
Kilometers

SCALE 1:50,000

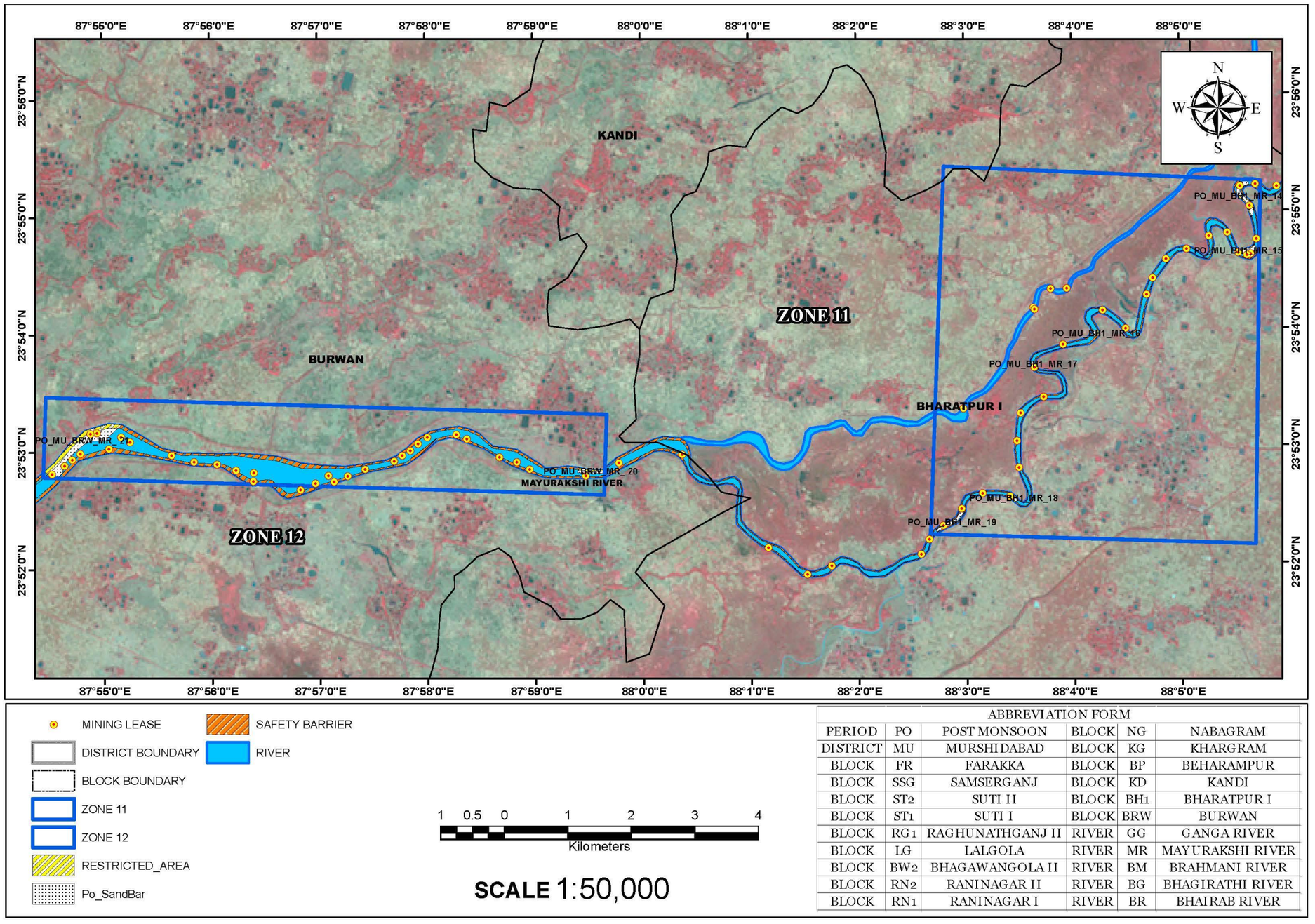
ABBREVIATION FORM					
PERIOD	PO	POST MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2B10: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*



ABBREVIATION FORM					
PERIOD	PO	POST MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2B11: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*



ABBREVIATION FORM					
PERIOD	PO	POST MONSOON	BLOCK	NG	NABAGRAM
DISTRICT	MU	MURSHIDABAD	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Plate 2B12: Distribution Map of Sand Bars on Rivers During Post-Monsoon Period of Murshidabad District*(Source: ISRO RESOURCE Sat 2 LISS III Sensor, November 2020)*

PLATE 3

WATERSHED MAP OF THE DISTRICT

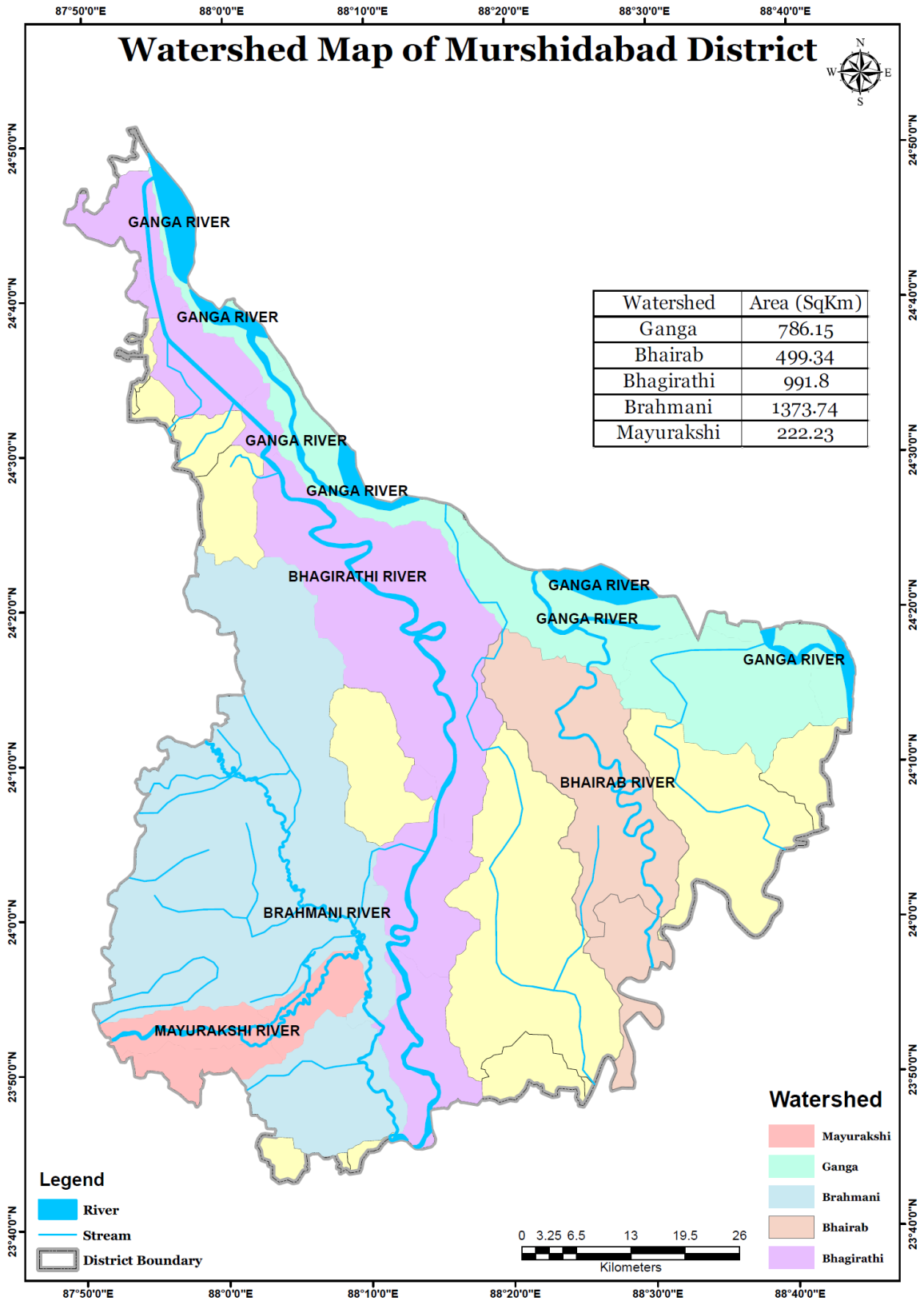
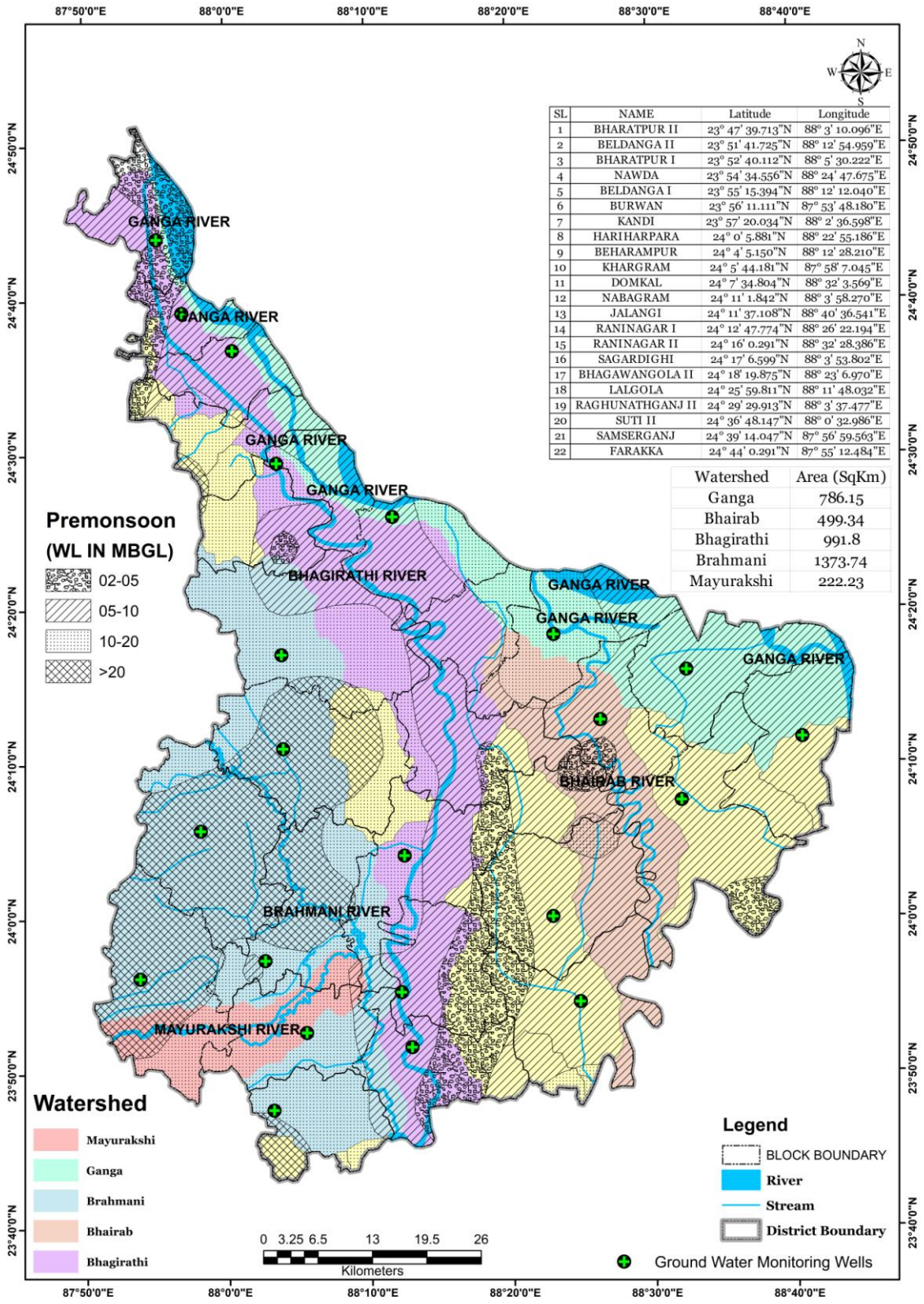


Plate 3A: Watershed map of Murshidabad District *(Source: World Wild Fund for Nature, September 2020)*



SL	NAME	Latitude	Longitude
1	BHARATPUR II	23° 47' 39.713"N	88° 3' 10.096"E
2	BELDANGA II	23° 51' 41.725"N	88° 12' 54.959"E
3	BHARATPUR I	23° 52' 40.112"N	88° 5' 30.222"E
4	NAWDA	23° 54' 34.556"N	88° 24' 47.675"E
5	BELDANGA I	23° 55' 15.394"N	88° 12' 12.040"E
6	BURWAN	23° 56' 11.111"N	87° 53' 48.180"E
7	KANDI	23° 57' 20.034"N	88° 2' 36.598"E
8	HARIHARPARA	24° 0' 5.881"N	88° 22' 55.186"E
9	BEHARAMPUR	24° 4' 5.150"N	88° 12' 28.210"E
10	KHARGRAM	24° 5' 44.181"N	87° 58' 7.045"E
11	DOMKAL	24° 7' 34.804"N	88° 32' 3.569"E
12	NABAGRAM	24° 11' 1.842"N	88° 3' 58.270"E
13	JALANGI	24° 11' 37.108"N	88° 40' 36.541"E
14	RANINAGAR I	24° 12' 47.774"N	88° 26' 22.194"E
15	RANINAGAR II	24° 16' 0.291"N	88° 32' 28.386"E
16	SAGARDIGHI	24° 17' 6.599"N	88° 3' 53.802"E
17	BHAGAWANGOLA II	24° 18' 19.875"N	88° 23' 6.970"E
18	LALGOLA	24° 25' 59.811"N	88° 11' 48.032"E
19	RAGHUNATHGANJ II	24° 29' 29.913"N	88° 3' 37.477"E
20	SUTI II	24° 36' 48.147"N	88° 0' 32.986"E
21	SAMSERGANJ	24° 39' 14.047"N	87° 56' 59.563"E
22	FARAKKA	24° 44' 0.291"N	87° 55' 12.484"E

Watershed	Area (SqKm)
Ganga	786.15
Bhairab	499.34
Bhagirathi	991.8
Brahmani	1373.74
Mayurakshi	222.23

Plate 3B: District Watershed map showing ground water level during Pre-monsoon period *(Source: World Wild Fund for Nature, September 2020)*

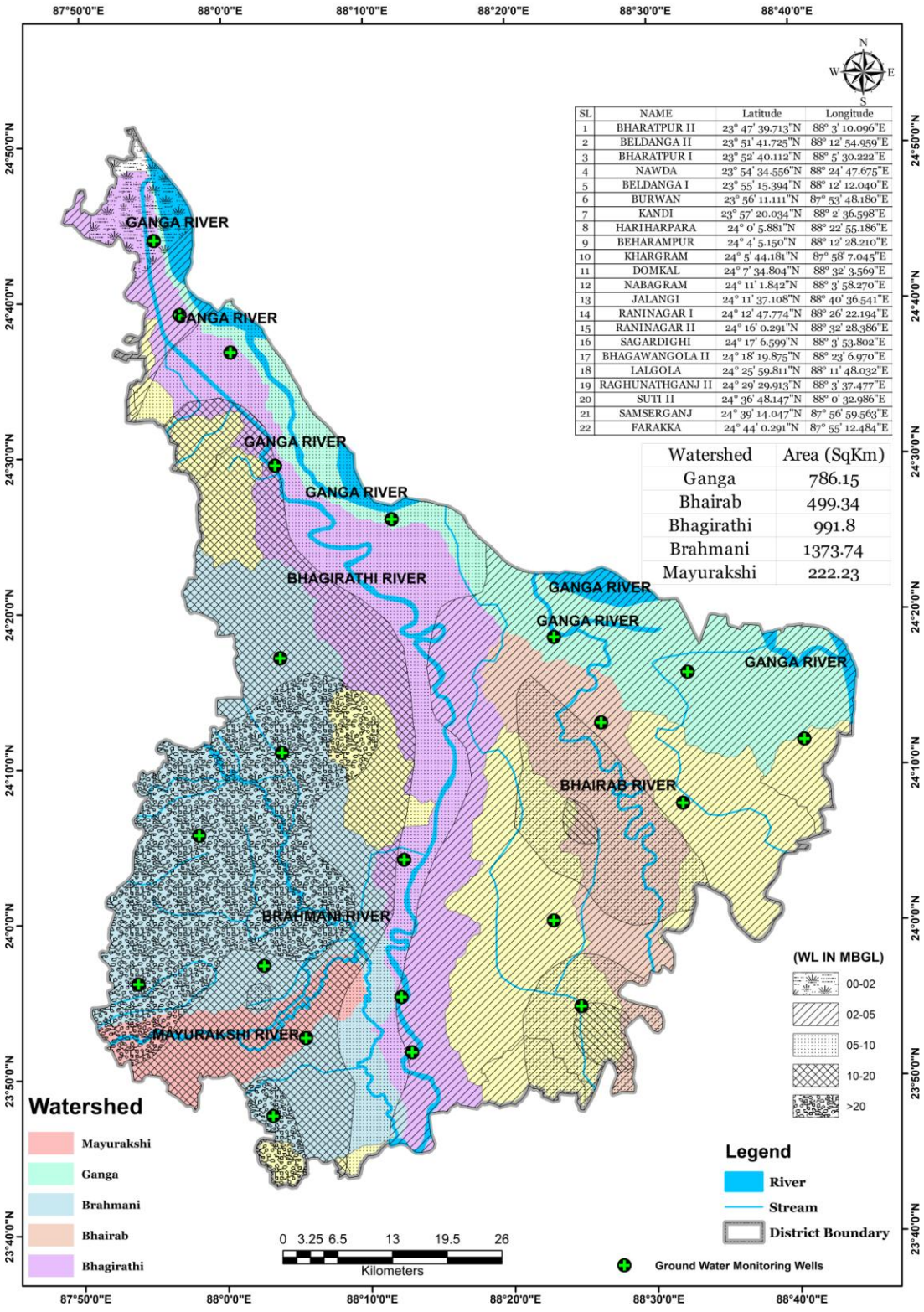


Plate 3C: District Watershed map showing ground water level during Post-monsoon period *(Source: World Wild Fund for Nature, September 2020)*

PLATE 4

FIELD SURVEY PHOTOGRAPHS

Picture of Riverbed deposit of Mayurakshi River (Date: 16/12/2020, Lat: 23° 57' 48.055" N Long: 88° 9' 6.808" E

Picture of Riverbed deposit of Brahmani River (Date: 16/12/2020, Lat: 24° 10’ 28.330” N N Long: 87° 59’ 36.817” E

4C: Picture of Riverbed deposit of Bhairab River (Date: 17/12/2020, Lat: 24° 18' 43.278" N Long: 88° 24' 54.195" E

4D: Picture of Riverbed deposit of Bhairab River (Date: 16/12/2020, Lat: 24° 10' 37.941" N Long: 88° 26' 14.378" E

PLATE 5

LONG TERM EROSION-ACCRETION MAP OF RIVER BANK

Plate 5A: Long term river course map showing very less erosion/ accretion along its banks *(Source: ISRO RESOURCE Sat 2 LISS III Sensor)*

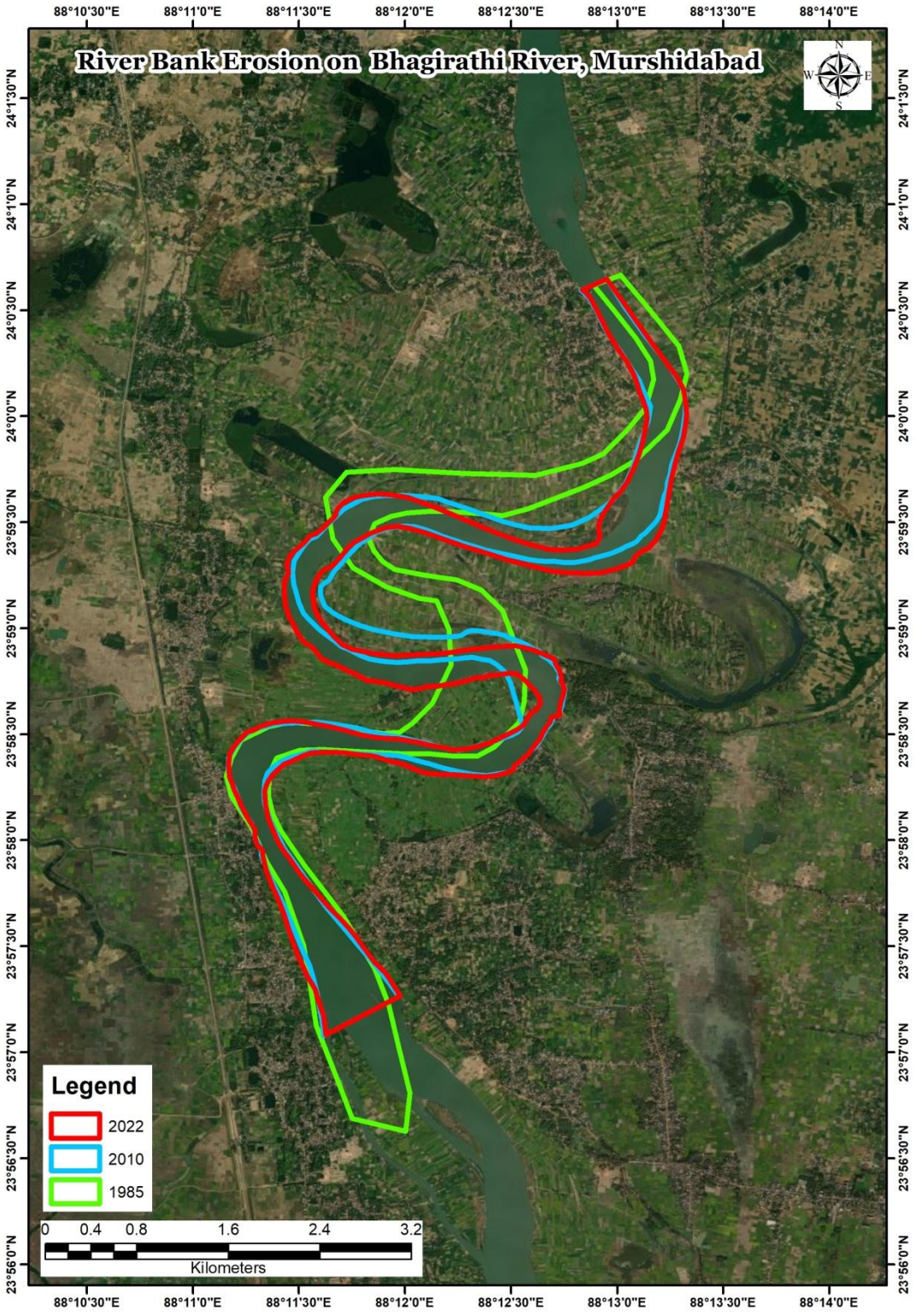


Plate 5B: Map showing long-term (10-year or more) erosion-accretion areas on both the banks of Bhagirathi River, Murshidabad *(Source: ISRO RESOURCE Sat 2 LISS III Sensor)*

Annexure 1
Compliance as per Enforcement & Monitoring Guidelines for sand Mining, 2020 (MoEF& CC) for preparation of District Survey Report

Sl. No.	Particulars	Status
1	District Survey Report for sand mining shall be prepared before the auction/e-auction/grant of the mining lease/Letter of Intent (LoI) by Mining department or department dealing the mining activity in respective states.	Noted.
2	In order to make the inventory of River Bed Material, a detailed survey of the district needs to be carried out, to identify the source of River Bed Material and alternative source of sand (M-Sand). The source will include rivers, de-siltation of reservoir/dams, Patta lands/Khatedari Land, M-sand etc.	Complied with and explained in Chapter 7 pg no 65 to 98.
3	District Survey Report is to be prepared in such a way that it not only identifies the mineral-bearing area but also define the mining and no mining zones considering various environmental and social factors.	Complied with and furnished in pg no 90-91.
4	Identification of the source of Sand & M-Sand. The sources may be from Rivers, Lakes, Ponds, Dams, De-silting locations, Patta land/Khtedari lands. The details in case of Rivers such as [name, length of river, type (Perennial or Non-Perennial), Villages, Tehsil, District], in case of Lakes, Ponds, Dams, De-silting locations [Name, owned/maintained by (State Govt./PSU), area, Villages, Tehsil, District] in case of Patta land/Khtedari lands [Owner Name, Sy No, Area, Agricultural/Non-Agricultural, Villages, Tehsil, District], in case of M-Sand Plant [Owner Name, Sy No, Area, Quantity/Annum, Villages, Tehsil, District], needs to be recorded .	Complied with and given in table 7.4 pg 75 to 77.
5	Defining the sources of Sand/M-Sand in the district is the next step for identification of the potential area of deposition/aggradation wherein mining lease could be granted. Detailed survey needs to be carried out for quantification of minerals. The purpose of mining in the river bed is for channelization of rivers so as to avoid the possibility of flooding and to maintain the flow of the rivers. For this, the entire river stretch needs to be surveyed and original ground level (OGL) to be recorded and area of aggradation/deposition needs to be ascertained by comparing the level difference between the outside riverbed OGL and water level. Once the area of aggradation/deposition is identified, then the quantity of River Bed Material available needs to be calculated. The next step is channelization of the river bed and for this central ¾th part of the river, width needs to be identified on a map. Out of the ¾th part area, where there is a deposition/aggradation of the material needs to be identified. The remaining ¼th area needs to be kept as no mining zone for the protection of banks. The specific gravity of the material also needs to be ascertained by analyzing the sample from a NABL accredited lab. Thus, the quantity of material available in metric ton needs to be calculated for mining and no mining zone.	Complied with and given in table 7.12 pg 90 to 91.

Sl. No.	Particulars	Status
6	The permanent boundary pillars need to be erected after identification of an area of aggradation and deposition outside the bank of the river at a safe location for future surveying. The distance between boundary pillars on each side of the bank shall not be more than 100 meters.	Benchmark Pillars are established in strategic locations while boundary pillars will be fixed while fixation of the mining lease boundary subsequent to district level verification.
7	Identifying the mining and no mining zone shall follow with defining the area of sensitivity by ascertaining the distance of the mining area from the protected area, forest, bridges, important structures, habitation etc. and based on the sensitivity the area needs to be defined in sensitive and non-sensitive area.	Complied with and furnished in pg no 91-92.
8	Demand and supply of the Riverbed Material through market survey needs to be carried out. In addition to this future demand for the next 5 years also needs to be considered.	Complied with and given in pg no 11-12.
9	It is suggested that as far as possible the sensitive areas should be avoided for mining, unless local safety condition arises. Such deviation shall be temporary & shall not be a permanent feature.	Complied with and furnished in pg no 91-92.
10	Sand and gravel could be extracted from the downstream of the sand bar at river bends. Retaining the upstream one to two-thirds of the bar and riparian vegetation is accepted as a method to promote channel stability.	Noted. The DSR is compose of all the potential sand zones for defining the resources. In a subsequent phase blocking of potential zones shall be done in due consultation with the district level committee. The areas mentioned in the observation points shall be excluded while blocking of sand mining leases which are part of these potential zones marked in this DSR.
11	The final area selected for the mining should be then divided into mining lease as per the requirement of State Government. It is suggested the mining lease area should be so selected as to cover the entire deposition area. Dividing a large area of deposition/aggradation into smaller mining leases should be avoided as it leads to loss of mineral and indirectly promote illegal mining.	Shall be Complied with.
12	Cluster situation shall be examined. A cluster is formed when one mining lease of homogenous mineral is within 500 meters of the other mining lease. In order to reduce the cluster formation mining lease size should be defined in such a way that distance between any two clusters preferably should not be less than 2.5 Km. Mining lease should be defined in such a way that the total area of the mining leases in a cluster should not be more than 10 Ha.	Noted. Due care will be taken while distribution of mining leases either to prevent cluster situation or keeping the prescribed distance in between two mining clusters.
13	The number of a contiguous cluster needs to be ascertained. Contiguous cluster is formed when one cluster is at a distance of 2.5 Km from the other cluster.	Noted and shall be complied with.

Sl. No.	Particulars	Status
14	The mining outside the riverbed on Patta land/Khatedari land be granted when there is possibility of replenishment of material. In case, there is no replenishment then mining lease shall only be granted when there is no riverbed mining possibility within 5 KM of the Patta land/Khatedari land. For government projects, mining could be allowed on Patta land/Khatedari land but the mining should only be done by the Government agency and material should not be used for sale in the open market. Cluster situation as mentioned in para k above is also applicable for the mining in Patta land/Khatedari land.	Noted.
15	The State Government should define the transportation route from the mining lease considering the maximum production from the mines as at this stage the size of mining leases, their location, the quantity of mineral that can be mined safely etc. is available with the State Government. It is suggested that the transportation route should be selected in such a way that the movement of trucks/tippers/tractors from the villages having habitation should be avoided. The transportation route so selected should be verified by the State Government for its carrying capacity.	Noted and final transport route will be submitted during preparation of mine plan.
16	Potential site for mining having its impact on the forest, protected area, habitation, bridges etc, shall be avoided. For this, a sub-divisional committee may be formed which after the site visit shall decide its suitability for mining.	Shall be Complied with.
17	Public consultation-The Comments of the various stakeholders may be sought on the list of mining lease to be auctioned. The State Government shall give an advertisement in the local and national newspaper for seeking comments of the general public on the list of mining lease included in the DSR. The DSR should be placed in the public domain for at least one month from the date of publication of the advertisement for obtaining comments of the general public. The comments so received shall be placed before the sub-divisional committee for active consideration. The final list of sand mining areas [leases to be granted on riverbed &Patta land/Khatedari land, de-siltation location (ponds/lakes/dams), M-Sand Plants (alternate source of sand)] after the public hearing needs to be defined in the final DSR.	After publication of the West Bengal Sand Mining Policy, 2021, it is now eminent that State owned The West Bengal Mineral Development and Trading Corporation Limited (WBMDTCL) shall be responsible for mining of sand/ gravel/ river bed materials in whole state of West Bengal. However, the existing mining leases which were in effect before hand of this Gazzate notification July 2021 will be in operation till the year 2027-28. In order to have the rational distribution of mining leases as per the prevailing norms and guidelines grant of mining leases in the state of West Bengal shall be carried out in phases till all the blocks are under the ambit of WBMDTCL. This DSR thus consist of the identified potential sand deposite areas within which the existing and future mining leases shall occur. The details of the mining leases as and when granted shall follow the procedure described in EMGSM 2020 and prevailing norms..
18	The LOI should not be granted for mining area falling on both riverbed and outside riverbed. Therefore, in the same lease, both types of area should not be included.	Shall be Complied with.

Annexure 2
Estimation of Sand Resources based on sediment load comparison between Pre and Post Monsoon period of Murshidabad District

Abbreviation used in the table as below

Particulars	Code	Details	Particulars	Code	Details
DISTRICT	MU	MURSHIDABAD			
PERIOD	PO	POST MONSOON	PERIOD	PR	PRE MONSOON
BLOCK	NG	NABAGRAM	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Pre monsoon						Post monsoon					
S L No	**Sand Bar_Code**	**RL (m)**	**Area in sq.m.**	**Sand Thickness in m.**	**Sand Volume in M. Cum**	**S L No**	**Sand Bar_Code**	**RL (m)**	**Area in sq.m.**	**Sand Thickness in m.**	**Sand Volume in M. Cum**
Estimation of Sand Resources in Pre monsoon period & Post monsoon period in sand bar regions of Ganga River											
1	PR_MU_FR_GG_1	18	14020074.31	2.00	28.04	1	PO_MU_FR_GG_1	19	10830136.03	3.00	32.49
2	PR_MU_FR_GG_2	17	5159238.15	2.00	10.32	2	PO_MU_FR_GG_2	18	4037936.49	3.00	12.11
3	PR_MU_SSG_GG_3	15	1971527.55	2.00	3.94	3	PO_MU_SSG_GG_3	16	901469.09	3.00	2.70
4	PR_MU_SSG_GG_4	12	1246491.68	2.00	2.49	4	PO_MU_ST2_GG_4	13	341273.03	3.00	1.02
5	PR_MU_ST2_GG_5	12	580796.04	2.00	1.16	5	PO_MU_ST2_GG_5	13	578401.89	3.00	1.74
6	PR_MU_ST2_GG_6	14	1502341.45	2.00	3.00	6	PO_MU_ST2_GG_6	15	1502341.45	3.00	4.51
7	PR_MU_ST1_GG_7	15	584015.74	2.00	1.17	7	PO_MU_ST2_GG_7	16	330610.47	3.00	0.99
8	PR_MU_ST1_GG_8	16	137637.93	2.00	0.28	8	PO_MU_ST2_GG_8	17	137637.93	3.00	0.41
9	PR_MU_ST1_GG_9	16	168844.59	2.00	0.34	9	PO_MU_ST2_GG_9	17	163669.14	3.00	0.49
10	PR_MU_RG2_GG_10	15	796223.33	2.00	1.59	10	PO_MU_RG2_GG_10	16	796223.33	3.00	2.39
11	PR_MU_RG2_GG_11	15	96473.81	2.00	0.19	11	PO_MU_RG2_GG_11	16	96473.81	3.00	0.29
12	PR_MU_RG2_GG_12	17	851650.68	2.00	1.70	12	PO_MU_RG2_GG_12	18	507957.67	3.00	1.52
13	PR_MU_RG2_GG_13	15	228361.27	2.00	0.46	13	PO_MU_RG2_GG_13	16	228361.27	3.00	0.69
14	PR_MU_RG2_GG_14	13	489043.30	2.00	0.98	14	PO_MU_RG2_GG_14	14	489043.30	3.00	1.47
15	PR_MU_RG2_GG_15	13	437523.10	2.00	0.88	15	PO_MU_RG2_GG_15	14	437523.10	3.00	1.31
16	PR_MU_RG2_GG_16	12	310983.97	2.00	0.62	16	PO_MU_RG2_GG_16	13	104960.90	3.00	0.31
17	PR_MU_LG_GG_17	12	259429.02	2.00	0.52	17	PO_MU_LG_GG_17	13	259429.02	3.00	0.78

Pre monsoon						Post monsoon					
S L No	**Sand Bar_Code**	**RL (m)**	**Area in sq.m.**	**Sand Thickness in m.**	**Sand Volume in M. Cum**	**S L No**	**Sand Bar_Code**	**RL (m)**	**Area in sq.m.**	**Sand Thickness in m.**	**Sand Volume in M. Cum**
18	PR_MU_BW2_GG_18	12	1111828.01	2.00	2.22	18	PO_MU_BW2_GG_18	13	261092.16	3.00	0.78
19	PR_MU_BW2_GG_19	12	7595216.34	2.00	15.19	19	PO_MU_BW2_GG_19	13	6614401.20	3.00	19.84
20	PR_MU_BW2_GG_20	12	7171309.92	2.00	14.34	20	PO_MU_BW2_GG_20	13	5337108.49	3.00	16.01
21	PR_MU_BW2_GG_21	10	598324.24	2.00	1.20	21	PO_MU_BW2_GG_21	11	87228.19	3.00	0.26
22	PR_MU_BW2_GG_22	12	127670.83	2.00	0.26	22	PO_MU_BW2_GG_22	13	71254.88	3.00	0.21
23	PR_MU_BW2_GG_23	12	120322.88	2.00	0.24	23	PO_MU_BW2_GG_23	13	120322.88	3.00	0.36
24	PR_MU_BW2_GG_24	12	110017.95	2.00	0.22	24	PO_MU_BW2_GG_24	13	110017.95	3.00	0.33
25	PR_MU_BW2_GG_25	12	105158.24	2.00	0.21	25	PO_MU_BW2_GG_25	13	105158.24	3.00	0.32
26	PR_MU_BW2_GG_26	12	235469.87	2.00	0.47	26	PO_MU_BW2_GG_26	13	235469.87	3.00	0.71
27	PR_MU_BW2_GG_27	13	386987.44	2.00	0.77	27	PO_MU_BW2_GG_27	14	386987.44	3.00	1.16
28	PR_MU_BW2_GG_28	14	306355.53	2.00	0.61	28	PO_MU_BW2_GG_28	15	306355.53	3.00	0.92
29	PR_MU_BW2_GG_29	12	337455.52	2.00	0.67	29	PO_MU_BW2_GG_29	13	337455.52	3.00	1.01
30	PR_MU_RN2_GG_30	12	485875.17	2.00	0.97	30	PO_MU_RN2_GG_30	13	485875.17	3.00	1.46
31	PR_MU_RN2_GG_31	15	187278.60	2.00	0.37	31	PO_MU_RN2_GG_31	16	187278.60	3.00	0.56
32	PR_MU_RN2_GG_32	13	890384.38	2.00	1.78	32	PO_MU_RN2_GG_32	14	764921.16	3.00	2.29
33	PR_MU_RN2_GG_33	13	590467.10	2.00	1.18	33	PO_MU_RN2_GG_33	14	470209.48	3.00	1.41
Estimation of Sand Resources in Pre monsoon period & Post monsoon period in sand bar regions of Bhairab River											
1	PR_MU_BW2_BR_1	18	141520.42	2.00	0.28	1	PO_MU_BW2_BR_1	16	68046.42	2.50	0.02
2	PR_MU_RB1_BR_2	18	27851.59	2.00	0.06	2	PO_MU_RB1_BR_2	15	27851.59	2.50	0.02
3	PR_MU_RB1_BR_3	18	39718.22	2.00	0.08	3	PO_MU_RB1_BR_3	14	39718.22	2.50	0.01
4	PR_MU_RB1_BR_4	17	22219.03	2.00	0.04	4	PO_MU_RB1_BR_4	14	22219.03	2.50	0.01
5	PR_MU_RB1_BR_5	15	50320.61	2.00	0.10	5	PO_MU_RB1_BR_5	12	50320.61	2.50	0.00
6	PR_MU_RB1_BR_6	15	28762.35	2.00	0.06	6	PO_MU_RB1_BR_6	12	28762.35	2.50	0.03
Estimation of Sand Resources in Pre monsoon period & Post monsoon period in sand bar regions of Brahmani River											
1	PR_MU_KG_BM_1	15	11434.24	2.00	0.02	1	PO_MU_KG_BM_1	18	6296.25	2.00	0.02
2	PR_MU_NG_BM_2	15	12167.28	2.00	0.02	2	PO_MU_NG_BM_2	18	6534.80	2.00	0.03
3	PR_MU_NG_BM_3	15	4408.57	2.00	0.01	3	PO_MU_NG_BM_3	18	4408.57	2.00	0.02
4	PR_MU_NG_BM_4	15	16587.51	2.00	0.03	4	PO_MU_NG_BM_4	17	2972.61	2.00	0.02
5	PR_MU_KG_BM_5	16	3883.52	2.00	0.01	5	PO_MU_KG_BM_5	15	1789.02	2.00	0.14
6	PR_MU_NG_BM_6	15	13739.09	2.00	0.03	6	PO_MU_NG_BM_6	15	13739.09	2.00	0.06
7	PR_MU_NG_BM_7	14	11770.73	2.00	0.02	7	PO_MU_NG_BM_7	15	11770.73	2.00	0.08
8	PR_MU_KG_BM_8	14	12864.40	2.00	0.03	8	PO_MU_KG_BM_8	15	12864.40	2.00	0.04
9	PR_MU_NG_BM_9	12	9760.93	2.00	0.02	9	PO_MU_NG_BM_9	15	9760.93	2.00	0.10
10	PR_MU_NG_BM_10	12	12012.08	2.00	0.02	10	PO_MU_NG_BM_10	15	12012.08	2.00	0.06
Estimation of Sand Resources in Pre monsoon period & Post monsoon period in sand bar regions of Mayurakshi River											
1	PR_MU_BP_MR_1	13.50	14036.75	2.00	0.03	1	PO_MU_BP_MR_1	14	4156.305566	2.50	0.01

Pre monsoon						Post monsoon					
S L No	**Sand Bar_Code**	**RL (m)**	**Area in sq.m.**	**Sand Thickness in m.**	**Sand Volume in M. Cum**	**S L No**	**Sand Bar_Code**	**RL (m)**	**Area in sq.m.**	**Sand Thickness in m.**	**Sand Volume in M. Cum**
2	PR_MU_BP_MR_2	12.50	11412.42	2.00	0.02	2	PO_MU_BP_MR_2	13	3483.503214	2.50	0.01
3	PR_MU_BP_MR_3	12.50	2975.56	2.00	0.01	3	PO_MU_BP_MR_3	13	2975.562519	2.50	0.01
4	PR_MU_KD_MR_4	12.50	7339.48	2.00	0.01	4	PO_MU_KD_MR_4	13	7339.477515	2.50	0.02
5	PR_MU_KD_MR_5	12.50	51304.96	2.00	0.10	5	PO_MU_KD_MR_5	13	9321.146173	2.50	0.02
6	PR_MU_KD_MR_6	13.50	30160.56	2.00	0.06	6	PO_MU_KD_MR_6	14	5675.171931	2.50	0.01
7	PR_MU_KD_MR_7	12.50	23682.74	2.00	0.05	7	PO_MU_KD_MR_7	13	11541.39302	2.50	0.03
8	PR_MU_KD_MR_8	13.50	19182.36	2.00	0.04	8	PO_MU_KD_MR_8	14	10399.30685	2.50	0.03
9	PR_MU_KD_MR_9	13.50	44411.92	2.00	0.09	9	PO_MU_KD_MR_9	14	5554.508708	2.50	0.01
10	PR_MU_KD_MR_10	12.50	8491.80	2.00	0.02	10	PO_MU_KD_MR_10	13	6146.224431	2.50	0.02
11	PR_MU_KD_MR_11	12.50	9448.42	2.00	0.02	11	PO_MU_KD_MR_11	13	6139.143317	2.50	0.02
12	PR_MU_KD_MR_12	13.50	27832.23	2.00	0.06	12	PO_MU_KD_MR_12	14	27832.22533	2.50	0.07
13	PR_MU_KD_MR_13	13.50	41327.11	2.00	0.08	13	PO_MU_KD_MR_13	14	32996.78369	2.50	0.08
14	PR_MU_BH1_MR_14	13.50	49172.94	2.00	0.10	14	PO_MU_BH1_MR_14	14	49172.94131	2.50	0.12
15	PR_MU_BH1_MR_15	12.50	36210.41	2.00	0.07	15	PO_MU_BH1_MR_15	13	24342.20675	2.50	0.06
16	PR_MU_BH1_MR_16	12.50	29298.15	2.00	0.06	16	PO_MU_BH1_MR_16	13	8617.634685	2.50	0.02
17	PR_MU_BH1_MR_17	13.50	6959.79	2.00	0.01	17	PO_MU_BH1_MR_17	14	2388.197858	2.50	0.01
18	PR_MU_BH1_MR_18	13.50	26808.25	2.00	0.05	18	PO_MU_BH1_MR_18	14	9392.268967	2.50	0.02
19	PR_MU_BH1_MR_19	13.50	44770.18	2.00	0.09	19	PO_MU_BH1_MR_19	14	31485.3672	2.50	0.08
20	PR_MU_BRW_MR_20	18.50	55136.69	2.00	0.11	20	PO_MU_BRW_MR_ 20	19	24114.15835	2.50	0.06
21	PR_MU_BRW_MR_21	21.50	228505.64	2.00	0.46	21	PO_MU_BRW_MR_ 21	22	229672.5752	2.50	0.57

Annexure 3
Boundary Coordinates of Potential Blocks of Murshidabad District

Abbreviation used in the table as below

Particulars	Code	Details	Particulars	Code	Details
DISTRICT	MU	MURSHIDABAD			
BLOCK	NG	NABAGRAM	BLOCK	KG	KHARGRAM
BLOCK	FR	FARAKKA	BLOCK	BP	BEHARAMPUR
BLOCK	SSG	SAMSERGANJ	BLOCK	KD	KANDI
BLOCK	ST2	SUTI II	BLOCK	BH1	BHARATPUR I
BLOCK	ST1	SUTI I	BLOCK	BRW	BURWAN
BLOCK	RG1	RAGHUNATHGANJ II	RIVER	GG	GANGA RIVER
BLOCK	LG	LALGOLA	RIVER	MR	MAYURAKSHI RIVER
BLOCK	BW2	BHAGAWANGOLA II	RIVER	BM	BRAHMANI RIVER
BLOCK	RN2	RANINAGAR II	RIVER	BG	BHAGIRATHI RIVER
BLOCK	RN1	RANINAGAR I	RIVER	BR	BHAIRAB RIVER

Coordinates of Potential Blocks of Mayurakshi River			
Name	**Coordinate ID**	**Latitude**	**Longitude**
MU_BP_MR_1	1	23° 58' 4.130" N	88° 9' 24.685" E
	2	23° 58' 4.045" N	88° 9' 22.259" E
	3	23° 58' 5.572" N	88° 9' 22.226" E
	4	23° 58' 5.829" N	88° 9' 25.153" E
	5	23° 58' 4.413" N	88° 9' 25.259" E
MU_BP_MR_2	1	23° 57' 58.420" N	88° 8' 58.512" E
	2	23° 57' 57.359" N	88° 8' 58.462" E
	3	23° 57' 58.882" N	88° 8' 57.257" E
	4	23° 57' 59.893" N	88° 8' 57.220" E
	5	23° 57' 59.722" N	88° 8' 57.964" E
	6	23° 57' 59.161" N	88° 8' 58.200" E
MU_BP_MR_3	1	23° 57' 48.669" N	88° 9' 7.488" E
	2	23° 57' 48.055" N	88° 9' 6.808" E
	3	23° 57' 48.100" N	88° 9' 6.234" E
	4	23° 57' 48.105" N	88° 9' 6.170" E
	5	23° 57' 48.131" N	88° 9' 5.836" E
	6	23° 57' 48.249" N	88° 9' 5.660" E
	7	23° 57' 48.567" N	88° 9' 6.337" E
	8	23° 57' 50.322" N	88° 9' 5.920" E
	9	23° 57' 50.254" N	88° 9' 7.127" E
	10	23° 57' 49.840" N	88° 9' 7.348" E
MU_KD_MR_4	1	23° 57' 41.585" N	88° 8' 51.933" E
	2	23° 57' 41.123" N	88° 8' 50.494" E

Coordinates of Potential Blocks of Mayurakshi River			
Name	**Coordinate ID**	**Latitude**	**Longitude**
	3	23° 57' 41.223" N	88° 8' 50.202" E
	4	23° 57' 41.474" N	88° 8' 49.467" E
	5	23° 57' 43.363" N	88° 8' 48.606" E
	6	23° 57' 43.845" N	88° 8' 48.614" E
	7	23° 57' 43.747" N	88° 8' 50.454" E
	8	23° 57' 43.136" N	88° 8' 51.666" E
	9	23° 57' 42.444" N	88° 8' 52.128" E
MU_KD_MR_5	1	23° 57' 34.358" N	88° 8' 48.497" E
	2	23° 57' 33.358" N	88° 8' 47.779" E
	3	23° 57' 35.315" N	88° 8' 43.752" E
	4	23° 57' 37.039" N	88° 8' 43.822" E
	5	23° 57' 34.365" N	88° 8' 48.466" E
MU_KD_MR_6	1	23° 57' 44.297" N	88° 8' 36.497" E
	2	23° 57' 43.593" N	88° 8' 36.547" E
	3	23° 57' 44.771" N	88° 8' 34.310" E
	4	23° 57' 47.227" N	88° 8' 33.792" E
	5	23° 57' 45.946" N	88° 8' 35.806" E
	6	23° 57' 45.186" N	88° 8' 36.435" E
MU_KD_MR_7	1	23° 57' 36.381" N	88° 8' 9.866" E
	2	23° 57' 35.512" N	88° 8' 13.294" E
	3	23° 57' 36.036" N	88° 8' 15.266" E
	4	23° 57' 34.118" N	88° 8' 15.879" E
	5	23° 57' 33.552" N	88° 8' 13.874" E
	6	23° 57' 33.758" N	88° 8' 11.253" E
MU_KD_MR_8	1	23° 57' 40.782" N	88° 8' 5.321" E
	2	23° 57' 40.486" N	88° 8' 4.708" E
	3	23° 57' 45.515" N	88° 8' 0.246" E
	4	23° 57' 46.050" N	88° 8' 0.781" E
	5	23° 57' 45.836" N	88° 8' 1.681" E
	6	23° 57' 44.637" N	88° 8' 3.351" E
	7	23° 57' 43.181" N	88° 8' 4.722" E
	8	23° 57' 42.067" N	88° 8' 5.278" E
MU_KD_MR_9	1	23° 57' 44.897" N	88° 7' 41.479" E
	2	23° 57' 43.564" N	88° 7' 37.472" E
	3	23° 57' 45.220" N	88° 7' 37.571" E
	4	23° 57' 45.494" N	88° 7' 40.450" E
	5	23° 57' 45.357" N	88° 7' 42.163" E
	6	23° 57' 44.969" N	88° 7' 41.959" E

Coordinates of Potential Blocks of Mayurakshi River			
Name	**Coordinate ID**	**Latitude**	**Longitude**
MU_KD_MR_10	1	23° 57' 29.970" N	88° 7' 16.623" E
	2	23° 57' 27.443" N	88° 7' 13.980" E
	3	23° 57' 27.765" N	88° 7' 13.361" E
	4	23° 57' 31.535" N	88° 7' 16.157" E
	5	23° 57' 30.743" N	88° 7' 16.900" E
MU_KD_MR_11	1	23° 57' 21.104" N	88° 7' 8.482" E
	2	23° 57' 17.843" N	88° 7' 3.703" E
	3	23° 57' 18.241" N	88° 7' 3.707" E
	4	23° 57' 18.268" N	88° 7' 3.595" E
	5	23° 57' 19.523" N	88° 7' 4.897" E
	6	23° 57' 20.416" N	88° 7' 5.681" E
	7	23° 57' 21.041" N	88° 7' 7.705" E
MU_KD_MR_12	1	23° 56' 24.569" N	88° 6' 38.129" E
	2	23° 56' 21.854" N	88° 6' 37.055" E
	3	23° 56' 22.305" N	88° 6' 36.023" E
	4	23° 56' 24.373" N	88° 6' 35.479" E
	5	23° 56' 26.174" N	88° 6' 36.243" E
	6	23° 56' 27.620" N	88° 6' 38.502" E
	7	23° 56' 28.293" N	88° 6' 40.567" E
	8	23° 56' 28.440" N	88° 6' 44.031" E
	9	23° 56' 28.425" N	88° 6' 46.183" E
	10	23° 56' 27.511" N	88° 6' 45.949" E
	11	23° 56' 27.203" N	88° 6' 44.309" E
MU_KD_MR_13	1	23° 55' 58.303" N	88° 6' 36.192" E
	2	23° 55' 58.311" N	88° 6' 35.069" E
	3	23° 55' 58.946" N	88° 6' 34.484" E
	4	23° 56' 1.294" N	88° 6' 36.549" E
	5	23° 56' 9.235" N	88° 6' 36.935" E
	6	23° 56' 12.660" N	88° 6' 35.992" E
	7	23° 56' 12.922" N	88° 6' 36.879" E
	8	23° 56' 11.972" N	88° 6' 37.432" E
	9	23° 56' 6.388" N	88° 6' 38.783" E
	10	23° 56' 4.075" N	88° 6' 39.125" E
	11	23° 56' 1.248" N	88° 6' 38.697" E
	12	23° 55' 59.665" N	88° 6' 38.169" E
MU_BH1_MR_14	1	23° 55' 14.180" N	88° 5' 38.311" E
	2	23° 55' 12.964" N	88° 5' 38.031" E
	3	23° 55' 12.974" N	88° 5' 37.841" E

Coordinates of Potential Blocks of Mayurakshi River			
Name	**Coordinate ID**	**Latitude**	**Longitude**
	4	23° 55' 12.550" N	88° 5' 36.677" E
	5	23° 55' 12.489" N	88° 5' 35.995" E
	6	23° 55' 11.295" N	88° 5' 34.581" E
	7	23° 55' 9.928" N	88° 5' 33.260" E
	8	23° 55' 8.244" N	88° 5' 34.181" E
	9	23° 55' 7.612" N	88° 5' 35.188" E
	10	23° 55' 6.789" N	88° 5' 35.717" E
	11	23° 55' 4.373" N	88° 5' 38.698" E
	12	23° 55' 3.246" N	88° 5' 39.588" E
	13	23° 55' 0.141" N	88° 5' 40.742" E
	14	23° 54' 57.669" N	88° 5' 40.488" E
	15	23° 54' 56.722" N	88° 5' 39.783" E
	16	23° 55' 0.105" N	88° 5' 38.497" E
	17	23° 55' 4.371" N	88° 5' 36.407" E
	18	23° 55' 7.868" N	88° 5' 31.918" E
	19	23° 55' 10.358" N	88° 5' 31.447" E
	20	23° 55' 12.680" N	88° 5' 31.467" E
	21	23° 55' 14.389" N	88° 5' 33.072" E
	22	23° 55' 14.791" N	88° 5' 37.099" E
MU_BH1_MR_15	1	23° 54' 40.776" N	88° 5' 42.117" E
	2	23° 54' 38.041" N	88° 5' 40.225" E
	3	23° 54' 37.099" N	88° 5' 37.612" E
	4	23° 54' 37.270" N	88° 5' 34.786" E
	5	23° 54' 38.580" N	88° 5' 31.618" E
	6	23° 54' 39.193" N	88° 5' 31.804" E
	7	23° 54' 39.170" N	88° 5' 31.815" E
	8	23° 54' 39.238" N	88° 5' 32.089" E
	9	23° 54' 39.924" N	88° 5' 38.874" E
	10	23° 54' 41.928" N	88° 5' 41.170" E
	11	23° 54' 42.180" N	88° 5' 40.744" E
	12	23° 54' 41.674" N	88° 5' 41.675" E
MU_BH1_MR_16	1	23° 53' 56.124" N	88° 4' 12.758" E
	2	23° 53' 55.969" N	88° 4' 10.356" E
	3	23° 53' 57.342" N	88° 4' 10.928" E
	4	23° 53' 59.168" N	88° 4' 10.795" E
	5	23° 53' 58.793" N	88° 4' 13.407" E
	6	23° 53' 58.165" N	88° 4' 13.595" E
	7	23° 53' 56.730" N	88° 4' 13.424" E

Coordinates of Potential Blocks of Mayurakshi River			
Name	**Coordinate ID**	**Latitude**	**Longitude**
MU_BH1_MR_17	1	23° 53' 41.115" N	88° 3' 38.673" E
	2	23° 53' 41.115" N	88° 3' 37.773" E
	3	23° 53' 41.244" N	88° 3' 37.002" E
	4	23° 53' 42.614" N	88° 3' 36.917" E
	5	23° 53' 43.440" N	88° 3' 37.409" E
	6	23° 53' 42.677" N	88° 3' 38.151" E
	7	23° 53' 41.642" N	88° 3' 38.592" E
	8	23° 53' 41.373" N	88° 3' 38.633" E
MU_BH1_MR_18	1	23° 52' 32.356" N	88° 3' 28.559" E
	2	23° 52' 31.613" N	88° 3' 27.497" E
	3	23° 52' 33.644" N	88° 3' 24.662" E
	4	23° 52' 33.777" N	88° 3' 24.287" E
	5	23° 52' 35.444" N	88° 3' 25.331" E
	6	23° 52' 34.288" N	88° 3' 26.993" E
MU_BH1_MR_19	1	23° 52' 19.370" N	88° 2' 49.799" E
	2	23° 52' 16.564" N	88° 2' 43.407" E
	3	23° 52' 17.279" N	88° 2' 42.947" E
	4	23° 52' 19.326" N	88° 2' 45.433" E
	5	23° 52' 20.917" N	88° 2' 48.366" E
	6	23° 52' 22.039" N	88° 2' 52.129" E
	7	23° 52' 22.386" N	88° 2' 52.608" E
	8	23° 52' 22.916" N	88° 2' 53.994" E
	9	23° 52' 23.689" N	88° 2' 54.406" E
	10	23° 52' 23.902" N	88° 2' 54.699" E
	11	23° 52' 25.454" N	88° 2' 55.346" E
	12	23° 52' 26.481" N	88° 2' 55.893" E
	13	23° 52' 28.189" N	88° 2' 56.486" E
	14	23° 52' 29.567" N	88° 2' 57.060" E
	15	23° 52' 29.490" N	88° 2' 58.761" E
	16	23° 52' 27.953" N	88° 2' 58.742" E
	17	23° 52' 25.641" N	88° 2' 58.074" E
	18	23° 52' 21.141" N	88° 2' 53.983" E
	19	23° 52' 20.547" N	88° 2' 52.602" E
MU_BRW_MR_ 20	1	23° 52' 49.431" N	87° 59' 24.116" E
	2	23° 52' 48.444" N	87° 59' 29.927" E
	3	23° 52' 48.733" N	87° 59' 37.998" E
	4	23° 52' 47.603" N	87° 59' 38.585" E
	5	23° 52' 47.496" N	87° 59' 32.461" E

Coordinates of Potential Blocks of Mayurakshi River			
Name	**Coordinate ID**	**Latitude**	**Longitude**
	6	23° 52' 47.739" N	87° 59' 28.159" E
	7	23° 52' 48.107" N	87° 59' 23.487" E
MU_BRW_MR_ 21	1	23° 52' 49.325" N	87° 54' 36.715" E
	2	23° 52' 46.730" N	87° 54' 33.706" E
	3	23° 52' 48.164" N	87° 54' 30.482" E
	4	23° 52' 49.140" N	87° 54' 28.871" E
	5	23° 52' 53.719" N	87° 54' 34.337" E
	6	23° 53' 3.056" N	87° 54' 42.475" E
	7	23° 53' 9.181" N	87° 54' 50.569" E
	8	23° 53' 12.478" N	87° 55' 2.605" E
	9	23° 53' 12.443" N	87° 55' 8.104" E
	10	23° 53' 8.171" N	87° 55' 3.097" E
	11	23° 53' 5.921" N	87° 55' 1.128" E
	12	23° 53' 5.814" N	87° 54' 52.884" E
	13	23° 53' 4.208" N	87° 54' 49.136" E
	14	23° 53' 0.014" N	87° 54' 43.684" E
	15	23° 52' 54.785" N	87° 54' 38.321" E

Coordinates of Potential Blocks of Bhairab River			
Name	**Coordinate_ID**	**Latitude**	**Longitude**
MU_BW2_BR_1	1	24° 18' 27.201" N	88° 25' 24.651" E
	2	24° 18' 25.215" N	88° 25' 24.298" E
	3	24° 18' 31.668" N	88° 25' 17.462" E
	4	24° 18' 36.807" N	88° 25' 7.414" E
	5	24° 18' 40.354" N	88° 24' 59.388" E
	6	24° 18' 43.024" N	88° 24' 48.748" E
	7	24° 18' 45.077" N	88° 24' 49.429" E
	8	24° 18' 43.278" N	88° 24' 54.195" E
	9	24° 18' 41.015" N	88° 24' 58.844" E
	10	24° 18' 39.845" N	88° 25' 2.548" E
	11	24° 18' 37.634" N	88° 25' 7.254" E
	12	24° 18' 35.792" N	88° 25' 11.063" E
	13	24° 18' 34.619" N	88° 25' 15.048" E
	14	24° 18' 33.241" N	88° 25' 18.974" E
	15	24° 18' 30.210" N	88° 25' 22.995" E

Coordinates of Potential Blocks of Bhairab River			
Name	**Coordinate_ID**	**Latitude**	**Longitude**
MU_RB1_BR_2	1	24° 17' 9.477" N	88° 26' 53.206" E
	2	24° 17' 7.545" N	88° 26' 54.068" E
	3	24° 17' 9.044" N	88° 26' 52.023" E
	4	24° 17' 10.784" N	88° 26' 50.016" E
	5	24° 17' 12.590" N	88° 26' 48.160" E
	6	24° 17' 14.529" N	88° 26' 46.905" E
	7	24° 17' 16.460" N	88° 26' 46.402" E
	8	24° 17' 17.970" N	88° 26' 46.794" E
	9	24° 17' 18.523" N	88° 26' 47.406" E
	10	24° 17' 14.403" N	88° 26' 49.866" E
MU_RB1_BR_3	1	24° 16' 37.721" N	88° 27' 0.615" E
	2	24° 16' 36.781" N	88° 26' 58.267" E
	3	24° 16' 42.039" N	88° 26' 58.918" E
	4	24° 16' 50.989" N	88° 26' 56.844" E
	5	24° 16' 51.299" N	88° 26' 57.367" E
	6	24° 16' 51.606" N	88° 26' 59.013" E
	7	24° 16' 49.016" N	88° 27' 0.039" E
	8	24° 16' 43.413" N	88° 27' 1.266" E
	9	24° 16' 40.724" N	88° 27' 1.470" E
	10	24° 16' 38.360" N	88° 27' 1.326" E
MU_RB1_BR_4	1	24° 14' 45.803" N	88° 24' 47.928" E
	2	24° 14' 39.818" N	88° 24' 43.842" E
	3	24° 14' 40.710" N	88° 24' 43.831" E
	4	24° 14' 41.828" N	88° 24' 43.843" E
	5	24° 14' 43.544" N	88° 24' 44.331" E
	6	24° 14' 46.027" N	88° 24' 45.578" E
	7	24° 14' 47.734" N	88° 24' 47.004" E
	8	24° 14' 49.011" N	88° 24' 48.331" E
	9	24° 14' 49.690" N	88° 24' 49.371" E
	10	24° 14' 50.102" N	88° 24' 51.345" E
	11	24° 14' 50.085" N	88° 24' 51.724" E
MU_RB1_BR_5	1	24° 10' 54.638" N	88° 26' 9.277" E
	2	24° 10' 54.594" N	88° 26' 7.871" E
	3	24° 10' 57.503" N	88° 26' 6.882" E
	4	24° 11' 2.591" N	88° 26' 3.104" E
	5	24° 11' 7.127" N	88° 25' 59.802" E
	6	24° 11' 10.285" N	88° 25' 59.547" E
	7	24° 11' 10.691" N	88° 25' 59.855" E
	8	24° 11' 10.929" N	88° 26' 1.246" E
	9	24° 11' 7.937" N	88° 26' 3.054" E
	10	24° 11' 3.037" N	88° 26' 6.121" E
	11	24° 10' 57.692" N	88° 26' 8.519" E

Coordinates of Potential Blocks of Bhairab River			
Name	**Coordinate_ID**	**Latitude**	**Longitude**
	12	24° 10' 54.705" N	88° 26' 9.623" E
MU_RB1_BR_6	1	24° 10' 22.866" N	88° 26' 16.741" E
	2	24° 10' 22.315" N	88° 26' 15.538" E
	3	24° 10' 24.404" N	88° 26' 15.504" E
	4	24° 10' 31.920" N	88° 26' 14.784" E
	5	24° 10' 37.761" N	88° 26' 13.390" E
	6	24° 10' 37.864" N	88° 26' 13.440" E
	7	24° 10' 37.941" N	88° 26' 14.378" E
	8	24° 10' 36.038" N	88° 26' 15.482" E
	9	24° 10' 32.415" N	88° 26' 16.566" E
	10	24° 10' 28.370" N	88° 26' 16.802" E
	11	24° 10' 24.068" N	88° 26' 17.035" E

Coordinates of potential Blocks of Brahmani River			
Name	**Coordinate_ID**	**Latitude**	**Longitude**
MU_KG_BM_1	1	24° 10’ 56.096” N	87° 59’ 5.279” E
	2	24° 10’ 55.928” N	87° 59’ 4.231” E
	3	24° 10’ 56.185” N	87° 59’ 2.072” E
	4	24° 10’ 58.173” N	87° 59’ 2.005” E
	5	24° 10’ 57.704” N	87° 59’ 5.893” E
	6	24° 10’ 56.648” N	87° 59’ 6.030” E
	7	24° 10’ 56.455” N	87° 59’ 5.837” E
MU_NG_BM_2	1	24° 10’ 46.906” N	87° 59’ 29.809” E
	2	24° 10’ 46.697” N	87° 59’ 29.938” E
	3	24° 10’ 46.773” N	87° 59’ 30.141” E
	4	24° 10’ 46.626” N	87° 59’ 30.510” E
	5	24° 10’ 46.673” N	87° 59’ 32.816” E
	6	24° 10’ 46.248” N	87° 59’ 33.341” E
	7	24° 10’ 45.263” N	87° 59’ 31.902” E
	8	24° 10’ 45.042” N	87° 59’ 31.536” E
	9	24° 10’ 45.032” N	87° 59’ 29.482” E
	10	24° 10’ 46.009” N	87° 59’ 28.711” E
	11	24° 10’ 47.345” N	87° 59’ 28.711” E
MU_NG_BM_3	1	24° 10’ 26.621” N	87° 59’ 36.113” E
	2	24° 10’ 26.621” N	87° 59’ 35.290” E
	3	24° 10’ 26.883” N	87° 59’ 35.056” E
	4	24° 10’ 28.330” N	87° 59’ 36.817” E
	5	24° 10’ 28.652” N	87° 59’ 38.426” E
	6	24° 10’ 28.659” N	87° 59’ 38.461” E
	7	24° 10’ 27.855” N	87° 59’ 38.323” E
	8	24° 10’ 27.392” N	87° 59’ 37.963” E
	9	24° 10’ 26.837” N	87° 59’ 36.992” E

Coordinates of potential Blocks of Brahmani River			
Name	**Coordinate_ID**	**Latitude**	**Longitude**
	10	24° 10’ 26.764” N	87° 59’ 36.828” E
MU_NG_BM_4	1	24° 10' 4.061" N	87° 59' 36.930" E
	2	24° 10' 3.975" N	87° 59' 36.647" E
	3	24° 10' 4.295" N	87° 59' 35.718" E
	4	24° 10' 4.432" N	87° 59' 35.526" E
	5	24° 10' 4.644" N	87° 59' 35.308" E
	6	24° 10' 6.543" N	87° 59' 34.554" E
	7	24° 10' 7.093" N	87° 59' 35.082" E
	8	24° 10' 6.988" N	87° 59' 35.391" E
	9	24° 10' 6.200" N	87° 59' 35.455" E
	10	24° 10' 5.501" N	87° 59' 35.787" E
	11	24° 10' 4.994" N	87° 59' 36.318" E
	12	24° 10' 4.473" N	87° 59' 37.116" E
MU_KG_BM_5	1	24° 9' 37.022" N	87° 59' 58.164" E
	2	24° 9' 37.118" N	87° 59' 56.868" E
	3	24° 9' 37.844" N	87° 59' 56.692" E
	4	24° 9' 37.897" N	87° 59' 57.461" E
MU_NG_BM_6	1	24° 9' 28.311" N	88° 0' 43.288" E
	2	24° 9' 26.551" N	88° 0' 42.074" E
	3	24° 9' 25.908" N	88° 0' 40.575" E
	4	24° 9' 26.722" N	88° 0' 38.145" E
	5	24° 9' 27.632" N	88° 0' 37.058" E
	6	24° 9' 28.302" N	88° 0' 37.333" E
	7	24° 9' 28.970" N	88° 0' 37.590" E
	8	24° 9' 29.211" N	88° 0' 37.991" E
	9	24° 9' 27.798" N	88° 0' 38.921" E
	10	24° 9' 27.575" N	88° 0' 40.934" E
	11	24° 9' 29.619" N	88° 0' 41.861" E
MU_NG_BM_7	1	24° 9' 16.385" N	88° 1' 12.568" E
	2	24° 9' 15.299" N	88° 1' 12.257" E
	3	24° 9' 15.658" N	88° 1' 10.870" E
	4	24° 9' 17.149" N	88° 1' 9.945" E
	5	24° 9' 18.485" N	88° 1' 8.865" E
	6	24° 9' 19.770" N	88° 1' 7.786" E
	7	24° 9' 20.901" N	88° 1' 8.094" E
	8	24° 9' 21.158" N	88° 1' 8.403" E
	9	24° 9' 21.342" N	88° 1' 8.734" E
	10	24° 9' 20.807" N	88° 1' 9.494" E
	11	24° 9' 18.715" N	88° 1' 11.660" E
	12	24° 9' 18.478" N	88° 1' 11.892" E
MU_KG_BM_8	1	24° 9' 5.885" N	88° 1' 24.144" E
	2	24° 9' 5.163" N	88° 1' 23.077" E

Coordinates of potential Blocks of Brahmani River			
Name	**Coordinate_ID**	**Latitude**	**Longitude**
	3	24° 9' 5.016" N	88° 1' 22.859" E
	4	24° 9' 4.779" N	88° 1' 21.612" E
	5	24° 9' 4.625" N	88° 1' 19.659" E
	6	24° 9' 4.677" N	88° 1' 17.603" E
	7	24° 9' 5.293" N	88° 1' 16.832" E
	8	24° 9' 5.898" N	88° 1' 16.971" E
	9	24° 9' 5.846" N	88° 1' 19.764" E
	10	24° 9' 6.343" N	88° 1' 23.088" E
	11	24° 9' 8.400" N	88° 1' 24.801" E
	12	24° 9' 7.452" N	88° 1' 25.518" E
	13	24° 9' 6.024" N	88° 1' 24.280" E
MU_NG_BM_9	1	24° 8' 36.921" N	88° 2' 41.357" E
	2	24° 8' 36.171" N	88° 2' 40.180" E
	3	24° 8' 37.349" N	88° 2' 38.252" E
	4	24° 8' 39.169" N	88° 2' 36.860" E
	5	24° 8' 40.133" N	88° 2' 36.539" E
	6	24° 8' 40.704" N	88° 2' 37.170" E
	7	24° 8' 38.261" N	88° 2' 40.415" E
	8	24° 8' 37.260" N	88° 2' 41.370" E
MU_NG_BM_10	1	24° 8' 3.470" N	88° 2' 47.825" E
	2	24° 8' 2.956" N	88° 2' 45.855" E
	3	24° 8' 4.155" N	88° 2' 44.398" E
	4	24° 8' 6.297" N	88° 2' 42.514" E
	5	24° 8' 7.667" N	88° 2' 41.828" E
	6	24° 8' 8.952" N	88° 2' 41.914" E
	7	24° 8' 9.552" N	88° 2' 42.257" E
	8	24° 8' 9.623" N	88° 2' 42.620" E
	9	24° 8' 7.097" N	88° 2' 43.430" E
	10	24° 8' 4.219" N	88° 2' 46.274" E
	11	24° 8' 3.475" N	88° 2' 47.831" E

Coordinates of potential Blocks of Ganga River			
Name	**Coordinate_ID**	**Latitude**	**Longitude**
MU_FR_GG_1	1	24° 43' 41.146" N	87° 56' 34.456" E
	2	24° 43' 25.417" N	87° 56' 28.746" E
	3	24° 44' 8.782" N	87° 56' 19.485" E
	4	24° 45' 5.158" N	87° 56' 8.341" E
	5	24° 45' 59.284" N	87° 55' 57.642" E
	6	24° 46' 0.115" N	87° 55' 57.432" E
	7	24° 46' 20.995" N	87° 55' 52.161" E
	8	24° 47' 40.163" N	87° 55' 32.179" E
	9	24° 47' 15.875" N	87° 56' 1.020" E

	10	24° 46' 46.567" N	87° 56' 28.157" E
	11	24° 46' 8.482" N	87° 56' 50.218" E
	12	24° 44' 53.786" N	87° 56' 59.127" E
	13	24° 44' 2.390" N	87° 56' 44.050" E
MU_FR_GG_2	1	24° 41' 40.977" N	87° 57' 19.654" E
	2	24° 41' 36.475" N	87° 57' 20.135" E
	3	24° 41' 47.352" N	87° 57' 6.742" E
	4	24° 42' 14.115" N	87° 56' 48.847" E
	5	24° 42' 34.655" N	87° 56' 43.509" E
	6	24° 43' 0.029" N	87° 56' 56.385" E
	7	24° 43' 17.161" N	87° 57' 20.370" E
	8	24° 43' 47.314" N	87° 57' 29.279" E
	9	24° 44' 38.024" N	87° 57' 33.381" E
	10	24° 43' 21.888" N	87° 57' 39.735" E
	11	24° 43' 0.523" N	87° 57' 36.087" E
	12	24° 42' 29.942" N	87° 57' 37.372" E
	13	24° 42' 20.461" N	87° 57' 42.113" E
	14	24° 42' 15.012" N	87° 57' 39.924" E
MU_SSG_GG_3	1	24° 39' 19.756" N	88° 0' 44.214" E
	2	24° 39' 15.785" N	88° 0' 25.952" E
	3	24° 39' 17.956" N	88° 0' 2.072" E
	4	24° 39' 23.620" N	87° 59' 39.707" E
	5	24° 39' 30.538" N	87° 59' 52.228" E
	6	24° 39' 34.557" N	87° 59' 57.553" E
	7	24° 39' 33.653" N	87° 59' 58.712" E
MU_ST2_GG_4	1	24° 38' 39.422" N	88° 1' 41.394" E
	2	24° 38' 37.251" N	88° 2' 3.647" E
	3	24° 38' 38.494" N	88° 2' 17.007" E
	4	24° 38' 19.837" N	88° 1' 58.678" E
	5	24° 38' 32.366" N	88° 1' 39.223" E
MU_ST2_GG_5	1	24° 37' 54.521" N	88° 2' 6.875" E
	2	24° 37' 42.153" N	88° 2' 4.117" E
	3	24° 37' 27.801" N	88° 1' 58.825" E
	4	24° 37' 25.572" N	88° 1' 50.806" E
	5	24° 37' 25.641" N	88° 1' 50.759" E
	6	24° 37' 49.283" N	88° 1' 47.333" E
	7	24° 37' 59.935" N	88° 1' 49.376" E
	8	24° 38' 0.309" N	88° 1' 49.448" E
MU_ST2_GG_6	1	24° 35' 13.414" N	88° 3' 20.621" E
	2	24° 35' 10.668" N	88° 3' 19.657" E
	3	24° 35' 17.781" N	88° 3' 11.062" E
	4	24° 35' 18.427" N	88° 3' 10.677" E
	5	24° 35' 59.038" N	88° 2' 54.833" E
	6	24° 36' 12.230" N	88° 2' 44.811" E

	7	24° 36' 47.608" N	88° 2' 16.372" E
	8	24° 37' 3.021" N	88° 2' 5.993" E
	9	24° 37' 1.510" N	88° 2' 10.206" E
	10	24° 36' 49.263" N	88° 2' 27.324" E
	11	24° 36' 37.012" N	88° 2' 45.005" E
	12	24° 36' 15.014" N	88° 3' 1.213" E
	13	24° 35' 57.788" N	88° 3' 7.541" E
	14	24° 35' 30.376" N	88° 3' 14.052" E
	15	24° 35' 26.349" N	88° 3' 15.949" E
	16	24° 35' 22.216" N	88° 3' 16.555" E
MU_ST2_GG_7	1	24° 33' 23.411" N	88° 4' 52.395" E
	2	24° 33' 23.427" N	88° 4' 50.138" E
	3	24° 33' 32.934" N	88° 4' 48.639" E
	4	24° 33' 49.061" N	88° 4' 45.166" E
	5	24° 34' 0.876" N	88° 4' 38.495" E
	6	24° 34' 2.725" N	88° 4' 39.640" E
	7	24° 34' 8.554" N	88° 4' 32.918" E
	8	24° 34' 13.984" N	88° 4' 24.160" E
	9	24° 34' 16.061" N	88° 4' 21.684" E
	10	24° 34' 21.886" N	88° 4' 15.137" E
	11	24° 34' 24.305" N	88° 4' 12.714" E
	12	24° 34' 27.380" N	88° 4' 21.357" E
	13	24° 34' 0.330" N	88° 4' 43.982" E
	14	24° 33' 58.994" N	88° 4' 45.981" E
	15	24° 33' 53.747" N	88° 4' 48.380" E
	16	24° 33' 35.780" N	88° 4' 54.758" E
	17	24° 33' 32.808" N	88° 4' 54.190" E
	18	24° 33' 25.671" N	88° 4' 52.287" E
	19	24° 33' 24.173" N	88° 4' 52.540" E
MU_ST2_GG_8	1	24° 32' 24.667" N	88° 4' 46.476" E
	2	24° 32' 20.383" N	88° 4' 42.868" E
	3	24° 32' 23.979" N	88° 4' 43.828" E
	4	24° 32' 31.131" N	88° 4' 47.425" E
	5	24° 32' 41.925" N	88° 4' 52.651" E
	6	24° 32' 54.812" N	88° 4' 54.096" E
	7	24° 32' 48.244" N	88° 4' 57.257" E
	8	24° 32' 36.859" N	88° 4' 55.514" E
MU_ST2_GG_9	1	24° 31' 41.503" N	88° 4' 47.779" E
	2	24° 31' 41.020" N	88° 4' 44.787" E
	3	24° 31' 42.331" N	88° 4' 43.848" E
	4	24° 31' 48.746" N	88° 4' 41.646" E
	5	24° 31' 59.490" N	88° 4' 40.384" E
	6	24° 32' 6.918" N	88° 4' 40.899" E
	7	24° 32' 13.910" N	88° 4' 44.795" E

	8	24° 32' 15.837" N	88° 4' 47.686" E
	9	24° 32' 1.964" N	88° 4' 45.194" E
	10	24° 31' 52.987" N	88° 4' 44.886" E
MU_RG2_GG_10	1	24° 29' 52.514" N	88° 5' 29.835" E
	2	24° 29' 40.919" N	88° 5' 27.478" E
	3	24° 29' 47.662" N	88° 5' 22.743" E
	4	24° 30' 0.836" N	88° 5' 20.882" E
	5	24° 30' 14.504" N	88° 5' 22.128" E
	6	24° 30' 19.144" N	88° 5' 22.732" E
	7	24° 30' 24.069" N	88° 5' 19.672" E
	8	24° 30' 29.269" N	88° 5' 14.358" E
	9	24° 30' 31.545" N	88° 5' 9.662" E
	10	24° 30' 32.920" N	88° 5' 9.397" E
	11	24° 30' 53.136" N	88° 5' 2.416" E
	12	24° 31' 12.880" N	88° 4' 54.878" E
	13	24° 31' 22.889" N	88° 4' 50.616" E
	14	24° 31' 21.546" N	88° 4' 53.372" E
	15	24° 31' 18.217" N	88° 5' 0.325" E
	16	24° 31' 14.808" N	88° 5' 1.821" E
	17	24° 31' 3.850" N	88° 5' 6.723" E
	18	24° 31' 2.868" N	88° 5' 7.032" E
	19	24° 30' 49.166" N	88° 5' 10.581" E
	20	24° 30' 33.619" N	88° 5' 19.472" E
	21	24° 30' 21.969" N	88° 5' 24.730" E
	22	24° 30' 17.016" N	88° 5' 28.222" E
	23	24° 30' 8.918" N	88° 5' 31.734" E
	24	24° 29' 53.214" N	88° 5' 30.881" E
MU_RG2_GG_11	1	24° 29' 5.479" N	88° 6' 4.373" E
	2	24° 29' 3.183" N	88° 6' 4.593" E
	3	24° 29' 6.910" N	88° 5' 54.756" E
	4	24° 29' 12.772" N	88° 5' 47.052" E
	5	24° 29' 20.556" N	88° 5' 41.245" E
	6	24° 29' 21.182" N	88° 5' 43.835" E
	7	24° 29' 20.444" N	88° 5' 44.684" E
	8	24° 29' 10.493" N	88° 5' 54.207" E
MU_RG2_GG_12	1	24° 30' 12.024" N	88° 9' 6.156" E
	2	24° 29' 42.695" N	88° 9' 7.437" E
	3	24° 29' 45.953" N	88° 9' 3.731" E
	4	24° 29' 53.149" N	88° 8' 54.994" E
	5	24° 30' 1.453" N	88° 8' 47.959" E
	6	24° 30' 13.486" N	88° 8' 45.229" E
	7	24° 30' 23.123" N	88° 8' 42.873" E
	8	24° 30' 29.226" N	88° 8' 39.339" E
	9	24° 30' 33.349" N	88° 8' 40.880" E

	10	24° 30' 20.268" N	88° 8' 52.264" E
MU_RG2_GG_13	1	24° 28' 5.305" N	88° 7' 2.854" E
	2	24° 28' 3.036" N	88° 7' 2.609" E
	3	24° 28' 9.115" N	88° 6' 50.031" E
	4	24° 28' 19.161" N	88° 6' 31.398" E
	5	24° 28' 26.651" N	88° 6' 23.569" E
	6	24° 28' 38.219" N	88° 6' 22.543" E
	7	24° 28' 34.877" N	88° 6' 25.414" E
	8	24° 28' 30.506" N	88° 6' 26.844" E
	9	24° 28' 22.591" N	88° 6' 34.090" E
	10	24° 28' 20.342" N	88° 6' 40.872" E
	11	24° 28' 18.659" N	88° 6' 43.574" E
	12	24° 28' 13.006" N	88° 6' 54.351" E
MU_RG2_GG_14	1	24° 27' 22.985" N	88° 8' 31.423" E
	2	24° 27' 22.213" N	88° 8' 31.743" E
	3	24° 27' 31.853" N	88° 7' 53.043" E
	4	24° 27' 46.373" N	88° 7' 19.122" E
	5	24° 27' 48.183" N	88° 7' 16.212" E
	6	24° 27' 48.229" N	88° 7' 22.814" E
	7	24° 27' 46.832" N	88° 7' 37.133" E
	8	24° 27' 40.690" N	88° 7' 53.289" E
	9	24° 27' 33.476" N	88° 8' 8.965" E
	10	24° 27' 29.126" N	88° 8' 15.504" E
	11	24° 27' 26.912" N	88° 8' 23.941" E
MU_RG2_GG_15	1	24° 27' 2.742" N	88° 9' 49.110" E
	2	24° 27' 1.730" N	88° 9' 46.470" E
	3	24° 27' 5.769" N	88° 9' 35.795" E
	4	24° 27' 8.434" N	88° 9' 24.731" E
	5	24° 27' 10.771" N	88° 9' 11.597" E
	6	24° 27' 14.494" N	88° 8' 57.160" E
	7	24° 27' 21.160" N	88° 8' 40.118" E
	8	24° 27' 26.996" N	88° 8' 41.862" E
	9	24° 27' 26.793" N	88° 8' 43.341" E
	10	24° 27' 16.701" N	88° 9' 15.012" E
	11	24° 27' 6.936" N	88° 9' 39.683" E
	12	24° 27' 4.522" N	88° 9' 47.198" E
MU_RG2_GG_16	1	24° 27' 25.354" N	88° 10' 10.088" E
	2	24° 27' 15.289" N	88° 10' 10.945" E
	3	24° 27' 23.419" N	88° 10' 4.899" E
	4	24° 27' 37.700" N	88° 10' 0.069" E
	5	24° 27' 47.198" N	88° 9' 55.013" E
	6	24° 27' 48.494" N	88° 9' 54.323" E
	7	24° 27' 35.379" N	88° 10' 6.189" E
MU_LG_GG_17	1	24° 26' 47.100" N	88° 11' 37.229" E

	2	24° 26' 45.118" N	88° 11' 26.837" E
	3	24° 26' 47.265" N	88° 11' 16.258" E
	4	24° 26' 53.765" N	88° 11' 3.465" E
	5	24° 27' 1.165" N	88° 10' 52.012" E
	6	24° 27' 1.601" N	88° 10' 51.336" E
	7	24° 26' 51.773" N	88° 11' 38.837" E
MU_BW2_GG_18	1	24° 22' 20.687" N	88° 23' 11.530" E
	2	24° 22' 8.944" N	88° 23' 5.774" E
	3	24° 22' 24.476" N	88° 22' 49.977" E
	4	24° 22' 24.524" N	88° 23' 5.269" E
MU_BW2_GG_19	1	24° 21' 49.813" N	88° 26' 9.832" E
	2	24° 21' 47.312" N	88° 26' 46.775" E
	3	24° 21' 51.970" N	88° 27' 5.606" E
	4	24° 22' 5.720" N	88° 27' 18.580" E
	5	24° 22' 5.579" N	88° 27' 26.156" E
	6	24° 21' 58.206" N	88° 27' 54.690" E
	7	24° 21' 44.553" N	88° 27' 50.121" E
	8	24° 21' 39.964" N	88° 27' 24.248" E
	9	24° 21' 33.207" N	88° 27' 0.111" E
	10	24° 21' 21.679" N	88° 26' 28.879" E
	11	24° 21' 13.933" N	88° 25' 55.344" E
	12	24° 21' 14.680" N	88° 25' 17.876" E
	13	24° 21' 23.781" N	88° 24' 45.754" E
	14	24° 21' 27.782" N	88° 24' 35.810" E
	15	24° 21' 36.679" N	88° 24' 18.345" E
	16	24° 21' 43.960" N	88° 24' 19.202" E
	17	24° 22' 4.091" N	88° 24' 32.479" E
	18	24° 22' 16.940" N	88° 24' 14.491" E
	19	24° 22' 28.348" N	88° 23' 57.253" E
	20	24° 22' 23.368" N	88° 24' 31.676" E
	21	24° 22' 12.585" N	88° 24' 52.036" E
	22	24° 22' 0.951" N	88° 25' 28.878" E
MU_BW2_GG_20	1	24° 21' 9.946" N	88° 28' 15.250" E
	2	24° 21' 0.952" N	88° 28' 39.664" E
	3	24° 20' 52.386" N	88° 28' 55.939" E
	4	24° 20' 51.101" N	88° 28' 44.375" E
	5	24° 20' 50.244" N	88° 28' 31.098" E
	6	24° 20' 37.424" N	88° 28' 38.128" E
	7	24° 20' 26.007" N	88° 27' 43.086" E
	8	24° 20' 44.510" N	88° 26' 46.036" E
	9	24° 20' 50.641" N	88° 26' 8.229" E
	10	24° 20' 57.525" N	88° 26' 27.318" E
	11	24° 21' 5.663" N	88° 26' 41.880" E
	12	24° 21' 3.093" N	88° 27' 2.011" E

	13	24° 21' 12.944" N	88° 27' 37.560" E
	14	24° 21' 15.514" N	88° 27' 57.262" E
MU_BW2_GG_21	1	24° 21' 14.037" N	88° 29' 43.173" E
	2	24° 21' 3.067" N	88° 29' 42.867" E
	3	24° 21' 5.894" N	88° 29' 38.498" E
	4	24° 21' 17.099" N	88° 29' 26.214" E
	5	24° 21' 16.668" N	88° 29' 28.606" E
MU_BW2_GG_22	1	24° 21' 36.312" N	88° 21' 51.136" E
	2	24° 21' 35.669" N	88° 21' 50.515" E
	3	24° 21' 36.782" N	88° 21' 49.144" E
	4	24° 21' 38.864" N	88° 21' 48.262" E
	5	24° 21' 43.361" N	88° 21' 45.949" E
	6	24° 21' 47.858" N	88° 21' 44.279" E
	7	24° 21' 53.769" N	88° 21' 43.508" E
	8	24° 22' 1.478" N	88° 21' 44.407" E
	9	24° 22' 1.895" N	88° 21' 45.474" E
	10	24° 21' 55.598" N	88° 21' 44.073" E
	11	24° 21' 39.528" N	88° 21' 50.309" E
MU_BW2_GG_23	1	24° 21' 8.647" N	88° 21' 50.989" E
	2	24° 21' 6.632" N	88° 21' 49.826" E
	3	24° 21' 7.565" N	88° 21' 49.265" E
	4	24° 21' 18.658" N	88° 21' 45.411" E
	5	24° 21' 30.951" N	88° 21' 46.139" E
	6	24° 21' 34.305" N	88° 21' 45.894" E
	7	24° 21' 34.276" N	88° 21' 46.452" E
	8	24° 21' 31.245" N	88° 21' 48.767" E
	9	24° 21' 28.432" N	88° 21' 50.732" E
	10	24° 21' 16.498" N	88° 21' 50.721" E
MU_BW2_GG_24	1	24° 20' 47.508" N	88° 22' 14.833" E
	2	24° 20' 47.361" N	88° 22' 11.993" E
	3	24° 20' 48.556" N	88° 22' 8.203" E
	4	24° 20' 52.855" N	88° 22' 3.602" E
	5	24° 20' 56.512" N	88° 21' 58.713" E
	6	24° 21' 1.326" N	88° 21' 54.258" E
	7	24° 21' 8.560" N	88° 21' 53.209" E
	8	24° 21' 12.527" N	88° 21' 53.396" E
	9	24° 20' 58.753" N	88° 22' 0.726" E
MU_BW2_GG_25	1	24° 20' 24.090" N	88° 22' 36.186" E
	2	24° 20' 23.242" N	88° 22' 35.068" E
	3	24° 20' 23.921" N	88° 22' 34.623" E
	4	24° 20' 34.243" N	88° 22' 23.872" E
	5	24° 20' 42.085" N	88° 22' 14.904" E
	6	24° 20' 42.075" N	88° 22' 16.290" E
	7	24° 20' 41.356" N	88° 22' 19.662" E

	8	24° 20' 39.121" N	88° 22' 24.171" E
	9	24° 20' 36.762" N	88° 22' 26.789" E
	10	24° 20' 33.608" N	88° 22' 29.999" E
	11	24° 20' 28.836" N	88° 22' 34.547" E
	12	24° 20' 25.466" N	88° 22' 36.201" E
MU_BW2_GG_26	1	24° 19' 10.818" N	88° 22' 57.641" E
	2	24° 19' 10.472" N	88° 22' 57.687" E
	3	24° 19' 10.681" N	88° 22' 57.645" E
	4	24° 19' 10.818" N	88° 22' 57.641" E
	5	24° 18' 52.701" N	88° 22' 59.940" E
	6	24° 18' 51.003" N	88° 22' 57.481" E
	7	24° 18' 53.612" N	88° 22' 54.318" E
	8	24° 18' 58.807" N	88° 22' 50.620" E
	9	24° 19' 3.802" N	88° 22' 49.923" E
	10	24° 19' 22.203" N	88° 22' 50.498" E
	11	24° 19' 40.259" N	88° 22' 51.257" E
	12	24° 19' 23.530" N	88° 22' 55.957" E
	13	24° 19' 20.756" N	88° 22' 56.324" E
	14	24° 19' 17.777" N	88° 22' 56.371" E
	15	24° 19' 10.376" N	88° 22' 56.611" E
	16	24° 18' 55.677" N	88° 22' 59.563" E
MU_BW2_GG_27	1	24° 18' 52.023" N	88° 24' 46.933" E
	2	24° 18' 44.530" N	88° 24' 42.747" E
	3	24° 18' 44.799" N	88° 24' 41.673" E
	4	24° 18' 42.456" N	88° 24' 35.875" E
	5	24° 18' 36.117" N	88° 24' 25.853" E
	6	24° 18' 32.748" N	88° 24' 16.854" E
	7	24° 18' 34.935" N	88° 24' 16.829" E
	8	24° 18' 40.253" N	88° 24' 22.988" E
	9	24° 18' 45.149" N	88° 24' 28.439" E
	10	24° 18' 50.044" N	88° 24' 33.890" E
	11	24° 18' 54.085" N	88° 24' 38.627" E
	12	24° 19' 0.661" N	88° 24' 48.321" E
	13	24° 19' 5.545" N	88° 24' 54.945" E
	14	24° 19' 8.531" N	88° 24' 57.559" E
	15	24° 19' 12.381" N	88° 24' 59.714" E
	16	24° 19' 14.071" N	88° 25' 3.018" E
	17	24° 19' 16.603" N	88° 25' 8.209" E
	18	24° 19' 17.160" N	88° 25' 17.601" E
	19	24° 19' 15.227" N	88° 25' 17.345" E
	20	24° 19' 13.563" N	88° 25' 15.356" E
	21	24° 19' 11.450" N	88° 25' 7.125" E
	22	24° 19' 3.955" N	88° 24' 55.560" E
	23	24° 18' 52.305" N	88° 24' 45.752" E

MU_BW2_GG_28	1	24° 19' 5.088" N	88° 27' 24.278" E
	2	24° 19' 3.684" N	88° 27' 19.982" E
	3	24° 19' 3.985" N	88° 27' 10.074" E
	4	24° 19' 4.595" N	88° 27' 1.611" E
	5	24° 19' 5.135" N	88° 26' 57.309" E
	6	24° 19' 6.241" N	88° 26' 50.051" E
	7	24° 19' 12.564" N	88° 26' 36.381" E
	8	24° 19' 15.494" N	88° 26' 34.051" E
	9	24° 19' 13.459" N	88° 26' 48.717" E
	10	24° 19' 9.703" N	88° 27' 20.273" E
	11	24° 19' 9.042" N	88° 27' 20.944" E
	12	24° 19' 6.133" N	88° 27' 22.938" E
MU_BW2_GG_29	1	24° 18' 46.578" N	88° 29' 9.222" E
	2	24° 18' 46.468" N	88° 29' 2.839" E
	3	24° 18' 47.636" N	88° 28' 48.962" E
	4	24° 18' 50.119" N	88° 28' 41.294" E
	5	24° 18' 52.587" N	88° 28' 35.128" E
	6	24° 18' 55.745" N	88° 28' 28.783" E
	7	24° 18' 57.931" N	88° 28' 16.231" E
	8	24° 19' 0.374" N	88° 28' 12.693" E
	9	24° 19' 1.800" N	88° 28' 11.976" E
	10	24° 19' 1.158" N	88° 28' 15.885" E
	11	24° 18' 55.162" N	88° 28' 46.791" E
	12	24° 18' 52.729" N	88° 28' 58.886" E
	13	24° 18' 51.393" N	88° 29' 12.455" E
	14	24° 18' 51.015" N	88° 29' 15.955" E
	15	24° 18' 48.263" N	88° 29' 12.808" E
MU_RN2_GG_30	1	24° 17' 39.869" N	88° 38' 17.363" E
	2	24° 17' 30.074" N	88° 38' 14.995" E
	3	24° 17' 36.376" N	88° 38' 9.642" E
	4	24° 17' 39.963" N	88° 38' 8.638" E
	5	24° 17' 48.968" N	88° 38' 11.005" E
	6	24° 17' 56.398" N	88° 38' 15.886" E
	7	24° 18' 6.365" N	88° 38' 24.742" E
	8	24° 18' 14.608" N	88° 38' 25.974" E
	9	24° 18' 18.533" N	88° 38' 20.957" E
	10	24° 18' 24.011" N	88° 38' 15.396" E
	11	24° 18' 28.187" N	88° 38' 13.507" E
	12	24° 18' 29.380" N	88° 38' 26.909" E
	13	24° 18' 30.556" N	88° 38' 32.372" E
	14	24° 18' 9.940" N	88° 38' 31.460" E
	15	24° 18' 4.253" N	88° 38' 29.219" E
	16	24° 17' 51.678" N	88° 38' 22.864" E
MU_RN2_GG_31	1	24° 17' 24.657" N	88° 38' 28.848" E

	2	24° 17' 21.108" N	88° 38' 28.026" E
	3	24° 17' 21.540" N	88° 38' 26.230" E
	4	24° 17' 25.325" N	88° 38' 19.748" E
	5	24° 17' 28.028" N	88° 38' 17.981" E
	6	24° 17' 33.797" N	88° 38' 18.956" E
	7	24° 17' 38.918" N	88° 38' 22.625" E
	8	24° 17' 46.508" N	88° 38' 27.001" E
	9	24° 17' 45.420" N	88° 38' 30.009" E
	10	24° 17' 24.824" N	88° 38' 28.576" E
MU_RN2_GG_32	1	24° 17' 0.228" N	88° 39' 39.799" E
	2	24° 16' 49.978" N	88° 39' 53.036" E
	3	24° 16' 44.544" N	88° 39' 58.360" E
	4	24° 16' 41.552" N	88° 39' 56.679" E
	5	24° 16' 50.778" N	88° 39' 42.555" E
	6	24° 16' 53.176" N	88° 39' 28.850" E
	7	24° 16' 52.693" N	88° 39' 27.665" E
	8	24° 16' 52.960" N	88° 39' 27.575" E
	9	24° 17' 4.738" N	88° 39' 8.729" E
	10	24° 17' 11.591" N	88° 38' 51.490" E
	11	24° 17' 11.649" N	88° 38' 51.273" E
	12	24° 17' 13.871" N	88° 38' 51.419" E
	13	24° 17' 17.892" N	88° 38' 57.335" E
	14	24° 17' 19.541" N	88° 39' 3.925" E
	15	24° 17' 17.250" N	88° 39' 16.797" E
	16	24° 17' 9.375" N	88° 39' 29.128" E
MU_RN2_GG_33	1	24° 16' 53.097" N	88° 40' 48.160" E
	2	24° 16' 50.114" N	88° 40' 43.032" E
	3	24° 16' 55.596" N	88° 40' 35.494" E
	4	24° 17' 0.784" N	88° 40' 35.850" E
	5	24° 17' 1.691" N	88° 40' 36.475" E
	6	24° 17' 6.630" N	88° 40' 41.660" E
	7	24° 17' 19.713" N	88° 41' 5.314" E
	8	24° 17' 21.180" N	88° 41' 8.743" E
	9	24° 17' 22.622" N	88° 41' 14.392" E
	10	24° 17' 20.641" N	88° 41' 18.588" E
	11	24° 17' 17.626" N	88° 41' 19.017" E
	12	24° 17' 7.481" N	88° 41' 3.167" E
	13	24° 17' 2.968" N	88° 40' 58.682" E
	14	24° 16' 58.420" N	88° 40' 51.843" E

Annexure 4
Map showing of Potential Blocks of Murshidabad District

POTENTIAL BLOCK PO_MU_KG_BM_1 OF BRAHMANI RIVER

87°59'0"E

87°59'5"E

24°10'55"N

N

W

E

S

BRAHMANI RIVER

4

5

6

7

3

1

2

PO_MU_KG_BM_1		
Coordinate_ID	Latitude	Longitude
1	24° 10' 56.096" N	87° 59' 5.279" E
2	24° 10' 55.928" N	87° 59' 4.231" E
3	24° 10' 56.185" N	87° 59' 2.072" E
4	24° 10' 58.173" N	87° 59' 2.005" E
5	24° 10' 57.704" N	87° 59' 5.893" E
6	24° 10' 56.648" N	87° 59' 6.030" E
7	24° 10' 56.455" N	87° 59' 5.837" E

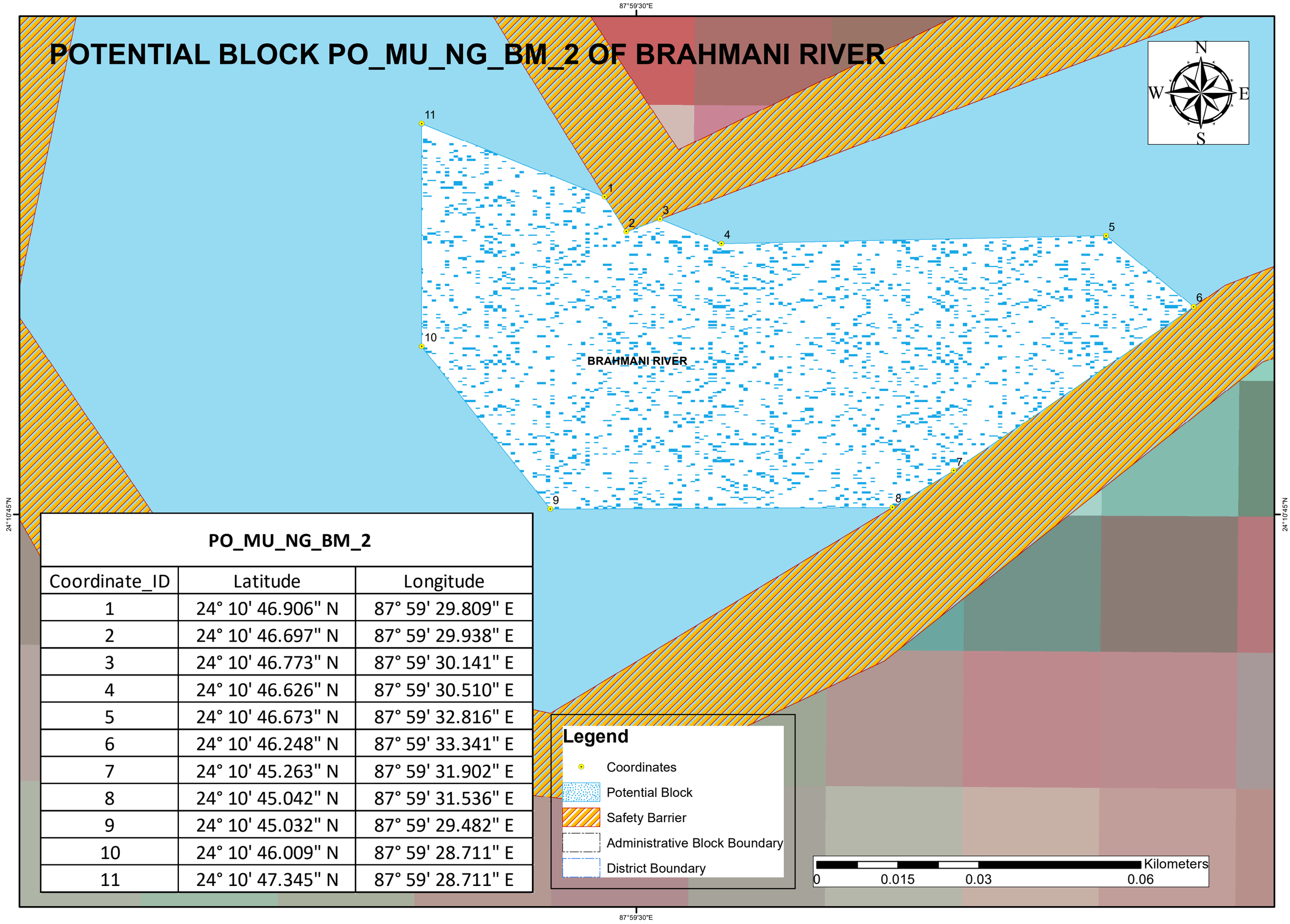
Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers

0 0.0175 0.035 0.07

POTENTIAL BLOCK PO_MU_NG_BM_2 OF BRAHMANI RIVER



PO_MU_NG_BM_2		
Coordinate_ID	Latitude	Longitude
1	24° 10' 46.906" N	87° 59' 29.809" E
2	24° 10' 46.697" N	87° 59' 29.938" E
3	24° 10' 46.773" N	87° 59' 30.141" E
4	24° 10' 46.626" N	87° 59' 30.510" E
5	24° 10' 46.673" N	87° 59' 32.816" E
6	24° 10' 46.248" N	87° 59' 33.341" E
7	24° 10' 45.263" N	87° 59' 31.902" E
8	24° 10' 45.042" N	87° 59' 31.536" E
9	24° 10' 45.032" N	87° 59' 29.482" E
10	24° 10' 46.009" N	87° 59' 28.711" E
11	24° 10' 47.345" N	87° 59' 28.711" E

POTENTIAL BLOCK PO_MU_NG_BM_3 OF BRAHMANI RIVER

87°59'35"E

N
W
E
S

BRAHMANI RIVER

1
2
3
4
5
6
7
8
9
10

PO_MU_NG_BM_3		
Coordinate_ID	Latitude	Longitude
1	24° 10' 26.621" N	87° 59' 36.113" E
2	24° 10' 26.621" N	87° 59' 35.290" E
3	24° 10' 26.883" N	87° 59' 35.056" E
4	24° 10' 28.330" N	87° 59' 36.817" E
5	24° 10' 28.652" N	87° 59' 38.426" E
6	24° 10' 28.659" N	87° 59' 38.461" E
7	24° 10' 27.855" N	87° 59' 38.323" E
8	24° 10' 27.392" N	87° 59' 37.963" E
9	24° 10' 26.837" N	87° 59' 36.992" E
10	24° 10' 26.764" N	87° 59' 36.828" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers
0 0.015 0.03 0.06

24°10'25"N

87°59'35"E

POTENTIAL BLOCK PO_MU_NG_BM_4 OF BRAHMANI RIVER

87°59'35"E

24°10'5"N

PO_MU_NG_BM_4		
Coordinate_ID	Latitude	Longitude
1	24° 10' 4.061" N	87° 59' 36.930" E
2	24° 10' 3.975" N	87° 59' 36.647" E
3	24° 10' 4.295" N	87° 59' 35.718" E
4	24° 10' 4.432" N	87° 59' 35.526" E
5	24° 10' 4.644" N	87° 59' 35.308" E
6	24° 10' 6.543" N	87° 59' 34.554" E
7	24° 10' 7.093" N	87° 59' 35.082" E
8	24° 10' 6.988" N	87° 59' 35.391" E
9	24° 10' 6.200" N	87° 59' 35.455" E
10	24° 10' 5.501" N	87° 59' 35.787" E
11	24° 10' 4.994" N	87° 59' 36.318" E
12	24° 10' 4.473" N	87° 59' 37.116" E

BRAHMANI RIVER

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.0125 0.025 0.05 Kilometers

87°59'35"E

POTENTIAL BLOCK PO_MU_KG_BM_5 OF BRAHMANI RIVER

87°59'55"E

N
W
E
S

5
4
1
3
2

BRAHMANI RIVER

PO_MU_KG_BM_5		
Coordinate_ID	Latitude	Longitude
1	24° 9' 37.623" N	87° 59' 58.164" E
2	24° 9' 37.022" N	87° 59' 58.164" E
3	24° 9' 37.118" N	87° 59' 56.868" E
4	24° 9' 37.844" N	87° 59' 56.692" E
5	24° 9' 37.897" N	87° 59' 57.461" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.0125 0.025 0.05 Kilometers

87°59'55"E

POTENTIAL BLOCK PO_MU_NG_BM_6 OF BRAHMANI RIVER

88°0'35"E

88°0'40"E

24°9'30"N

24°9'25"N

N

W

E

S

PO_MU_NG_BM_6		
Coordinate_ID	Latitude	Longitude
1	24° 9' 28.311" N	88° 0' 43.288" E
2	24° 9' 26.551" N	88° 0' 42.074" E
3	24° 9' 25.908" N	88° 0' 40.575" E
4	24° 9' 26.722" N	88° 0' 38.145" E
5	24° 9' 27.632" N	88° 0' 37.058" E
6	24° 9' 28.302" N	88° 0' 37.333" E
7	24° 9' 28.970" N	88° 0' 37.590" E
8	24° 9' 29.211" N	88° 0' 37.991" E
9	24° 9' 27.798" N	88° 0' 38.921" E
10	24° 9' 27.575" N	88° 0' 40.934" E
11	24° 9' 29.619" N	88° 0' 41.861" E

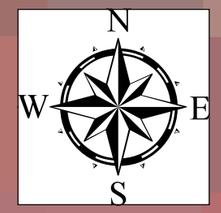
BRAHMANI RIVER

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.025 0.05 0.1 Kilometers

POTENTIAL BLOCK PO_MU_NG_BM_7 OF BRAHMANI RIVER



88°1'5"E

88°1'10"E

24°9'20"N

24°9'15"N

BRAHMANI RIVER

PO_MU_NG_BM_7		
Coordinate_ID	Latitude	Longitude
1	24° 9' 16.385" N	88° 1' 12.568" E
2	24° 9' 15.299" N	88° 1' 12.257" E
3	24° 9' 15.658" N	88° 1' 10.870" E
4	24° 9' 17.149" N	88° 1' 9.945" E
5	24° 9' 18.485" N	88° 1' 8.865" E
6	24° 9' 19.770" N	88° 1' 7.786" E
7	24° 9' 20.901" N	88° 1' 8.094" E
8	24° 9' 21.158" N	88° 1' 8.403" E
9	24° 9' 21.342" N	88° 1' 8.734" E
10	24° 9' 20.807" N	88° 1' 9.494" E
11	24° 9' 18.715" N	88° 1' 11.660" E
12	24° 9' 18.478" N	88° 1' 11.892" E

Legend

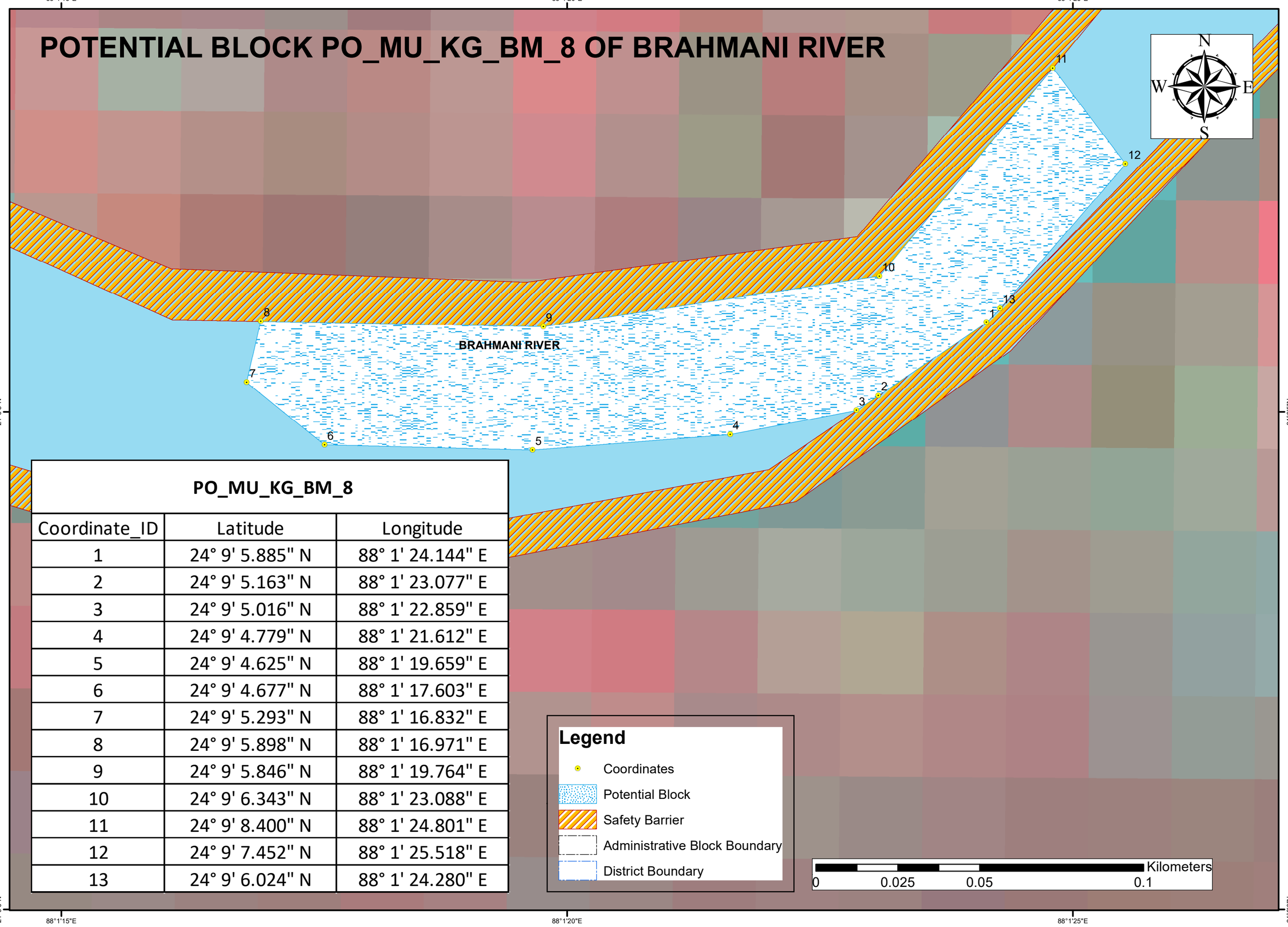
- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.025 0.05 0.1 Kilometers

POTENTIAL BLOCK PO_MU_KG_BM_8 OF BRAHMANI RIVER

88°1'15"E 88°1'20"E 88°1'25"E

24°9'5"N



PO_MU_KG_BM_8		
Coordinate_ID	Latitude	Longitude
1	24° 9' 5.885" N	88° 1' 24.144" E
2	24° 9' 5.163" N	88° 1' 23.077" E
3	24° 9' 5.016" N	88° 1' 22.859" E
4	24° 9' 4.779" N	88° 1' 21.612" E
5	24° 9' 4.625" N	88° 1' 19.659" E
6	24° 9' 4.677" N	88° 1' 17.603" E
7	24° 9' 5.293" N	88° 1' 16.832" E
8	24° 9' 5.898" N	88° 1' 16.971" E
9	24° 9' 5.846" N	88° 1' 19.764" E
10	24° 9' 6.343" N	88° 1' 23.088" E
11	24° 9' 8.400" N	88° 1' 24.801" E
12	24° 9' 7.452" N	88° 1' 25.518" E
13	24° 9' 6.024" N	88° 1' 24.280" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.025 0.05 0.1 Kilometers

24°9'0"N

88°1'15"E 88°1'20"E 88°1'25"E

POTENTIAL BLOCK PO_MU_NG_BM_9 OF BRAHMANI RIVER

88°2'35"E

88°2'40"E

24°8'40"N

N

W

E

S

BRAHMANI RIVER

PO_MU_NG_BM_9		
Coordinate_ID	Latitude	Longitude
1	24° 8' 36.921" N	88° 2' 41.357" E
2	24° 8' 36.171" N	88° 2' 40.180" E
3	24° 8' 37.349" N	88° 2' 38.252" E
4	24° 8' 39.169" N	88° 2' 36.860" E
5	24° 8' 40.133" N	88° 2' 36.539" E
6	24° 8' 40.704" N	88° 2' 37.170" E
7	24° 8' 38.261" N	88° 2' 40.415" E
8	24° 8' 37.260" N	88° 2' 41.370" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers

0 0.0175 0.035 0.07

POTENTIAL BLOCK PO_MU_NG_BM_10 OF BRAHMANI RIVER

88°2'40"E
88°2'45"E
24°8'10"N
24°8'5"N

N
W
E
S

BRAHMANI RIVER

PO_MU_NG_BM_10		
Coordinate_ID	Latitude	Longitude
1	24° 8' 3.470" N	88° 2' 47.825" E
2	24° 8' 2.956" N	88° 2' 45.855" E
3	24° 8' 4.155" N	88° 2' 44.398" E
4	24° 8' 6.297" N	88° 2' 42.514" E
5	24° 8' 7.667" N	88° 2' 41.828" E
6	24° 8' 8.952" N	88° 2' 41.914" E
7	24° 8' 9.552" N	88° 2' 42.257" E
8	24° 8' 9.623" N	88° 2' 42.620" E
9	24° 8' 7.097" N	88° 2' 43.430" E
10	24° 8' 4.219" N	88° 2' 46.274" E
11	24° 8' 3.475" N	88° 2' 47.831" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers
0 0.025 0.05 0.1

POTENTIAL BLOCK PO_MU_BW2_BR_1 OF BHAIRAB RIVER

88°24'50"E 88°24'55"E 88°25'0"E 88°25'5"E 88°25'10"E 88°25'15"E 88°25'20"E 88°25'25"E

24°18'45"N 24°18'40"N 24°18'35"N 24°18'30"N 24°18'25"N 24°18'20"N

BHAIRAB RIVER

PO_MU_BW2_BR_1		
Coordinate_ID	Latitude	Longitude
1	24° 18' 27.201" N	88° 25' 24.651" E
2	24° 18' 25.215" N	88° 25' 24.298" E
3	24° 18' 31.668" N	88° 25' 17.462" E
4	24° 18' 36.807" N	88° 25' 7.414" E
5	24° 18' 40.354" N	88° 24' 59.388" E
6	24° 18' 43.024" N	88° 24' 48.748" E
7	24° 18' 45.077" N	88° 24' 49.429" E
8	24° 18' 43.278" N	88° 24' 54.195" E
9	24° 18' 41.015" N	88° 24' 58.844" E
10	24° 18' 39.845" N	88° 25' 2.548" E
11	24° 18' 37.634" N	88° 25' 7.254" E
12	24° 18' 35.792" N	88° 25' 11.063" E
13	24° 18' 34.619" N	88° 25' 15.048" E
14	24° 18' 33.241" N	88° 25' 18.974" E
15	24° 18' 30.210" N	88° 25' 22.995" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.075 0.15 0.3 Kilometers

POTENTIAL BLOCK PO_MU_RB1_BR_2 OF BHAIRAB RIVER

88°26'40"E 88°26'45"E 88°26'50"E 88°26'55"E

24°17'15"N 24°17'10"N

BHAIRAB RIVER

PO_MU_RB1_BR_2		
Coordinate_ID	Latitude	Longitude
1	24° 17' 9.477" N	88° 26' 53.206" E
2	24° 17' 7.545" N	88° 26' 54.068" E
3	24° 17' 9.044" N	88° 26' 52.023" E
4	24° 17' 10.784" N	88° 26' 50.016" E
5	24° 17' 12.590" N	88° 26' 48.160" E
6	24° 17' 14.529" N	88° 26' 46.905" E
7	24° 17' 16.460" N	88° 26' 46.402" E
8	24° 17' 17.970" N	88° 26' 46.794" E
9	24° 17' 18.523" N	88° 26' 47.406" E
10	24° 17' 14.403" N	88° 26' 49.866" E

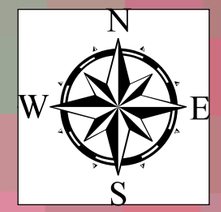
Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.04 0.08 0.16 Kilometers

N W E S

POTENTIAL BLOCK PO_MU_RB1_BR_3 OF BHAIRAB RIVER



88°26'45"E 88°26'50"E 88°26'55"E 88°27'0"E 88°27'5"E

24°16'50"N 24°16'45"N 24°16'40"N

BHAIRAB RIVER

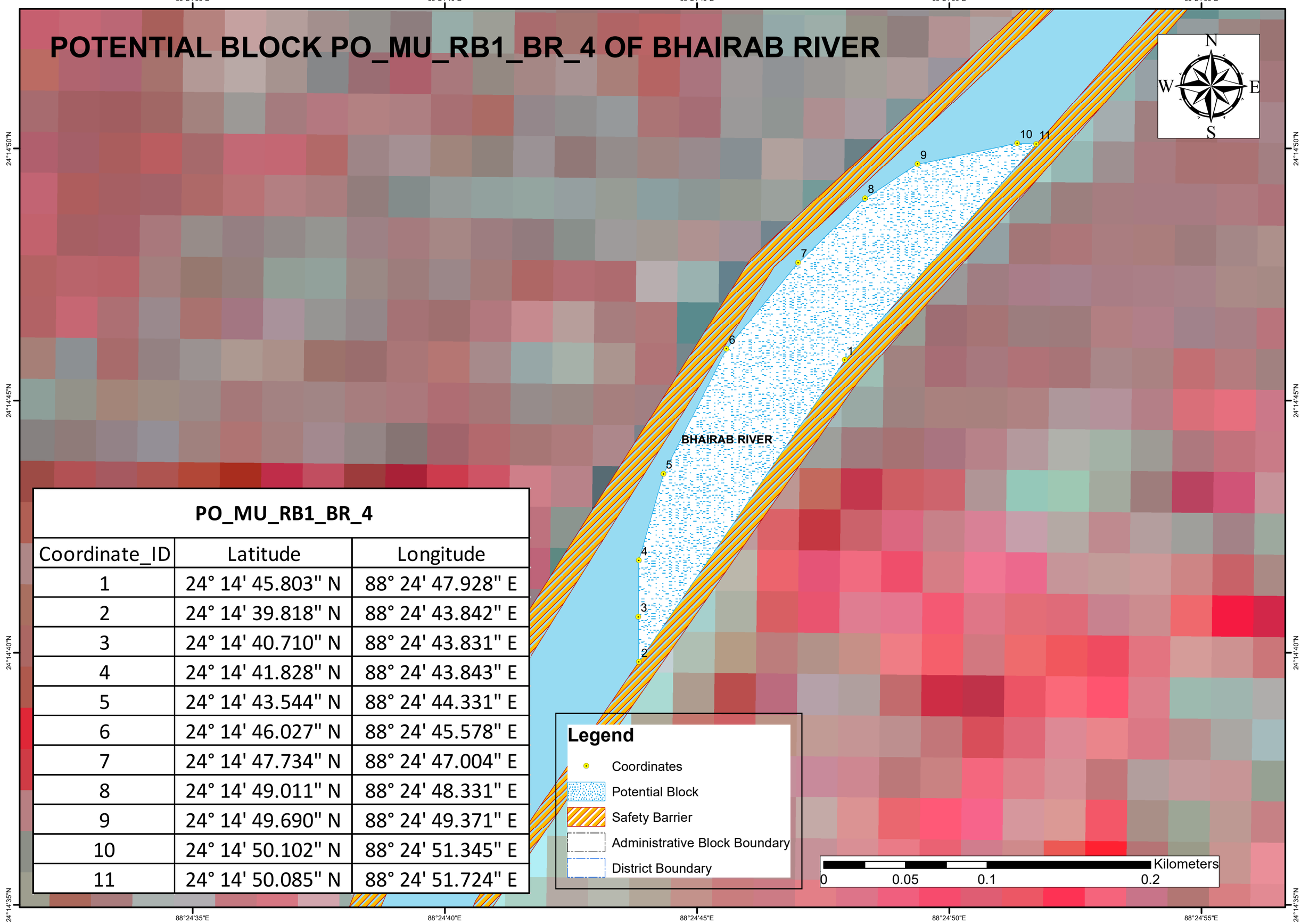
PO_MU_RB1_BR_3		
Coordinate_ID	Latitude	Longitude
1	24° 16' 37.721" N	88° 27' 0.615" E
2	24° 16' 36.781" N	88° 26' 58.267" E
3	24° 16' 42.039" N	88° 26' 58.918" E
4	24° 16' 50.989" N	88° 26' 56.844" E
5	24° 16' 51.299" N	88° 26' 57.367" E
6	24° 16' 51.606" N	88° 26' 59.013" E
7	24° 16' 49.016" N	88° 27' 0.039" E
8	24° 16' 43.413" N	88° 27' 1.266" E
9	24° 16' 40.724" N	88° 27' 1.470" E
10	24° 16' 38.360" N	88° 27' 1.326" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

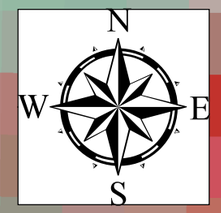
0 0.05 0.1 0.2 Kilometers

POTENTIAL BLOCK PO_MU_RB1_BR_4 OF BHAIRAB RIVER



PO_MU_RB1_BR_4		
Coordinate_ID	Latitude	Longitude
1	24° 14' 45.803" N	88° 24' 47.928" E
2	24° 14' 39.818" N	88° 24' 43.842" E
3	24° 14' 40.710" N	88° 24' 43.831" E
4	24° 14' 41.828" N	88° 24' 43.843" E
5	24° 14' 43.544" N	88° 24' 44.331" E
6	24° 14' 46.027" N	88° 24' 45.578" E
7	24° 14' 47.734" N	88° 24' 47.004" E
8	24° 14' 49.011" N	88° 24' 48.331" E
9	24° 14' 49.690" N	88° 24' 49.371" E
10	24° 14' 50.102" N	88° 24' 51.345" E
11	24° 14' 50.085" N	88° 24' 51.724" E

POTENTIAL BLOCK PO_MU_RB1_BR_5 OF BHAIRAB RIVER



88°25'45"E 88°25'50"E 88°25'55"E 88°26'0"E 88°26'5"E 88°26'10"E 88°26'15"E

24°11'10"N

24°11'5"N

24°10'55"N

BHAIRAB RIVER

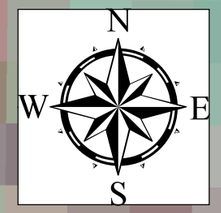
PO_MU_RB1_BR_5		
Coordinate_ID	Latitude	Longitude
1	24° 10' 54.638" N	88° 26' 9.277" E
2	24° 10' 54.594" N	88° 26' 7.871" E
3	24° 10' 57.503" N	88° 26' 6.882" E
4	24° 11' 2.591" N	88° 26' 3.104" E
5	24° 11' 7.127" N	88° 25' 59.802" E
6	24° 11' 10.285" N	88° 25' 59.547" E
7	24° 11' 10.691" N	88° 25' 59.855" E
8	24° 11' 10.929" N	88° 26' 1.246" E
9	24° 11' 7.937" N	88° 26' 3.054" E
10	24° 11' 3.037" N	88° 26' 6.121" E
11	24° 10' 57.692" N	88° 26' 8.519" E
12	24° 10' 54.705" N	88° 26' 9.623" E

Legend

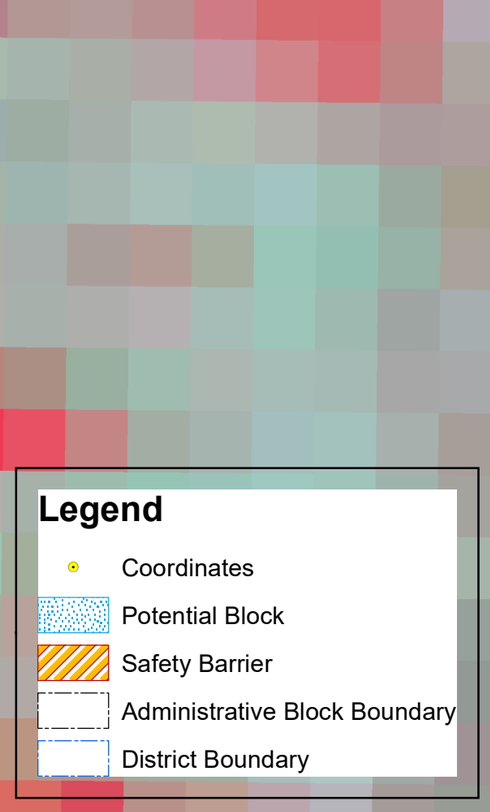
- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

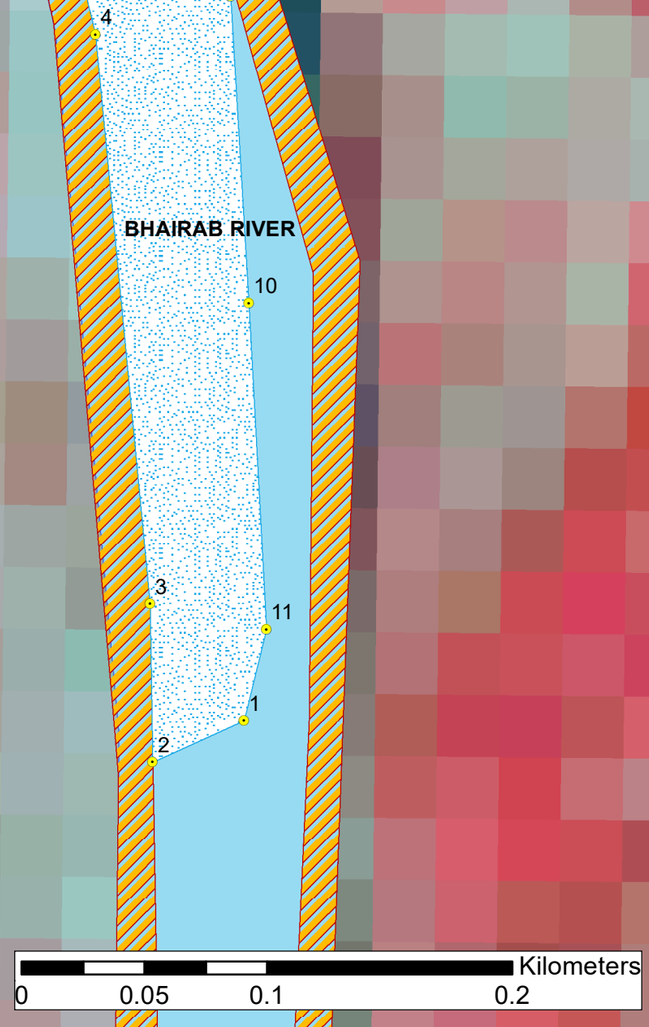
0 0.05 0.1 0.2 Kilometers

POTENTIAL BLOCK PO_MU_RB1_BR_6 OF BHAIRAB RIVER

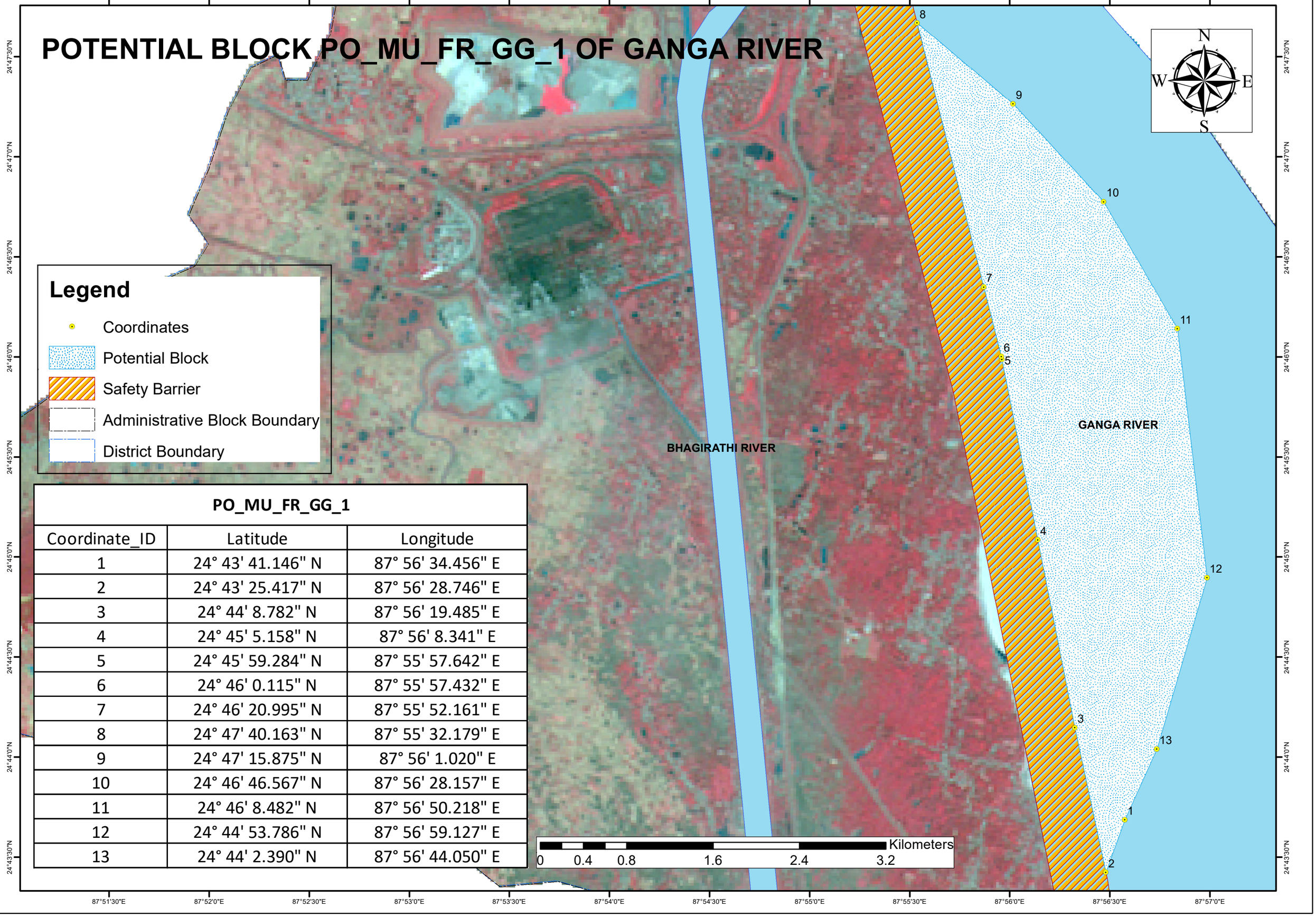


PO_MU_RB1_BR_6		
Coordinate_ID	Latitude	Longitude
1	24° 10' 22.866" N	88° 26' 16.741" E
2	24° 10' 22.315" N	88° 26' 15.538" E
3	24° 10' 24.404" N	88° 26' 15.504" E
4	24° 10' 31.920" N	88° 26' 14.784" E
5	24° 10' 37.761" N	88° 26' 13.390" E
6	24° 10' 37.864" N	88° 26' 13.440" E
7	24° 10' 37.941" N	88° 26' 14.378" E
8	24° 10' 36.038" N	88° 26' 15.482" E
9	24° 10' 32.415" N	88° 26' 16.566" E
10	24° 10' 28.370" N	88° 26' 16.802" E
11	24° 10' 24.068" N	88° 26' 17.035" E





POTENTIAL BLOCK PO_MU_FR_GG_1 OF GANGA RIVER



Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

PO_MU_FR_GG_1

Coordinate_ID	Latitude	Longitude
1	24° 43' 41.146" N	87° 56' 34.456" E
2	24° 43' 25.417" N	87° 56' 28.746" E
3	24° 44' 8.782" N	87° 56' 19.485" E
4	24° 45' 5.158" N	87° 56' 8.341" E
5	24° 45' 59.284" N	87° 55' 57.642" E
6	24° 46' 0.115" N	87° 55' 57.432" E
7	24° 46' 20.995" N	87° 55' 52.161" E
8	24° 47' 40.163" N	87° 55' 32.179" E
9	24° 47' 15.875" N	87° 56' 1.020" E
10	24° 46' 46.567" N	87° 56' 28.157" E
11	24° 46' 8.482" N	87° 56' 50.218" E
12	24° 44' 53.786" N	87° 56' 59.127" E
13	24° 44' 2.390" N	87° 56' 44.050" E

POTENTIAL BLOCK PO_MU_FR_GG_2 OF GANGA RIVER

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

BHAGIRATHI RIVER

GANGA RIVER

PO_MU_FR_GG_2

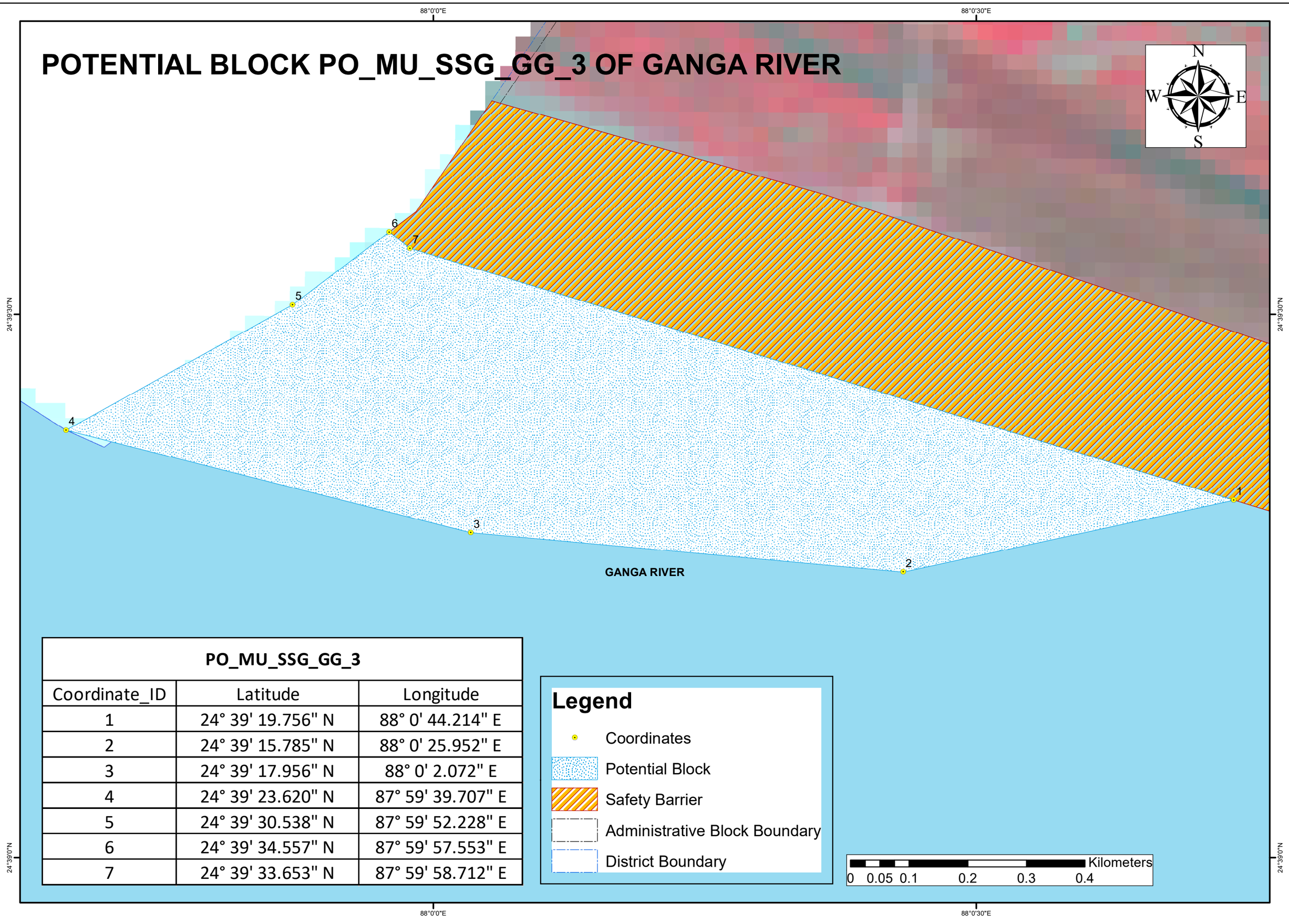
PO_MU_FR_GG_2		
Coordinate_ID	Latitude	Longitude
1	24° 41' 40.977" N	87° 57' 19.654" E
2	24° 41' 36.475" N	87° 57' 20.135" E
3	24° 41' 47.352" N	87° 57' 6.742" E
4	24° 42' 14.115" N	87° 56' 48.847" E
5	24° 42' 34.655" N	87° 56' 43.509" E
6	24° 43' 0.029" N	87° 56' 56.385" E
7	24° 43' 17.161" N	87° 57' 20.370" E
8	24° 43' 47.314" N	87° 57' 29.279" E
9	24° 44' 38.024" N	87° 57' 33.381" E
10	24° 43' 21.888" N	87° 57' 39.735" E
11	24° 43' 0.523" N	87° 57' 36.087" E
12	24° 42' 29.942" N	87° 57' 37.372" E
13	24° 42' 20.461" N	87° 57' 42.113" E
14	24° 42' 15.012" N	87° 57' 39.924" E

Kilometers
0 0.275 0.55 1.1 1.65 2.2

87°53'30"E 87°54'0"E 87°54'30"E 87°55'0"E 87°55'30"E 87°56'0"E 87°56'30"E 87°57'0"E 87°57'30"E

24°44'30"N 24°44'0"N 24°43'30"N 24°43'0"N 24°42'30"N 24°42'0"N

POTENTIAL BLOCK PO_MU_SSG_GG_3 OF GANGA RIVER



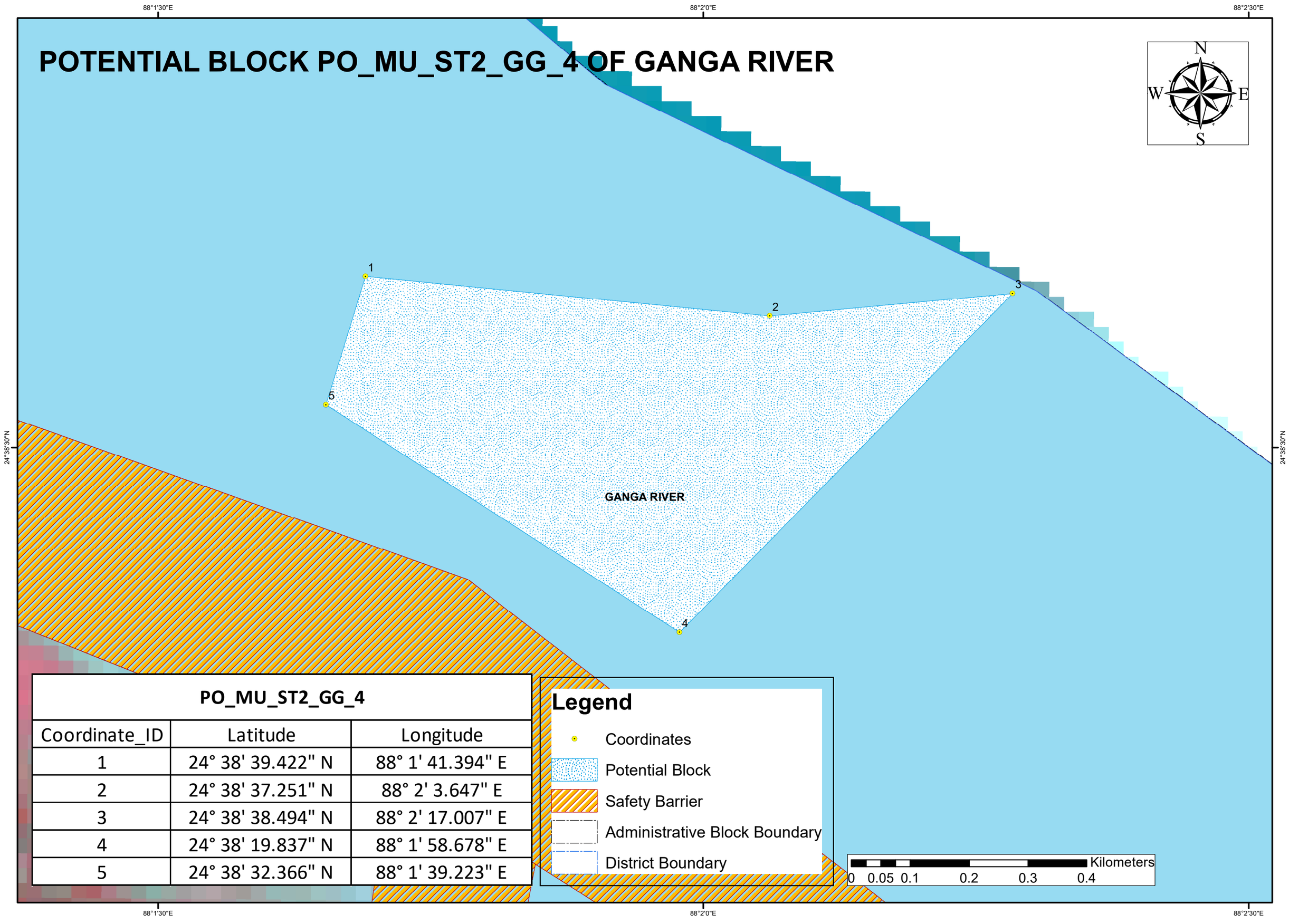
PO_MU_SSG_GG_3		
Coordinate_ID	Latitude	Longitude
1	24° 39' 19.756" N	88° 0' 44.214" E
2	24° 39' 15.785" N	88° 0' 25.952" E
3	24° 39' 17.956" N	88° 0' 2.072" E
4	24° 39' 23.620" N	87° 59' 39.707" E
5	24° 39' 30.538" N	87° 59' 52.228" E
6	24° 39' 34.557" N	87° 59' 57.553" E
7	24° 39' 33.653" N	87° 59' 58.712" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.05 0.1 0.2 0.3 0.4 Kilometers

POTENTIAL BLOCK PO_MU_ST2_GG_4 OF GANGA RIVER



PO_MU_ST2_GG_4		
Coordinate_ID	Latitude	Longitude
1	24° 38' 39.422" N	88° 1' 41.394" E
2	24° 38' 37.251" N	88° 2' 3.647" E
3	24° 38' 38.494" N	88° 2' 17.007" E
4	24° 38' 19.837" N	88° 1' 58.678" E
5	24° 38' 32.366" N	88° 1' 39.223" E

POTENTIAL BLOCK PO_MU_ST2_GG_5 OF GANGA RIVER

88°1'30"E

88°2'0"E

24°38'0"N

24°37'30"N

GANGA RIVER

GANGA RIVER

N

W

E

S

1

2

3

4

5

6

7

8

PO_MU_ST2_GG_5		
Coordinate_ID	Latitude	Longitude
1	24° 37' 54.521" N	88° 2' 6.875" E
2	24° 37' 42.153" N	88° 2' 4.117" E
3	24° 37' 27.801" N	88° 1' 58.825" E
4	24° 37' 25.572" N	88° 1' 50.806" E
5	24° 37' 25.641" N	88° 1' 50.759" E
6	24° 37' 49.283" N	88° 1' 47.333" E
7	24° 37' 59.935" N	88° 1' 49.376" E
8	24° 38' 0.309" N	88° 1' 49.448" E

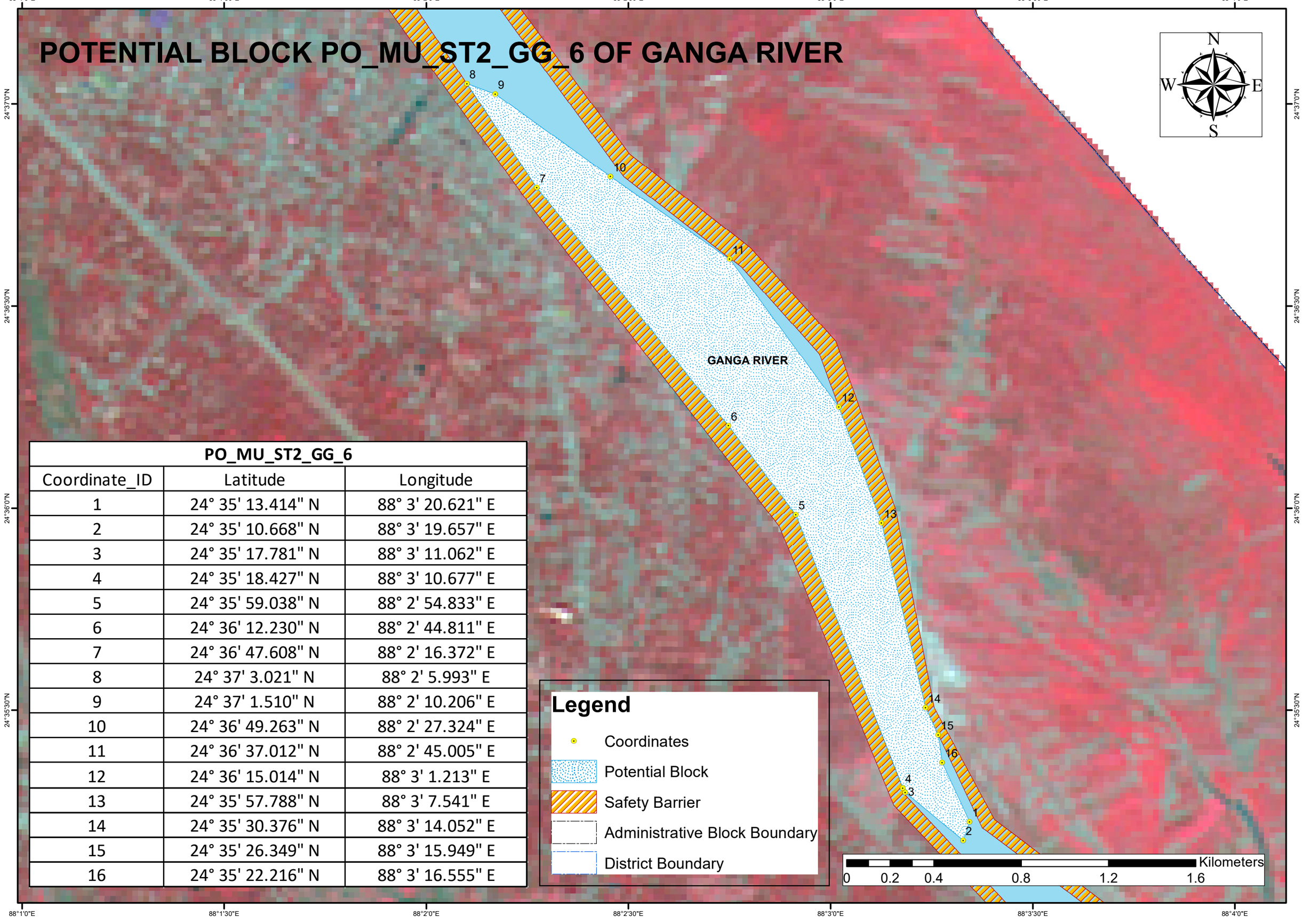
Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers

0 0.075 0.15 0.3 0.45 0.6

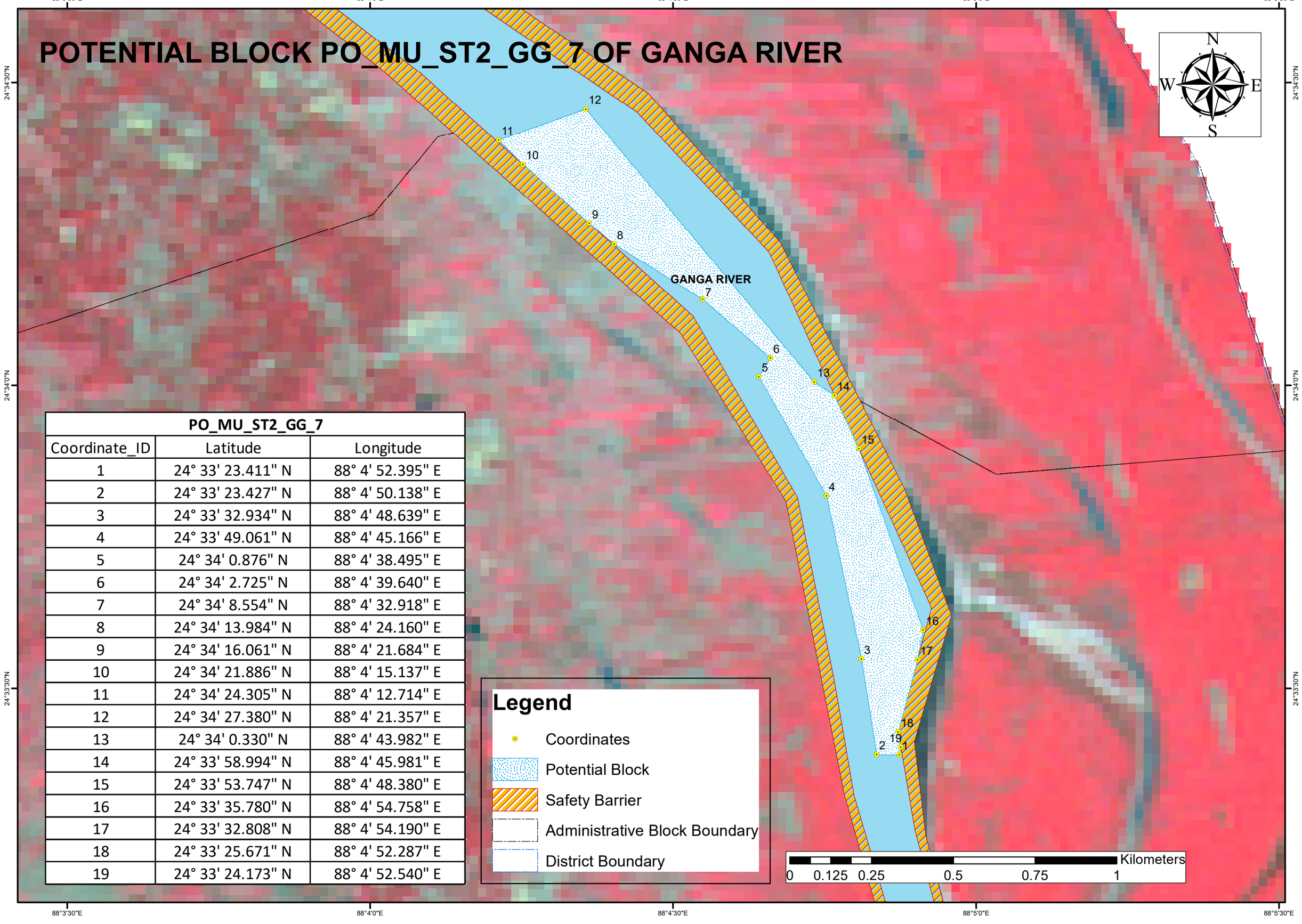
POTENTIAL BLOCK PO_MU_ST2_GG_6 OF GANGA RIVER



PO_MU_ST2_GG_6		
Coordinate_ID	Latitude	Longitude
1	24° 35' 13.414" N	88° 3' 20.621" E
2	24° 35' 10.668" N	88° 3' 19.657" E
3	24° 35' 17.781" N	88° 3' 11.062" E
4	24° 35' 18.427" N	88° 3' 10.677" E
5	24° 35' 59.038" N	88° 2' 54.833" E
6	24° 36' 12.230" N	88° 2' 44.811" E
7	24° 36' 47.608" N	88° 2' 16.372" E
8	24° 37' 3.021" N	88° 2' 5.993" E
9	24° 37' 1.510" N	88° 2' 10.206" E
10	24° 36' 49.263" N	88° 2' 27.324" E
11	24° 36' 37.012" N	88° 2' 45.005" E
12	24° 36' 15.014" N	88° 3' 1.213" E
13	24° 35' 57.788" N	88° 3' 7.541" E
14	24° 35' 30.376" N	88° 3' 14.052" E
15	24° 35' 26.349" N	88° 3' 15.949" E
16	24° 35' 22.216" N	88° 3' 16.555" E

POTENTIAL BLOCK PO_MU_ST2_GG_7 OF GANGA RIVER

PO_MU_ST2_GG_7		
Coordinate_ID	Latitude	Longitude
1	24° 33' 23.411" N	88° 4' 52.395" E
2	24° 33' 23.427" N	88° 4' 50.138" E
3	24° 33' 32.934" N	88° 4' 48.639" E
4	24° 33' 49.061" N	88° 4' 45.166" E
5	24° 34' 0.876" N	88° 4' 38.495" E
6	24° 34' 2.725" N	88° 4' 39.640" E
7	24° 34' 8.554" N	88° 4' 32.918" E
8	24° 34' 13.984" N	88° 4' 24.160" E
9	24° 34' 16.061" N	88° 4' 21.684" E
10	24° 34' 21.886" N	88° 4' 15.137" E
11	24° 34' 24.305" N	88° 4' 12.714" E
12	24° 34' 27.380" N	88° 4' 21.357" E
13	24° 34' 0.330" N	88° 4' 43.982" E
14	24° 33' 58.994" N	88° 4' 45.981" E
15	24° 33' 53.747" N	88° 4' 48.380" E
16	24° 33' 35.780" N	88° 4' 54.758" E
17	24° 33' 32.808" N	88° 4' 54.190" E
18	24° 33' 25.671" N	88° 4' 52.287" E
19	24° 33' 24.173" N	88° 4' 52.540" E



POTENTIAL BLOCK PO_MU_ST2_GG_8 OF GANGA RIVER

88°4'30"E

88°5'0"E

24°32'30"N

N

W

E

S

6

7

5

8

GANGA RIVER

4

1

3

2

Kilometers

0 0.05 0.1 0.2 0.3 0.4

PO_MU_ST2_GG_8		
Coordinate_ID	Latitude	Longitude
1	24° 32' 24.667" N	88° 4' 46.476" E
2	24° 32' 20.383" N	88° 4' 42.868" E
3	24° 32' 23.979" N	88° 4' 43.828" E
4	24° 32' 31.131" N	88° 4' 47.425" E
5	24° 32' 41.925" N	88° 4' 52.651" E
6	24° 32' 54.812" N	88° 4' 54.096" E
7	24° 32' 48.244" N	88° 4' 57.257" E
8	24° 32' 36.859" N	88° 4' 55.514" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

POTENTIAL BLOCK PO_MU_ST2_GG_9 OF GANGA RIVER

88°4'30"E

24°32'0"N

N
W
E
S

GANGA RIVER

PO_MU_ST2_GG_9		
Coordinate_ID	Latitude	Longitude
1	24° 31' 41.503" N	88° 4' 47.779" E
2	24° 31' 41.020" N	88° 4' 44.787" E
3	24° 31' 42.331" N	88° 4' 43.848" E
4	24° 31' 48.746" N	88° 4' 41.646" E
5	24° 31' 59.490" N	88° 4' 40.384" E
6	24° 32' 6.918" N	88° 4' 40.899" E
7	24° 32' 13.910" N	88° 4' 44.795" E
8	24° 32' 15.837" N	88° 4' 47.686" E
9	24° 32' 1.964" N	88° 4' 45.194" E
10	24° 31' 52.987" N	88° 4' 44.886" E

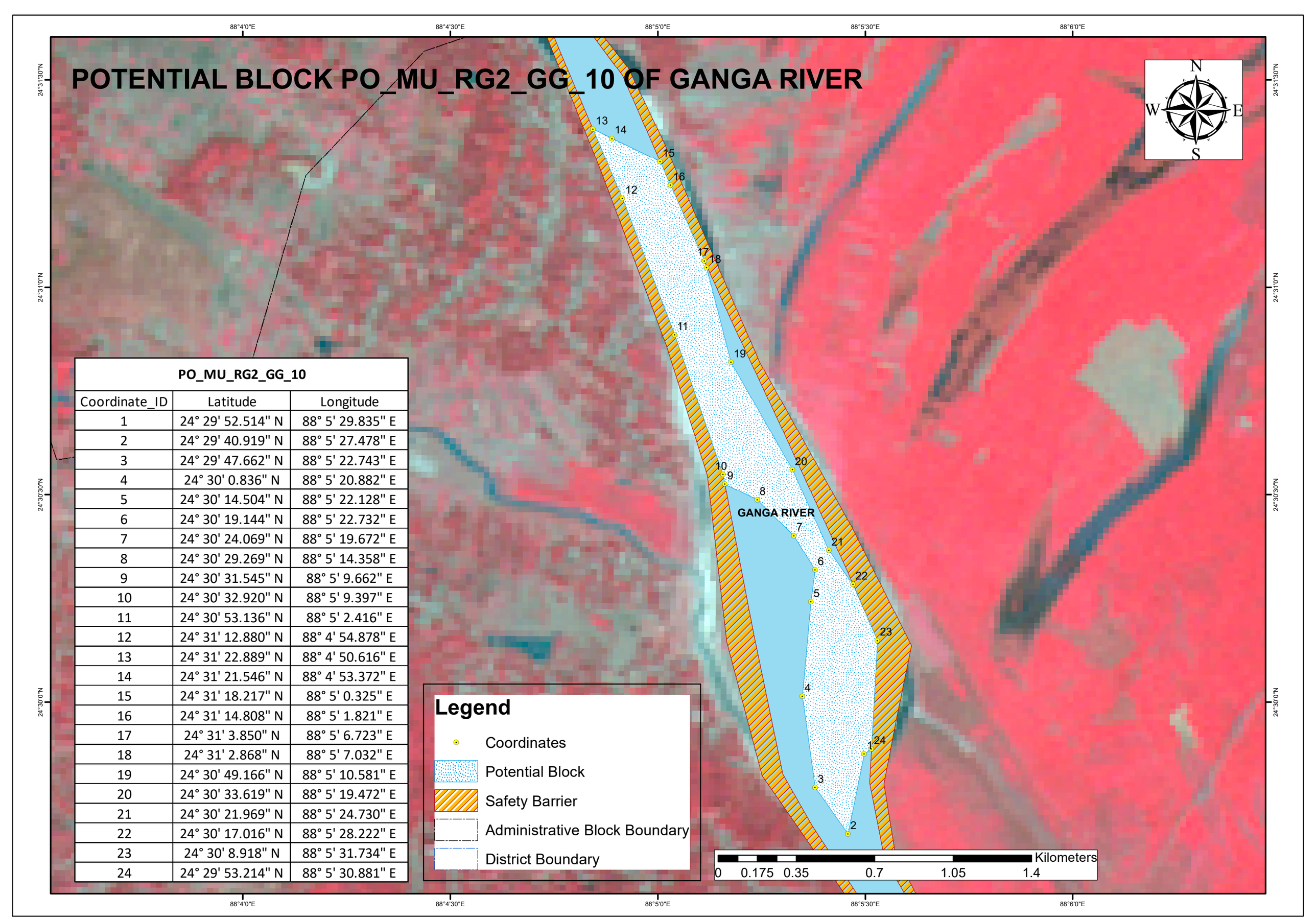
Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.05 0.1 0.2 0.3 0.4 Kilometers

POTENTIAL BLOCK PO_MU_RG2_GG_10 OF GANGA RIVER

PO_MU_RG2_GG_10		
Coordinate_ID	Latitude	Longitude
1	24° 29' 52.514" N	88° 5' 29.835" E
2	24° 29' 40.919" N	88° 5' 27.478" E
3	24° 29' 47.662" N	88° 5' 22.743" E
4	24° 30' 0.836" N	88° 5' 20.882" E
5	24° 30' 14.504" N	88° 5' 22.128" E
6	24° 30' 19.144" N	88° 5' 22.732" E
7	24° 30' 24.069" N	88° 5' 19.672" E
8	24° 30' 29.269" N	88° 5' 14.358" E
9	24° 30' 31.545" N	88° 5' 9.662" E
10	24° 30' 32.920" N	88° 5' 9.397" E
11	24° 30' 53.136" N	88° 5' 2.416" E
12	24° 31' 12.880" N	88° 4' 54.878" E
13	24° 31' 22.889" N	88° 4' 50.616" E
14	24° 31' 21.546" N	88° 4' 53.372" E
15	24° 31' 18.217" N	88° 5' 0.325" E
16	24° 31' 14.808" N	88° 5' 1.821" E
17	24° 31' 3.850" N	88° 5' 6.723" E
18	24° 31' 2.868" N	88° 5' 7.032" E
19	24° 30' 49.166" N	88° 5' 10.581" E
20	24° 30' 33.619" N	88° 5' 19.472" E
21	24° 30' 21.969" N	88° 5' 24.730" E
22	24° 30' 17.016" N	88° 5' 28.222" E
23	24° 30' 8.918" N	88° 5' 31.734" E
24	24° 29' 53.214" N	88° 5' 30.881" E



POTENTIAL BLOCK PO_MU_RG2_GG_11 OF GANGA RIVER

88°6'0"E

N
W
E
S

GANGA RIVER

1
2
3
4
5
6
7
8

PO_MU_RG2_GG_11		
Coordinate_ID	Latitude	Longitude
1	24° 29' 5.479" N	88° 6' 4.373" E
2	24° 29' 3.183" N	88° 6' 4.593" E
3	24° 29' 6.910" N	88° 5' 54.756" E
4	24° 29' 12.772" N	88° 5' 47.052" E
5	24° 29' 20.556" N	88° 5' 41.245" E
6	24° 29' 21.182" N	88° 5' 43.835" E
7	24° 29' 20.444" N	88° 5' 44.684" E
8	24° 29' 10.493" N	88° 5' 54.207" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.04 0.08 0.16 0.24 0.32 Kilometers

24°29'0"N

88°6'0"E

POTENTIAL BLOCK PO_MU_RG2_GG_12 OF GANGA RIVER

88°8'0"E 88°8'30"E 88°9'0"E

24°30'30"N

24°30'0"N

N W E S

GANGA RIVER

PO_MU_RG2_GG_12		
Coordinate_ID	Latitude	Longitude
1	24° 30' 12.024" N	88° 9' 6.156" E
2	24° 29' 42.695" N	88° 9' 7.437" E
3	24° 29' 45.953" N	88° 9' 3.731" E
4	24° 29' 53.149" N	88° 8' 54.994" E
5	24° 30' 1.453" N	88° 8' 47.959" E
6	24° 30' 13.486" N	88° 8' 45.229" E
7	24° 30' 23.123" N	88° 8' 42.873" E
8	24° 30' 29.226" N	88° 8' 39.339" E
9	24° 30' 33.349" N	88° 8' 40.880" E
10	24° 30' 20.268" N	88° 8' 52.264" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.075 0.15 0.3 0.45 0.6 Kilometers

POTENTIAL BLOCK PO_MU_RG2_GG_13 OF GANGA RIVER

88°6'30"E

88°7'0"E

24°28'30"N

N

W

E

S

GANGA RIVER

PO_MU_RG2_GG_13		
Coordinate_ID	Latitude	Longitude
1	24° 28' 5.305" N	88° 7' 2.854" E
2	24° 28' 3.036" N	88° 7' 2.609" E
3	24° 28' 9.115" N	88° 6' 50.031" E
4	24° 28' 19.161" N	88° 6' 31.398" E
5	24° 28' 26.651" N	88° 6' 23.569" E
6	24° 28' 38.219" N	88° 6' 22.543" E
7	24° 28' 34.877" N	88° 6' 25.414" E
8	24° 28' 30.506" N	88° 6' 26.844" E
9	24° 28' 22.591" N	88° 6' 34.090" E
10	24° 28' 20.342" N	88° 6' 40.872" E
11	24° 28' 18.659" N	88° 6' 43.574" E
12	24° 28' 13.006" N	88° 6' 54.351" E

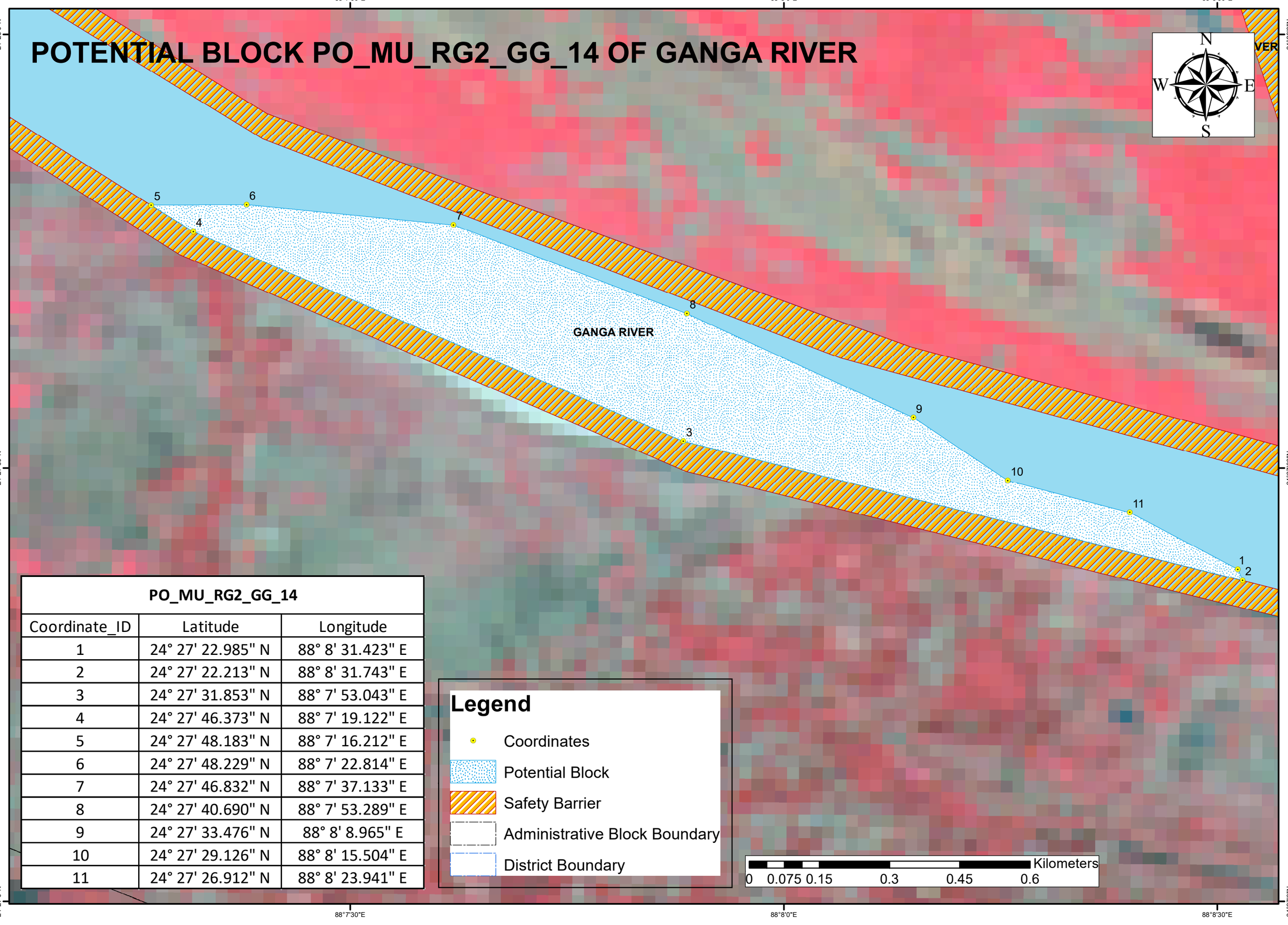
Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers

0 0.05 0.1 0.2 0.3 0.4

POTENTIAL BLOCK PO_MU_RG2_GG_14 OF GANGA RIVER



PO_MU_RG2_GG_14		
Coordinate_ID	Latitude	Longitude
1	24° 27' 22.985" N	88° 8' 31.423" E
2	24° 27' 22.213" N	88° 8' 31.743" E
3	24° 27' 31.853" N	88° 7' 53.043" E
4	24° 27' 46.373" N	88° 7' 19.122" E
5	24° 27' 48.183" N	88° 7' 16.212" E
6	24° 27' 48.229" N	88° 7' 22.814" E
7	24° 27' 46.832" N	88° 7' 37.133" E
8	24° 27' 40.690" N	88° 7' 53.289" E
9	24° 27' 33.476" N	88° 8' 8.965" E
10	24° 27' 29.126" N	88° 8' 15.504" E
11	24° 27' 26.912" N	88° 8' 23.941" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers
0 0.075 0.15 0.3 0.45 0.6

POTENTIAL BLOCK PO_MU_RG2_GG_15 OF GANGA RIVER

88°9'0"E 88°9'30"E

24°27'30"N 24°27'0"N

N W E S

GANGA RIVER

GANGA RIVER

PO_MU_RG2_GG_15		
Coordinate_ID	Latitude	Longitude
1	24° 27' 2.742" N	88° 9' 49.110" E
2	24° 27' 1.730" N	88° 9' 46.470" E
3	24° 27' 5.769" N	88° 9' 35.795" E
4	24° 27' 8.434" N	88° 9' 24.731" E
5	24° 27' 10.771" N	88° 9' 11.597" E
6	24° 27' 14.494" N	88° 8' 57.160" E
7	24° 27' 21.160" N	88° 8' 40.118" E
8	24° 27' 26.996" N	88° 8' 41.862" E
9	24° 27' 26.793" N	88° 8' 43.341" E
10	24° 27' 16.701" N	88° 9' 15.012" E
11	24° 27' 6.936" N	88° 9' 39.683" E
12	24° 27' 4.522" N	88° 9' 47.198" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.075 0.15 0.3 0.45 0.6 Kilometers

POTENTIAL BLOCK PO_MU_RG2_GG_16 OF GANGA RIVER

88°9'30"E

88°10'0"E

24°27'30"N

N

W

E

S

GANGA RIVER

PO_MU_RG2_GG_16		
Coordinate_ID	Latitude	Longitude
1	24° 27' 25.354" N	88° 10' 10.088" E
2	24° 27' 15.289" N	88° 10' 10.945" E
3	24° 27' 23.419" N	88° 10' 4.899" E
4	24° 27' 37.700" N	88° 10' 0.069" E
5	24° 27' 47.198" N	88° 9' 55.013" E
6	24° 27' 48.494" N	88° 9' 54.323" E
7	24° 27' 35.379" N	88° 10' 6.189" E

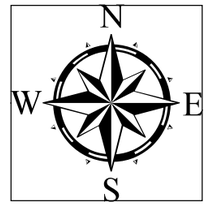
Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers

0 0.05 0.1 0.2 0.3 0.4

POTENTIAL BLOCK PO_MU_LG_GG_17 OF GANGA RIVER



88°11'0"E

88°11'30"E

24°27'0"N

24°26'30"N

6

5

4

7

3

1

2

GANGA RIVER

PO_MU_LG_GG_17		
Coordinate_ID	Latitude	Longitude
1	24° 26' 47.100" N	88° 11' 37.229" E
2	24° 26' 45.118" N	88° 11' 26.837" E
3	24° 26' 47.265" N	88° 11' 16.258" E
4	24° 26' 53.765" N	88° 11' 3.465" E
5	24° 27' 1.165" N	88° 10' 52.012" E
6	24° 27' 1.601" N	88° 10' 51.336" E
7	24° 26' 51.773" N	88° 11' 38.837" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.05 0.1 0.2 0.3 0.4 Kilometers

POTENTIAL BLOCK PO_MU_BW2_GG_18 OF GANGA RIVER

88°23'0"E

24°22'30"N

24°22'0"N

N

W

E

S

3

4

1

2

GANGA RIVER

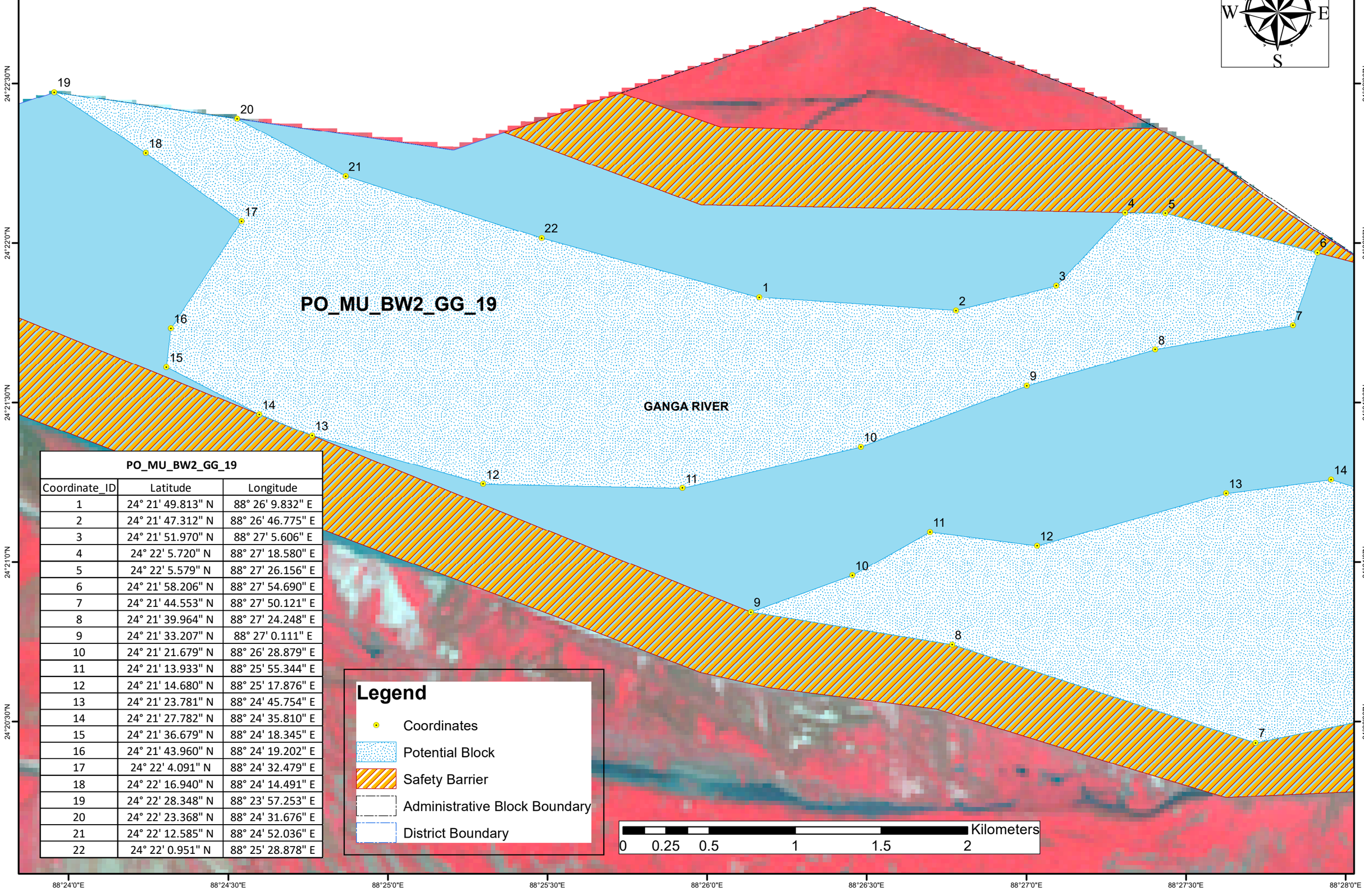
PO_MU_BW2_GG_18		
Coordinate_ID	Latitude	Longitude
1	24° 22' 20.687" N	88° 23' 11.530" E
2	24° 22' 8.944" N	88° 23' 5.774" E
3	24° 22' 24.476" N	88° 22' 49.977" E
4	24° 22' 24.524" N	88° 23' 5.269" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.05 0.1 0.2 0.3 0.4 Kilometers

POTENTIAL BLOCK PO_MU_BW2_GG_19 **OF GANGA RIVER**



PO_MU_BW2_GG_19		
Coordinate_ID	Latitude	Longitude
1	24° 21' 49.813" N	88° 26' 9.832" E
2	24° 21' 47.312" N	88° 26' 46.775" E
3	24° 21' 51.970" N	88° 27' 5.606" E
4	24° 22' 5.720" N	88° 27' 18.580" E
5	24° 22' 5.579" N	88° 27' 26.156" E
6	24° 21' 58.206" N	88° 27' 54.690" E
7	24° 21' 44.553" N	88° 27' 50.121" E
8	24° 21' 39.964" N	88° 27' 24.248" E
9	24° 21' 33.207" N	88° 27' 0.111" E
10	24° 21' 21.679" N	88° 26' 28.879" E
11	24° 21' 13.933" N	88° 25' 55.344" E
12	24° 21' 14.680" N	88° 25' 17.876" E
13	24° 21' 23.781" N	88° 24' 45.754" E
14	24° 21' 27.782" N	88° 24' 35.810" E
15	24° 21' 36.679" N	88° 24' 18.345" E
16	24° 21' 43.960" N	88° 24' 19.202" E
17	24° 22' 4.091" N	88° 24' 32.479" E
18	24° 22' 16.940" N	88° 24' 14.491" E
19	24° 22' 28.348" N	88° 23' 57.253" E
20	24° 22' 23.368" N	88° 24' 31.676" E
21	24° 22' 12.585" N	88° 24' 52.036" E
22	24° 22' 0.951" N	88° 25' 28.878" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

POTENTIAL BLOCK PO_MU_BW2_GG_20 OF GANGA RIVER

88°26'30"E 88°27'0"E 88°27'30"E 88°28'0"E 88°28'30"E 88°29'0"E

24°21'0"N 24°20'30"N 24°20'0"N 24°19'30"N

GANGA RIVER

PO_MU_BW2_GG_20		
Coordinate_ID	Latitude	Longitude
1	24° 21' 9.946" N	88° 28' 15.250" E
2	24° 21' 0.952" N	88° 28' 39.664" E
3	24° 20' 52.386" N	88° 28' 55.939" E
4	24° 20' 51.101" N	88° 28' 44.375" E
5	24° 20' 50.244" N	88° 28' 31.098" E
6	24° 20' 37.424" N	88° 28' 38.128" E
7	24° 20' 26.007" N	88° 27' 43.086" E
8	24° 20' 44.510" N	88° 26' 46.036" E
9	24° 20' 50.641" N	88° 26' 8.229" E
10	24° 20' 57.525" N	88° 26' 27.318" E
11	24° 21' 5.663" N	88° 26' 41.880" E
12	24° 21' 3.093" N	88° 27' 2.011" E
13	24° 21' 12.944" N	88° 27' 37.560" E
14	24° 21' 15.514" N	88° 27' 57.262" E

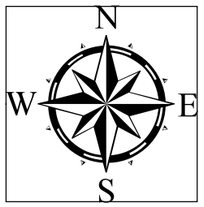
Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.175 0.35 0.7 1.05 1.4 Kilometers

POTENTIAL BLOCK PO_MU_BW2_GG_21 OF GANGA RIVER

88°29'30"E



PO_MU_BW2_GG_21		
Coordinate_ID	Latitude	Longitude
1	24° 21' 14.037" N	88° 29' 43.173" E
2	24° 21' 3.067" N	88° 29' 42.867" E
3	24° 21' 5.894" N	88° 29' 38.498" E
4	24° 21' 17.099" N	88° 29' 26.214" E
5	24° 21' 16.668" N	88° 29' 28.606" E

Legend

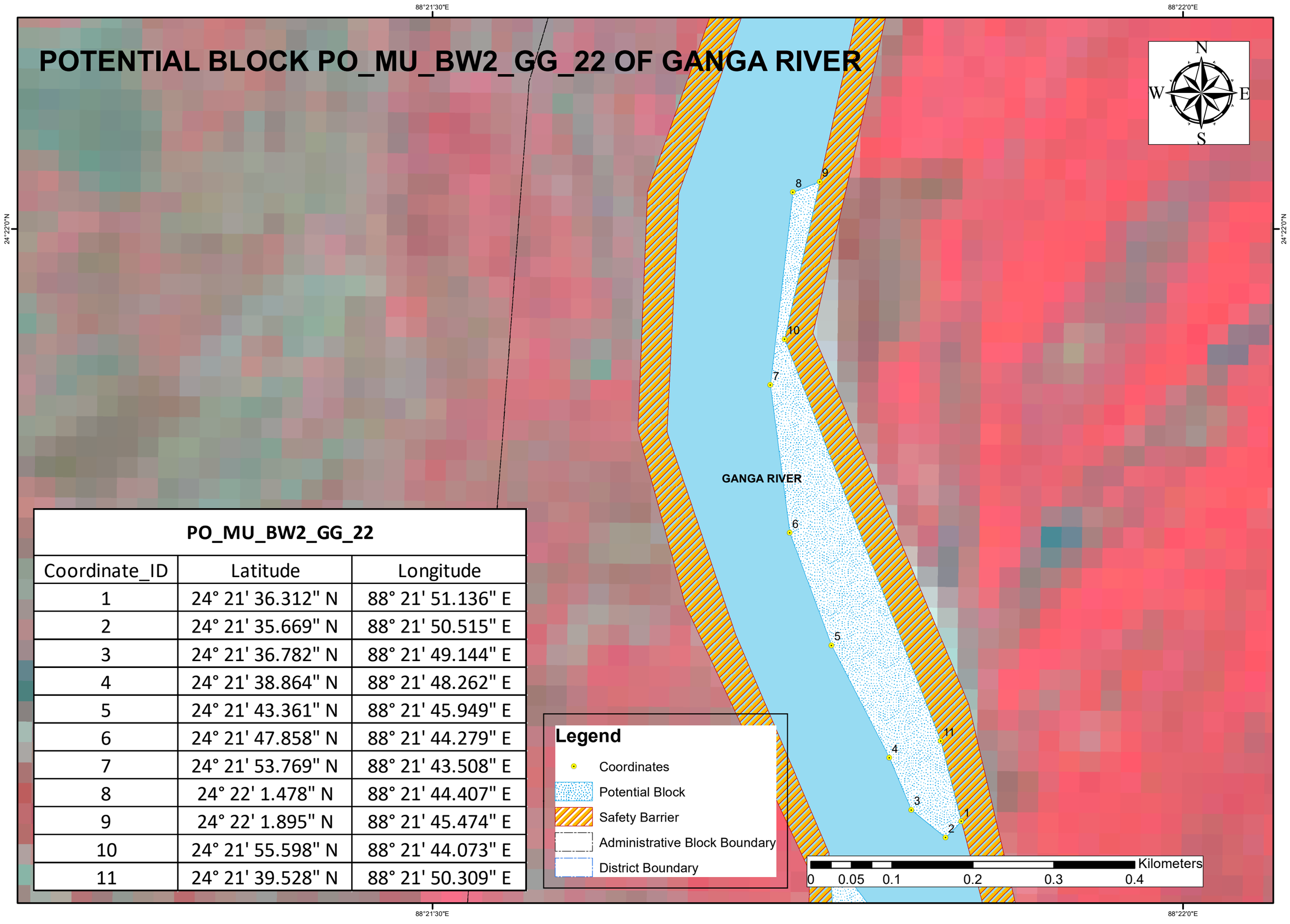
- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers
0 0.0325 0.065 0.13 0.195 0.26

24°21'0"N

88°29'30"E

POTENTIAL BLOCK PO_MU_BW2_GG_22 OF GANGA RIVER

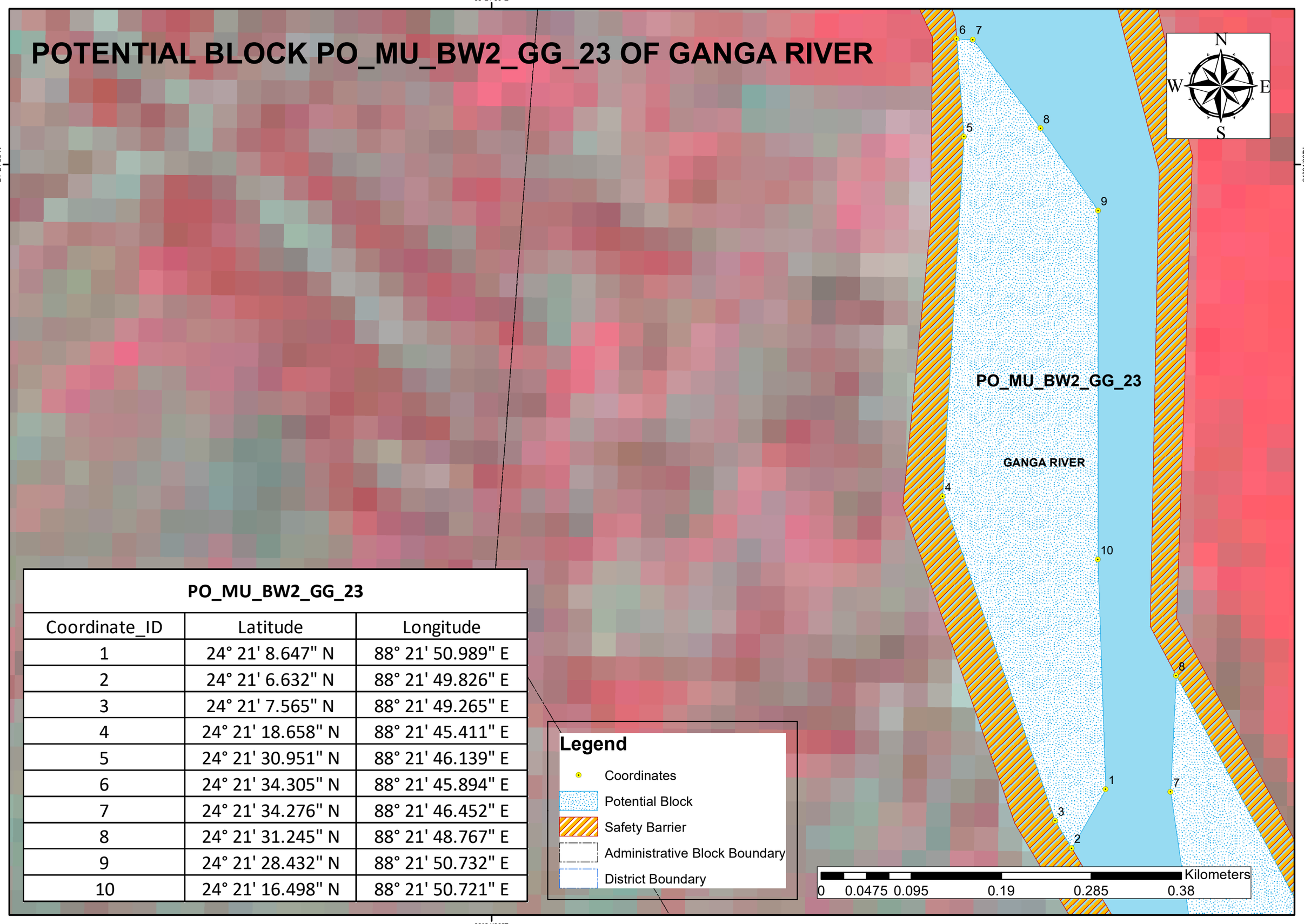


PO_MU_BW2_GG_22		
Coordinate_ID	Latitude	Longitude
1	24° 21' 36.312" N	88° 21' 51.136" E
2	24° 21' 35.669" N	88° 21' 50.515" E
3	24° 21' 36.782" N	88° 21' 49.144" E
4	24° 21' 38.864" N	88° 21' 48.262" E
5	24° 21' 43.361" N	88° 21' 45.949" E
6	24° 21' 47.858" N	88° 21' 44.279" E
7	24° 21' 53.769" N	88° 21' 43.508" E
8	24° 22' 1.478" N	88° 21' 44.407" E
9	24° 22' 1.895" N	88° 21' 45.474" E
10	24° 21' 55.598" N	88° 21' 44.073" E
11	24° 21' 39.528" N	88° 21' 50.309" E

POTENTIAL BLOCK PO_MU_BW2_GG_23 OF GANGA RIVER

88°21'30"E

24°21'30"N



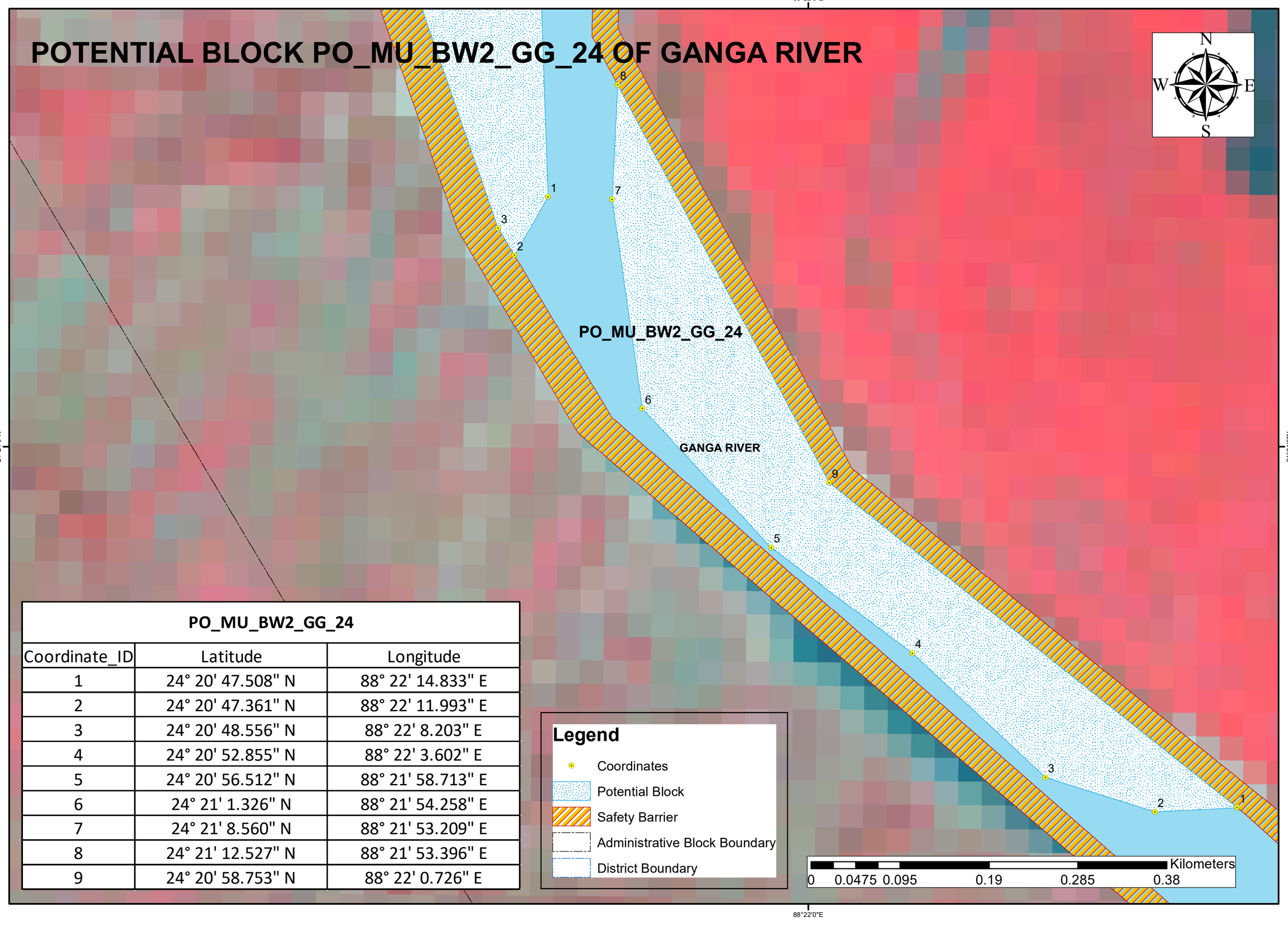
PO_MU_BW2_GG_23		
Coordinate_ID	Latitude	Longitude
1	24° 21' 8.647" N	88° 21' 50.989" E
2	24° 21' 6.632" N	88° 21' 49.826" E
3	24° 21' 7.565" N	88° 21' 49.265" E
4	24° 21' 18.658" N	88° 21' 45.411" E
5	24° 21' 30.951" N	88° 21' 46.139" E
6	24° 21' 34.305" N	88° 21' 45.894" E
7	24° 21' 34.276" N	88° 21' 46.452" E
8	24° 21' 31.245" N	88° 21' 48.767" E
9	24° 21' 28.432" N	88° 21' 50.732" E
10	24° 21' 16.498" N	88° 21' 50.721" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

88°21'30"E

POTENTIAL BLOCK PO_MU_BW2_GG_24 OF GANGA RIVER



PO_MU_BW2_GG_24		
Coordinate_ID	Latitude	Longitude
1	24° 20' 47.508" N	88° 22' 14.833" E
2	24° 20' 47.361" N	88° 22' 11.993" E
3	24° 20' 48.556" N	88° 22' 8.203" E
4	24° 20' 52.855" N	88° 22' 3.602" E
5	24° 20' 56.512" N	88° 21' 58.713" E
6	24° 21' 1.326" N	88° 21' 54.258" E
7	24° 21' 8.560" N	88° 21' 53.209" E
8	24° 21' 12.527" N	88° 21' 53.396" E
9	24° 20' 58.753" N	88° 22' 0.726" E

POTENTIAL BLOCK PO_MU_BW2_GG_25 OF GANGA RIVER

88°22'30"E

24°20'30"N

GANGA RIVER

PO_MU_BW2_GG_25		
Coordinate_ID	Latitude	Longitude
1	24° 20' 24.090" N	88° 22' 36.186" E
2	24° 20' 23.242" N	88° 22' 35.068" E
3	24° 20' 23.921" N	88° 22' 34.623" E
4	24° 20' 34.243" N	88° 22' 23.872" E
5	24° 20' 42.085" N	88° 22' 14.904" E
6	24° 20' 42.075" N	88° 22' 16.290" E
7	24° 20' 41.356" N	88° 22' 19.662" E
8	24° 20' 39.121" N	88° 22' 24.171" E
9	24° 20' 36.762" N	88° 22' 26.789" E
10	24° 20' 33.608" N	88° 22' 29.999" E
11	24° 20' 28.836" N	88° 22' 34.547" E
12	24° 20' 25.466" N	88° 22' 36.201" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers
0 0.04 0.08 0.16 0.24 0.32

POTENTIAL BLOCK PO_MU_BW2_GG_26 OF GANGA RIVER

88°22'0"E 88°22'30"E 88°23'0"E

24°19'30"N 24°19'0"N

N W E S

GANGA RIVER

PO_MU_BW2_GG_26		
Coordinate_ID	Latitude	Longitude
1	24° 18' 52.701" N	88° 22' 59.940" E
2	24° 18' 51.003" N	88° 22' 57.481" E
3	24° 18' 53.612" N	88° 22' 54.318" E
4	24° 18' 58.807" N	88° 22' 50.620" E
5	24° 19' 3.802" N	88° 22' 49.923" E
6	24° 19' 22.203" N	88° 22' 50.498" E
7	24° 19' 40.259" N	88° 22' 51.257" E
8	24° 19' 23.530" N	88° 22' 55.957" E
9	24° 19' 20.756" N	88° 22' 56.324" E
10	24° 19' 17.777" N	88° 22' 56.371" E
11	24° 19' 10.376" N	88° 22' 56.611" E
12	24° 18' 55.677" N	88° 22' 59.563" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers
0 0.075 0.15 0.3 0.45 0.6

POTENTIAL BLOCK PO_MU_BW2_GG_27 OF GANGA RIVER

PO_MU_BW2_GG_27		
Coordinate_ID	Latitude	Longitude
1	24° 18' 51.041" N	88° 24' 46.401" E
2	24° 18' 44.530" N	88° 24' 42.747" E
3	24° 18' 44.799" N	88° 24' 41.673" E
4	24° 18' 42.456" N	88° 24' 35.875" E
5	24° 18' 36.117" N	88° 24' 25.853" E
6	24° 18' 32.748" N	88° 24' 16.854" E
7	24° 18' 34.935" N	88° 24' 16.829" E
8	24° 18' 40.253" N	88° 24' 22.988" E
9	24° 18' 45.149" N	88° 24' 28.439" E
10	24° 18' 50.044" N	88° 24' 33.890" E
11	24° 18' 54.085" N	88° 24' 38.627" E
12	24° 19' 0.661" N	88° 24' 48.321" E
13	24° 19' 5.545" N	88° 24' 54.945" E
14	24° 19' 8.531" N	88° 24' 57.559" E
15	24° 19' 12.381" N	88° 24' 59.714" E
16	24° 19' 14.071" N	88° 25' 3.018" E
17	24° 19' 16.603" N	88° 25' 8.209" E
18	24° 19' 17.160" N	88° 25' 17.601" E
19	24° 19' 15.227" N	88° 25' 17.345" E
20	24° 19' 13.563" N	88° 25' 15.356" E
21	24° 19' 11.450" N	88° 25' 7.125" E
22	24° 19' 3.955" N	88° 24' 55.560" E
23	24° 18' 52.305" N	88° 24' 45.752" E

PO_MU_BW2_GG_27

GANGA RIVER

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.125 0.25 0.5 0.75 1 Kilometers

88°23'30"E 88°24'0"E 88°24'30"E 88°25'0"E

24°19'30"N 24°19'0"N 24°18'30"N

POTENTIAL BLOCK PO_MU_BW2_GG_28 OF GANGA RIVER

88°26'30"E 88°27'0"E 88°27'30"E

24°19'0"N

N W E S

GANGA RIVER

PO_MU_BW2_GG_28		
Coordinate_ID	Latitude	Longitude
1	24° 19' 5.088" N	88° 27' 24.278" E
2	24° 19' 3.684" N	88° 27' 19.982" E
3	24° 19' 3.985" N	88° 27' 10.074" E
4	24° 19' 4.595" N	88° 27' 1.611" E
5	24° 19' 5.135" N	88° 26' 57.309" E
6	24° 19' 6.241" N	88° 26' 50.051" E
7	24° 19' 12.564" N	88° 26' 36.381" E
8	24° 19' 15.494" N	88° 26' 34.051" E
9	24° 19' 13.459" N	88° 26' 48.717" E
10	24° 19' 9.703" N	88° 27' 20.273" E
11	24° 19' 9.042" N	88° 27' 20.944" E
12	24° 19' 6.133" N	88° 27' 22.938" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers
0 0.05 0.1 0.2 0.3 0.4

POTENTIAL BLOCK PO_MU_BW2_GG_29 OF GANGA RIVER

88°28'30"E 88°29'0"E

24°19'0"N

24°18'30"N

N W E S

GANGA RIVER

PO_MU_BW2_GG_29		
Coordinate_ID	Latitude	Longitude
1	24° 18' 46.578" N	88° 29' 9.222" E
2	24° 18' 46.468" N	88° 29' 2.839" E
3	24° 18' 47.636" N	88° 28' 48.962" E
4	24° 18' 50.119" N	88° 28' 41.294" E
5	24° 18' 52.587" N	88° 28' 35.128" E
6	24° 18' 55.745" N	88° 28' 28.783" E
7	24° 18' 57.931" N	88° 28' 16.231" E
8	24° 19' 0.374" N	88° 28' 12.693" E
9	24° 19' 1.800" N	88° 28' 11.976" E
10	24° 19' 1.158" N	88° 28' 15.885" E
11	24° 18' 55.162" N	88° 28' 46.791" E
12	24° 18' 52.729" N	88° 28' 58.886" E
13	24° 18' 51.393" N	88° 29' 12.455" E
14	24° 18' 51.015" N	88° 29' 15.955" E
15	24° 18' 48.263" N	88° 29' 12.808" E

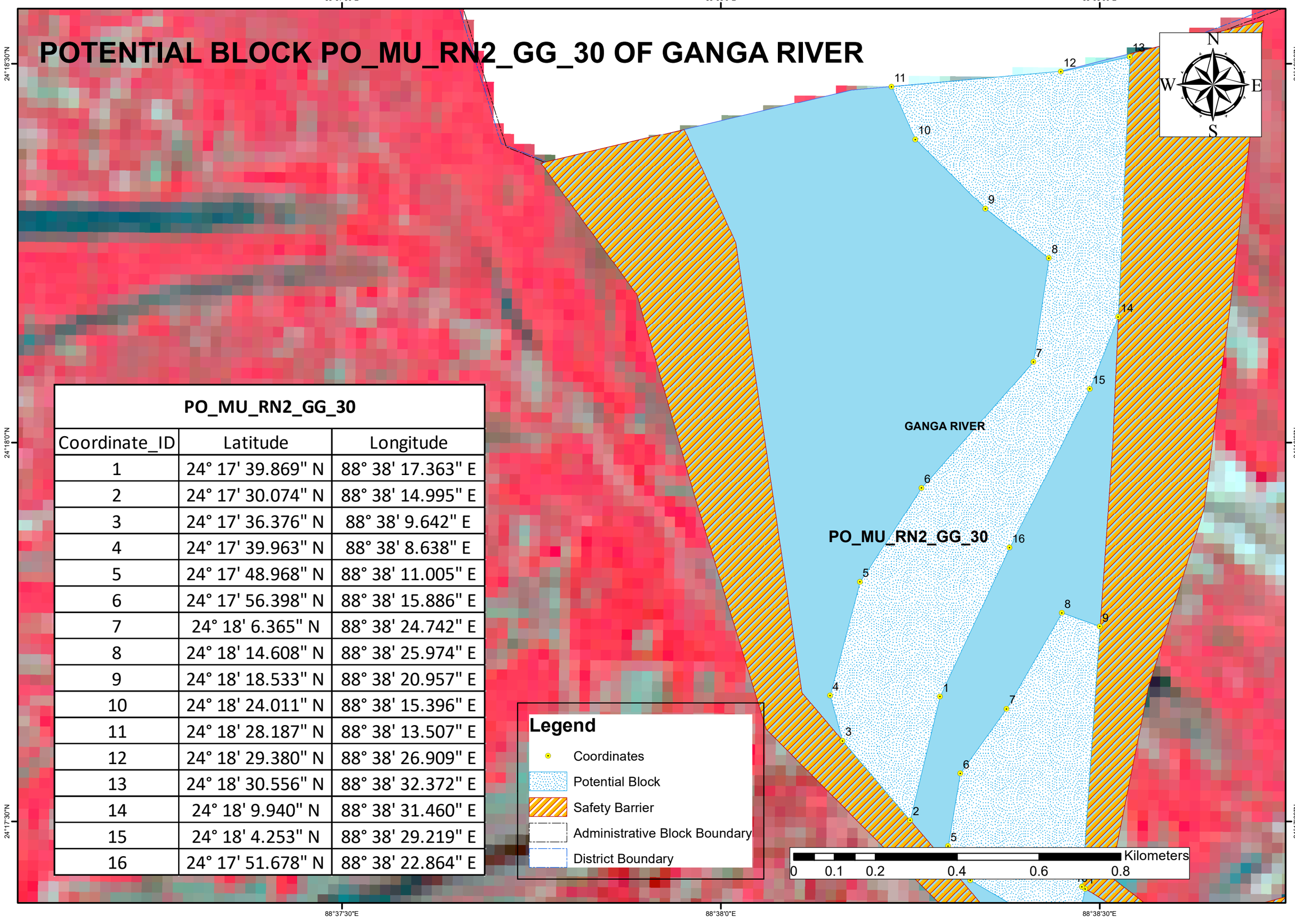
Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

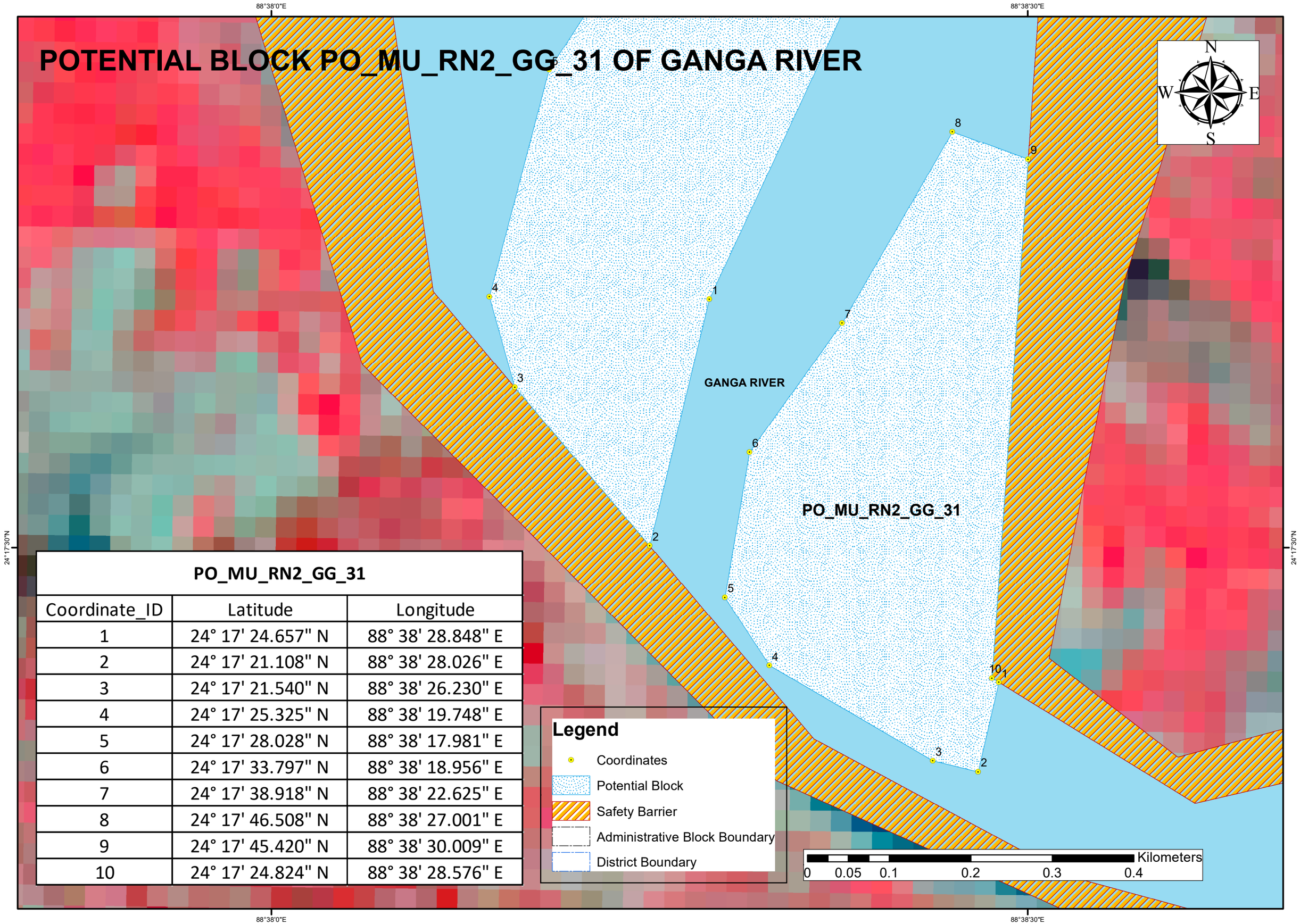
Kilometers
0 0.075 0.15 0.3 0.45 0.6

POTENTIAL BLOCK PO_MU_RN2_GG_30 OF GANGA RIVER

PO_MU_RN2_GG_30		
Coordinate_ID	Latitude	Longitude
1	24° 17' 39.869" N	88° 38' 17.363" E
2	24° 17' 30.074" N	88° 38' 14.995" E
3	24° 17' 36.376" N	88° 38' 9.642" E
4	24° 17' 39.963" N	88° 38' 8.638" E
5	24° 17' 48.968" N	88° 38' 11.005" E
6	24° 17' 56.398" N	88° 38' 15.886" E
7	24° 18' 6.365" N	88° 38' 24.742" E
8	24° 18' 14.608" N	88° 38' 25.974" E
9	24° 18' 18.533" N	88° 38' 20.957" E
10	24° 18' 24.011" N	88° 38' 15.396" E
11	24° 18' 28.187" N	88° 38' 13.507" E
12	24° 18' 29.380" N	88° 38' 26.909" E
13	24° 18' 30.556" N	88° 38' 32.372" E
14	24° 18' 9.940" N	88° 38' 31.460" E
15	24° 18' 4.253" N	88° 38' 29.219" E
16	24° 17' 51.678" N	88° 38' 22.864" E



POTENTIAL BLOCK PO_MU_RN2_GG_31 OF GANGA RIVER



PO_MU_RN2_GG_31		
Coordinate_ID	Latitude	Longitude
1	24° 17' 24.657" N	88° 38' 28.848" E
2	24° 17' 21.108" N	88° 38' 28.026" E
3	24° 17' 21.540" N	88° 38' 26.230" E
4	24° 17' 25.325" N	88° 38' 19.748" E
5	24° 17' 28.028" N	88° 38' 17.981" E
6	24° 17' 33.797" N	88° 38' 18.956" E
7	24° 17' 38.918" N	88° 38' 22.625" E
8	24° 17' 46.508" N	88° 38' 27.001" E
9	24° 17' 45.420" N	88° 38' 30.009" E
10	24° 17' 24.824" N	88° 38' 28.576" E

POTENTIAL BLOCK PO_MU_RN2_GG_32 OF GANGA RIVER

88°39'0"E 88°39'30"E 88°40'0"E

24°17'0"N

N W E S

GANGA RIVER

PO_MU_RN2_GG_32		
Coordinate_ID	Latitude	Longitude
1	24° 17' 0.228" N	88° 39' 39.799" E
2	24° 16' 49.978" N	88° 39' 53.036" E
3	24° 16' 44.544" N	88° 39' 58.360" E
4	24° 16' 41.552" N	88° 39' 56.679" E
5	24° 16' 50.778" N	88° 39' 42.555" E
6	24° 16' 53.176" N	88° 39' 28.850" E
7	24° 16' 52.693" N	88° 39' 27.665" E
8	24° 16' 52.960" N	88° 39' 27.575" E
9	24° 17' 4.738" N	88° 39' 8.729" E
10	24° 17' 11.591" N	88° 38' 51.490" E
11	24° 17' 11.649" N	88° 38' 51.273" E
12	24° 17' 13.871" N	88° 38' 51.419" E
13	24° 17' 17.892" N	88° 38' 57.335" E
14	24° 17' 19.541" N	88° 39' 3.925" E
15	24° 17' 17.250" N	88° 39' 16.797" E
16	24° 17' 9.375" N	88° 39' 29.128" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers
0 0.075 0.15 0.3 0.45 0.6

POTENTIAL BLOCK PO_MU_RN2_GG_33 OF GANGA RIVER

PO_MU_RN2_GG_33		
Coordinate_ID	Latitude	Longitude
1	24° 16' 53.097" N	88° 40' 48.160" E
2	24° 16' 50.114" N	88° 40' 43.032" E
3	24° 16' 55.596" N	88° 40' 35.494" E
4	24° 17' 0.784" N	88° 40' 35.850" E
5	24° 17' 1.691" N	88° 40' 36.475" E
6	24° 17' 6.630" N	88° 40' 41.660" E
7	24° 17' 19.713" N	88° 41' 5.314" E
8	24° 17' 21.180" N	88° 41' 8.743" E
9	24° 17' 22.622" N	88° 41' 14.392" E
10	24° 17' 20.641" N	88° 41' 18.588" E
11	24° 17' 17.626" N	88° 41' 19.017" E
12	24° 17' 7.481" N	88° 41' 3.167" E
13	24° 17' 2.968" N	88° 40' 58.682" E
14	24° 16' 58.420" N	88° 40' 51.843" E

GANGA RIVER

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers
0 0.075 0.15 0.3 0.45 0.6

88°40'0"E 88°40'30"E 88°41'0"E
24°17'30"N 24°17'0"N 24°16'30"N

POTENTIAL BLOCK PO_MU_BP_MR_1 OF MAYURAKSHI RIVER

88°9'20"E 88°9'22"E 88°9'24"E 88°9'26"E

23°58'6"N

23°58'4"N

MAYURAKSHI RIVER

1
2
3
4
5

PO_MU_BP_MR_1		
Coordinate_ID	Latitude	Longitude
1	23° 58' 4.130" N	88° 9' 24.685" E
2	23° 58' 4.045" N	88° 9' 22.259" E
3	23° 58' 5.572" N	88° 9' 22.226" E
4	23° 58' 5.829" N	88° 9' 25.153" E
5	23° 58' 4.413" N	88° 9' 25.259" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.0125 0.025 0.05 Kilometers

POTENTIAL BLOCK PO_MU_BP_MR_2 OF MAYURAKSHI RIVER

88°8'56"E
88°8'58"E
88°9'0"E
23°58'0"N
23°57'58"N

MAYURAKSHI RIVER

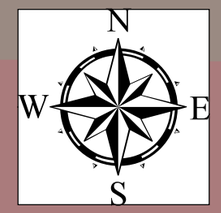
PO_MU_BP_MR_2		
Coordinate_ID	Latitude	Longitude
1	23° 57' 58.420" N	88° 8' 58.512" E
2	23° 57' 57.359" N	88° 8' 58.462" E
3	23° 57' 58.882" N	88° 8' 57.257" E
4	23° 57' 59.893" N	88° 8' 57.220" E
5	23° 57' 59.722" N	88° 8' 57.964" E
6	23° 57' 59.161" N	88° 8' 58.200" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers
0 0.0125 0.025 0.05

POTENTIAL BLOCK PO_MU_BP_MR_3 OF MAYURAKSHI RIVER



88°9'4"E 88°9'6"E 88°9'8"E

23°57'50"N

23°57'48"N

PO_MU_BP_MR_3		
Coordinate_ID	Latitude	Longitude
1	23° 57' 48.669" N	88° 9' 7.488" E
2	23° 57' 48.055" N	88° 9' 6.808" E
3	23° 57' 48.100" N	88° 9' 6.234" E
4	23° 57' 48.105" N	88° 9' 6.170" E
5	23° 57' 48.131" N	88° 9' 5.836" E
6	23° 57' 48.249" N	88° 9' 5.660" E
7	23° 57' 48.567" N	88° 9' 6.337" E
8	23° 57' 50.322" N	88° 9' 5.920" E
9	23° 57' 50.254" N	88° 9' 7.127" E
10	23° 57' 49.840" N	88° 9' 7.348" E

MAYURAKSHI RIVER

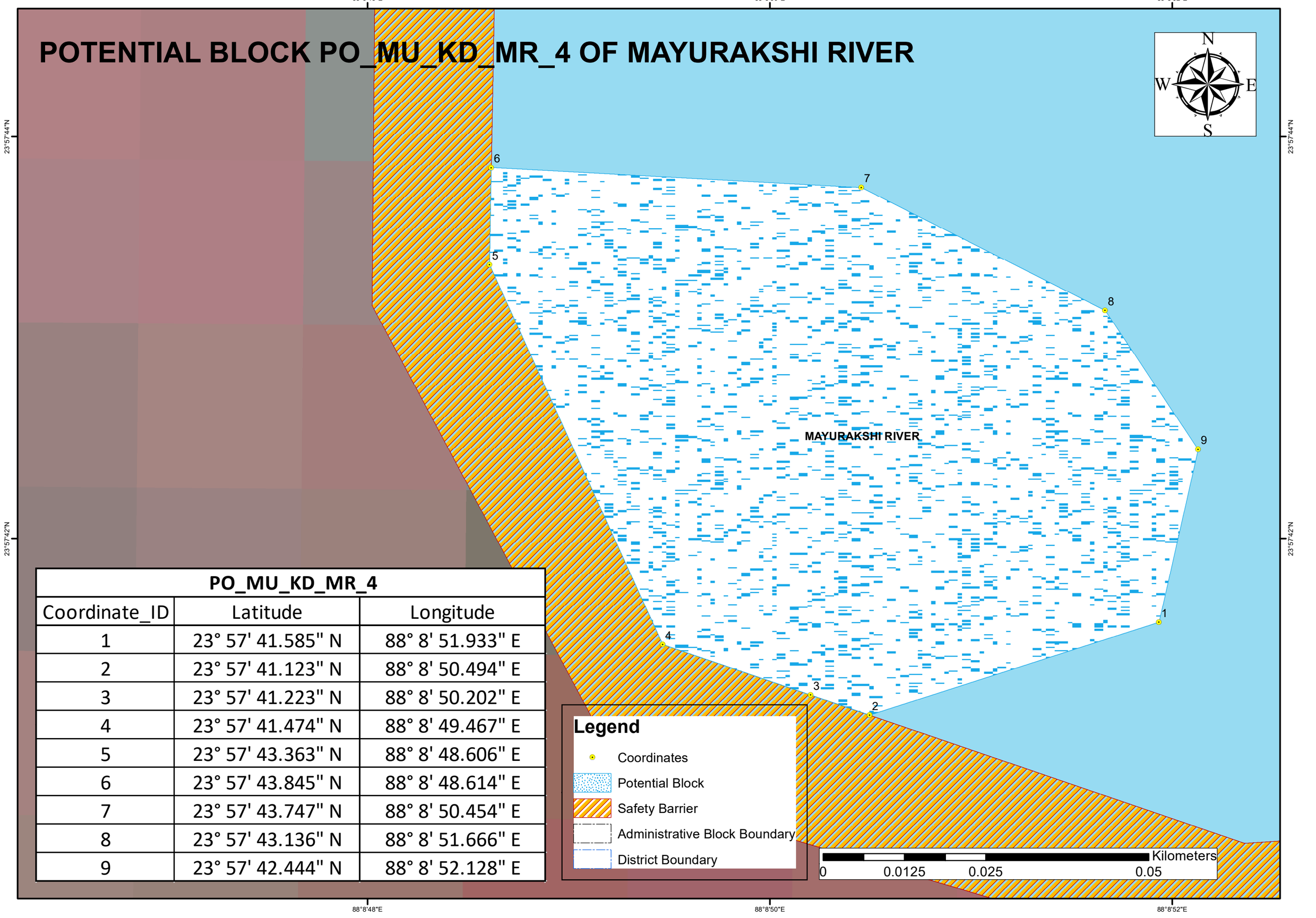
1 2 3 4 5 6 7 8 9 10

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

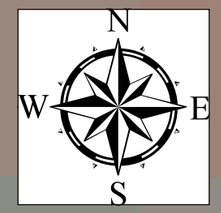
0 0.0125 0.025 0.05 Kilometers

POTENTIAL BLOCK PO_MU_KD_MR_4 OF MAYURAKSHI RIVER



PO_MU_KD_MR_4		
Coordinate_ID	Latitude	Longitude
1	23° 57' 41.585" N	88° 8' 51.933" E
2	23° 57' 41.123" N	88° 8' 50.494" E
3	23° 57' 41.223" N	88° 8' 50.202" E
4	23° 57' 41.474" N	88° 8' 49.467" E
5	23° 57' 43.363" N	88° 8' 48.606" E
6	23° 57' 43.845" N	88° 8' 48.614" E
7	23° 57' 43.747" N	88° 8' 50.454" E
8	23° 57' 43.136" N	88° 8' 51.666" E
9	23° 57' 42.444" N	88° 8' 52.128" E

POTENTIAL BLOCK PO_MU_KD_MR_5 OF MAYURAKSHI RIVER



88°8'42"E 88°8'44"E 88°8'46"E 88°8'48"E

23°57'38"N 23°57'36"N 23°57'34"N 23°57'32"N

4
3
MAYURAKSHI RIVER
5
1
2

PO_MU_KD_MR_5		
Coordinate_ID	Latitude	Longitude
1	23° 57' 34.358" N	88° 8' 48.497" E
2	23° 57' 33.358" N	88° 8' 47.779" E
3	23° 57' 35.315" N	88° 8' 43.752" E
4	23° 57' 37.039" N	88° 8' 43.822" E
5	23° 57' 34.365" N	88° 8' 48.466" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers
0 0.0175 0.035 0.07

POTENTIAL BLOCK PO_MU_KD_MR_6 OF MAYURAKSHI RIVER

88°8'32"E
88°8'34"E
88°8'36"E
23°57'46"N
23°57'44"N

MAYURAKSHI RIVER

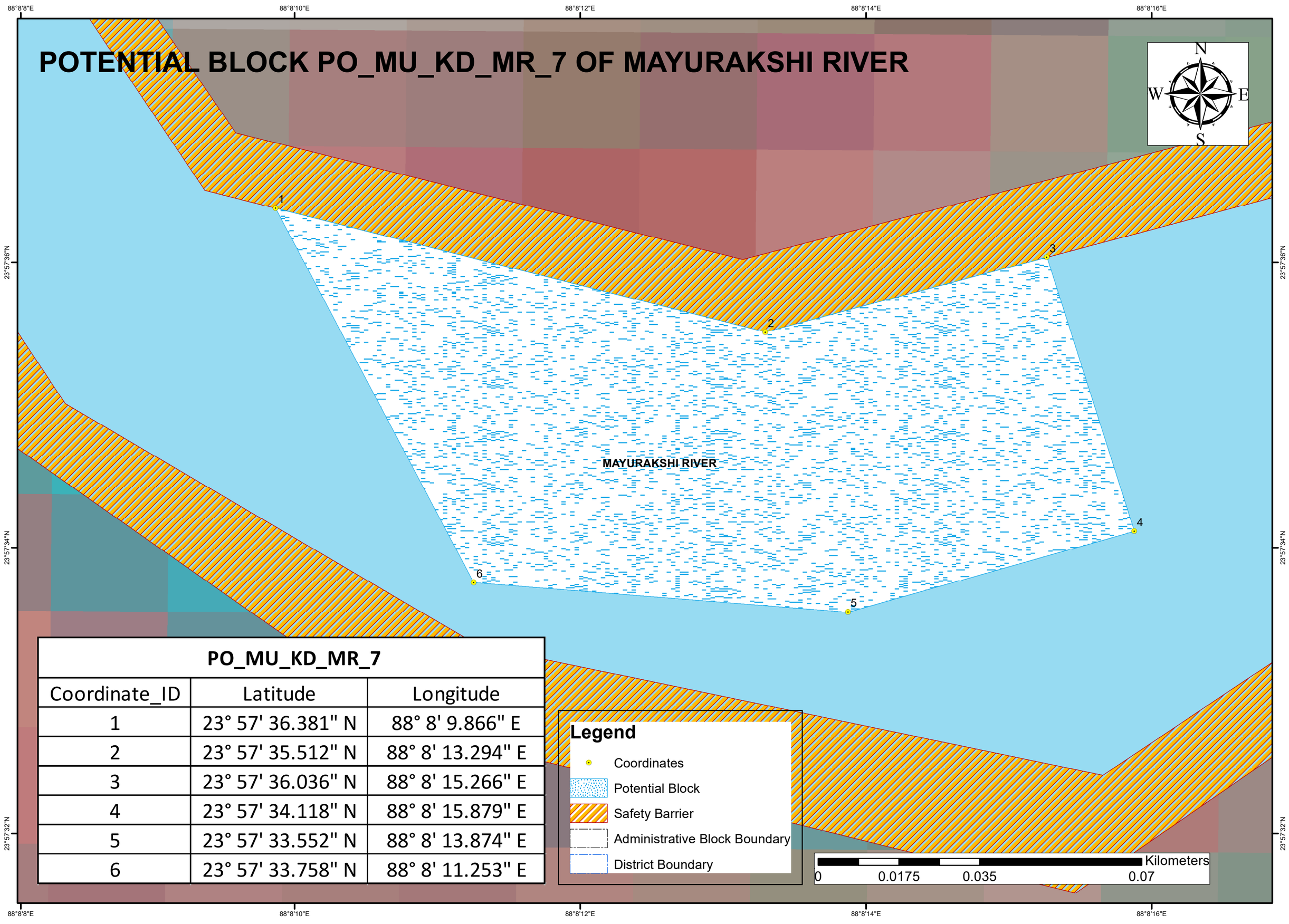
PO_MU_KD_MR_6		
Coordinate_ID	Latitude	Longitude
1	23° 57' 44.297" N	88° 8' 36.497" E
2	23° 57' 43.593" N	88° 8' 36.547" E
3	23° 57' 44.771" N	88° 8' 34.310" E
4	23° 57' 47.227" N	88° 8' 33.792" E
5	23° 57' 45.946" N	88° 8' 35.806" E
6	23° 57' 45.186" N	88° 8' 36.435" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.0125 0.025 0.05 Kilometers

POTENTIAL BLOCK PO_MU_KD_MR_7 OF MAYURAKSHI RIVER



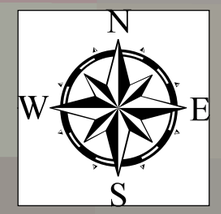
PO_MU_KD_MR_7		
Coordinate_ID	Latitude	Longitude
1	23° 57' 36.381" N	88° 8' 9.866" E
2	23° 57' 35.512" N	88° 8' 13.294" E
3	23° 57' 36.036" N	88° 8' 15.266" E
4	23° 57' 34.118" N	88° 8' 15.879" E
5	23° 57' 33.552" N	88° 8' 13.874" E
6	23° 57' 33.758" N	88° 8' 11.253" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers
0 0.0175 0.035 0.07

POTENTIAL BLOCK PO_MU_KD_MR_8 OF MAYURAKSHI RIVER



88°7'56"E 88°7'58"E 88°8'0"E 88°8'2"E 88°8'4"E 88°8'6"E 88°8'8"E

23°57'46"N 23°57'44"N 23°57'42"N 23°57'40"N

MAYURAKSHI RIVER

PO_MU_KD_MR_8		
Coordinate_ID	Latitude	Longitude
1	23° 57' 40.782" N	88° 8' 5.321" E
2	23° 57' 40.486" N	88° 8' 4.708" E
3	23° 57' 45.515" N	88° 8' 0.246" E
4	23° 57' 46.050" N	88° 8' 0.781" E
5	23° 57' 45.836" N	88° 8' 1.681" E
6	23° 57' 44.637" N	88° 8' 3.351" E
7	23° 57' 43.181" N	88° 8' 4.722" E
8	23° 57' 42.067" N	88° 8' 5.278" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers
0 0.025 0.05 0.1

POTENTIAL BLOCK PO_MU_KD_MR_9 OF MAYURAKSHI RIVER

88°7'38"E 88°7'40"E 88°7'42"E

23°57'46"N 23°57'44"N 23°57'42"N

MAYURAKSHI RIVER

1 2 3 4 5 6

PO_MU_KD_MR_9		
Coordinate_ID	Latitude	Longitude
1	23° 57' 44.897" N	88° 7' 41.479" E
2	23° 57' 43.564" N	88° 7' 37.472" E
3	23° 57' 45.220" N	88° 7' 37.571" E
4	23° 57' 45.494" N	88° 7' 40.450" E
5	23° 57' 45.357" N	88° 7' 42.163" E
6	23° 57' 44.969" N	88° 7' 41.959" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.0125 0.025 0.05 Kilometers

POTENTIAL BLOCK PO_MU_KD_MR_10 OF MAYURAKSHI RIVER

88°7'10"E 88°7'12"E 88°7'14"E 88°7'16"E 88°7'18"E

23°57'32"N 23°57'30"N 23°57'28"N 23°57'26"N

N W E S

4 5 1 3 2

MAYURAKSHI RIVER

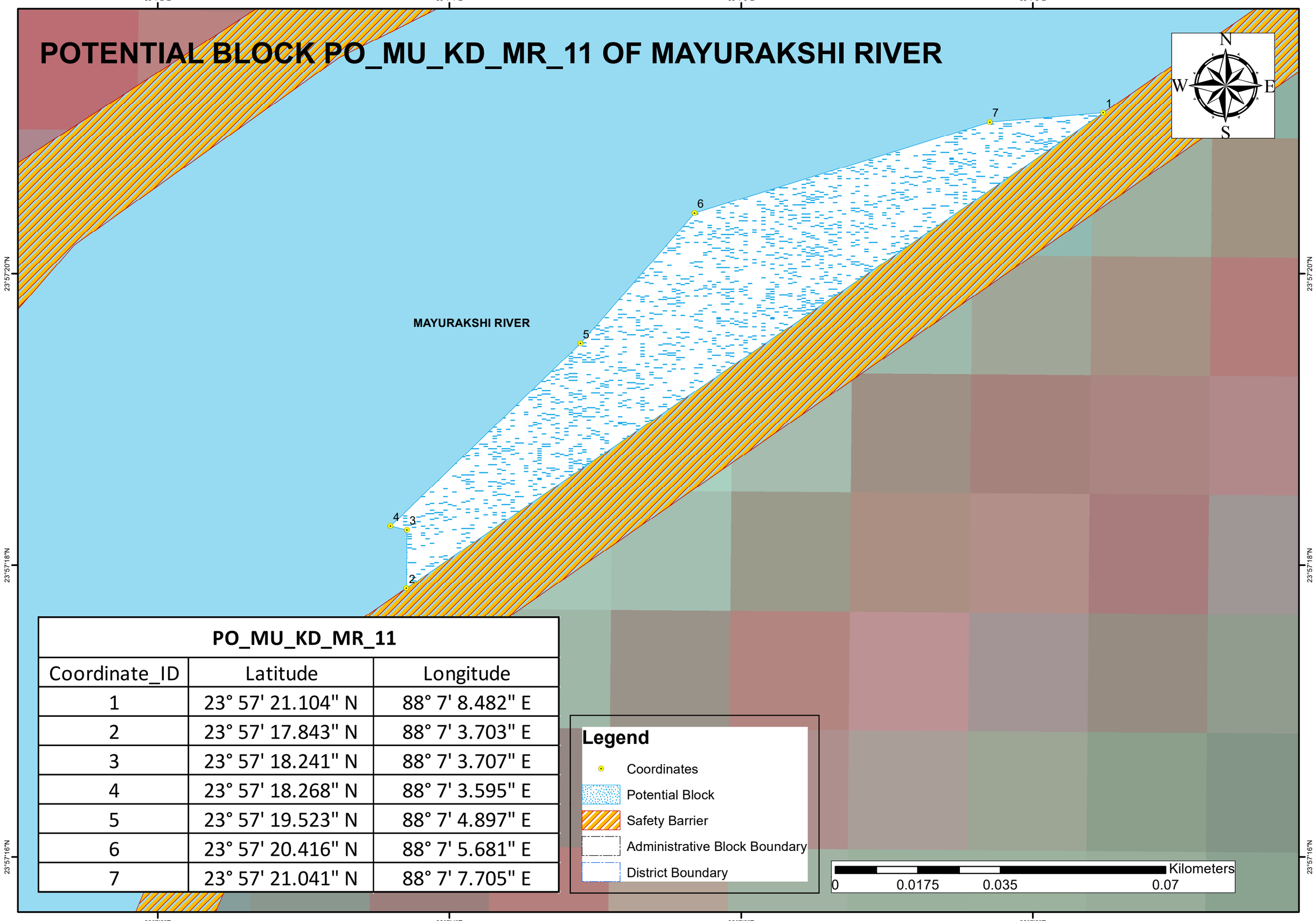
PO_MU_KD_MR_10		
Coordinate_ID	Latitude	Longitude
1	23° 57' 29.970" N	88° 7' 16.623" E
2	23° 57' 27.443" N	88° 7' 13.980" E
3	23° 57' 27.765" N	88° 7' 13.361" E
4	23° 57' 31.535" N	88° 7' 16.157" E
5	23° 57' 30.743" N	88° 7' 16.900" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

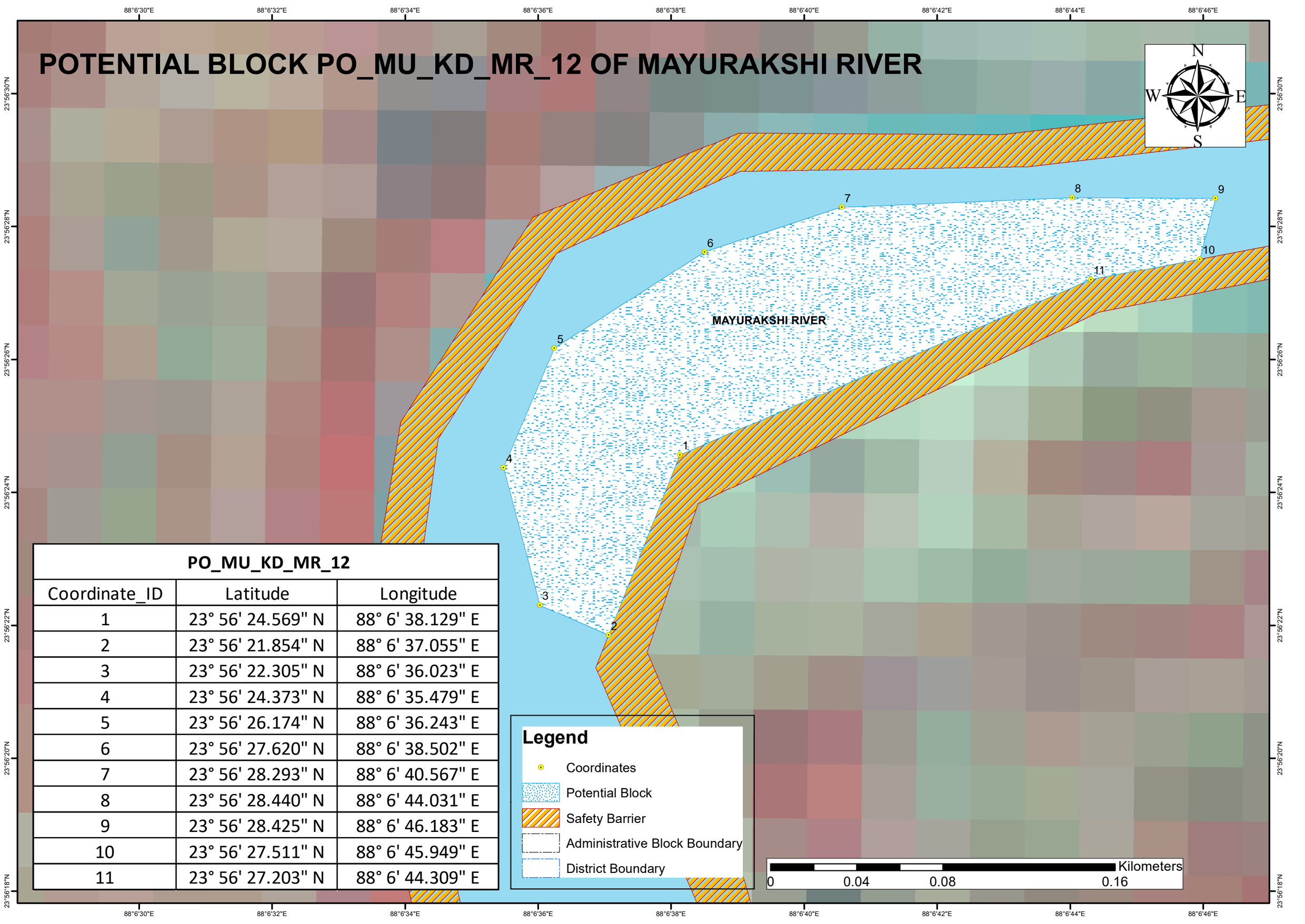
0 0.0175 0.035 0.07 Kilometers

POTENTIAL BLOCK PO_MU_KD_MR_11 OF MAYURAKSHI RIVER



PO_MU_KD_MR_11		
Coordinate_ID	Latitude	Longitude
1	23° 57' 21.104" N	88° 7' 8.482" E
2	23° 57' 17.843" N	88° 7' 3.703" E
3	23° 57' 18.241" N	88° 7' 3.707" E
4	23° 57' 18.268" N	88° 7' 3.595" E
5	23° 57' 19.523" N	88° 7' 4.897" E
6	23° 57' 20.416" N	88° 7' 5.681" E
7	23° 57' 21.041" N	88° 7' 7.705" E

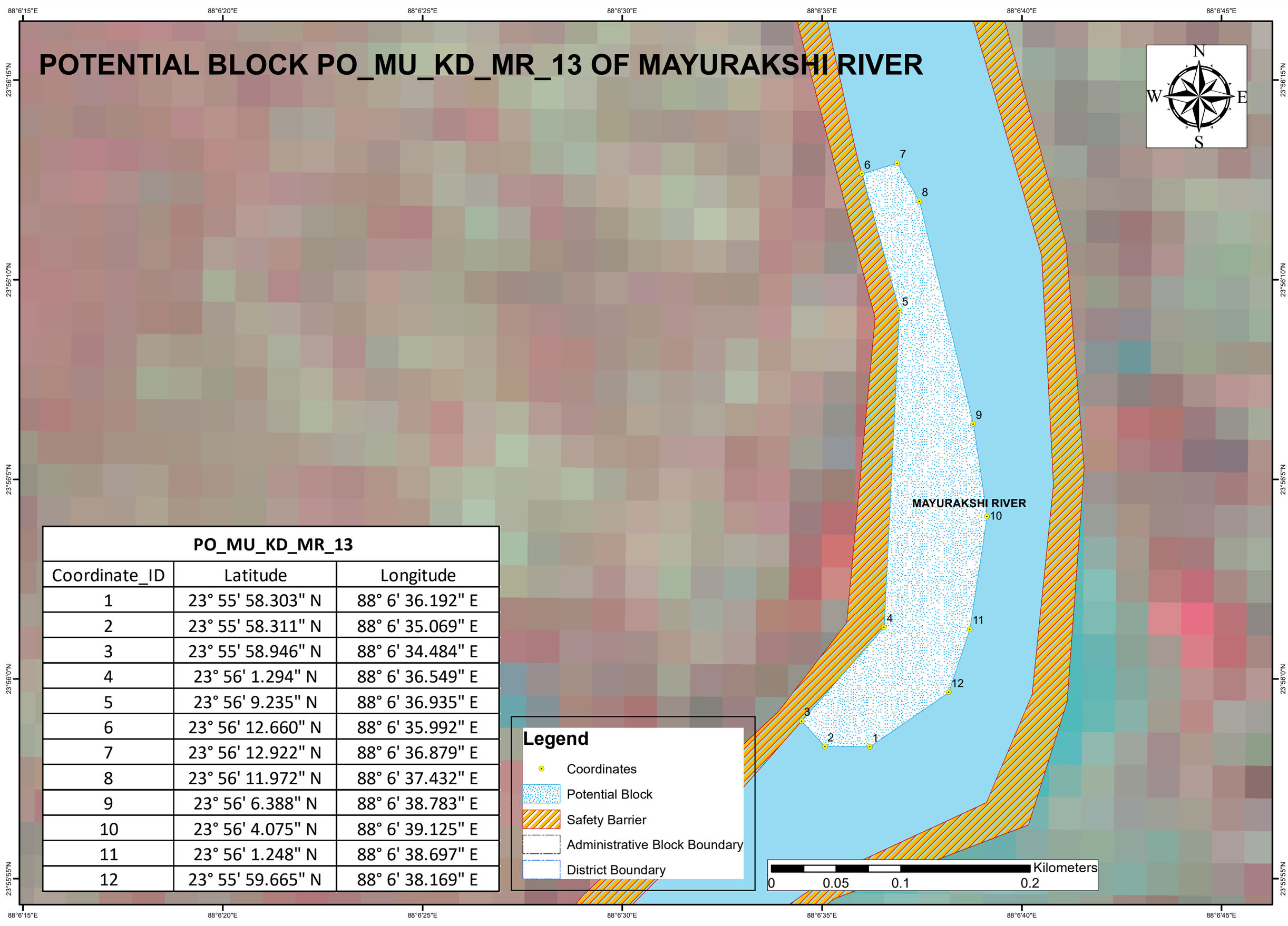
POTENTIAL BLOCK PO_MU_KD_MR_12 OF MAYURAKSHI RIVER



PO_MU_KD_MR_12		
Coordinate_ID	Latitude	Longitude
1	23° 56' 24.569" N	88° 6' 38.129" E
2	23° 56' 21.854" N	88° 6' 37.055" E
3	23° 56' 22.305" N	88° 6' 36.023" E
4	23° 56' 24.373" N	88° 6' 35.479" E
5	23° 56' 26.174" N	88° 6' 36.243" E
6	23° 56' 27.620" N	88° 6' 38.502" E
7	23° 56' 28.293" N	88° 6' 40.567" E
8	23° 56' 28.440" N	88° 6' 44.031" E
9	23° 56' 28.425" N	88° 6' 46.183" E
10	23° 56' 27.511" N	88° 6' 45.949" E
11	23° 56' 27.203" N	88° 6' 44.309" E

POTENTIAL BLOCK PO_MU_KD_MR_13 OF MAYURAKSHI RIVER

PO_MU_KD_MR_13		
Coordinate_ID	Latitude	Longitude
1	23° 55' 58.303" N	88° 6' 36.192" E
2	23° 55' 58.311" N	88° 6' 35.069" E
3	23° 55' 58.946" N	88° 6' 34.484" E
4	23° 56' 1.294" N	88° 6' 36.549" E
5	23° 56' 9.235" N	88° 6' 36.935" E
6	23° 56' 12.660" N	88° 6' 35.992" E
7	23° 56' 12.922" N	88° 6' 36.879" E
8	23° 56' 11.972" N	88° 6' 37.432" E
9	23° 56' 6.388" N	88° 6' 38.783" E
10	23° 56' 4.075" N	88° 6' 39.125" E
11	23° 56' 1.248" N	88° 6' 38.697" E
12	23° 55' 59.665" N	88° 6' 38.169" E



POTENTIAL BLOCK PO_MU_BH1_MR_14 OF MAYURAKSHI RIVER

PO_MU_BH1_MR_14		
Coordinate_ID	Latitude	Longitude
1	23° 55' 14.180" N	88° 5' 38.311" E
2	23° 55' 12.964" N	88° 5' 38.031" E
3	23° 55' 12.974" N	88° 5' 37.841" E
4	23° 55' 12.550" N	88° 5' 36.677" E
5	23° 55' 12.489" N	88° 5' 35.995" E
6	23° 55' 11.295" N	88° 5' 34.581" E
7	23° 55' 9.928" N	88° 5' 33.260" E
8	23° 55' 8.244" N	88° 5' 34.181" E
9	23° 55' 7.612" N	88° 5' 35.188" E
10	23° 55' 6.789" N	88° 5' 35.717" E
11	23° 55' 4.373" N	88° 5' 38.698" E
12	23° 55' 3.246" N	88° 5' 39.588" E
13	23° 55' 0.141" N	88° 5' 40.742" E
14	23° 54' 57.669" N	88° 5' 40.488" E
15	23° 54' 56.722" N	88° 5' 39.783" E
16	23° 55' 0.105" N	88° 5' 38.497" E
17	23° 55' 4.371" N	88° 5' 36.407" E
18	23° 55' 7.868" N	88° 5' 31.918" E
19	23° 55' 10.358" N	88° 5' 31.447" E
20	23° 55' 12.680" N	88° 5' 31.467" E
21	23° 55' 14.389" N	88° 5' 33.072" E
22	23° 55' 14.791" N	88° 5' 37.099" E

MAYURAKSHI RIVER

Legend

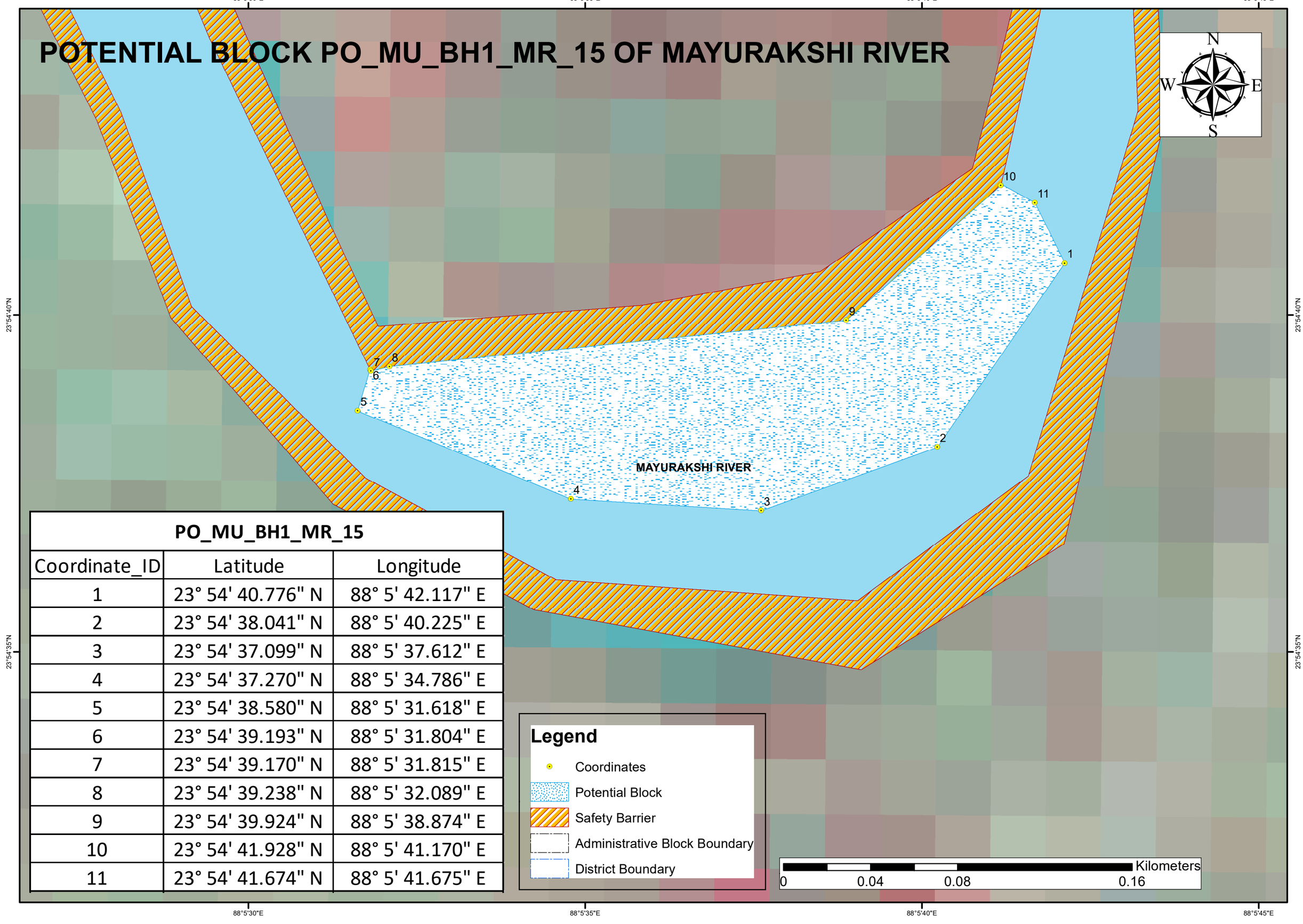
- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.05 0.1 0.2 Kilometers

88°5'20"E 88°5'25"E 88°5'30"E 88°5'35"E 88°5'40"E 88°5'45"E

23°55'15"N 23°55'10"N 23°55'5"N 23°55'0"N 23°54'55"N

POTENTIAL BLOCK PO_MU_BH1_MR_15 OF MAYURAKSHI RIVER



PO_MU_BH1_MR_15		
Coordinate_ID	Latitude	Longitude
1	23° 54' 40.776" N	88° 5' 42.117" E
2	23° 54' 38.041" N	88° 5' 40.225" E
3	23° 54' 37.099" N	88° 5' 37.612" E
4	23° 54' 37.270" N	88° 5' 34.786" E
5	23° 54' 38.580" N	88° 5' 31.618" E
6	23° 54' 39.193" N	88° 5' 31.804" E
7	23° 54' 39.170" N	88° 5' 31.815" E
8	23° 54' 39.238" N	88° 5' 32.089" E
9	23° 54' 39.924" N	88° 5' 38.874" E
10	23° 54' 41.928" N	88° 5' 41.170" E
11	23° 54' 41.674" N	88° 5' 41.675" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

POTENTIAL BLOCK PO_MU_BH1_MR_16 OF MAYURAKSHI RIVER

88°4'5"E 88°4'10"E 88°4'15"E

23°54'0"N

23°53'55"N

N W E S

4 5 6 3 7 1 2

MAYURAKSHI RIVER

PO_MU_BH1_MR_16		
Coordinate_ID	Latitude	Longitude
1	23° 53' 56.124" N	88° 4' 12.758" E
2	23° 53' 55.969" N	88° 4' 10.356" E
3	23° 53' 57.342" N	88° 4' 10.928" E
4	23° 53' 59.168" N	88° 4' 10.795" E
5	23° 53' 58.793" N	88° 4' 13.407" E
6	23° 53' 58.165" N	88° 4' 13.595" E
7	23° 53' 56.730" N	88° 4' 13.424" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers

0 0.025 0.05 0.1

POTENTIAL BLOCK PO_MU_BH1_MR_17 OF MAYURAKSHI RIVER

88°3'35"E

88°3'40"E

23°53'40"N

MAYURAKSHI RIVER

PO_MU_BH1_MR_17		
Coordinate_ID	Latitude	Longitude
1	23° 53' 41.115" N	23° 53' 41.115" N
2	23° 53' 41.115" N	23° 53' 41.115" N
3	23° 53' 41.231" N	23° 53' 41.231" N
4	23° 53' 41.392" N	23° 53' 41.392" N
5	23° 53' 42.614" N	23° 53' 42.614" N
6	23° 53' 43.440" N	23° 53' 43.440" N
7	23° 53' 42.677" N	23° 53' 42.677" N
8	23° 53' 41.642" N	23° 53' 41.642" N
9	23° 53' 41.373" N	23° 53' 41.373" N

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers

0 0.0125 0.025 0.05

POTENTIAL BLOCK PO_MU_BH1_MR_18 OF MAYURAKSHI RIVER

88°3'25"E

88°3'30"E

23°52'35"N

N

W

E

S

5

6

4

3

MAYURAKSHI RIVER

1

2

PO_MU_BH1_MR_18		
Coordinate_ID	Latitude	Longitude
1	23° 52' 32.356" N	88° 3' 28.559" E
2	23° 52' 31.613" N	88° 3' 27.497" E
3	23° 52' 33.644" N	88° 3' 24.662" E
4	23° 52' 33.777" N	88° 3' 24.287" E
5	23° 52' 35.444" N	88° 3' 25.331" E
6	23° 52' 34.288" N	88° 3' 26.993" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers

0 0.0175 0.035 0.07

POTENTIAL BLOCK PO_MU_BH1_MR_19 OF MAYURAKSHI RIVER

PO_MU_BH1_MR_19		
Coordinate_ID	Latitude	Longitude
1	23° 52' 19.370" N	88° 2' 49.799" E
2	23° 52' 16.564" N	88° 2' 43.407" E
3	23° 52' 17.279" N	88° 2' 42.947" E
4	23° 52' 19.326" N	88° 2' 45.433" E
5	23° 52' 20.917" N	88° 2' 48.366" E
6	23° 52' 22.039" N	88° 2' 52.129" E
7	23° 52' 22.386" N	88° 2' 52.608" E
8	23° 52' 22.916" N	88° 2' 53.994" E
9	23° 52' 23.689" N	88° 2' 54.406" E
10	23° 52' 23.902" N	88° 2' 54.699" E
11	23° 52' 25.454" N	88° 2' 55.346" E
12	23° 52' 26.481" N	88° 2' 55.893" E
13	23° 52' 28.189" N	88° 2' 56.486" E
14	23° 52' 29.567" N	88° 2' 57.060" E
15	23° 52' 29.490" N	88° 2' 58.761" E
16	23° 52' 27.953" N	88° 2' 58.742" E
17	23° 52' 25.641" N	88° 2' 58.074" E
18	23° 52' 21.141" N	88° 2' 53.983" E
19	23° 52' 20.547" N	88° 2' 52.602" E

MAYURAKSHI RIVER

N
W
E
S

Legend

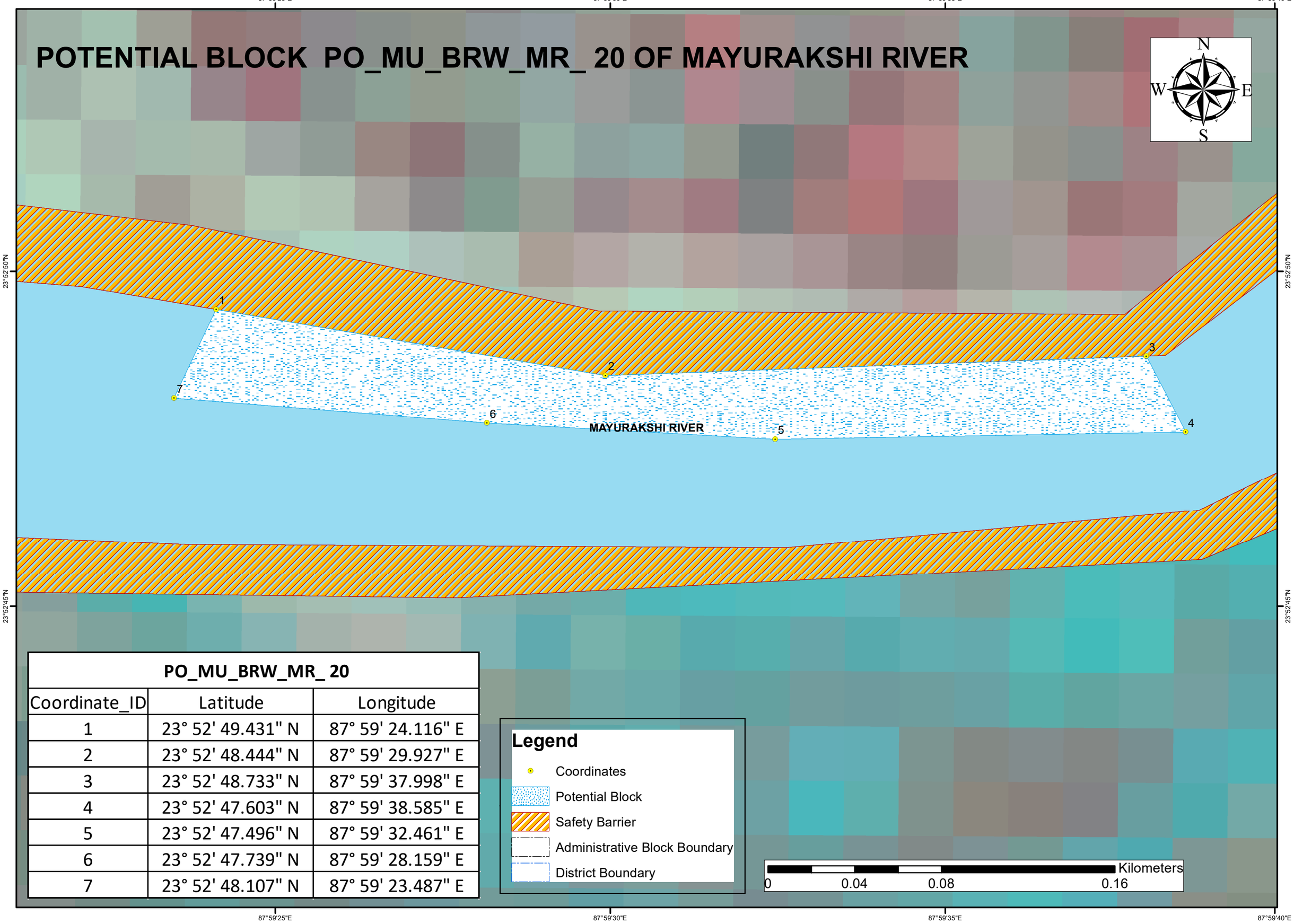
- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

0 0.05 0.1 0.2 Kilometers

88°2'35"E 88°2'40"E 88°2'45"E 88°2'50"E 88°2'55"E 88°3'0"E

23°52'30"N 23°52'25"N 23°52'20"N 23°52'15"N 23°52'10"N

POTENTIAL BLOCK PO_MU_BRW_MR_ 20 OF MAYURAKSHI RIVER



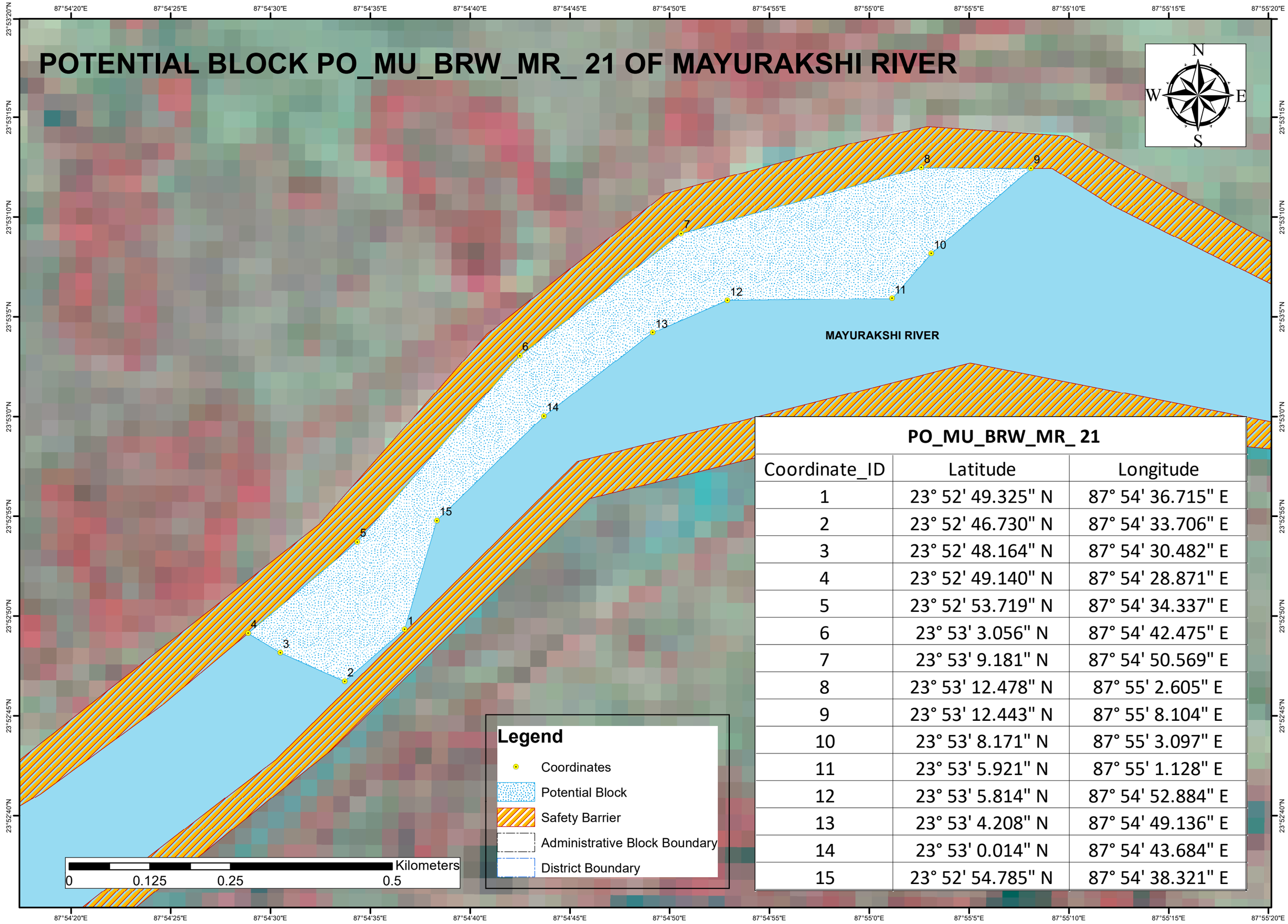
PO_MU_BRW_MR_ 20		
Coordinate_ID	Latitude	Longitude
1	23° 52' 49.431" N	87° 59' 24.116" E
2	23° 52' 48.444" N	87° 59' 29.927" E
3	23° 52' 48.733" N	87° 59' 37.998" E
4	23° 52' 47.603" N	87° 59' 38.585" E
5	23° 52' 47.496" N	87° 59' 32.461" E
6	23° 52' 47.739" N	87° 59' 28.159" E
7	23° 52' 48.107" N	87° 59' 23.487" E

Legend

- Coordinates
- Potential Block
- Safety Barrier
- Administrative Block Boundary
- District Boundary

Kilometers
0 0.04 0.08 0.16

POTENTIAL BLOCK PO_MU_BRW_MR_ 21 OF MAYURAKSHI RIVER



PO_MU_BRW_MR_ 21		
Coordinate_ID	Latitude	Longitude
1	23° 52' 49.325" N	87° 54' 36.715" E
2	23° 52' 46.730" N	87° 54' 33.706" E
3	23° 52' 48.164" N	87° 54' 30.482" E
4	23° 52' 49.140" N	87° 54' 28.871" E
5	23° 52' 53.719" N	87° 54' 34.337" E
6	23° 53' 3.056" N	87° 54' 42.475" E
7	23° 53' 9.181" N	87° 54' 50.569" E
8	23° 53' 12.478" N	87° 55' 2.605" E
9	23° 53' 12.443" N	87° 55' 8.104" E
10	23° 53' 8.171" N	87° 55' 3.097" E
11	23° 53' 5.921" N	87° 55' 1.128" E
12	23° 53' 5.814" N	87° 54' 52.884" E
13	23° 53' 4.208" N	87° 54' 49.136" E
14	23° 53' 0.014" N	87° 54' 43.684" E
15	23° 52' 54.785" N	87° 54' 38.321" E

Annexure 5
Map showing Potential In-situ mineral blocks of Murshidabad District

POTENTIAL ZONE OF INSITU STONE DEPOSITION(RAJMAHAL TRAP AS PER GEOLOGICAL MAP AFTER GSI) HAS BEEN IDENTIFIED WITH THE HELP OF SATELLITE IMAGERY & FIELD INVESTIGATION, IN THE NORTHERN PART OF MURSHIDABAD DISTRICT,BAHADURPUR GRAM PANCHAYAT.

ZONE 1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Legend

- ZONE COORDINATE
- ZONE
- INSITU STONE DEPOSITION(12.02 SQ KMS.)
- DISTRICT BOUNDARY

ZONE COORDINATES		
POINT NAME	LATITUDE	LONGITUDE
1	24° 45' 57.162" N	87° 49' 4.876" E
2	24° 45' 57.096" N	87° 50' 1.547" E
3	24° 45' 51.153" N	87° 50' 4.894" E
4	24° 45' 55.300" N	87° 50' 19.896" E
5	24° 45' 39.708" N	87° 50' 48.408" E
6	24° 45' 40.777" N	87° 51' 1.322" E
7	24° 45' 48.265" N	87° 51' 11.728" E
8	24° 45' 47.101" N	87° 52' 31.107" E
9	24° 44' 9.255" N	87° 52' 31.573" E
10	24° 43' 48.104" N	87° 52' 15.164" E
11	24° 43' 45.840" N	87° 52' 2.586" E
12	24° 44' 5.780" N	87° 51' 8.449" E
13	24° 44' 17.480" N	87° 50' 22.945" E
14	24° 45' 7.956" N	87° 49' 31.199" E
15	24° 45' 7.348" N	87° 48' 57.877" E
16	24° 45' 22.973" N	87° 48' 57.483" E
17	24° 45' 23.107" N	87° 49' 4.455" E

0 0.5 1 2 Kilometers

ANNEXURE 6.1

Compliance to the Observations
Government of West Bengal
Office of the Additional District Magistrate and
District Land & Land Reforms Officer, Murshidabad
District Survey Report, Murshidabad, West Bengal
Memo No. 3479/X-34/C21, dated 28.10.2021

SL NO	OBSERVATIONS	COMPLIANCE
1	No comments/ objections/ suggestions have been received	Noted.

ANNEXURE 6.2

Compliance to the Minutes of the twenty-eighth meeting of the reconstituted State Level Expert Appraisal Committee, West Bengal held on 08.01.2022 at 10:30 a.m. at the Conference Room, Paribesh Bhawan, Kolkata

Sl. No.	Observations	Compliance
1	In the drainage map watersheds and micro-watersheds should be marked	The watershed level upto 3rd order streams are marked in the drainage map and is depicted in Plate No. 3A
2	Hydrographs at key intersections along the entire stretch of the river falling in the particular district along with a discussion on the runoff of the river in the upstream and downstream within the district.	Given in section 3.6 page no 30 to 33. Depth of mining has been selected in accordance with the depth to water level depicting from the Hydrographs.
3	A separate map showing locations of dams, barrages, bridge, river bed tube wells, river bed collector wells and infiltration galleries.	Given as Plate no 1B. All major bridges, Barrages, river bed wells, and other hydraulic structures are marked in the drainage map of the district and also labelled.
4	Depth to base flow in the riverbed sand mining areas, present and proposed, in pre-monsoon and post-monsoon periods.	Depth of the base flow is below proposed mining depth as observed from the field study. During study period, no mining activity commenced.
5	Field photographs showing activities of replenishment study.	Representative Photographs of Survey of the River bed profile used for replenishment and aggradation measurement study is being furnished in Plate no 4.
6	A map showing long-term (10-year or more) erosion-accretion areas on both the banks of the rivers which would help to identify no-mining zone on the river bed along with a discussion.	Given in Plate no 5A & 5B. Though all the rivers of the district doesn't shows much difference when studied the image archives from 1985 to 2022, however, a stretch of Bhagirathi River shows curtailed Ox-Bow lake is being furnished as one of the representative image detection study. Change in last 10 years found to be negligible.
7	In each proposed block, the RL of the sand surface (pre and post Monsoon) will be useful and the suggested mining depth corresponds to a particular RL of the deepest layer mined (not depth on absolute terms in case replenished quantity is different)	Elevation levels for each potential zone are furnished in Table no 7.4, Page no 75-77. However, DGPS survey of each blocks shall be carried while preparation of the Mining Plans and final adjustment of depth parameters shall be done accordingly. In no circumstances, mining depth shall be increased beyond the depth suggested for each potential zones in this DSR.
8	Depth of mining considered for calculation of potential reserve. It presumes that base flow depth is more than the mining depth in pre-monsoon period. That needs to be substantiated with data for each block.	Depth of Mining Considered for each potential zones are furnished on the basis of average and is given in Table no 7.10, Page no 89. However, after finalization of the sand Blocks, each blocks shall be surveyed again during the course of Mining Plan preparation and final depths shall be suggested accordingly.

Sl. No.	Observations	Compliance
9	Ground water level pre and post monsoon in the watershed (of district) may be put in a map.	Complied with. The same has been furnished as Plate no 3B and 3C.
10	It was also suggested to show in maps the approach roads (accessibility plan complying with guidelines) for the blocks.	The major transport networks for the district are depicted in Figure no 10.2, Page no 110. The accessibility from each block shall be detailed in the Mining Plan.
11	Sand mining in designated upstream blocks may affect the replenishment in blocks downstream and this consideration may be relevant for estimating the percentage of replenishment. What should be the percentage for minable reserve with respect to potential reserve of sand?	This study shall be undertaken by the Mines Branch, Dep. Of Industry, Commerce & Enterprise, GoWB in subsequent years and annual reports shall be generated covering these points. However, as per the EMGSM, 2020, not more than 60% of the area will be covered under extraction plan.
12	Data on river flow on all seasons and the sediment load data (especially during seasons of replenishment) will constitute a baseline condition to judge any effect of increased mining on the river flow characteristics.	This study shall be undertaken by the Mines Branch, Dep. Of Industry, Commerce & Enterprise, GoWB in subsequent years and annual reports shall be generated covering these points.
13	Existing mining leases may be shown on river map along with potential blocks	Existing Mining Leases having Environmental Clearance as on 31st January, 2022 are furnished in Plate no 2A and 2B
14	On the river map, potential new blocks and existing blocks may also be designated by serial or code number so that it matches with the tables.	Given in Plate no 2A and 2B
15	It will be appropriate if the methodology adopted (not only the available theory) for annual replenishment estimation is clearly and objectively narrated with applicable data and sample calculations.	Change detection through satellite imagery study, Field evidences and empirical formulae are utilized for replenishment study. Detail discussions are done in section 7 of this report.
16	Representative satellite and/or drone photography, if used for surveying, may also be produced in DSR.	All the plates are satellite imagery based and are furnished in Plate no 2A and 2B
17	The suggested mining depth should be indicated for each block in the table (not done for PurbaBardhaman).	Complied with. Suggested mining depths are furnished as Annexure 2.
18	Order of sections in the report are not logical in some reports.	Complied with. Corrected and as per specified format of DSR.
19	A table showing all general compliances in DSR as per the Mining Rules may be furnished.	Complied with. Given as Annexure-1.
20	For existing mines (sand and other minerals), minable reserve has not been mentioned.	Details of the mining leases given in Table no 8.1, Page no 97-105.
21	All the documents leave much to be desired in respect of reserve assessment and replenishments estimations.	Given in section 7.2/v, page no 73-88.

Sl. No.	Observations	Compliance
22	Reserve assessment has been rudimentary and the replenishment estimation needs to be carried out using accepted methods and models available for the purpose.	No attempt has been done for mineable reserve assessment in this DSR. Efforts has been restricted to define the potential sand resources in each rivers of the district. Mineable reserve estimation shall be done once the Blocks are demarcated as per West Bengal Minor Mineral Concession Rules, 2016 and based on EMGSM 2020.
23	Rivers are one of the main sources to supply sand for construction projects. Depending on river morphology and hydraulic characteristics, its sediment transport capacity, and mining operation method, the extraction of river bed materials may affect its ecosystem through bank and bed erosion. This needs to be incorporated in the DSR.	Mining impact given in Chapter 11, page no 111-114.
24	To advance the mechanisms of river pit infilling, the effects of various parameters (i.e., the distance between pits, the pit plan shape, the pit depth, sediment size, and approaching flow velocity) needs to be investigated.	This study shall be undertaken by the Mines Branch, Dep. Of Industry, Commerce & Enterprise, GoWB in subsequent years and annual reports shall be generated covering these points.
25	Monitoring should provide data to evaluate the upstream and downstream effects of sand and gravel extraction activities, and long-term changes. A brief report summarizing the annual results of the physical and biological monitoring should document the evolution of the sites over time, and the cumulative effects of sand and gravel extraction. The summary should also recommend any maintenance or modification of extraction rates needed to minimize impacts of extraction.	This study shall be undertaken by the Mines Branch, Dep. Of Industry, Commerce & Enterprise, GoWB in subsequent years and annual reports shall be generated covering these points.
26	Sand Replenishment, Geomorphology and Hydrology Physical monitoring requirements of sand and gravel extraction activities should include surveyed channel cross-sections, longitudinal profiles, bed material measurements, geomorphic maps, and discharge and sediment transport measurements. The physical data will illustrate bar replenishment and any changes in channel morphology, bank erosion, or particle size.	Explained in detailed in Chapter no 7, Page no 65 to 95.
27	With reference to (point no 4.1.1 g) of enforcement guidelines 2020 read with Standard environmental conditions for sand mining (point no 8 page 73) of SSMMG-2016, all DSRs so prepared, should contain a chapter on NO MINING ZONE with name of mouza, dag no and geo references along with areas of sensitivity. Appraisal of the DSRs should NOT be taken for consideration without the chapter on NO MINING ZONE and AREAS of SENSITIVITY.	Section on No mining zone is given in Page no 91-92.

Sl. No.	Observations	Compliance
28	The areas of sensitivity should contain those NON-FOREST AREAS which are in excellent line of habitat for wild animals, birds, turtles, dolphins and other aquatic life, which need be excluded from the list of mining areas on ecological and environmental grounds. This is utmost necessary and has to be done to avoid conflict about wetland use in near future.	ENVIS centre on Wildlife and Protection areas map as published in August 2020, does not show any wildlife habitat in the potential sand mining areas.
29	For example, low lying swamps by the side of river Ajay in Paschim Midnapur and Ahiran lake, pathanbeel, Bishnupur beel area in Murshidabad District provide an excellent nitche for migratory birds in the winter. Part of river Damodar and the confluence of Damodar and Hooghly in East Barddhaman District house one of the last surviving habitats of endangered gangetic dolphin (Platinista gangeticus), should be identified in consultation with the concerned forest circles of the Department of Forests and to be excluded from the list of mining areas.	Part of comment 30.
30	Though all the DSRs so prepared, have not followed the same format yet it is felt that necessary remedial measures to mitigate the effect of mining and a reclamation plan in mined out areas should be included, especially in those DSRs which have not yet mentioned the same.	DSR Format Compliance under Notification S. O. 3611 (E), Dated 25th July 2018, Appendix-X (I).
31	Data, satellite imageries and allied information in respect of flora, fauna and their habitat biological environment, if collected from ENVIS centre may be included in the DSRs for ready reference.	Source of all the secondary figures and tables included in the DSR.
32	DSR comprises of secondary data which are required to be endorsed by concerned Departments.	References for secondary data are furnished in the DSR under references.
33	Revision should be done every year and actual survey should be done.	This study shall be undertaken by the Mines Branch, Dep. Of Industry, Commerce & Enterprise, GoWB in subsequent years and annual reports shall be generated covering these points.
34	It is to be clearly mentioned that there are no other minerals than sand in this district.	Noted
35	Dates of NIC database and other data should be provided	Noted and given in page no 14-15.
36	Outcome / response to the public consultation should be mentioned	Given as compliance statements in the DSR.
37	No-Mining-Zone should be clearly mentioned with special mention to the ecologically and otherwise sensitive zones. Bridges and river-bed tubewells should also be clearly demarcated. Wildlife should also	Restricted zone given as Plate no 2A and 2B. Location of bridges, dam given in 1B.

Sl. No.	Observations	Compliance
	be considered	
38	Hydrographs of the rivers and volume of rain should be studied to correlate with the minable sand reserve	Incorporated in the Replenishment study section 7.2/v, page no 73-88.
39	Text parts (as in Chapter 6) should be provided with proper reference and citation of authentic books. Sources of Tables and figures should be mentioned. Some are very old data – those should be replaced by latest data	Source of all the secondary figures and tables included in the DSR.
40	Depth of mining and distance from banks should be clearly mentioned and highlighted	Given in Table no 7.10.
41	Secondary (Collected) data/ map from other departments should be certified from the respective departments (e.g., Forest and wildlife data, demography, aquifer, transportation route to the blocks)	References used from Public Domain/ Websites are furnished in the Reference section in this DSR.
42	Evidence (like dated photographs) of surveying, collection of primary data to be provided	Field photographs are furnished in Plate 4.
43	Sample calculation and methodology for calculation for minable resource and replenishment data to be provided with proper units	Given in Table no 7.6 and Table no 7.11.
44	If any predictive model is used, its validity should be established	Predictive Model has been carried out based on EMGSM 2020. The validity checking requires consecutive study which needs to be undertaken by the concerned department.
45	Evidence for 4 times physical survey to be provided	Field photographs are furnished in Plate 4. Field registers are available at office and can be furnished on demand.
46	Table-3.2, Table-3.3 : Unit of rainfall should be provided	Table updated, page no 22-24
47	Legend mismatch is there in Fig 7.3	Legend modified
48	Land utilization and forests data are upto 2013/2014 – should be updated	Latest Available database incorporated in the DSR

ANNEXURE 6.3

Compliance to the SEAC members' comments received through mail on 25th March 2022

Sr. No.	Observations	Compliance
1	Inclusion executive summary at the beginning	Executive summary included in page no 2 to 3.
2	Compliance table of the DM/SEAC members' observations may be placed at the end. Instead, a table of compliance with the guidelines to be placed at the beginning indicating the page number	Complied with and given as separate document.
3	DSR specific observation should not be included in all in the compliance table of all theDSR.	Complied with.
4	DSR compliance table should come just after the executive summary	Complied with and given as Annexure-1.
5	Need to mention page number in the DSR compliance table.	Modified table furnished compliance as Annexure-1.
6	Should include Brick Earth and its mining regulations.	Not Applicable
7	Legend should be given for sand bar coding	Complied with and furnished as abbreviation in page no 77-78.
8	Citation of reference should be given for Empirical formula by which Replenishment calculated.	Complied with and given in page no 82 to 85.
9	Map Source to be given for each map such as Watershed, Transport, Location, Drainage etc.	Complied with and given in Plate no 1 and 3.
10	Mention conclusion and Recommendation instead Summary	Complied with and given in page no 118-119.
11	Reference should be in a standard referencing format	Complied with and given in page no 120-121.
12	Source and date of collecting data for satellite imagery should be given.	Complied with and given in Plate no 2.

ANNEXURE 6.4

Compliance to the Minutes of the 61st meeting of the SEIAA, West Bengal held on 23.05.2022 at Kolkata

Sl. No.	Observations	Compliance
1	List of definitions of technical terms used in the DSR to be included.	Complied with.
2	Each potential zone should have a unique code no. and area bearing all the coordinates of all the points defining the boundary.	Complied with. Please refer Annexure 3.
3	A map showing the potential zone with the legend, mentioning all the coordinates of the polygon, defining the zone to be attached as annexure in the DSR.	Complied with. Please refer Annexure 4.
4	Dept. of Industry, Commerce & Enterprises will issue unique code with reference to the original coding of potential zones to each lessee. This unique code issued to lessee should be reflected in the LoI.	Shall be complied with.
5	Dept. of Industry, Commerce & Enterprises will upload the updated map showing the location of the LoI issued against the area and sand mining lease areas in different colour coding.	Shall be complied with.
6	Date of approval should be mentioned in all the pages of the annexures of DSRs.	Noted.
7	The consultant is further requested to refer the DSRs prepared by other states in order to confirm that no relevant point is missed out in any of our DSRs.	Complied with.
8	The consultant may also refer to the baseline data available with Irrigation Dept.	At present Replenishment Study is being conducted for all the sand producing Districts of West Bengal. This will be covered in the relevant reports.

ANNEXURE 6.5

Compliance to the Minutes of the 66th meeting of the SEIAA, West Bengal held on 06.07.2022 at Kolkata

Sl. No.	Observations	Compliance
1	The format of all the DSRs should be uniform.	Complied with.
2	The corrections required to be done regarding Annexure-3.	Complied with. Please refer Annexure 3.
3	List of existing lease is attached with the documents in Chapter 8.2. The list should contain the date of issue and validity.	Complied with. The details of the existing leases updated as per the data provided from concern department.
4	Sequence of meetings and observation given by SEAC and SEIAA should be mentioned in chronological order and be a part of the whole document.	Complied with. Please refer Annexure-6.

Annexure 7
SEIAA 68th Meeting (26th July, 2022) Minutes of Meeting

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State Environment Impact Assessment Authority
Pranisampad Bhawan, 5th Floor, Sector-III, Salt Lake, Kolkata - 700106
(West Bengal)
Minutes of SEIAA Meeting

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Subject:- 68th meeting of SEIAA

Venue:- Conference Room of Environment Department, Prani Sampad Bhavan, 5th Floor, LB Block, Sector III, Salt Lake, Kolkata 700106.

From :- 26 Jul 2022

To :- 26 Jul 2022

1. Proposal No. :- **SIA/WB/IND/31555/2019** File No- **EN/T-II-1/020/2019** Proposed installation of 2 X 20 MT Induction Furnaces and 1,48,800MT/Annum Rolling Mill at LR Plot Nos. (enclosed as Annexure – 1), Village & Mouza – Nidhirampur, PS – Gangajalghati, JL No. 034, PIN – 722133, District - Bankura, West Bengal by **M/s. Shree Ramdoot Rollers Pvt. Ltd.**	Type- **EC**

INTRODUCTION

The proponent made online application vide proposal no. **SIA/WB/IND/31555/2019** dated **26 Feb 2022** along with copies of EIA/EMP seeking environment clearance under the provisions of the EIA Notification, 2006 for the above mentioned project. The proposed project activity is listed at SL.No. **3(a) Metallurgical industries (ferrous & non ferrous)**, under Category "**B1**" of EIA Notification 2006 and the proposal is appraised at State level.

The **Installation of 2 X 20 MT Induction Furnaces with Continuous Caster and 1,48,800 MT/Annum Rolling Mill** of M/s **SHREE RAMDOOT ROLLERS PVT LTD** located in Village & Mouza – Nidhirampur, PS – Gangajalghati, JL No. 034, PIN – 722133, District – Bankura, State **West Bengal** was initially received in the Ministry on **26 Feb 2019** for obtaining Terms of Reference (ToR) as per EIA Notification, 2006. The Project was appraised by the State Expert Appraisal Committee [SEAC] during its **172nd Meeting** meeting held between **30 Apr 2019** to **30 Apr 2019** and prescribed ToRs to the project for undertaking detailed EIA study for obtaining Environmental Clearance. Accordingly, ToR was prescribed to the project on **06 May 2019**.

The project was placed in the 66th meeting of SEIAA held on 05.07.2022 and it was observed that some documents required to be uploaded in the PARIVESH Portal. The project proponent uploaded documents on 11.07.2022.

PROJECT DETAILS

The project of M/s **SHREE RAMDOOT ROLLERS PVT LTD** located in as follows :

State of the project				
S. No.	**State**	**District**	**Tehsil**	**Village**
(1.)	West Bengal	Bankura	Gangajalghati	Nidhirampur

14. **Project configuration/product details**

S. No.	Project configuration/product details	Quantity	Unit	Other Unit	Mode of Transport/Transmission of Product	Other Mode of Transport

2 X 20 MT Induction Furnaces with continuous caster and 1,48,800MT/Annum Rolling Mill		

Raw Material Requirement is as follows :

Raw Material Requirement details								
S. No.	**Item**	**Quantity per annum**	**Unit**	**Other Unit**	**Source**	**Mode of Transport/Transmission of Product**	**Other Mode of Transport**	**Distance of Source from Project Site(Kilometers)**
(1.)	Silico Manganese	858	1		India	Road		2
(2.)	MS Scrap	16948	1		India	Road		2
(3.)	Scrap	3570	1		India	Road		2
(4.)	sponge Iron	104555	1		India	Road		2
(5.)	Pig Iron	19693	1		India	Road		2
(6.)	Aluminium	24.8	1		India	Road		2
(7.)	Ferro Alloy, FeSi	100	1		India	Road		2

Details of Previous ToR								
S. No.	**Item**	**Quantity**	**Unit**	**Other Unit**	**Source**	**Mode of Transport/Transmission of Product**	**Other Mode of Transport**	**Distance of Source from Project Site(Kilometers)**
ToR issued vide Memo No. 413-2N-24/2019(E) dated 06.05.2019 for 2 X 20 MT Induction Furnaces with continuous caster and 1,48,800MT/Annum Rolling Mill								

Expansion Details :					
S. No.	**Product/Activity (Capacity / Area)**	**Quantity**		**Unit**	**Other Unit**
		From	**To**		
(1.)	TMT Rebars/Rods	0	148800	Tons per Annum(TPA)	
(2.)	M.S. Ignots/Billets	45000	75280	Tons per Annum(TPA)	

DELIBERATION IN SEIAA

SEIAA considered the submission uploaded on 11.07.2022 by the project proponent and accepted the same.

RECOMMENDATIONS OF SEIAA

The application for EC is approved under violation category.

Conclusion

Recommended

S.No	Conditions
(1)	**I. Statutory compliance** i. The project proponent shall obtain forest clearance under the provisions of Forest (Conservation) Act, 1986, in case of the diversion of forest land for non-forest purpose involved in the project. ii. The project proponent shall obtain clearance from the National Board for Wildlife, if applicable. iii. The project proponent shall prepare a Site-Specific Conservation Plan & Wildlife Management Plan and approved by the Chief Wildlife Warden. The recommendations of the approved Site-Specific Conservation Plan / Wildlife Management Plan shall be implemented in consultation with the State Forest Department. The implementation report shall be furnished along with the six-monthly compliance report. (in case of the presence of schedule-I species in the study area). iv. The project proponent shall obtain Consent to Establish / Operate under the provisions of Air (Prevention & Control of Pollution) Act, 1981 and the Water (Prevention & Control of Pollution) Act, 1974 from the concerned State Pollution Control Board / Committee. v. The project proponent shall obtain the necessary permission from the Competent Authority, in case of drawl of ground water or in case of drawl of surface water required for the project. vi. The project proponent shall obtain authorization under the Hazardous and other Waste Management Rules, 2016 as amended from time to time. **II. Air quality monitoring and preservation** i. The project proponent shall install 24x7 continuous emission monitoring system at process stacks to monitor stack emission with respect to standards prescribed in Environment (Protection) Rules 1986 vide G.S.R.277(E) dated 31st March 2012 (applicable to IF / EAF) as amended from time to time as amended from time to time) and connected to SPCB and CPCB online servers and calibrate these system from time to time according to equipment supplier specification through labs recognized under Environment (Protection) Act, 1986 or NABL accredited laboratories. ii. The project proponent shall monitor fugitive emissions in the plant premises at least once in every quarter through laboratories recognized under Environment (Protection) Act, 1986 or NABL accredited laboratories. iii. The project proponent shall install system carryout Continuous Ambient Air Quality monitoring for common / criterion parameters relevant to the main pollutants released (e.g. PM_{10} and $PM_{2.5}$ in reference to PM emission. and SO2 and NO_x in reference to SO2 and NO_x emissions) within and outside the plant area (at least at four locations one within and three outside the plant area at an angle of 120^0 each), covering upwind and downwind directions. (case to case basis small plants: Manual; Large plants: Continuous) iv. The project proponent shall submit monthly summary report of continuous stack emission and air quality monitoring and results of manual stack monitoring and manual monitoring of air quality / fugitive emissions to Regional Office of MoEF&CC/SEIAA, Zonal office of CPCB and Regional Office of SPCB along with six-monthly monitoring report. v. Appropriate Air Pollution Control (APC) system shall be provided for all the dust generating points including fugitive dust from all vulnerable sources. vi. The project proponent shall provide leakage detection and mechanized bag cleaning facilities for better maintenance of bags.

vii. Sufficient number of mobile or stationery vacuum cleaners shall be provided to clean plant roads, shop floors, roofs, regularly.

viii. Recycle and reuse iron are fines, coal and coke fines, lime fines and such other fines collected in the pollution control devices and vacuum cleaning devices in the process after briquetting / agglomeration.

ix. The project proponent shall use leak proof trucks / dumpers carrying coal and other raw materials and cover them with tarpaulin.

x. The project proponent shall provide covered sheds for raw materials like scrap and sponge iron, lump ore, coke, coal, etc.

xi. The project proponent shall provide primary and secondary fume extraction system at all melting furnaces.

xii. Design the ventilation system for adequate air changes as per ACGIH document for all tunnels, motor houses, Oil Cellars.

III. Water quality monitoring and preservation

i. The project proponent shall install 24x7 continuous effluent monitoring system with respect to standards prescribed in Environment (Protection) Rules 1986 vide G.S.R.277(E) dated 31st March 2012 (applicable to IF / EAF) as amended from time to time; as amended from time to time) and connected to SPCB and CPCB online servers and calibrate these system from time to time according to equipment supplier specification through labs recognized under Environment (Protection) Act. 1986 or NABL accredited laboratories. (case to case basis small plants: Manual; Large plants: Continuous)

ii. The project proponent shall monitor regularly ground water quality at least twice a year (pre and post monsoon) at sufficient numbers of piezometers / sampling wells in the plant and adjacent areas through labs recognized under Environment (Protection) Act, 1986 and NABL accredited laboratories.

iii. The project proponent shall submit monthly summary report of continuous effluent monitoring and results of manual effluent testing and manual monitoring of ground water quality to Regional Office of MoEF&CC/SEIAA, Zonal office of CPCB and Regional Office of SPCB along with six-monthly monitoring report.

iv. Adhere to 'Zero Liquid Discharge'.

v. Sewage Treatment Plant shall be provided for treatment of domestic wastewater to meet the prescribed standards.

vi. The project proponent shall provide the ETP for effluents of rolling mills to meet the standards prescribed in G.S.R.277(E)31st March 2012 (applicable to IF / EAF) as amended from time to time.

vii. Garland drains and collection pits shall be provided for each stock pile to arrest the run-off in the event of heavy rains and to check the water pollution due to surface run off.

viii. The project proponent shall practice rainwater harvesting to maximum possible extent.

ix. The project proponent shall make efforts to minimise water consumption in the steel plant complex by segregation of used water, practicing cascade use and by recycling treated water.

IV. Noise monitoring and prevention

i. Noise level survey shall be carried as per the prescribed guidelines and report in this regard shall be submitted to Regional Officer of the Ministry / SEIAA as a part of six-monthly compliance report.

ii. The ambient noise levels should conform to the standards prescribed under E(P)A Rules, 1986 viz. 75 dB(A) during day time and 70 dB(A) during night time.

V. Energy Conservation measures

i. The project proponent shall provide waste heat recovery system (pre-heating of combustion air) at the flue gases of reheating furnaces.

ii. Practice hot charging of slabs and billets / blooms as far as possible.

iii. Ensure installation of regenerative type burners on all reheating furnaces.

iv. Provide solar power generation on roof tops of buildings, for solar light system for all common areas, street lights, parking around project area and maintain the same regularly.

v. Provide the project proponent for LED lights in their offices and residential areas.

VI. Waste management

i. Used refractories shall be recycled as far as possible.

ii. Oily scum and metallic sludge recovered from roiling mills ETP shall be mixed, dried, and briquetted and reused melting Furnaces.

iii. The waste oil, grease and other hazardous waste shall be disposed of as per the Hazardous & Other Waste (Management & Transboundary Movement) Rules, 2016.

iv. Kitchen waste shall be composted or converted to biogas for further use. (to be decided on case to case basis depending on type and size of plant).

VII. Green Belt

i. Green belt shall be developed in an area equal to 33% of the plant area with a native tree species in accordance with CPCB guidelines. The greenbelt shall inter alia cover the entire periphery of the plant. The project proponent should follow plantation plan approved by DFO, Bankura North Division vide Memo no. 1282/13-2 dated 30.05.2022.

ii. The project proponent shall prepare GHG emissions inventory for the plant and shall submit the programme for reduction of the same including carbon sequestration including plantation.

VIII. Public hearing and Human health issues

i. Emergency preparedness plan based on the Hazard Identification and Risk Assessment (HIRA) and Disaster Management Plan shall be implemented.

ii. The project proponent shall carry out heat stress analysis for the workmen who work in high temperature work zone and provide Personal Protection Equipment (PPE) as per the norms of Factory Act.

iii. Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, creche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.

iv. Occupational health surveillance or the workers shall be done on a regular basis and records maintained as per the Factories Act.

IX. Environment Management Plan (EMP)

i. The project proponent should submit the proposed EMP on six monthly basis. The office Memorandum issued by the MoEF&CC vide F.No.22-65/2017-IA, III dated 30/09/2020 should be strictly followed.

ii. Need based activities for local people is part of the EMP. Details of such activities submitted by the project proponent for expansion project is given in Annexure-2.

iii. The company shall have a well laid down environmental policy duly approve by the Board of Directors. The environmental policy should prescribe for standard operating procedures to have proper checks and balances and to bring into focus any infringements / deviation / violation of the environmental / forest / wildlife norms / conditions. The company shall have defined system

of reporting infringements / deviation / violation of the environmental / forest / wildlife norms / conditions and / or shareholders / stake holders. The copy of the Board resolution in this regard shall be submitted to the MoEF&CC/SEIAA as a part of six-monthly report.

iv. A separate Environmental Cell both at the project and company head quarter level, with qualified personnel shall be set up under the control of Senior Executive, who will directly to the head of the organization.

v. Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose. Year wise progress of implementation of action plan shall be reported to the Ministry / Regional Office / SEIAA along with the Six Monthly Compliance Report.

vi. Self-environmental audit shall be conducted annually. Every three years third party environmental audit shall be carried out.

vii. All the recommendations made in the Charter on Corporate Responsibility for Environment Protection (CREP) for the plants shall be implemented.

X. Miscellaneous

i. The environmental clearance accorded shall be valid for a period of 10 years for the proposed project.

ii. The project proponent shall make public the environmental clearance granted for their project along with the environmental conditions and safeguards at their cost by prominently advertising it at least in two local newspapers of the District or State, of which one shall be in the vernacular language within seven days and in addition this shall also be displayed in the project proponent's website permanently.

iii. The copies of the environmental clearance shall be submitted by the project proponents to the Heads of local bodies, Panchayats and Municipal Bodies in addition to the relevant offices of the Government who in turn has to display the same for 30 days from the date of receipt.

iv. The project proponent shall upload the status of compliance of the stipulated environment clearance conditions, including result of monitored data on their website and update the same on half-yearly basis.

v. The project proponent shall monitor the criteria pollutants level namely; PM10, SO2, NOx (ambient levels as well as stack emissions) or critical sectoral parameters, indicated for the projects and display the same at a convenient location for disclosure to the public and put on the website of the company.

vi. The project proponent shall submit six-monthly reports on the status of the compliance of the stipulated environmental conditions on the website of the Ministry of Environment, Forest and Climate Change /SEIAA at environment clearance portal.

vii. The project proponent shall submit the environmental statement for each financial year in Form-V to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently and put on the website of the company.

viii. The project proponent shall inform the Regional Office as well as the Ministry/SEIAA. the date of financial closure and final approval of the project by the concerned authorities, commencing the land development work and start of production operation by the project.

a. The project authorities must strictly adhere to the stipulations made by the State Pollution Control Board and the State Government.

b. The project proponent shall abide by all the commitments and recommendations made in the EIA / EMP report, commitment made during Public Hearing and also that during their

presentation to the Expert Appraisal Committee / SEAC.

ix. No further expansion or modifications in the plant shall be carried out without prior approval of the Ministry of Environment, Forests and Climate Change (MoEF&CC)/SEIAA.

x. Concealing factual data or submission of false / fabricated data may result in revocation of this environmental clearance and attract action under the provisions of Environment (Protection) Act, 1986.

xi. The Ministry / SEIAA may revoke or suspend the clearance, if implementation of any of the above conditions is not satisfactory.

xii. The Ministry / SEIAA reserves the right to stipulate additional conditions if found necessary. The Company in a time bound manner shall implement these conditions.

xiii. The Regional Office of this Ministry / SEIAA shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer(s) of the Regional Office / SEIAA by furnishing the requisite data / information / monitoring reports.

xiv. The above conditions shall be enforced, inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and the Public Liability Insurance Act, 1991 along with their amendments and Rules and any other orders passed by the Hon'ble Supreme Court of India / High Courts and any other Court of Law relating to the subject matter.

xv. Any appeal against this EC shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.

Annexure - 1

List of Plot Nos. for the project of Shree Ramdoot Rollers Pvt. Ltd.

Khatian No:-1618				
SL No.	**Plot No.**	**Total area of the plot (in acre)**	**% in Total Plot**	**Share (in acre)**
1	3255	0.11	1.000	**0.11**
2	3256	0.12	1.000	**0.12**
3	3257	0.02	1.000	**0.02**
4	3258	0.02	1.000	**0.02**
5	3259	0.05	1.000	**0.05**
6	3260	0.05	1.000	**0.05**
7	3261	0.12	1.000	**0.12**
8	3262	0.36	1.000	**0.36**
9	3263	0.06	1.000	**0.06**
10	3264	0.06	1.000	**0.06**
11	3265	0.04	1.000	**0.04**
12	3266	0.06	1.000	**0.06**
13	3328	0.14	1.000	**0.14**
14	3329	0.17	1.000	**0.17**
15	3330	0.22	1.000	**0.22**
16	3331	0.08	1.000	**0.08**

17	3332	0.12	1.000	**0.12**
18	3333	0.06	1.000	**0.06**
19	3334	0.04	1.000	**0.04**
20	3335	0.05	1.000	**0.05**
21	3336	0.26	1.000	**0.26**
22	3339	0.02	1.000	**0.02**
23	3340	0.04	1.000	**0.04**
24	3341	0.03	1.000	**0.03**
25	3342	0.06	1.000	**0.06**
26	3343	0.04	0.500	**0.02**
27	3344	0.06	1.000	**0.06**
28	3345	0.04	1.000	**0.04**
29	3346	0.06	1.000	**0.06**
30	3347	0.03	1.000	**0.03**
31	3348	0.03	1.000	**0.03**
32	3349	0.05	1.000	**0.05**
33	3350	0.12	1.000	**0.12**
34	3351	0.06	1.000	**0.06**
35	3352	0.01	1.000	**0.01**
36	3353	0.08	1.000	**0.08**
37	3354	0.16	1.000	**0.16**
38	3355	0.02	1.000	**0.02**
39	3356	0.06	1.000	**0.06**
40	3357	0.23	1.000	**0.23**
41	3358	0.25	1.000	**0.25**
42	3359	0.04	1.000	**0.04**
43	3360	0.08	1.000	**0.08**
44	3361	0.05	1.000	**0.05**
45	3362	0.02	1.000	**0.02**
46	3363	0.07	1.000	**0.07**
47	3364	0.03	1.000	**0.03**
48	3365	0.03	1.000	**0.03**
49	3366	0.1	1.000	**0.10**
50	3367	0.04	1.000	**0.04**
51	3368	0.03	1.000	**0.03**
52	3369	0.02	1.000	**0.02**
53	3370	0.02	1.000	**0.02**
54	3371	0.05	1.000	**0.05**
55	3372	0.02	1.000	**0.02**
56	3373	0.09	1.000	**0.09**
57	3374	0.28	1.000	**0.28**
58	3375	0.48	1.000	**0.48**
59	3382	0.1	1.000	**0.10**
60	3383	0.63	1.000	**0.63**
61	3384	0.8	1.000	**0.80**
62	3385	0.11	1.000	**0.11**

63	3386	0.99	0.125	**0.12**
		Total (A)		**6.85**

Khatian No:-1618				
SL No.	**Plot No.**	**Total area of the plot(in acre)**	**% in Total Plot**	**Share (in acre)**
1	3327	0.42	0.167	0.07
		Total (B)		**0.07**

Khatian No:-1687				
SL No.	**Plot No.**	**Total area of the plot (in acre)**	**% in Total Plot**	**Share (in acre)**
1	3105	1.35	0.1250	**0.16**
2	3145	0.10	1.0000	**0.10**
3	3146	0.92	1.0000	**0.92**
4	3150	0.14	1.0000	**0.14**
5	3151	0.82	1.0000	**0.82**
6	3152	0.11	1.0000	**0.11**
7	3153	0.09	1.0000	**0.09**
8	3154	0.61	1.0000	**0.61**
9	3179	0.21	0.0314	**0.01**
10	3181	0.27	1.0000	**0.27**
11	3186	0.26	0.9999	**0.26**
12	3187	0.35	1.0000	**0.35**
13	3188	0.31	1.0000	**0.31**
14	3189	0.26	1.0000	**0.26**
15	3190	0.24	1.0000	**0.24**
16	3191	0.67	1.0000	**0.67**
17	3192	0.26	1.0000	**0.26**
18	3193	0.12	1.0000	**0.12**
19	3194	0.13	1.0000	**0.13**
20	3195	0.11	1.0000	**0.11**
21	3196	0.37	1.0000	**0.37**
22	3197	0.39	1.0000	**0.39**
23	3198	0.16	1.0000	**0.16**
24	3199	0.02	1.0000	**0.02**
25	3200	0.21	1.0000	**0.21**
26	3201	0.46	1.0000	**0.46**
27	3202	0.25	1.0000	**0.25**
28	3203	0.27	1.0000	**0.27**
29	3204	0.21	1.0000	**0.21**

30	3206	0.12	1.0000	**0.12**
31	3207	0.39	0.5000	**0.19**
32	3208	0.22	1.0000	**0.22**
33	3209	0.28	0.1071	**0.03**
34	3211	0.18	0.1666	**0.03**
35	3212	0.52	0.3846	**0.20**
36	3213	0.46	0.4402	**0.20**
37	3217	0.36	0.6667	**0.24**
38	3218	0.52	0.4038	**0.21**
39	3223	0.31	1.0000	**0.31**
40	3226	0.15	0.6222	**0.10**
41	3227	0.14	0.7142	**0.10**
42	3229	0.21	1.0000	**0.21**
43	3232	0.26	1.0000	**0.26**
44	3233	0.04	1.0000	**0.04**
45	3234	0.08	1.0000	**0.08**
46	3235	0.08	1.0000	**0.08**
47	3237	0.08	1.0000	**0.08**
48	3238	0.05	1.0000	**0.05**
49	3239	0.11	1.0000	**0.11**
50	3240	0.02	1.0000	**0.02**
51	3242	0.12	1.0000	**0.12**
52	3243	0.01	1.0000	**0.01**
53	3244	0.26	1.0000	**0.26**
54	3245	0.27	1.0000	**0.27**
55	3246	0.29	1.0000	**0.29**
56	3247	0.06	1.0000	**0.06**
57	3248	0.05	1.0000	**0.05**
58	3249	0.70	1.0000	**0.70**
59	3250	0.14	1.0000	**0.14**
60	3251	0.01	1.0000	**0.01**
61	3252	1.00	1.0000	**1.00**
62	3253	0.04	1.0000	**0.04**
63	3254	0.02	1.0000	**0.02**
64	3267	0.18	1.0000	**0.18**
65	3268	0.10	1.0000	**0.10**
66	3269	0.06	1.0000	**0.06**
67	3270	0.10	1.0000	**0.10**
68	3271	0.36	0.0833	**0.03**
69	3292	0.27	0.0500	**0.01**
70	3376	0.08	1.0000	**0.08**
71	3377	0.08	1.0000	**0.08**
72	3378	0.02	1.0000	**0.02**
73	3379	0.01	1.0000	**0.01**
74	3380	0.01	1.0000	**0.01**
75	3381	0.21	1.0000	**0.21**

76	3386	0.99	0.3750	**0.37**
		Total (C)		**15.39**

TOTAL LAND (A+B+C) = 22.31 Acres

Annexure-2

NEED BASED ACTIVITIES FOR LOCAL PEOPLE FOR EXPANSION PROJECT

(This will be in addition to the activities for existing project for which EC was obtained vide no. EN/2430/T-II-1/166/2007 dated 12.11.2008)

S.NO.	ACTIVITY	TIME FRAME	AMOUNT INVOLVED (INR)
1	Provision of solar panel lighting around common areas of road up to approx. 1.5 km	Within 12 months	6,00,000
2	Provision of Medical check up and Eye Testing along with Cataract operation and providing spectacles free of cost	Within 6-9 months	8,00,000
3	Construction of separate toilets for boys & girls in nearby schools	Within 12-18 months	6,00,000
4	Providing free computers to the nearby schools	within 12-18 months	2,60,000
5	Provision of RO treatment facility with cooling water supply in the nearby schools	within 12-18 months	2,00,000
6	Construction of approach road of around 1400 meter	Within 6-9 months	55,00,000
7	Providing medicine and supplements to nearby Goshalas	With 3-6 months	2,50,000

II. MISCELLANEOUS

(1) Discussion regarding compliance of W.P.A. 11523 of 2022 dated 30.06.2022 of Calcutta High Court.

Background:

M/s. Shree Ramdoot Rollers Pvt. Ltd. being the project proponent made an online application vide proposal no. SIA/WB/IND/31555/2019 dated 26.02.2022 along with copies of EIA/EMP seeking environment clearance under the provisions of the EIA Notification, 2006 for the above-mentioned project. The proposed project activity is listed at SL. No. 3(a) Metallurgical industries (ferrous & non ferrous) under Category "B1" of EIA Notification 2006.

The application was being processed from time to time based on their submittals. In 63rd SEIAA meeting held on 14.06.2022, the application for EC was deferred because the application was incomplete in nature. One of the reasons for such deferment was the engagement of environmental consultant without NABET accreditation as consultant for the project.

SEIAA verified the updated list published on 09.05.2022 of accredited consultant organization vide url:

https://nabet.qci.org.in/status-amp-register and found that the consulting organization namely Pacific Scientific Consultancy Private Limited is not listed therein. Therefore, the PP was requested to engage a NABET Accredited Environmental Consultant Organization for the project.

Meanwhile, Hon'ble Calcutta High Court issued an order vide W.P.A. 11523 of 2022 dated 30.06.2022 wherein M/s. Pacific Scientific Consultancy Pvt. Ltd. & Ors, represented as petitioner and The State of West Bengal & Ors. as respondent.

The court disposed off the matter with the directive to consider the petitioner's application afresh and come to a reasoned order within a period of six weeks from the date of communication of the court order.

Observation:

The matter was discussed in detail by SEIAA in the presence of the Sr. Law Officer, Dept. of Environment, Govt. of WB. In the SEIAA meeting dated 14.06.2022 it was decided that 'henceforth environmental consultant without NABET accreditation shall not be allowed to act as consultant for any project being submitted for EC'. Though SEIAA has also accepted the environmental consultants who had obtained specific stay orders from different courts.

As mentioned above, SEIAA is bound to comply with the Notifications and Govt. Orders issued by MoEF&CC, GoI from time to time. Regarding engagement of environmental consultant for any project, NABET accreditation is mandatory as mentioned both in the Office Memorandum vide F. No. J-11013/77/2004-IA II (I) dated 28.06.2010 and Notification No. S.O.648(E) dated 03.03.2016 and PARIVESH portal. It is being observed that the consulting organizations without NABET accreditation are engaged by the project proponents time and again and they produce stay orders from the different courts in order to accept them as consultants. SEIAA find it difficult to entertain such agencies without NABET accreditation as there is no specific time period mentioned in such stay orders which are presented before the SEIAA, WB.

The environmental consultant organization has a critical role in preparation of Environmental Impact Assessment Report & Environment Management Plan. NABET accreditation checks and ensures the quality of such organizations. The environmental parameters and correct prediction of impacts play a crucial role in safeguarding the environment and public at large.

Hence, in the interest of public and environmental cause it was decided to file an Appeal against the aforesaid order of Hon'ble Calcutta High Court regarding quashing the impugned decision of SEIAA, WB as stated in the Minutes of the Meeting dated 14.06.2022.

A senior advocate may please be engaged to file this appeal and it is further suggested that MoEF&CC may be included as respondent in the matter.

(2) Discussion on draft DSRs of Uttar Dinajpur and Murshidabad.

The DSRs of Uttar Dinajpur and Murshidabad are approved.