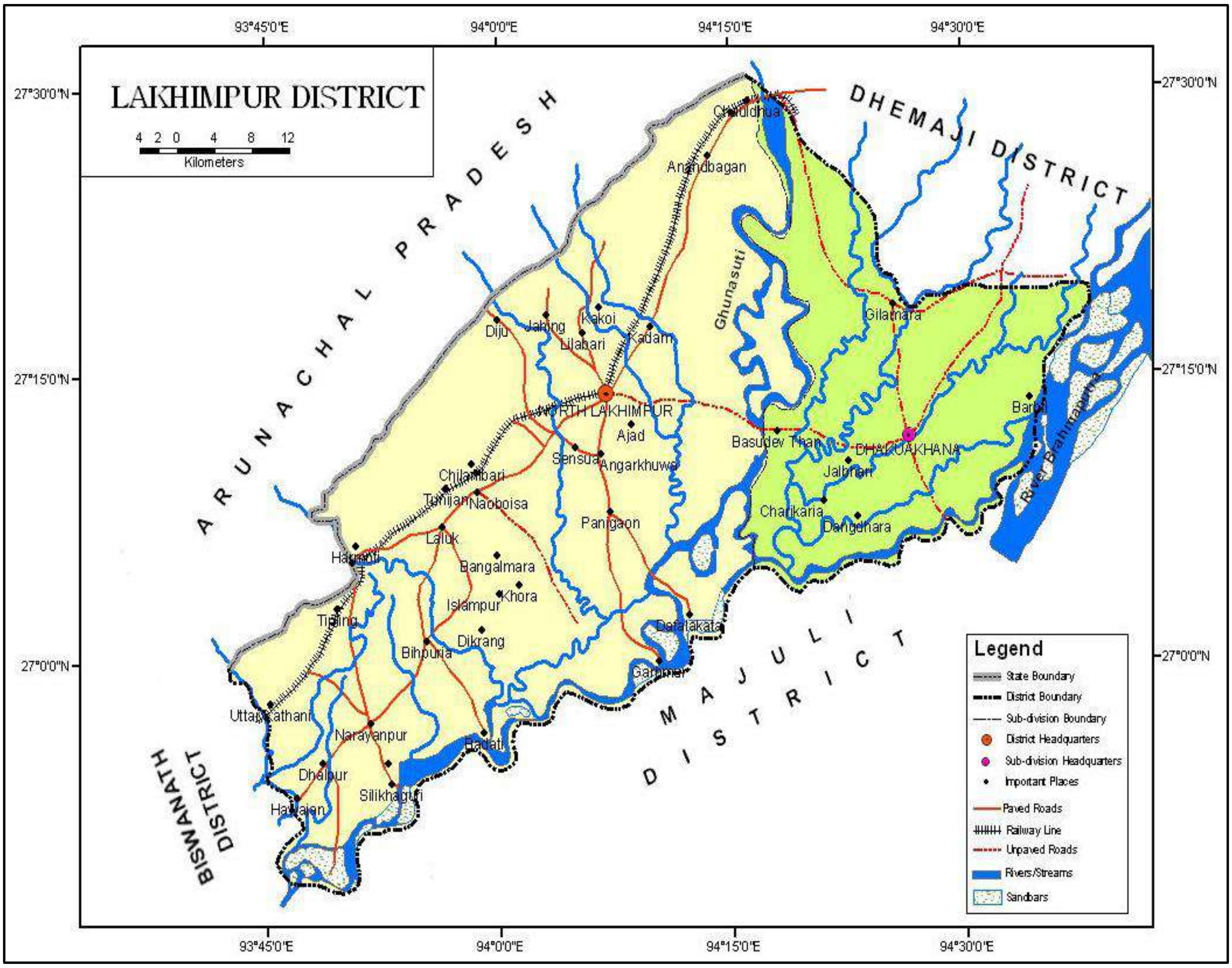
DISTRICT SURVEY REPORT(DRAFT)

LAKHIMPUR DISTRICT, ASSAM



<u>Prepared by:</u>

OFFICE OF THE DISTRICT COMMISSIONER

LAKHIMPUR DISTRICT,

GOVERNMENT OF ASSAM

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Acknowledgements:

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1.0 Introduction

According to MoEF&CC Notification No.125 (Extraordinary, Part II Section 3, Sub-section (ii), S.O.141(E) dated 15thJanuary 2016, it is mandatory to have District Survey Report (DSR) for Mining of Minor Minerals. This will ensure environmentally sustainable mining for minor minerals under close supervision of district authorities. A detailed procedure and format for preparation of District Survey Report (DSR) has been discretely discussed under Para 7(iii)(a) and Annexure (x) of the Notification issued by Ministry of Environment, Forest and Climate Change, Government of India on 15th January 2016.

As per MoEF&CC Notification dated 25th July 2018, preparation of DSR requires both primary and secondary data generation. District Survey Report will cover General information of the district, Demography, Geomorphology, Topography, Forest and Agricultural information, Climate and Rainfall conditions, Land Use pattern, calculation of total amount of replenishment, details of Royalty and revenue received in last three years etc. etc.

Mineral wise District Survey Report must be prepared in every district for Sand mining / River bed mining and other minor minerals mining in order to obtain Environment Clearance.

The main purpose of preparing the district survey report 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 District Survey Report (DSR) will contain mainly data published and endorsed by various departments and websites about Geology of the area, Mineral wealth details of rivers, Details of Lease and Mining activity in the district along with Sand mining and revenue of minerals.

1.1Objective of DSR

1) Identification of areas of aggradations or deposition where mining can be allowed.
2) Identification of areas of erosion and proximity to infrastructural structures and installations where mining should be prohibited.
3) Calculation of annual rate of replenishment and allowing time for replenishment after mining in that area.
4) To balance development and environment.

1.2The process involved in the preparation of DSR

A. Collection of Baseline Data from the Districts.

B. Development of related maps from satellite and secondary sources.

C. Understanding river flows and sedimentation vis-a vis sand mining.

D. Tabulation and mapping of existing sand / gravel mining locations and yield.

E. Correlation with satellite data for pre and post monsoon sand MM yield.

F. Suggesting new locations for sand and other MM approval.

G. To design and prepare DSR as per MoEF & CC guidelines.

H. Interaction with line departments for data / document ownership.

G. Draft DSR in to be kept in public domain for 21 days including public consultation.

1.3 Methodology of DSR preparation |

Step 1 : Identification of Date Source ….

DSR has been prepared on the basis of Primary data base and Secondary data base collected from various sources. This is a critical process in order to identify the authentic data sources prior to collation of data set. Sources of secondary data used in this DSR are mostly data published by the State government and district census in 2011. Mining lease and revenue generated from minor minerals have been prepared on the basis of available data from the District Forest Office of the district.

Step 2 : Data analysis and Preparation of Maps……

DSR involves the analytical implication of dataset captured during the preparation of report. The principal steps in map preparation involves determination of appropriate classification system through Visual Image Interpretation, selection of samples, Satellite Image pre-processing and accuracy assessment. ISRO RESOURCE has been adapted for supervised classification.

Step 3 : Primary Data Collection:

During the preparation of DSR, primary or field data has been collected from the district which involves assessment of the mineral resources in the district by means of pitting and trenching in pre-determined interval. This gave a clear picture about characterization of minerals and their distribution.

Step 4 : Replenishment Study:

Replenishment study is very important in the sense that in case more sediment is removed than the system can replenish, then there will be adverse and severe impact on environment. Physical survey has been carried out in order to define the topography, contours and offsets of the riverbed. Annual replenishment of the riverbed has been calculated using field survey, satellite imagery and empirical formula. The study was carried out on existing mine leases and an approach of direct measurement methodology was adapted. The depth and area of mining leases are measured through GPS/ Total Station just before the closure of the mines during pre-monsoon period and the same area was resurveyed in the post-monsoon period.

Step 5 : Preparation of Report:

The DSR clearly elaborates the general profile, geomorphology, land use pattern and geology of the district. This report describes the availability and distribution of riverbed sands and other minor minerals in the district and at the same time, includes inventorization of the minerals, recent trends of production of minor minerals and revenue generated from them. Moreover, potential environmental impacts due to mining of such materials, required mitigation measures to be adapted along with risk assessment and hazard management have also been indicated.

2.0 About Lakhimpur District

The name Lakhimpur was derived from the name "Lakhmipur" which was given by the Sutiya king namely. Lakshminarayan who ruled during the 15th century. Later, it was changed by the Baro-Bhuyans to Lakhimpur.

The district is bounded on the north by Kamle and Papumpare districts of Arunachal Pradesh and in the east by Dhemaji district and Subansiri River.

Majuli district is situated on the southern side and Biswanath district on the west.
Lakhimpur district has a total area of 2277 sq. km.

Lakhimpur district is an administrative district in the state of Assam, located between $26^o48'00''$ and $27^o53'00''$North Latitude and $93^o42'00''$ and $94^o20'00''$ East Longitude, with Dhakuakhana as civil Sub-Division.

The district headquarter is located at North Lakhimpur.
The nearest Airport is Lilabari airport, located 5 km away from district headquarters.
The railway station is situated at Nakari, 2 km away from town.

2.1 Demographics:

According to 2011 census, Lakhimpur district has a population of 1,042,137, roughly.

Equal to the population of Cyprus or US state of Rhode Island.

This gives it a ranking of 435th in India (out of a total of 640).

The district has got a population density 457 inhabitants per square kilometer.

Its population growth rate over the decade 2001-2011 was 17.06%.

Lakhimpur has a sex ratio of 965 females for every thousand males and literacy rate of 78.39% and 8.77% of the population lives in urban areas.

Scheduled castes and Tribes make up 7.85% and 23.93% of the population respectively.

2.2 Religion:

According to 2011 census, Hindus - 76.49%, Muslims -18.57%, Christians - 4.43%, Others or not stated - 0.51%, of the population.

2.3 Languages:

At the time of the 2011 census, 57.8% of the population spoke Assamese, 17.64% Mishing, 12.96% Bengali, 2.46% Sadri, 2.35% Nepali, 1.21% Deori and 1.17% Hindi as their first language.

2.4 Divisions:

There are four Assam Legislative Assembly Constituencies in this district at present, viz. Bihpuria, Naoboicha, Lakhimpur and Dhakuakhana (Now, after Delimitation, the district will have five LA Constituencies, viz. Ranganadi, Naoboicha, Bihpuria, Lakhimpur and Dhakuakhana).

Dhakuakhana is designated for Scheduled Tribes. Bihpuria is in the Tezpur Lok Sabha Constituency, whilst the other three are in the Lakhimpur Lok Sabha constituency, at present.

There are 2 Nos. Sub-divisions (as on 2013) with 9 nos. of Blocks and 81 nos. of Gaon Panchayats.

2.5 Tourism and Wildlife

Lakhimpur is absolutely a green place in Assam and a paradise for nature lover, with high hills/mountains of Arunachal in the north.

Lakhimpur welcomes tourists wholeheartedly, being quite away from hustle and bustle of city life. Lakhimpur is home to evergreen forests of Dullung and Kakoi, with sizable Wild Elephant population, Satajan and Bordoibum Beelmukh wetlands known for their presence of various birds, throughout the year.

1) Proposed Bordoibum Beelmukh Wildlife Sanctuary is located between Lakhimpur and Dhemaji districts and covers an area of 11.25 km. Different species of birds like large Whistling Teal, lesser Adjutant stork, Kingfisher, pleasant tailed Jacana, Black headed Gull, Indian River tern, White Wagtail, Purple Moorhen, Black headed Oriole etc. could be seen in this wetland.
2) There are other beautiful places in Lakhimpur, like -

a) Luit Khabolu, a mishing tribal village, located 10 km away from North Lakhimpur on the way to Jorhat. Large number of migratory birds could be seen here.
b) Dullung and Kakoi Reserve Forests.
c) Joyhing, a place of amazing scenic beauty where people like to picnic.
d) The major Sattras, for vaishnav culture, in the district are Adi-elengi, Baligaon Auniati Sakha, Gharmora Sattra etc.
e) Letekupukhuri, birth place of Sri Sri Madhab Deb.
f) Majuli, the largest river island in the world is very near to Lakhimpur, where people can also have the opportunity to see Assamese way of worship in the Sattras.
g) Other religious places of importance are Basudeb Than, Podumoni Than, etc.

3.0. Drainage System :

The Brahmaputra river controls the main drainage system in the district.

The Subansiri –Ranga Nadi –Dikrong –Boginadi System (including Bhabar and Kimin) that debouches in Brahmaputra forms an intricate drainage network in the district. The Subansiri, the largest tributary of river Brahmaputra is a Trans-Himalayan river originating from the Western part of Mount Pororu (5059 m) in the Tibetan Himalaya.

The tributaries are in general meandering as well as braided in nature. Peak discharge observed during monsoon and generally perennial in nature. However, near the foothills small streams generally dry up during the month of March / April.

The riverbed and the bank materials are boulders, cobbles, pebbles and sands of various grades with very low clay materials concentration.

All the major drainage viz. Kakoi, Baginadi merges to river Subansiri in the south western part. Before emerging to Subansiri, these streams create water logged and marshy condition in the southwest part of the district. The Kawaimari Beel and the Bhimpara Beel are created by these two tributaries of Subansiri in the downstream.

The drainage pattern of this area is denditric.

4.0. Rainfall and Climate :

The climate of the district is subtropical and humid characterized by high rainfall.

The annual rainfall is 3268 mm and the relative humidity 74 to 89 percent with a mean of 81 percent. The district receives South-West monsoon rainfall from the month of

April and continues up to September/October. The highest rainfall areas of the district are located near the foothills of Arunachal Himalayas, i.e. in the northern part of the district. The maximum temperature goes upto 35^{o}C during June / July and minimum temperature falls to 8^{o}C in December and January.

Lakhimpur district recorded 52.5 mm of rainfall on June 2023 which is 147 percent

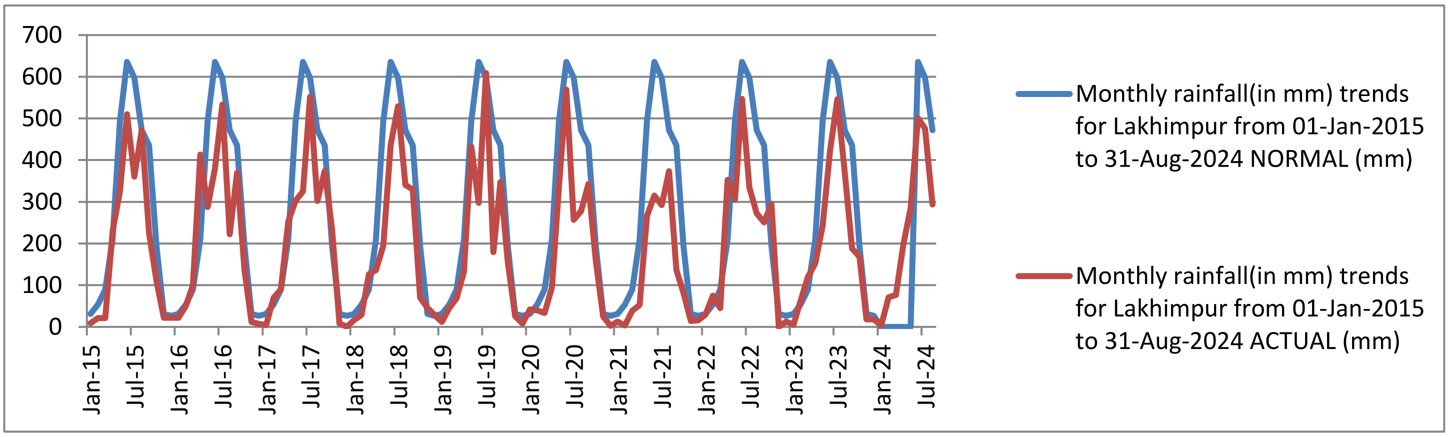
more than the normal of 21.3 mm.

This district is situated in the eastern part of Assam. The climate of the area is sub-tropical in nature with hot and humid summer, followed by dry autumn and cold winter. The average humidity is 90% while the average rainfall is 2015 mm.

Heavy downpour from June to September under the influence of south-west monsoon is a common feature of the climate of the region. It shows increasing trend from south to north. The area records the maximum temperature of 23^{0}C – 34^{0}C during the summer months, while the months of December and January record the lowest temperature of 7^{0}C – 15^{0}C

Highest Temperature	: 34 °C
Lowest Temperature	: 7 °C
Average Annual Relative Humidity	: 90%
Average Annual Rainfall	: 2015 mm

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	16.4	18.5	21.8	24.3	26.2	28.1	28.8	28.8	27.9	25.7	21.4	17.5
Min. Temperature (°C)	10	12.8	16	19.4	22.2	24.6	25.3	25.3	24.4	21.4	15.7	11.2
Max. Temperature (°C)	22.8	24.2	27.7	29.3	30.2	31.7	32.4	32.3	31.5	30	27.1	23.9
Precipitation / Rainfall (mm)	35	47	112	178	519	618	548	469	444	192	31	22



<u>Figure 1</u>

Climate Table/ Historical Weather Data of Lakhimpur District

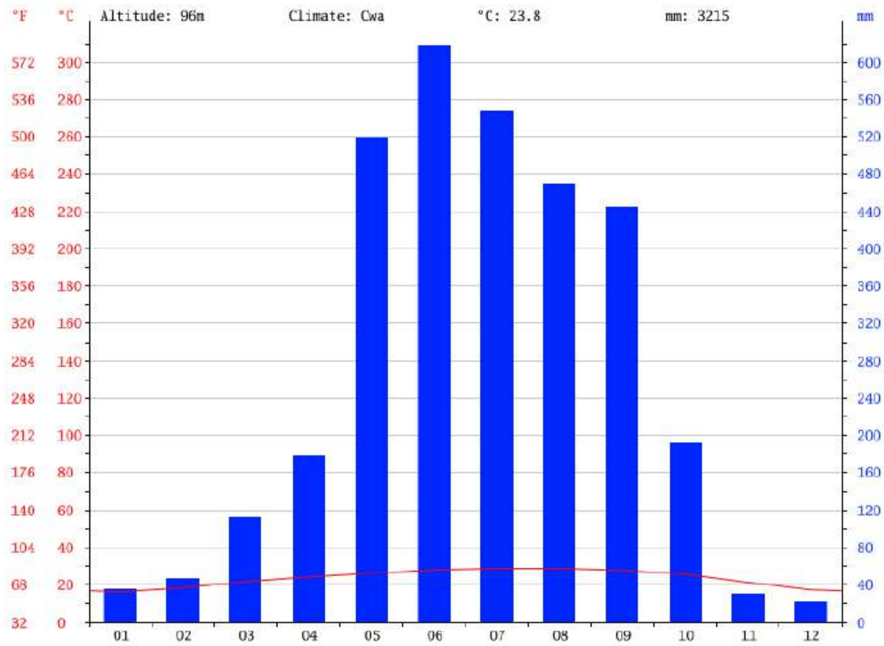


Figure 2

Climate Graph of Lakhimpur District

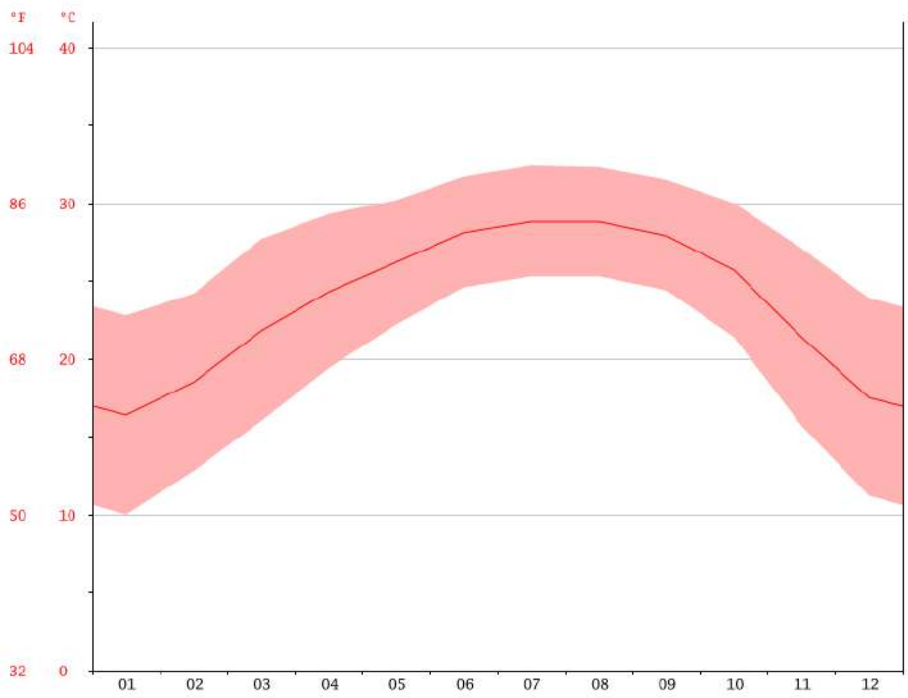


Figure 3

Temperature Graph of Lakhimpur District

5.0 Physiography of Lakhimpur:

Physiographically, the area can broadly be divided into three parts i.e. the hilly tract,

the foothill region and the extensive flood plain created by the river Brahmaputra and its tributaries in southern part. The hilly tracts comprise Siwalik sediments of lesser Himalayas.

The southern limit of the sub-Himalaya is marked by Himalayan Frontal Fold (HFF). The HFF may be observed near Banderdewa and Harmutty tea garden and further southward almost along Tarajuli – Pisola - Gorubandha track, where the Siwalkik Hills terminate abruptly with steep slope and come in contact with Brahmaputra plain towards south. Two terrace surfaces have been identified as the Harmutty and Jayhing surfaces that represent low and high level terraces. These terrace deposits are characterized by undulating surface comprising of boulders, pebbles and quartzitic and gneissic rocks with fine sand, silt and clay act as matrix. The alluvial flood plain consists of younger and older alluvial deposits. It represents various sub-features viz. palaeochannel, swampy / marshy land, river terraces, flood plains, point bars, channel bar and river channel. The average altitude in the central and southern flood plain varies from 80 to 85 m above MSL with very gentle slope throughout. The slope of the entire district drops from northern and eastern corners towards south.

The foothill region is characterized by older terrace deposit. Two terrace surfaces have been identified as the Harmutti and Joyhing surfaces that represent high and low level terraces. These terrace deposits are characterized by undulating surface comprising of boulders, pebbles of quartzite and gneissic rocks with fine sand, silt and clay act as matrix. The alluvial flood plain consists of younger and older alluvial deposits. It represents various sub-features, viz. palaeochannel, swampy/marshy land, and river terraces, flood plains, point bars, channel bar and river channel. The average altitude in the central and southern flood plain varies from 80-85m above MSL with very gentle slope throughout. The 92 m contour marks the northern limits of the flood plain area. The slope of the entire district drops from north and eastern corners towards south.

6.0 Geology of Lakhimpur District : (Map No. 8)

a) The area of Lakhimpur district falls under Survey of India Toposheet No. 83E/12 (part), 83E/15(part), 83E/16, 83F/13 (part), 83I /2 (part), 83I /3.4,6,7,8,11, 83I /12 (part) and 83J/1. The latitude and longitude of Lakhimpur district are 26º48’00” – 27º53’00” N and 93º42’00” – 94º20’00” respectively.

The Lakhimpur district falls parts of the Upper Assam Shelf. The northern boundary of the district is marked by Himalayan Frontal Fault (HFF). The Siwalik sediments crop out in the northern fringe area of the district bordering the Arunachal Himalayas where the HFF has passed through the district.

Age	Formation / Group	Lithology
Recent	Flood Plain	Sand, Silt, Clay with occasional pebbles, cobbles
Upper Pleistocene	Jayhing Surface (Formation)	Pebbles, Grit, Coarse to fine Sand, Silt, Silty Clay with Sand matrix
Pleistocene to Pliocene	Harmutty Surface(Formation)	Boulders, Cobbles and Pebbles mainly of quartzite, Sandstone, Gneissic Rocks with argillaceous and siliceous matrix.
Recent	Flood Plain	Sandstones, Siltstones, Mudstones, Shales, Conglomerates etc.

b) Rivers and Water Bodies : (Map no.5 & 6)

A number of rivers enter the area from northeast and northern direction.

The Subansiri River is, a major tributary of Brahmaputra, flowing through district, Arunachal Pradesh and enters the Lakhimpur district of Assam. Subansiri river flood plain is composed of quaternary alluvial deposits of Harmutty surface (Formation), Jayhing surface (Formation), North Lakhimpur Formation and recent flood plain deposits. Deposits of Harmutty surface and Jayhing surface from the piedmont plain in the north, bordering the southernmost range of Arunachal Himalayas and running in NE-SW direction, as a narrow strip. North Lakhimpur Formation stands out as an isolated geomorphic high within recent flood plain deposits. Remaining part of the flood plain exposes recent flood plain deposits.

List showing Length of the Main Rivers of Lakhimpur District		
SL No.	**River**	**Length**
1.	Subansiri River	79.10 km
2.	Ranganadi River	27.20 km
3.	Dikrong River	42.78 km

Harmutty Surface

This is the northernmost lithounit of Subansiri flood plain and is overlain by flood deposits of Jayhing Surface (Formation) to south. It is composed of boulders, cobbles and pebbles, mainly of quartzite, sandstone, gneissic rocks with argillaceous and siliceous matrix and are consolidated. The boulders, cobbles and pebbles are ill-sorted, rounded to sub-rounded. The top part of the Formation is highly oxidized and shows reddish brown or yellowish colour. It is composed of mainly sand, silt and silt clay. The Formation is well exposed around Harmutty, Dijoo and Ananda (Pathalipam) Tea Estate.

Jayhing Surface

Jayhing overlies Harmutty Formation lying to south of the former. This consists of pebbles, grit, coarse to fine sand, silt, clay with sandy matrix. These are semi-consolidated, do not show any oxidation. Deposits of this Formation slope southward and merge with flood plain deposits. These are exposed in Jayhing Tea Estate, south of Dijoo Tea Estate, Lilabari, Silonibari Tea Estate and in the section of Kakoinala.

North Lakhimpur Formation

This is composed of silt, silty clay and is compact. This exists as inliner within recent flood plain deposits. This is exposed around North Lakhimpur, Bordoibum Tea Garden and Ghilamara. This does not show any oxidation.

Recent Flood Plain Deposits

The recent flood plain deposits include both channel deposits and overbank deposits. The channel deposit comprises of Point bars, Channel bars and Channel fill deposits. The overbank deposits include natural levee and black swamp deposits.

1. Point bar deposit: These are composed of sand and are silt at places, up to the level of flood plain.
2. Channel bars deposit: These are mostly triangular in shape and are composed of ill-sorted boulders, Cobbles, Pebbles of quartzite, Sandstone with sandy matrix, gneisses in foot hills region. Some of these bars bear a thin blanket of fine sand, silt and clay are partially stabilized by vegetation. Channel bars situated further downstream, are mainly composed of sand and silt. These are highly unstable and have a tendency to shift from season to season.
3. Natural Levee deposit : These consist of various combination of silt, silty sand and silty clay forming an impervious top stratum. These overlie the underlying the previous sandy horizon. These are formed by deposition of successive overbank flows. These constitute bulk of the recent flood plain deposits.

4. Back swamp deposit: These are formed by the vertical accretion of suspended materials in flood basin and are composed mainly of silty clay and clay. These are finely laminated and inter-bedded. They are characteristically rich in organic materials and are formed behind natural deposits.
5. Channel Fill deposit: These consist mainly of bed load sand, having a top horizon of silt, silty sand and silty clay in various proportion, formed by vertical accretion. Presently these are under extensive cultivation and hence are noticeable on ground. These represent palaeochannels or remnants of old abandoned channels entirely filled up by sands.

c) Soil and Vegetation:

The district's soil is primarily alluvial, supporting extensive agricultural activities.

The region also has areas of forest land, sparse vegetation, and water bodies

d) Hydrogeology:

Lakhimpur can be divided into two hydrogeological units i.e. semi-consolidated and

unconsolidated formations. The semi-consolidated formation is composed of Neogene-Siwalik Group rocks, which border the northern boundary of the district.

e) Land Use: (Map No. 7)

The land use in Lakhimpur includes agricultural land, forest land, sand bars, settlements, sparse vegetation and water-bodies (have been elaborated in following pages). Forest area is about 32,816.112 hectares. These categories reflect both natural and human-induced changes in the landscape.

This diverse geomorphology makes Lakhimpur a region of significant ecological and agricultural importance.

.7. Soil Types:

The soils of the district can broadly be classified into the following groups:

1. Red Loamy Soil: These are found in the northern border of the district.

Type of this soil develops in the hilly slopes under high rainfall conditions.

This soil is characterized by low nitrogen, low phosphate and medium to high potash. pH is acidic.

2. Lateritic Soil: The lateritic soils are the product of high leaching and found in hilly region. pH of soil is acidic due to intensive leaching of bases and formation of clay Materials and ferric hydroxides. The lateritic soil is characterized by brick red to brownish red color and poor plant nutrient.

3. New Alluvial Soils: The new alluvial soils are found in the flood plain area and are Subjected to occasional floods and consequently receive considerable silt deposit after the flood recedes. These are yellow to yellowish grey in colour and are admixtures of sand, silt and clay in varying proportions. Mineral weathering and geo-chemical changes are normal. But incipient changes in the top layer have been noticed due to biological activity.

Soil pH is feebly alkaline and moderately rich in plant nutrient.

4. Older Alluvial Soil: It develops at higher levels and practically unaltered alluvium representing a broad spectrum of sand, silt and humus rich clay depending on landform. The soils are comparatively more acidic than the newer alluvial soil and hence more crop sensitive. The soils of the district as classified by NBBS and ICAR, Nagpurare :Udalfs - Orchapts – Acquents, Fluvent – Aquepts,Aquepts – Aqualfs – Fluvent.

8.0. Groundwater Scenario: (Map No. 9)

8.1. Hydrogeology: The district can be divided into two hydrogeological units viz. Semi-consolidated and unconsolidated formations based on geology and hydro-geological character. The semi-consolidated formation is composed of Neogene Siwalik Group of rocks bordering the northern boundary of the district. The Siwalik rocks are not suitable for ground water development. The major water bearing formations include alluvial sediments in foothills and floodplain that constitute the unconsolidated formation. The piedmont zone extends over 8-10 km from the foothill, which is laterally followed by younger flood plain area extending up to northern bank of the Brahmaputra River in the south the railway line roughly marks the southern boundary of the piedmont zone (Bhabar Belt).The alluvial formations in the foothills are composed of sand, pebble, cobble and boulders. These materials have high permeability. In the flood plain area, little gravel mingles with different grades of sand.

Major water bearing formation comprises of sand, gravel and pebbles.

Pre-monsoon depth to water level during 2012 was 1.59 to 5.33 bgl..

Post-monsoon depth to water level during 2012 was 0.39 to 3.60 bgl.

Long term water level trend during 2001 to 2010 (in m/year) : Post-monsoon WL of 59% of GWMS indicate a declining trend of 0.017 to 0.298 meter per year and 41% of GWMS indicate a rising trend of 0.005 to 0.139 meter / year.

Shallow Aquifer

The water bearing horizons occur within 30-50 mgbl is considered to constitute shallow aquifer system. Ground water in this aquifer occurs under unconfined to semi confined conditions. The aquifer materials comprise sands of different grades with varying proportions of gravels. The grain size of the aquifer materials is found to decrease towards the southern part of the district. The semi-confining layers are not persistent throughout the district. The top-confining layer is consisted of clay with

interlayer sand and its thickness varies from 15.0 m to nearly 1.0 m. The lower confining layer is generally 3.0 m thick and is not regionally extensive.

Deeper Aquifer:

In the deeper aquifers, ground water occurs under semi-confined to confined conditions. The upper confining layer is generally 3 m to 9 mthick. The aquifer materials are composed of sands and gravels of different size grade. In this district, CGWB and NER had explored the subsurface down to the depth of 200m in Panigaon and Jalukata areas. The cumulative thickness of the granular zones in the deeper aquifer varies from 60.0 m to 150.0 m. There is a clear distinction of grain size of aquifer materials in the northern, southern and western part of the district. Presence of multi-aquifer system in the western part of the district around Dholpur, Narayanpur is deciphered from lithologs.

The confining layers are not persistent. However, towards east, around Panigaon and Dhakuakhana areas, single aquifer zone is found down to the depth of 130 mgbl. The grain size of the aquifer material increases towards south i.e. towards the foothill.

Ground Water Movement:

As mentioned earlier, the district is bounded in the north by Arunachal Himalayas and in the south by Brahmaputra River. Evidently, the ground water flow direction is from the higher elevation in north towards the plain area in the south. In the western part of the district, the ground water flow is from northwest to southeast. Whereas in the central and eastern part (around Dhakuakhana and Ghilamara area) of the district, the flow is almost north – south. The highest water table is 110 m above mean sea level in the flood plain area towards south. In general, the gradient of flow is high towards west as compared to the gradient in the eastern part. In the northern foothill region, the water table gradient is steeper (1.5m / km) and it forms the recharge zone for the entire district. The study of water level data has revealed that the general fluctuation of water table during pre and post monsoon is in between 0 to 2 m in plain area is more than 2 min areas adjacent to river Dikrang.

The major part of the gross rise in water table during April to July dissipates quickly. Low ground water fluctuation in the area is due to low ground water draft and rapid ground water movement through the aquifer where by and large scale draft at one place is compensated by ground water recharge from other places.

Ground Water Resources:

Almost entire district is occupied by unconsolidated alluvial sediments, except the hilly areas in the northern part. There is no command area in the district. The bottom of the unconfined aquifer is found within 10 to 20 mgbl. The total annual ground water recharge of the district estimated as 1,30,597 ham. Total number of shallow tube wells are1758.The annual unit draft of 2.6 ham per tube well has been taken for irrigation purpose.

The per capita domestic requirement for the rural population has been considered as 60 lpcd and for the urban population, it is 135 lpcd. The total annual draft calculated for the district was 128.76 mcm, where irrigation draft is 105.98 mcm, and domestic and industrial draft is 22.78 mcm respectively. The allocation for domestic and industrial water supply up to the year 2025 has been worked out to be 32.14 mcm.

The balance ground water resources for future irrigation use are 1060.03 mcm. Thus there will be a balance of 1198.15 mcm.

Major ground water problems and issues include high iron concentrations of 354 habitations. Most of the chemical parameters are within the permissible limit set by BIS, except Fe (content range being 0.13 to 0.69 mg/L.

Net ground water availability in 2009 was 1198.15 mcm.

Number of Dug-wells , as on 2013,

9.0. Natural Hazards / Flood Management:

Lakhimpur district is always badly hit by floods and is one of the most flood-affected areas. The district is in the list of most flood prone districts of the Assam State Disaster Management Authority as well. Floods in the state led to a death of 124 people and Lakhimpur was one of the most flood-affected districts. Lakhimpur district recorded 52.5 mm of rainfall on June 2023 which is 147 per cent more than the normal of 21.3 mm. The embankment on the left bank of the river Ranganadi, which got breached in 2008, runs for a length of 27 kilometers. Nine years elapsed but the same 27 km till remains incomplete, although a project worth Rs.362 crore was sanctioned in 2014. Embankment at Amtola was breached almost at the same region Majgaon, which along Joinpur and Gourighat Balijan comprising the Amtola Revenue Circle, was probably the worst affected. People in Lakhimpur suspect that in addition to the incessant rain, their wows were exacerbated by the excess water released by the dam. However, North Eastern Electric Power Corporation Limited which runs the dam, has denied it and claimed that the situation would have been much worse if the dam was not there.

Flood Management:

As a practice, three phases of flood management actions are envisaged i.e. pre-flood, during flood and post-flood. The pre-flood activities include preparatory measures involving assessment of vulnerability, development of personnel and organizational database, to chalk-out emergency action plan such as deployment of early warning procedure and training of personnel for evacuation and rescue. Arrangement of commodities and relief materials also to be done along with verification updating of existing search and rescue operations. It is desired that a District Disaster Management Committee is formed well before the onset of the monsoon to guarantee adequate preparedness. It is also welcome that various Non-government Organizations come forward and properly get involved in this venture. All the information relating to disaster management must be well documented in order to accomplish future management plans. It is important to note that The National Commission for Integrated Water Resources Develoopment,1999 recommended management approach rather than control, emphasizing failure to provide complete protection. Such strategies include flood-plain zoning, flood proofing, forecasting, disaster preparedness, response planning and insurance. Regarding flood-plain zoning, the National Commission already proposed a legislation to classify flood prone zones according to occurrence and intensity. Now-a-days, flood forecasting has become easier with advancement of satellite and remote-sensing technology.

Flood-Plain:

Flood –plain is said to be an area of land which is adjacent to a stream or river which stretches from the banks of its channel to the base of the enclosing valley walls, and which experiences flooding during periods of high-discharge. The soils usually consist of sands, silts and clays. Flood-plains are formed during erosion of a meander sideways as it travels downstream. At a time when a river breaks its banks, it leaves behind layers of silts (alluvium). These layers gradually build up to create the floor of the plain which generally contain unconsolidated sediments, very often extending below the bed of the stream. Flood-plains are accumulation of sand, gravel, loam, silt, clay and often serve as important aquifers

.

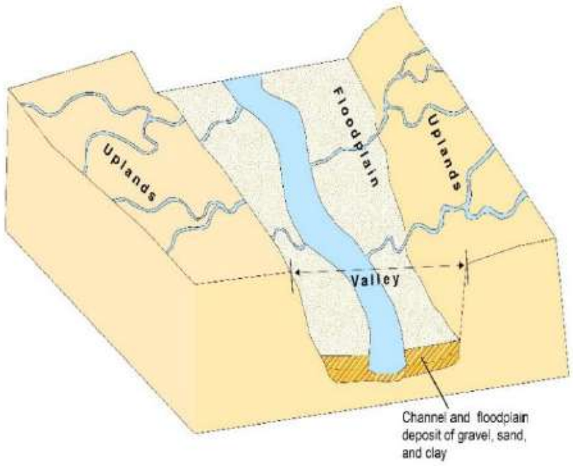


Figure 4

Subansiri river flood plain is well known for its placer gold occurrences since ancient times. Investigation for the prospect of placer gold in palaeochannels of Subansiri Flood Plain was carried out by DGMS, Assam and Geological Survey of India.

Pit sampling of some palaeochannels demarcated in the flood plain by Photo-interpretation and test panning of those alluvial samples were done to check the incidence of placer gold in the said channels.

10. Replenishment of Sand and its Assessment

Based on the fundamentals of hydraulic, river flow has the ability to transport the debris as the resisting force is exerted on the water. The downstream of the river is based on the gravitational force acting as an inducing force while the friction resistance helps in the degrading process of the channel. The deposition on river bed is very pronounced during rainy season although the quantum of deposition varies from stream to stream depending on several factors like catchment, lithology, discharge, profile of river and geomorphology of the river course. In order to calculate the mineral deposits in the stream beds, the mineral constituents have been categorized as sand, gravel, silt and clay. Further, the Survey of India Topo-sheets should be used as base map to know the practical extent of river course. The sediment transportation is largely influenced by the grain size as the movement is influenced by the turbulence at the bed of the channel. The evaluation of sediment transport is important for appropriate management and policy implementation. The replenishment volume is determined by a 5-month dry period and as per River Sand Management Guidelines (2009).

10.1. Procedure for assessment of sediment replenishment :

The main objective of this study to assess the replenishment volume in order to calculate the optimum volume of sand to be extracted, supported by specific objectives in identifying the particle size in the river and determination of sediment transport during the low flow season. Regular replenishment study is mandatory and require to be carried out in order to keep a balance between deposition and extracted quantities.

Sediment load deposition in a river depends on catchment area, weathering index of the various minerals of that area, land-use pattern, rainfall data and grain-size distribution of the sediments.

Catchment Yield can be calculated using the following formula :

Catchment Yield (m^3) = Catchment Area (m^2) x Run-off Coefficient (%) x Rainfall (m)

Procedure:

Step no.1: Sampling stations to be identified as monitoring points within the study area. Sampling stations to be selected on the basis of active sand mining activity, the past sand mining area and the control stations. Control stations are to be used to represent the river reaches with no sand mining activity, so as to reflect the natural morphological characteristics without any human-made alterations. Such stations will represent the undisturbed condition for comparison with disturbed ones.

Step no.2: Following physical parameters are to be ascertained.

a) Channel width in meter (W)
b) Total cross-sectional area in m^2 (A)
c) Minimum and maximum velocity in m/s (V)
d) Water discharge in m/s (Q)
e) Total Dissolved Solid (TDS)
   It may also be necessary to determine the channel slope and hydraulic radius, depending on the method of calculation followed.

All the above parameters are to be measured in-situ based on one water cycle (low-flow and high-flow). High-flow sampling period is preferred to be within November to January and low-flow sampling period may be during May-June.

Step no.3: It is desired that three samples are taken from each station from the upstream to the downstream. The samples are to be left to dry for 24 hours prior to obtaining bed material classification. Preferable sieve diameters are 2 mm, 1 mm, 0.5 mm, 0.25 mm,0.125 mm, 0.063 mm and 0.01 mm.

The changes in grain-size distribution determine the transport of sediment and sedimentation the river towards downstream. The result shall be represented as a cumulative distribution curve.

Step no.4: The total bed load can be calculated using the following equation :

$$T_j = \sum_{1}^{n} G_b \text{ where } G_b = \frac{W_i}{(T \times h_s)} \cdot \times b$$

Here, T_j is rate of bed load for the pre-defined cross-section in kilogram per second and G_b is rate of bed load for each section within the pre-defined cross-section in kilogram per second, W_i is weight of bed load sample in kg, T is duration of sampling in second, h_s nozzle width in meter, b = ratio between width of channel and number of se3ction within cross-section.

Other equations can also be used for calculation as shown below :

1) **<u>Manning's Equation</u>**

$Q = V.\,A. = (1.00 / n)\,.A.\,R^{2/3}\,.\sqrt{S}$ where
Q = Flow rate (m^3 /s) ; V = Velocity (m/s) ; A = Flow area (m^2) ;
R = Hydraulic Radius (m) :S = Channel Slope (m / m);
n = Manning's Roughness Co-efficient= $0.39\,S^{0.38}\,R^{-0.15}$

2) <u>Yang Equation (1972)</u>

$\log C_T = \{5.435 - 0.286 \log \log (W_s\, d_{50})\} / U - 0.475 \log U / W_S$ where
C_T = Total sand concentration in ppm
W_S = Terminal fall velocity (m / s)
d_{50} = Average particle diameter of granular material in mm
U = Shear Velocity in m / s = $(gRS_O)^{1/2}$
$R_e = U.\,d_{50} / v$; If $R_e < 70$, then $V_c / W_s = [2.5 / (\log U d_{50} - 0.06)] + 0.66$
If $R_e > 70$, then $V_c / W_s = 2.05$

3) **Dandy – Bolton Equation** :

Y = X . EK. CVF. PE. SL. ROKF

where Y - Sediment yield in tons per hectare
EK - Soil erodibility factor
CVF - Crop management factor considers prevention of soil loss

PE – Erosion control practice factor
SL - Slope length and steepness factor
ROKF – Coarse fragment factor
X is energy factor and equal to $1.586 \times (Q \times q)^{0.56} \times WSA^{0.12}$ where
Q =Runoff volume in mm, estimated using the SCS curve number method. ; q_p= Peak runoff rate in mm / hour ;
WSA = Watershed area in hectares ;
Peak flow q is calculated as per equation $q = C \times i \times A$ where
C – runoff coefficient representing watershed characteristics
i - rainfall intensity for the watershed's time of concentration

4) Peak Flood Discharge calculation can be carried out using **Dicken's Formula**

$Q = CA^{3/4}$ where Q = Maximum flood discharge in a river (m^3/hr)
A = Area of catchment in km^2
C = a constant varying widely between 2.8 to 5.6 for catchments in plains and 14 to 28 for catchments in hills

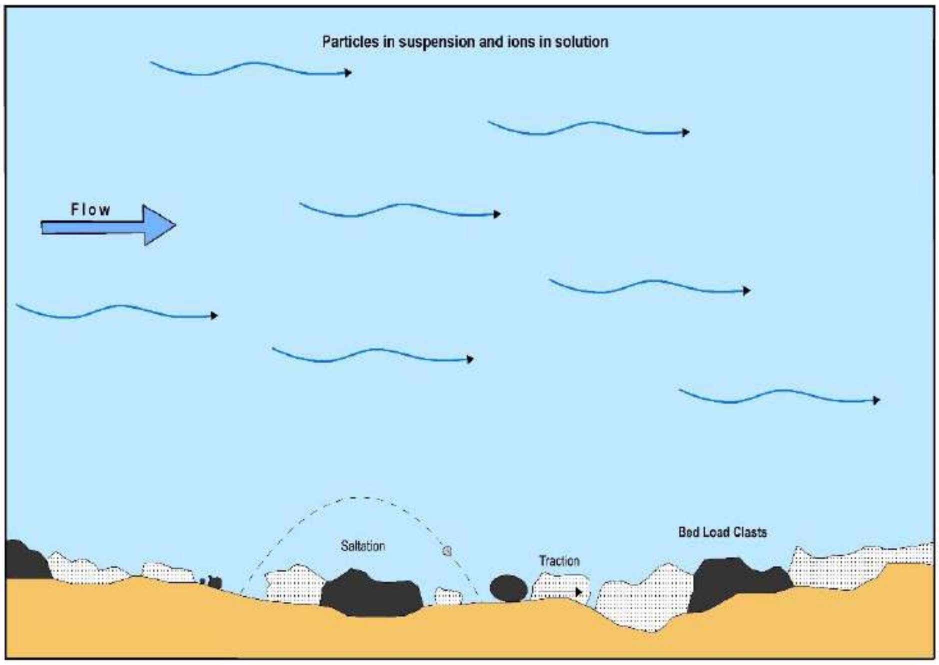


Figure 5

OR Jarvis Formula : Q = $CA^{1/2}$ where C = a constant varying between 1.77 as minimum to 177 as maximum. Flood of 100% chance is when C =177.

OR Rational Formula:Q = C.I.A where C is Run-off coefficient depending on the characteristics of the catchment area, being a ratio of Runoff : Rainfall
I = Intensity of Rainfall m/sec ;

Bed Load Transport calculation is very difficult considering the fact three modes of transport may occur simultaneously i.e. rolling, sliding and saltation. There are a few equations in order to compute the total sediment load, most of which have both theoretical and empirical basis.

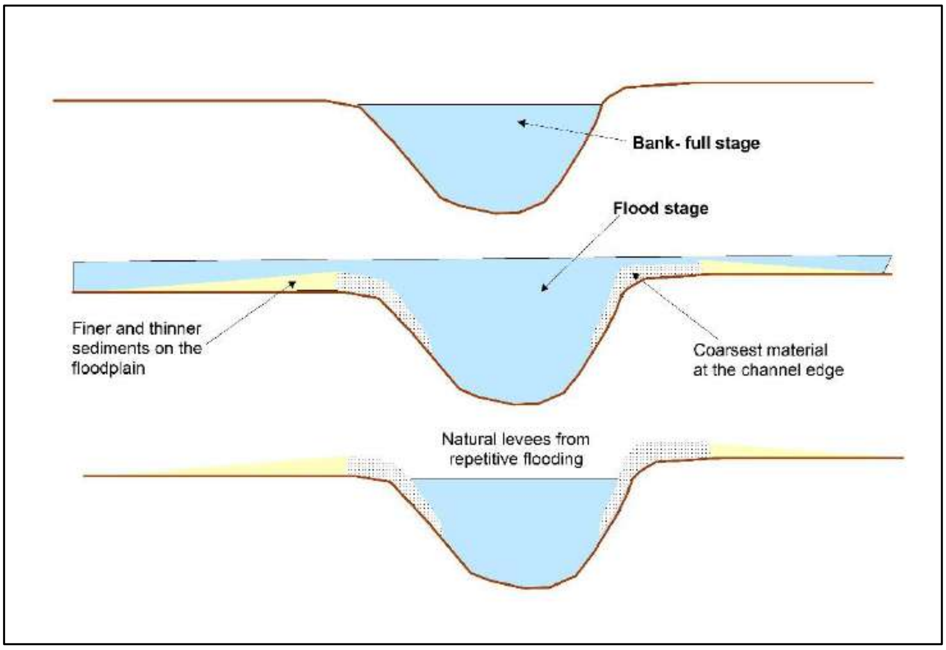


Figure 6

1) **Ackers and White equation (1973):**

$C_t = C_s G_s (d_{50} / h) (v / U_*)^{n'} [F_{gr} – A_1) -1]^m$ where $F_{gr} = U n' / (G_s-1) g.d_{50}$

$x (V / \{ 5.66 \log(10h/d_{50})\}^{1-n'}$

A_1 = Critical particle mobility factor
C_s = Concentration coefficient in the sediment transport function
C_t = Total sediment concentration
d_{50}= Medium grain size
d_{gr} = Dimensionless particle diameter = $d_{50} [g(G_s -1) /v^2]^{1/3}$

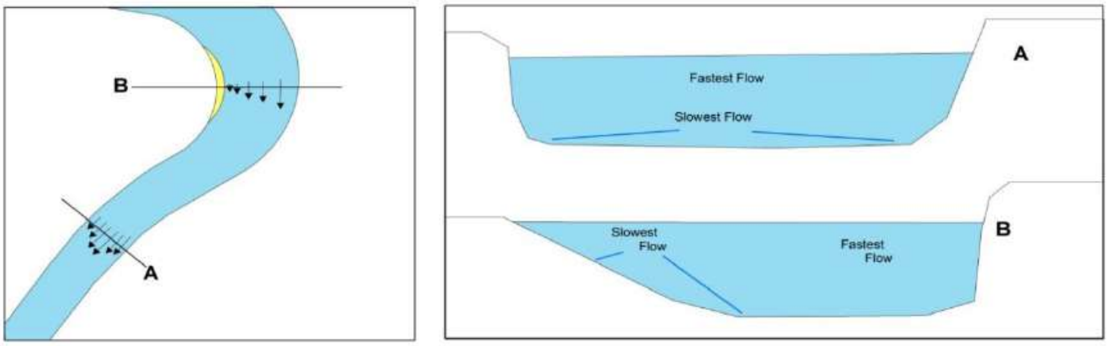


Figure 7

10.2.Deposition Process of Sediments in the River

Sediment is naturally occurring material, broken down by process of weathering and erosion and subsequently carried out or transported by the action of wind, tides, water and force of gravity acting upon the particles. Among these, water is the strongest agent for transportation of sediments and the degree of transportation depends on the strength and velocity of flow.

In general, there are three categories of river.

1) Youthful River
2) Mature River
3) Old Age River

A few characteristics of each of these are described below.

Youthful River

This river is the most dynamic of all the rivers. Such rivers are found at higher elevations, mainly in mountain areas where the slope of the land is steeper. Water moves very fast over such a landscape. These rivers can also be a tributary of a older and larger river, very far away. They also may be close to the beginning of the larger river.

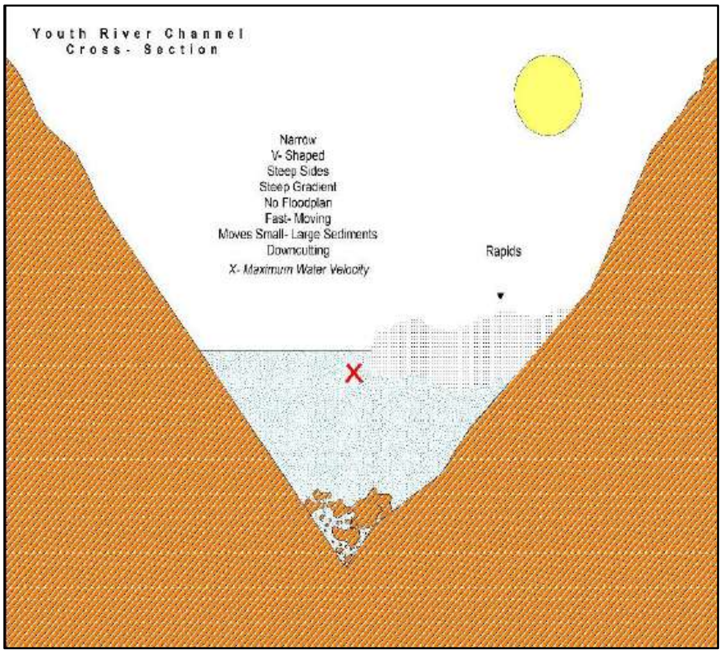


Figure 8

Mature River

Such Rivers down cuts to a much lesser degree than the Youthful Rivers does. They erode laterally but not as extensively as compared to Old Age River. They pass over enough steep landscape that slope of the river creates a velocity capable of moving

not only the finer sedilen5ts but also larger pebbles and cobbles by way of rolling, bouncing and saltation along the river bed. They may flow through mountainous areas but not as high areas as in case of the Youthful River. The channel of a Mature River is U-shaped, more deep but less wide than Old Age River.

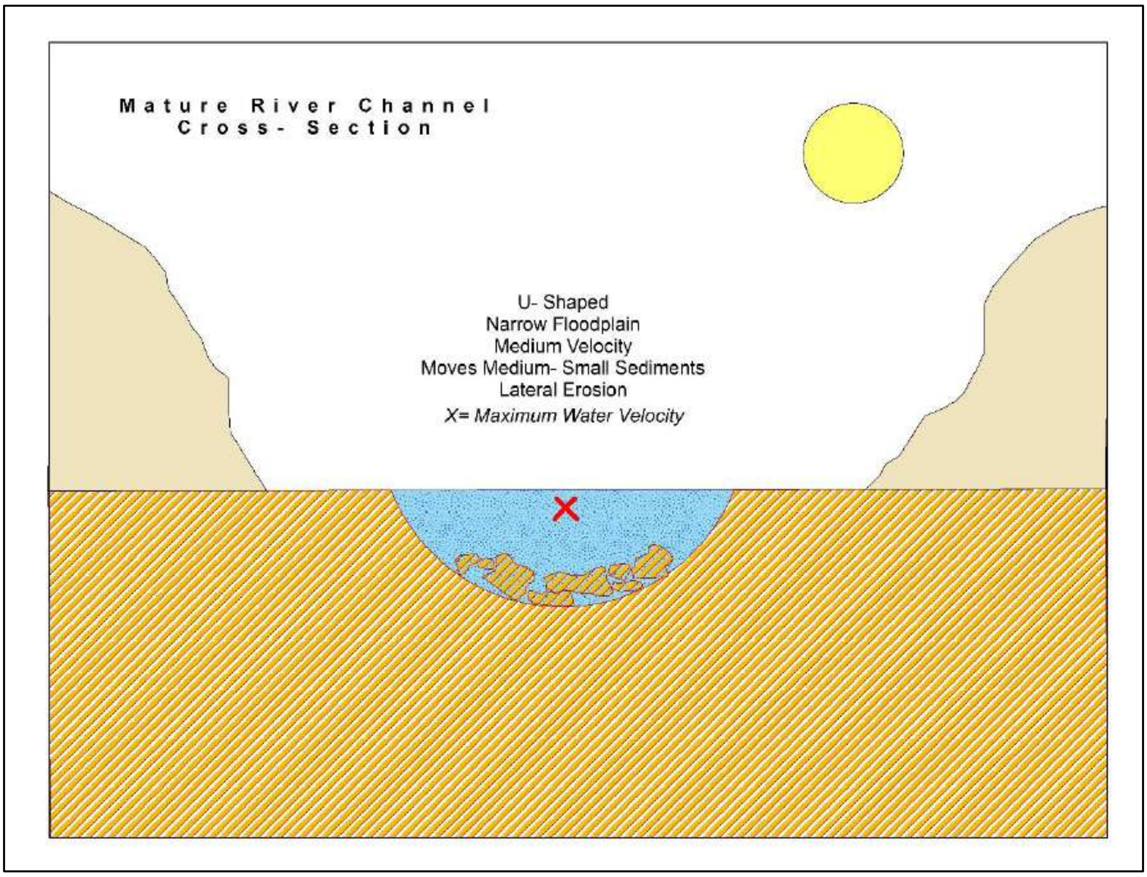


Figure: 9

Old Age River :

An Old Age River rests in almost flat valley due to many years of erosion that took place over the years. Their course is not straight with widened flood plains. They are the slowest river with a high degree of sediments

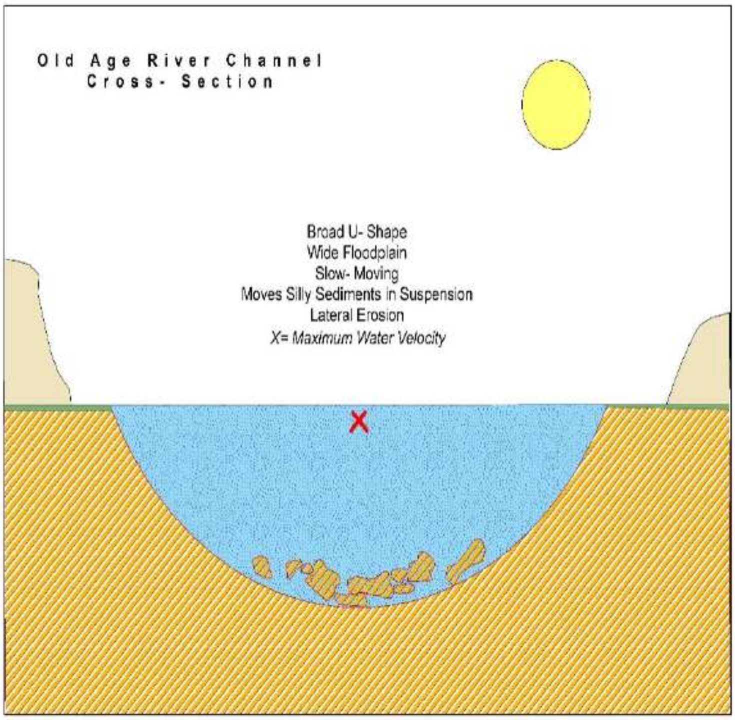


Figure: 10

10.3. Stream Erosion and Deposition

Water flow in a stream largely depends on its gradient and also governed by the geometry of the stream channel. Velocity of water flow decreases with increase in friction along the stream bed. As a result, it is slowest at the bottom and edges and fastest near the surface and in the middle portion. On a curved section of a stream, flow velocity is highest on the extremes and slowest in the middle. An important factor that determine velocity of stream water is the size of sediments on the stream bed because large particles tend to slow down the flow more than the small particles. During a flood as the water level rises, there is more cross-sectional area available for the water to flow. But as long as the river remains confined, the velocity of water flow naturally increases. Small dimensional particles rest at the bottom for a while where they are moved by saltation and traction. These particles can also be held in suspension in the flowing water, at a time when the velocity is high. As we are aware of, stream water can also have dissolved load which may represent about 15% of the mass transported and consists of minerals like calcium (Ca^{2+}) and Chloride (Cl^{-}) in dissolved condition.

<u>Typical Particle-size (mm) Distribution Curve</u>:

A stream typically reaches the highest velocity as and when it is close to flooding over its banks (Bank-full Stage). As soon as the flooding stream flows over its banks and

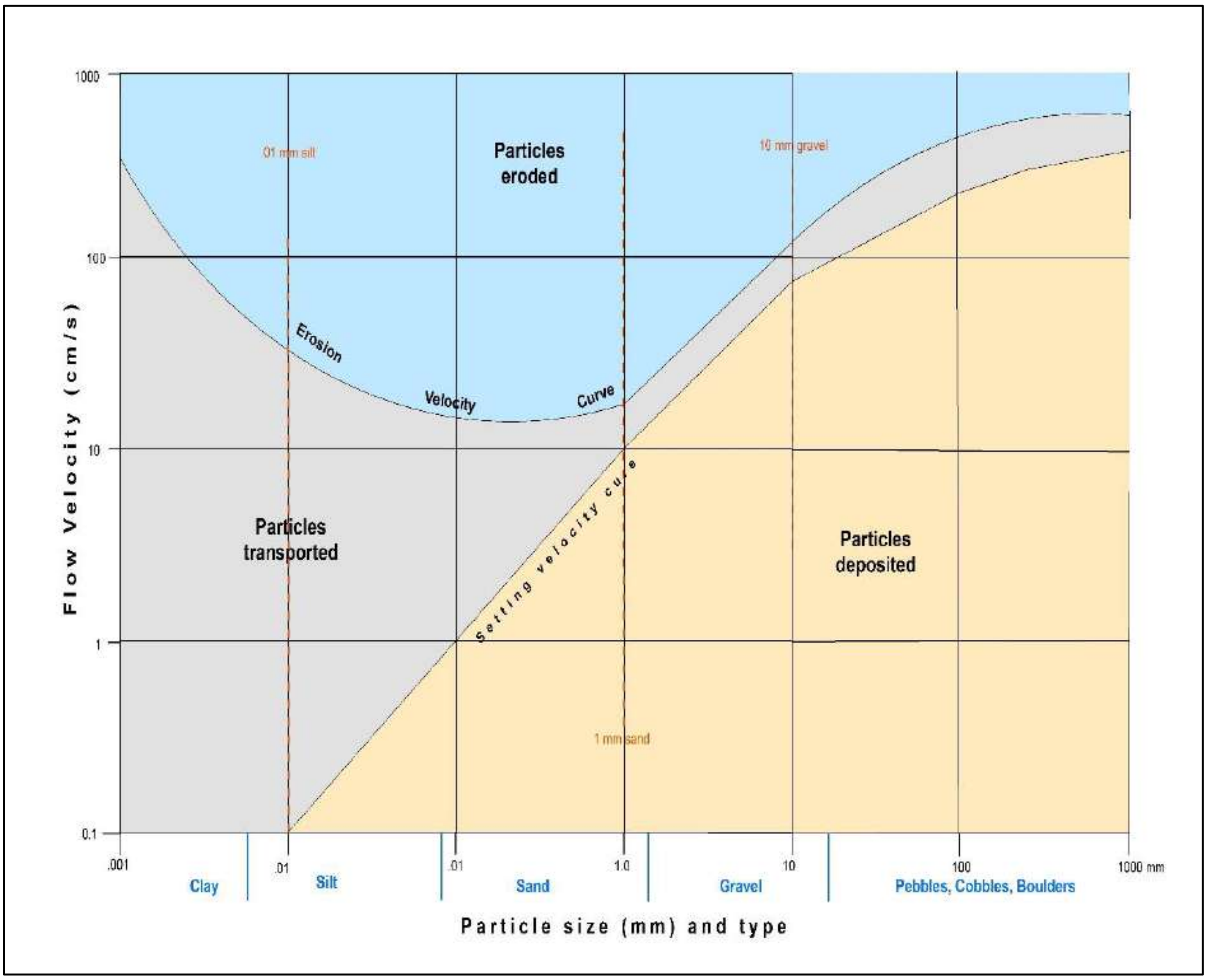


Figure 11

occupies the wide area in the flood plain, larger area becomes available and consequently the velocity comes down. At this juncture, sediment that was earlier being carried by high velocity of water gets deposited near the edge of the channel forming a natural bank or levee.

11. SAND MINING GUIDELINES:

In order to ensure sustainable and systematic sand mining with monitored protection ofenvironment, the guidelines laid down in following documents are followed:

1) Sustainable Sand Mining Management Guidelines 2016 by MoEF&CC.

2) Enforcement & Monitoring Guidelines for Sand Mining 2020 by MoEF&CC.

3) Assam Minor Mineral Concession Rules, 2013.

The above documents have been strictly adhered to during Preparation of Mining Plan and Progressive Mine Closure Plan under the guidance of a registered RQP. This will facilitate grant of any mineral concessions like “Mining Lease”, “Mining Contract” or “Mining Permit” in respect of minor minerals for systematic, scientific and progressive development of all mines, quarries as well as river bed mining. As per guidelines prescribed in above said documents, special attention has been given on the following aspects:

1) 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 both sides of the bank shall not be more than 100 meters.

2) Proper channelization of river is to be carried out so as to avoid the possibility of flooding and to maintain the flow of rivers.

3) The mining plan should include original ground level (OGL), available from District Survey Report (DSR) and to be recorded at an interval not more than 10 m x 10 m along and across the length of the river. Area of aggradation /deposition needs to be ascertained by comparing the level difference between the OGL and water level.

4) Riverbed 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 width of the river. Central 3/4th part of the river needs to be identified on a map, out of which the area of deposition / aggradation needs to be identified. Remaining 1/4th area needs to be marked as ‘no mining zone’.

5) The sediment sampling should include the bed material and bed material load before, using and after the extraction period. The above exercise by DSR require four surveys i.e. 1st survey in the month of April, 2nd survey at the time of closing of mines for monsoon, 3rd survey needs to be carried out after monsoon to know the quantum of material deposited/replenished and the 4th survey to be carried out at the end of March to know the Quantum of material excavated. The above information will be available in District Survey Report (DSR).

6) The particle size distribution and bulk density of deposited material are required to be assessed by a NABL recognised laboratory.

7) Depth of mining should be restricted to 3 meters and distance from the bank should be 1/4th of the river width and should not be less than 7.5 meters. Alternatively, distance from the bank should be 3 meters or 10% of the river width, whichever is less.

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

9) A buffer distance/ un-mined block of 50 meters after every block of 1000 meters over which mining is undertaken, shall be maintained.

10) Sand and gravel may be extracted across the entire active channel during the dry season only. No sand mining during monsoon session, as defined in DSR or IMD for each state.

11) Sand and gravel shall not be extracted up to a distance of 1 km from major bridges and highways on both sides, or five (5) times span of a bridge/public civil structure(including water intake points) on up-stream side and ten(10) times 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.

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

13) River mining from outside should not affect rivers. No mining shall be permitted in an area up to a width of 100 meters from the active edge of the embankments or distance prescribed by irrigation department. The mining from area outside river bed shall be permitted subject to a condition that a safety margin of two (2) meters shall be maintained above the groundwater level while undertaking mining operation.

14) Sand and gravel shall not be extracted within 200 to 500 meters from any crucial hydraulic structure such as pumping station, water intakes.

15) All sand carrying vehicle (from source to destination) to be tracked through GPS or RFID. There should be one entry and exit point for trucks / dumpers. Project Proponent should carryout effective monitoring of the same. In case of vehicle break-down, the validity of transport permit can be extended by State Authority, if so required.

12. Mineral and Industrial Resources of Lakhimpur District :

The Lakhimpur district is poor in mineral resources. The great Subansiri River has legends of once famous gold washing. But as of now, there is no major exploration of minerals in the district, except some minor exploration for petroleum by ONGC near Dhakuakhana, Minor minerals like river bed sand; stone boulders etc. are often exploited. Details of Mining Permit Areas and Mining Contract Areas in Lakhimpur District have been indicated in following pages.

Adequate infrastructural facilities such as land, industrial accommodation, power, water, financial institutions etc. reduce the investment risk and attract the prospective entrepreneurs to set-up new industrial ventures. As far as infrastructure facilities are concerned, the Lakhimpur district is poorly reflected in the industrial field. There is no large and Public Sector undertaking industries in the district.

The district is rich in traditional artisan talents, particularly in the field of art of Endi silk worm rearing, Eri-coonspinning and weaving, handloom, cane, bamboo Works.

Agricultural and allied sector like livestock, poultry and pisciculture is the prime occupation of the people living in the district.

Registered Industrial units …. 526

Registered Medium and Large unit … 3

Average no. of daily workers in SSI … 391

Employment in large and medium Industries 360

TABLE - I

13. Details of MPA under Lakhimpur Division.

Sl. No.	Name of MPA	Area (in Ha.)	GPS co-ordinate	
1	Dolohat Singra MPA (Sandy Soil)	3.80	N27°10.739'	E93°59.028'
			N27°10.706'	E93°59.069 '
			N27°10.688 '	E93°59.109 '
			N27°10.714 '	E93°59.144 '
			N27°10.755 '	E93°59.153 '
			N27°10.787 '	E93°59.128 '
			N27°10.816 '	E93°59.089 '
			N27°10.821 '	E93°59.041 '
			N27°10.787 '	E93°59.013 '
			N27°10.754 '	E93°59.012 '
			N27°10.740 '	E93°59.027 '
2	Ghagar Sand & Gravel MPA	0.48	**Copy enclosed as Annex-1**	
3	Dikrong River Merbil Sand, Gravel & Earth MPA	2.71	N27°6'7.56"	E93°51'19.55"
			N27°6'11.80"	E93°51'13.70"
			N27°6'14.13"	E93°51'26.26”
			N27°6'13.60"	E93°51'26.66"
4	Ranganadi Earth MPA	8.73	N27°11'45.45"	E94°03'55.22"
			N27°11'48.28"	E94°04'1.78"
			N27°11'41.54"	E94°04'5.04"
			N27°11'38.72"	E94°03'58.40"
			N27°11'37.12"	E94°03'57.50"
			N27°11'38.22"	E94°04'53.64"
			N27°11'31.56"	E94°04'53.93"
			N27°11'29.43"	E94°03'57.82"

5	North Dikrong Sand, Gravel & Earth MPA	2.6	N27°7'24.36"	E93°48'52.14"
			N27°7'24.18"	E93°48'52.98"
			N27°7'23.64"	E93°48'56.46"
			N27°7'24.36"	E93°49'0.00"
			N27°7'25.56"	E93°49'3.24"
			N27°7'26.52"	E93°49'1.38"
			N27°7'27.30"	E93°48'57.60"
			N27°7'28.02"	E93°48'54.66"
			N27°7'26.82"	E93°48'52.08"
6	Kakoi MPA	2.50	**Copy enclosed as Annex-2**	
7	Kananadi Sand & Gravel MPA	1.0	**Copy enclosed as Annex-3**	
8	Tramjuli Sand & Gravel MPA	0.98	N27°03'19.4"	E93°46'17.4"
			N27°03'19.1"	E93°46'16.1"
			N27°02'58.7"	E93°46'24.6"
			N27°02'58.9"	E93°46'25.7"
9	Bogoli Sand & Gravel MPA	1.3	N27°07'56.3"	E93°51'44.1"
			N27°07'49.3"	E93°51'49.3"
			N27°07'53.5"	E93°51'46.9"
			N27°07'59.1"	E93°51'44.8"
			N27°07'56.3"	E93°51'44.1"
			N27°07'52.5"	E93°51'46.1"
			N27°07'50.7"	E93°51'49.3"
			N27°07'56.7"	E93°51'45.9"
			N27°07'59.2"	E93°51'43.2"
10	Upper Dikrong Sand & Gravel MPA	2.0	N27°07.502'	E93°48.681'
			N27°07.452'	E93°48.778'
			N27°07.474'	E93°48.828'
			N27°07.521'	E93°48.724'

11	Lower Dikrong-Parbatipur Sand & Gravel MPA	2.20	**Copy enclosed as Annex-4**	
12	Dhekianala Sand, Gravel & Earth MPA	2.2	N27°18.233'	E94°00.925'
			N27°18.197'	E94°00.876'
			N27°18.114'	E94°00.954'
			N27°18.153'	E94°01.001'
13	Dikrong Sand & Gravel MPA	2.0	**Copy enclosed as Annex-5**	
14	Ranganadi Earth MPA	4.5	N27°11'54.09"	E94°3'49.73"
			N27°11'57.32"	E94°3'52.69"
			N27°11'52.36"	E94°3'58.33"
			N27°11'47.89"	E94°3'2.85"
			N27°11'45.89"	E94°3'0.16"
			N27°11'49.61"	E94°3'55.49"
15	Ranganadi Sand & Gravel MPA	1.0	N27°17.573'	E94°01.876'
			N27°17.567 '	E94°01.870 '
			N27°17.562 '	E94°01.860 '
			N27°17.557 '	E94°01.847 '
			N27°17.559 '	E94°01.827 '
			N27°17.564 '	E94°01.811 '
			N27°17.575 '	E94°01.802 '
			N27°17.586 '	E94°01.796 '
			N27°17.594 '	E94°01.802 '
			N27°17.600 '	E94°01.809 '
			N27°17.607 '	E94°01.827 '
			N27°17.605 '	E94°01.845 '
			N27°17.602 '	E94°01.874 '
			N27°17.597 '	E94°01.882 '
			N27°17.597 '	E94°01.882 '
			N27°17.589 '	E94°01.883 '

			N27°17.582 '	E94°01.879 '
			N27°17.573 '	E94°01.876 '
16	Dikrong Chapori Sand, Gravel & Earth MPA	2.0	N27°05'59.72"	E93°50'42.99"
			N27°06'1.57"	E93°50'42.99"
			N27°05'54.58"	E93°50'52.27"
			N27°05'52.77"	E93°50'50.66"
17	Ranganadi Earth MPA	1.4	N27°12'1.62"	E94°03'46.69"
			N27°12'0.32"	E94°03'47.62"
			N27°11'58.33"	E94°03'48.95"
			N27°11'56.49"	E94°03'46.45"
			N27°11'58.25"	E94°03'44.46"
			N27°12'0.04"	E94°03'42.78"
18	Gomari Sand & Gravel MPA	3.0	N27°27'17.70"	E94°16'3.30"
			N27°27'20.06"	E94°16'6.41"
			N27°27'22.83"	E94°16'9.90"
			N27°27'19.27"	E94°16'12.86"
			N27°27'16.89"	E94°16'9.27"
			N27°27'14.81"	E94°16'6.17"
19	Bhimpara Sand & Gravel MPA	2.5	N27°25'45.56"	E94°14'58.40"
			N27°25'47.15"	E94°14'54.80"
			N27°25'41.07"	E94°14'50.75"
			N27°25'39.11"	E94°14'54.22"
20	Lower Dikrong Meneha Sand, Gravel & Boulder MPA	1.47	N27°04'56.64"	E93°54'21.27"
			N27°04'55.80"	E93°54'20.57"
			N27°04'54.43"	E93°54'19.48"
			N27°04'52.30"	E93°54'26.59"
			N27°04'51.19"	E93°54'25.86"
			N27°04'48.86"	E93°54'24.30"
			N27°04'47.71"	E93°54'23.55"

21	Lower Dikrong Pithaguri Sand & Gravel MPA	2.0	N27°05.328 '	E93°51.770 '
			N27°05.338 '	E93°51.794 '
			N27°05.331 '	E93°51.810 '
			N27°05.316 '	E93°51.830 '
			N27°05.294 '	E93°51.852 '
			N27°05.271 '	E93°51.872 '
			N27°05.244 '	E93°51.890 '
			N27°05.227 '	E93°51.902 '
			N27°05.216 '	E93°51.868 '
			N27°05.231 '	E93°51.849 '
			N27°05.263 '	E93°51.810 '
			N27°05.282 '	E93°51.795 '
			N27°05.303 '	E93°51.779 '
			N27°05.317 '	E93°51.772 '
			N27°05.330 '	E93°51.770 '
22	Upper Dikrong Bolder MPA	1.5	N27.12732°	E93.80834°
			N27.128372°	E93.806534°
			N27.127925°	E93.806018°
			N27.12686°	E93.80787°
23	Ranganadi River Bed Ordinary Clay MPA	1.2	N27.207228	E94.057042
			N27.207756	E94.056792
			N27.208483	E94.056431
			N27.208094	E94.055708
			N27.207511	E94.056022
			N27.206908	E94.056361
24	Ranganadi River Ordinary Clay MPA near Bogolijan.	1.3	N27°14'9.70"	E94°3'1.62"
			N27°14'9.73"	E94°3'4.68"
			N27°14'6.92"	E94°3'5.22"
			N27°14'4.71"	E94°3'5.65"

			N27°14'4.57"	E94°3'2.71"
			N27°14'6.79"	E94°3'2.25"
25	Ranganadi River Ordinary Clay MPA	2.5	N27°12'07.36"	E94°03'35.66"
			N27°12'09.44"	E94°03'38.52"
			N27°12'04.29"	E94°03'45.57"
			N27°12'02.11"	E94°03'42.99"
26	Ranganadi River Ordinary Clay MPA	1.67	N27°12'0.525"	E94°03'47.627"
			N27°12'2.011"	E94°03'52.113"
			N27°12'58.325"	E94°03'53.653"
			N27°12'56.709"	E94°03'48.743"
27	5No Pithaguri Sand & Gravel MPA	2.0	N27.087067°	E93.873756°
			N27.087876°	E93.873675°
			N27.088086°	E93.875831°
			N27.087190°	E93.875841°
28	Durpang (Lower) Sand & Gravel MPA	1.91	N27.036856	E93.781193
			N27.036645	E93.780405
			N27.034392	E93.781502
			N27.034559	E93.782083
29	Dikrong River Bagannalla MPA	1.82	N27.115943	E93.824605
			N27.115590	E93.824089
			N27.113889	E93.825035
			N27.114247	E93.825995
30	No.2 Chenimora Kongkur Gaon Ordinary Clay MPA (Plot-K)	39.43	N26°58'12.85"	E94° 1'20.23"
			N26°57'51.22"	E94° 1'14.81"
			N26°57'32.89"	E94° 0'57.60"
			N26°58'1.16"	E94° 0'57.18"
31	Subansiri River Ordinary Clay MPA.	21.58	N27.007858°	E94.045176°
			N27.005357°	E94.042130°
			N27.005866°	E94.039774°

			N27.004515°	E94.038464°
			N27.002094°	E94.042004°
			N27.007094°	E94.047173°
32	No.2 Chenimora Kongkur Gaon Ordinary Clay MPA (Plot-L)	2.64	N26°58'32.02"	E94° 1'53.68"
			N26°58'42.66"	E94° 1'54.22"
			N26°58'43.28"	E94° 1'46.99"
			N26°58'40.83"	E94° 1'48.29"
			N26°58'39.67"	E94° 1'50.91"
33	Dhunabari Gaon Ordinary Clay MPA (Plot-E)	5.03	N27°0'10.30"	E94° 1'0.10"
			N27°0'14.95"	E94° 1'5.93"
			N27°0'8.56"	E94° 1'11.34"
			N27°0'4.56"	E94° 1'4.93"
34	Dhunabari Gaon Ordinary Clay MPA (Plot-F,G,H&I)	3.68	**Plot-F** N27°0'26.690"	E94° 1'22.120"
			N27°0'24.990"	E94° 1'23.060"
			N27°0'25.680"	E94° 1'26.500"
			N27°0'28.040"	E94° 1'25.180"
			Plot-G N27°0'28.700"	E94° 1'25.730"
			N27°0'30.750"	E94° 1'28.920"
			N27°0'26.000"	E94° 1'27.530"
			N27°0'27.950"	E94° 1'31.030"
			Plot-H N27°0'31.840"	E94° 1'29.900"
			N27°0'32.710"	E94° 1'33.450"
			N27°0'30.210"	E94° 1'35.980"
			N27°0'29.010"	E94° 1'31.580"
			Plot-I N27°0'33.150"	E94° 1'34.610"

			N27°0'35.250"	E94° 1'37.670"
			N27°0'32.680"	E94° 1'39.700"
			N27°0'30.500"	E94° 1'37.090"
35	Ranganadi Sand & Gravel MPA	4.84	**Copy enclosed as Annex-6**	
36	Kananadi Sand & Gravel MPA	0.53	**Copy enclosed as Annex-7**	
37	Kathalguri Sand & Gravel MPA	2.0	N27.068385	E93.918070
			N27.067979	E93.917334
			N27.065840	E93.918420
			N27.066156	E93.919034

Ghagor MPA			
38	SL No.	Latitude	Longitude
	1	27° 18' 16.09" N	94° 0' 53.55" E
	2	27° 18' 16.50" N	94° 1' 0.78" E
	3	27° 18' 14.84" N	94° 1' 2.89" E
	4	27° 18' 12.50" N	94° 1' 5.37" E
	5	27° 18' 9.81" N	94° 1' 9.41" E
	6	27° 18' 8.64" N	94° 1' 13.16" E
	7	27° 18' 6.21" N	94° 1' 16.36" E
	8	27° 18' 3.63" N	94° 1' 18.91" E
	9	27° 18' 1.32" N	94° 1' 20.49" E
	10	27° 17' 58.45" N	94° 1' 21.52" E
	11	27° 17' 56.78" N	94° 1' 22.79" E
	12	27° 17' 55.31" N	94° 1' 19.83" E
	13	27° 17' 58.33" N	94° 1' 19.41" E
	14	27° 18' 1.51" N	94° 1' 18.28" E
	15	27° 18' 4.43" N	94° 1' 15.29" E
	16	27° 18' 7.32" N	94° 1' 12.35" E
	17	27° 18' 8.81" N	94° 1' 8.90" E
	18	27° 18' 11.64" N	94° 1' 5.01" E
	19	27° 18' 15.51" N	94° 1' 0.51" E
	20	27° 18' 13.52" N	94° 0' 54.41" E
	(Ghagor MPA)		
39	SL No.	Latitude	Longitude
	1	27° 27.862' N	94° 13.542' E
	2	27° 27.864' N	94° 13.545' E
	3	27° 27.863' N	94° 13.550' E

	4	27° 27.862' N	94° 13.554' E
	5	27° 27.859' N	94° 13.557' E
	6	27° 27.855' N	94° 13.559' E
	7	27° 27.850' N	94° 13.558' E
	8	27° 27.848' N	94° 13.558' E
	9	27° 27.847' N	94° 13.557' E
	10	27° 27.847' N	94° 13.555' E
	11	27° 27.847' N	94° 13.553' E
	12	27° 27.843' N	94° 13.551' E
	13	27° 27.840' N	94° 13.554' E
	14	27° 27.837' N	94° 13.556' E
	15	27° 27.837' N	94° 13.556' E
	16	27° 27.834' N	94° 13.559' E
	17	27° 27.831' N	94° 13.561' E
	18	27° 27.802' N	94° 13.559' E
	19	27° 27.801' N	94° 13.559' E
	20	27° 27.800' N	94° 13.555' E
	21	27° 27.800' N	94° 13.555' E
	22	27° 27.801' N	94° 13.553' E
	23	27° 27.800' N	94° 13.548' E
	24	27° 27.802' N	94° 13.547' E
	25	27° 27.802' N	94° 13.547' E
	26	27° 27.804' N	94° 13.547' E
	27	27° 27.810' N	94° 13.546' E
	28	27° 27.811' N	94° 13.543' E
	29	27° 27.807' N	94° 13.541' E
	30	27° 27.805' N	94° 13.539' E
	31	27° 27.804' N	94° 13.538' E
	32	27° 27.804' N	94° 13.535' E
	33	27° 27.804' N	94° 13.533' E
	34	27° 27.804' N	94° 13.531' E
	35	27° 27.805' N	94° 13.528' E
	(Kakoi MPA)		
40	SL No.	Latitude	Longitude
	1	27° 19' 30.6" N	94° 05' 19.7" E
	2	27° 19' 30.3" N	94° 05' 19.8" E
	3	27° 19' 29.9" N	94° 05' 19.9" E
	4	27° 19' 29.3" N	94° 05' 20.0" E
	5	27° 19' 28.7" N	94° 05' 20.2" E
	6	27° 19' 28.3" N	94° 05' 20.2" E
	7	27° 19' 28.0" N	94° 05' 19.9" E
	8	27° 19' 28.0" N	94° 05' 19.2" E
	9	27° 19' 27.9" N	94° 05' 18.4" E
	10	27° 19' 28.3" N	94° 05' 17.4" E
	11	27° 19' 28.7" N	94° 05' 16.4" E

	12	27° 19' 29.0" N	94° 05' 15.5" E
	13	27° 19' 29.3" N	94° 05' 14.2" E
	14	27° 19' 29.9" N	94° 05' 13.1" E
	15	27° 19' 30.6" N	94° 05' 12.1" E
	16	27° 19' 31.2" N	94° 05' 11.6" E
	17	27° 19' 31.8" N	94° 05' 11.2" E
	18	27° 19' 32.6" N	94° 05' 10.6" E
	19	27° 19' 33.2" N	94° 05' 09.7" E
	20	27° 19' 33.7" N	94° 05' 09.1" E
	21	27° 19' 34.2" N	94° 05' 08.6" E
	22	27° 19' 34.4" N	94° 05' 08.9" E
	23	27° 19' 34.7" N	94° 05' 09.5" E
	24	27° 19' 34.9" N	94° 05' 10.7" E
	25	27° 19' 33.8" N	94° 05' 12.0" E
	26	27° 19' 33.1" N	94° 05' 12.9" E
	27	27° 19' 32.4" N	94° 05' 13.7" E
	28	27° 19' 32.1" N	94° 05' 14.2" E
	29	27° 19' 31.7" N	94° 05' 15.0" E
	30	27° 19' 31.4" N	94° 05' 16.0" E
	31	27° 19' 31.1" N	94° 05' 16.9" E
	32	27° 19' 31.2" N	94° 05' 17.4" E
	33	27° 19' 31.2" N	94° 05' 18.0" E
	34	27° 19' 31.1" N	94° 05' 18.7" E
	35	27° 19' 30.9" N	94° 05' 19.4" E
	36	27° 19' 30.6" N	94° 05' 19.8" E
	(Kananadi MPA)		
	SL No.	Latitude	Longitude
41	1	27° 25' 59.69" N	94° 12' 37.76" E
	2	27° 25' 59.32" N	94° 12' 38.25" E
	3	27° 25' 58.46" N	94° 12' 39.57" E
	4	27° 25' 58.23" N	94° 12' 40.50" E
	5	27° 25' 56.90" N	94° 12' 41.81" E
	6	27° 25' 55.55 N	94° 12' 41.83" E
	7	27° 25' 53.87" N	94° 12' 42.57" E
	8	27° 25' 52.76" N	94° 12' 42.66" E
	9	27° 25' 51.97" N	94° 12' 42.74" E
	10	27° 25' 50.88" N	94° 12' 43.36" E
	11	27° 25' 50.72" N	94° 12' 44.63" E
	12	27° 25' 49.30" N	94° 12' 45.00" E
	13	27° 25' 48.36" N	94° 12' 45.03" E
	14	27° 25' 49.16" N	94° 12' 44.00" E
	15	27° 25' 50.08" N	94° 12' 42.60" E
	16	27° 25' 51.15" N	94° 12' 42.15" E
	17	27° 25' 51.78" N	94° 12' 41.69" E
	18	27° 25' 53.22" N	94° 12' 41.79" E

	19	27° 25' 55.05" N	94° 12' 40.92" E
	20	27° 25' 55.87" N	94° 12' 40.95" E
	21	27° 25' 57.06" N	94° 12' 40.76" E
	22	27° 25' 58.23" N	94° 12' 39.49" E
	23	27° 25' 59.40" N	94° 12' 37.42" E
	24	27° 25' 59.69" N	94° 12' 37.76" E
	(Lower Dikrong- Parbotipur)		
	SL No.	Latitude	Longitude
	1	27° 05' 59.20" N	93° 50' 36.10" E
	2	27° 05' 59.50" N	93° 50' 36.30" E
	3	27° 05' 59.80" N	93° 50' 36.60" E
	4	27° 06' 00.30" N	93° 50' 37.00" E
	5	27° 06' 00.70" N	93° 50' 37.30" E
	6	27° 06' 00.50" N	93° 50' 38.00" E
	7	27° 06' 00.30" N	93° 50' 38.70" E
	8	27° 06' 00.00" N	93° 50' 39.70" E
	9	27° 05' 59.60" N	93° 50' 40.70" E
	10	27° 05' 59.40" N	93° 50' 41.40" E
	11	27° 05' 58.80" N	93° 50' 42.50" E
	12	27° 05' 58.20" N	93° 50' 43.50" E
	13	27° 05' 58.20" N	93° 50' 43.50" E
	14	27° 05' 57.70" N	93° 50' 44.40" E
	15	27° 05' 57.20" N	93° 50' 45.60" E
	16	27° 05' 57.00" N	93° 50' 46.10" E
	17	27° 05' 56.80" N	93° 50' 46.90" E
	18	27° 05' 56.80" N	93° 50' 47.50" E
	19	27° 05' 56.30" N	93° 50' 47.60" E
	20	27° 05' 55.80" N	93° 50' 47.50" E
	21	27° 05' 55.30" N	93° 50' 47.40" E
	22	27° 05' 55.20" N	93° 50' 46.60" E
	23	27° 05' 55.30" N	93° 50' 45.50" E
	24	27° 05' 55.70" N	93° 50' 44.10" E
	25	27° 05' 56.20" N	93° 50' 42.80" E
	26	27° 05' 56.70" N	93° 50' 41.70" E
	27	27° 05' 57.30" N	93° 50' 40.50" E
	28	27° 05' 57.70" N	93° 50' 39.60" E
	29	27° 05' 58.00" N	93° 50' 38.80" E
	30	27° 05' 58.40" N	93° 50' 37.90" E
	31	27° 05' 58.80" N	93° 50' 36.90" E
	32	27° 05' 59.10" N	93° 50' 36.10" E
	(Dikrong MPA)		
	SL No.	Latitude	Longitude
42	1	27° 06.492' N	93° 50.176' E
	2	27° 06.444' N	93° 50.163' E
	3	27° 06.450' N	93° 50.158' E

	4	27° 06.459' N	93° 50.147' E
	5	27° 06.468' N	93° 50.138' E
	6	27° 06.478' N	93° 50.128' E
	7	27° 06.485' N	93° 50.120' E
	8	27° 06.493' N	93° 50.111' E
	9	27° 06.498' N	93° 50.103' E
	10	27° 06.504' N	93° 50.095' E
	11	27° 06.510' N	93° 50.089' E
	12	27° 06.517' N	93° 50.082' E
	13	27° 06.523' N	93° 50.074' E
	14	27° 06.527' N	93° 50.067' E
	15	27° 06.532' N	93° 50.056' E
	16	27° 06.538' N	93° 50.046' E
	17	27° 06.534' N	93° 50.038' E
	18	27° 06.524' N	93° 50.031' E
	19	27° 06.517' N	93° 50.028' E
	20	27° 06.509' N	93° 50.033' E
	21	27° 06.499' N	93° 50.041' E
	22	27° 06.489' N	93° 50.053' E
	23	27° 06.483' N	93° 50.060' E
	24	27° 06.472' N	93° 50.070' E
	25	27° 06.464' N	93° 50.080' E
	26	27° 06.455' N	93° 50.091' E
	27	27° 06.447' N	93° 50.101' E
	28	27° 06.440' N	93° 50.113' E
	29	27° 06.432' N	93° 50.122' E
	30	27° 06.423' N	93° 50.135' E
	31	27° 06.415' N	93° 50.146' E
	32	27° 06.407' N	93° 50.154' E
	33	27° 06.404' N	93° 50.160' E
	34	27° 06.407' N	93° 50.166' E
	35	27° 06.412' N	93° 50.173' E
	36	27° 06.420' N	93° 50.179' E
	37	27° 06.430' N	93° 50.176' E

14. TABLE - II

(Details of MCA in Lakhimpur)

Sl. No.	Name of MCA	Area (in Ha.)	GPS co-ordinate	
1	**Lower Subansiri Sand & Gravel MCA**	24	N27°27.317'	E94°15.355'
			N27°27.432 '	E94°15.464 '
			N27°27.536 '	E94°15.631 '
			N27°27.618 '	E94°15.792 '
			N27°27.721 '	E94°15.782 '
			N27°27.859 '	E94°15.778 '
			N27°27.919 '	E94°15.689 '
			N27°27.731 '	E94°15.621 '
			N27°27.507 '	E94°15.481 '
			N27°27.392 '	E94°15.290 '
2	**Bhimpara Sand, Gravel & Earth MCA**	9	N27°26'15.60"	E94°15'18.20"
			N27°26'15.60"	E94°15'13.70"
			N27°26'11.88"	E94°15'10.58"
			N27°26'8.09"	E94°15'6.84"
			N27°26'4.52"	E94°15'3.25"
			N27°26'2.41"	E94°15'8.30"
			N27°26'0.77"	E94°15'12.95"
			N27°26'2.80"	E94°15'13.80"
			N27°26'8.17"	E94°15'15.65"
3	**Joyhing Sand & Gravel MCA**	4.5	N27°19'45.00"	E94°2'28.80"
			N27°19'43.81"	E94°2'27.10"

			N27°19'40.50"	E94°2'29.75"
			N27°19'31.23"	E94°2'25.63"
			N27°19'24.13"	E94°2'23.09"
			N27°19'25.13"	E94°15'8.55"
			N27°19'26.10"	E94°15'12.80"
			N27°19'32.37"	E94°15'13.47"
4	**Kakoi Sand, Gravel & Earth MCA**	6	N27°20'32.18"	E93°4'6.27"
			N27°20'33.27"	E93°4'8.73"
			N27°20'27.49"	E93°4'14.06"
			N27°20'18.00"	E93°4'22.80"
			N27°20'19.54"	E93°4'24.08"
			N27°20'24.98"	E93°4'12.62"
5	**Ranganadi Sand & Gravel MCA**	4.95	N27°17'49.13"	E94°01'31.39"
			N27°17'44.09"	E94°01'30.28"
			N27°17'43.80"	E94°01'34.83"
			N27°17'42.55"	E94°01'42.76"
			N27°17'48.60"	E94°01'42.50"
			N27°17'47.95"	E94°01'35.60"
6	**Dirgha Sand, Gravel & Earth MCA**	4.84	N27°2.686'	E94°06.843'
			N27°2.561'	E94°06.861'
			N27°2.520'	E94°06.760'
			N27°2.606'	E94°06.708'
7	**Boginadi Gravel MCA**	8.8	N27°23'41.81"	E94°8'10.66"
			N27°23'40.35"	E94°8'6.58"
			N27°23'38.7"	E94°8'2.50"
			N27°23'32.15"	E94°8'5.76"
			N27°23'26.50"	E94°8'9.40"
			N27°23'27.83"	E94°8'12.47"
			N27°23'29.10"	E94°8'15.42"
			N27°23'34.75"	E94°8'12.61"

8	**Lower Dikrong Sand & Gravel MCA**	6	N27.102619°	E93.845252°
			N27.101475°	E93.844794°
			N27.101314°	E93.849091°
			N27.100000°	E93.848528°
9	**Bogoli Sand & Gravel MCA**	3	N27.140208°	E93.85773°
			N27.140320°	E93.858191°
			N27.141185°	E93.857795°
			N27.141986°	E93.857601°
			N27.143300°	E93.857533°
			N27.144717°	E93.857718°
			N27.145536°	E93.858116°
			N27.146046°	E93.858194°
			N27.146093°	E93.857669°
			N27.145267°	E93.857639°
			N27.143744°	E93.857051°
			N27.143024°	E93.856946°
			N27.141962°	E93.857062°
10	**Durpang Sand & Gravel MCA**	5.2	N27°2'43.94"	E93°46'22.03"
			N27°2'42.42"	E93°46'16.66"
			N27°2'34.36"	E93°46'28.54"
			N27°2'36.21"	E93°46'33.48"
11	**North Dikrong Sand & Gravel MCA**	4.91	N27.121803°	E93.821242°
			N27.121842°	E93.820364°
			N27.117078°	E93.821398°
			N27.117294°	E93.822454°
12	**Singra Sand & Gravel MCA**	6	N27°14'51.2"	E93°56'37.8"
			N27°14'51.3"	E93°56'37.7"
			N27°14'50.8"	E93°56'41.6"
			N27°14'45.4"	E93°56'45.0"

13	**Dikrong Sand & Gravel MCA**	6.2	N27°06'18.6"	E93°19'12.2"
			N27°06'38.3"	E93°19'36.0"
			N27°06'38.8"	E93°19'51.3"
			N27°06'34.6"	E93°19'58.7"

Dullung Reserved Forest MCA:

Ghagor Mining Contract Area					
Sl No.	Longitude	Latitude	Sl No.	Longitude	Latitude
1	94.220892	27.456726	18	94.214242	27.468637
2	94.220453	27.458292	19	94.214686	27.468329
3	94.219876	27.459209	20	94.215068	27.467471
4	94.218283	27.460178	21	94.215367	27.467305
5	94.218067	27.461354	22	94.215783	27.467329
6	94.21844	27.462197	23	94.216403	27.467021
7	94.21824	27.462825	24	94.216494	27.4664232
8	94.217083	27.464199	25	94.216131	27.465953
9	94.21714	27.465209	26	94.216584	27.46518
10	94.216887	27.46539	27	94.216598	27.463981
11	94.216638	27.46614	28	94.217418	27.46302
12	94.217023	27.466826	29	94.217623	27.462324
13	94.216899	27.467092	30	94.217462	27.460595
14	94.215875	27.467637	31	94.21802	27.459496
15	94.215148	27.467977	32	94.218804	27.459207
16	94.215051	27.468462	33	94.220073	27.457653
17	94.214677	27.468705	34	94.220095	27.456535
Approach Road					
Sl No.	Longitude	Latitude	Sl No.	Longitude	Latitude
1	94.22087	27.456712	10	94.222047	27.455594
2	94.220879	27.455636	11	94.221895	27.455745
3	94.221023	27.455512	12	94.221589	27.455636
4	94.221154	27.455481	13	94.221454	27.45554
5	94.221324	27.455556	14	94.221336	27.455522
6	94.221438	27.455568	15	94.221159	27.455448
7	94.221575	27.455667	16	94.221009	27.455484
8	94.221901	27.455786	17	94.220846	27.455627
9	94.222057	27.455623	18	94.220834	27.456705

Ranga Reserved Forest MCA:

9.0 Ha. Kimin Mining Contract Area		
Sl No.	Latitude	Longitrude
1	N27.294602°	E94.003933°
2	N27.295334°	E94.005064°
3	N27.296536°	E94.007527°
4	N27.297894°	E94.008771°
5	N27.298453°	E94.009701°
6	N27.299077°	E94.009097°
7	N27.297833°	E94.006814°
8	N27.296471°	E94.005619°
9	N27.295223°	E94.003399°
10	N27.294584°	E94.001659°
11	N27.293863°	E94.002042°
0.16 Ha. Approach Road		
Sl No.	GPS Coordinates	
1	N27.294645°	E94.004007°
2	N27.293921°	E94.003980°
3	N27.292562°	E94.003964°
4	N27.292090°	E94.003895°
5	N27.291728°	E94.003818°
6	N27.291597°	E94.003800°
7	N27.291207°	E94.003762°
8	N27.291061°	E94.003721°
9	N27.291072°	E94.003687°
10	N27.291213°	E94.003727°
11	N27.291604°	E94.003761°
12	N27.291738°	E94.003778°
13	N27.292095°	E94.003859°
14	N27.292563°	E94.003926°
15	N27.293913°	E94.003939°
16	N27.294622°	E94.003970°

15. Revenue Collection for last three years against MCA & MPA

Sl. No.	Name of Mine	Area (ha)	Revenue Realised in Rs. (2021-2022)	(2022-2023)	(2023-2024)
01	Durpang Sand and Gravel MCA	5.2	21,25,000.00	21,25,000.00	19,18,416.00
02	Lower Subansiri Sand & Gravel MCA	24	81,64,287.00	1,08,85,716.00	1,08,85,716.00 .
03	Dirgha Sand, Gravel & Earth MCA	4.84	6,71,315.00	6,67,721.00	8,04,844.00
04	Kakoi Sand, Gravel & Earth MCA	4.5	2,55,423.00	2,50,008.00	2,50,008.00
05	Ranganadi Sand& Gravel MCA	4.95	32,50,052.00	63,49,812.00	75,87,755.00
06	Joyhing Sand& Gravel MCA	4.46	6,93,571.00	27,74,284.00	28,19,176.00
07	Bogoli Sand& Gravel MCA	3	10,45,786.00	31,37,358.00	41,83,144.00
08	Lower Dikrong Sand& Gravel MCA	6	-	43,14,286.00	86,76,740.00
09	Bhimpara Sand, Gravel & Earth MCA	7.5	9,58,333.00	47,91,667.00	86,25,000.00
10	North Dikrong Sand& Gravel MCA	5	2,04,34,807.00	75,72,140.00	-
11	Boginadi Gravel MCA	8.8	-	11,55,000.00	-
12	Dikrong Sand& Gravel MCA	6.2	16,76,337.00	-	-
13	Boginadi Sand, Gravel & Earth MCA	4.5	3,42,661.00	-	-
14	Bhimpara Sand& Gravel MCA	9	8,81,590.00	-	-
15	Upper Dikrong Sand& Gravel MPA	2	1,51,740.00	-	-
16	Bogoli Sand& Gravel MPA	1.3	28,960.00	-	-
17	Gomari Sand& Gravel MPA	3	5,24,000.00	1,00,000.00	-
18	Lower Dikrong Meneha Sand, Gravel & Earth MPA	1.47	-	12,66,000.00	4,28,000.00
19	Kakoi Earth MPA	2.5	1,50,000.00	-	-
20	Lower Dikrong Pithaguri Sand, Gravel & Earth MPA	2	-	2,38,000.00	84,000.00
21	Ranganadi Earth MPA	1.4	1,08,180.00	3,42,900.00	-
22	Dikrong Chapori Sand, Gravel & Earth MPA	2	1,70,000.00	21,32,120.00	-

23	Dijoo Chapori PP Land Sand, Gravel & Earth MPA	1.38	-	6,45,000.00	2,41,500.00
24	Ranganadi River Earth MPA	2.5	-	8,40,000.00	-
25	Ranganadi River Ordinary Clay MPA	1.2	-	-	3,33,000.00
26	Ranganadi River Earth MPA	1.3		90,000.00	3,27,000.00
27	Bhimpara Sand& Gravel MPA	2.5	-	2,70,000.00	-
28	Upper Dikrong Boulder MPA	1.5	-	4,40,000.00	80,000.00
29	Tramjuli Sand& Gravel MPA	0.9	-	2,96,000.00	89,000.00
30	Subansiri River Ordinary Clay MPA	21.56	-	-	15,00,000.00
31	Dikrong River Bagan Nallah MPA	1.82	-	-	1,40,000.00
32	Ranganadi Sand& Gravel MPA	4.95	-	-	19,10,000.00
33	5 no. Pithaguri Sand& Gravel MPA	2	-	-	3,61,111.00
34	Dhunabari Gaon Ordinary Clay MPA	3.68	-	-	10,20,780.00
35	Durpang (Lower) Sand& Gravel MPA	1.91	-	-	90,050.00
36	Third Schedule Royalty		-	**1,37,63,980.00**	6,48,30,036.00
		Total	**4,16,32,042.00**	**6,44,46,992.00**	**11,71,85,276.00**

Last 3 (three) years minor mineral seized, vehicle seized & revenue realized.

Sl. No.	Year	Gravel (in M³)	Sand (in M³)	Earth (in M³)	Total offence drawn	Vehicle seized	Total revenue realized (in Rs.)
1	2021-22	877.25	380	308	159	158	69,10,038
2	2022-23	471	414	1908.07	198	192	1,15,45,430
3	2023-24	2658.81	2389.65	15589.262	220	193	1,37,21,199
	Total	**4007.06**	**3183.65**	**17805.332**	**577**	**543**	**3,21,76,667**

16. Geology of Assam:

Introduction

Assam, located in the northeastern part of India, is geologically diverse, encompassing a range of geological formations that reflect its complex tectonic history. Assam geological province is an onshore province covering approximately 78,438 km2. The geological province is bounded to the north by the Brahmaputra valley bordering Arunachal Pradesh, to the west by the West Bengal and Bangladesh plains, and to the south and east by the Indo-Burma Ranges and the Central Burma Basin. Major features within the Assam geological province include the Assam Shelf, Brahmaputra River valley, the Barak Valley, parts of the Shillong Plateau, Mikir Hills, and a foreland portion of the Indian Shield. The Assam Shelf consists of a portion of the Paleocene to Eocene continental shelf of the Indian plate which became emergent and which is being overthrust by the Himalayas to the northwest and by the Burma micro-plate to the southeast.

Geotectonic evolution of Assam

Geological province of Assam has passed through five important phases during its geological history. The first of these relates to when it was a part of the Gondwana Supercontinent. The second phase came in the Permo- Carboniferous, when its adjoining areas were rifted and the coal-bearing Gondwana was deposited. This phase seems to have been accompanied locally by some volcanic activity and the area was still a part of the Gondwanaland. The third phase came in Late Triassic/Early Jurassic when, with the drifting away of Southern Tibet, the northern fringe of India including the part that is now Assam became open to marine Sedimentation. The Sung Valley Carbonatite intrusion took place during this period. The fourth phase started when the eastern boundary also broke apart in Late Jurassic-Early Cretaceous and the southern and eastern shores of Assam became open to marine sedimentation. This phase also saw the beginning of some igneous activity with the outpouring of Garo Hills, Sylhet, and Mikir Hills Traps (basalts), and the formation of a number of basic and ultrabasic intrusives.

The fifth phase started with its collision with Myanmar to the east and Tibet to the north around Early Eocene and continued with all the stages of collision tectonics thereafter. During this phase, the entire land was caught up, as in a vice, between the two collision zones. The Mishmi Hills added a third compressional force from the northeast and subsequently a major uplift of the Shillong Plateau-Mikir Hills also contributed.

Stratigraphy

The lithology of Assam comprises (a) Proterozoic Gneissic Complex, (b) Palaeo-Mesoproterozoic Shillong Group of rocks, (c) Granite Plutons of Neo-Proterozoic−Lower Palaeozoic age, (d) Lower Gondwana sedimentary rocks of Permo-carboniferous age, (e) Alkali Complexes of Samchampi and volcanic rocks represented by Sylhet Trap of Cretaceous age, (f) Lower Tertiary (Paleocene-Eocene) shelf sediments of the Jaintia Group extending along the southern and eastern flanks of Mikir Hills and geosynclinals sediments of Disang Group in parts of the North Cachar Hills, (g) Upper Tertiary (Oligocene to Pliocene) shelf and General Geology and Stratigraphy geosynclinal sediments covering the southern flanks of Mikir Hills, the North Cachar Hills and the hills of the Cachar district in the Surma valley area. These rocks are also exposed along the northern foothills of Naga-Patkai range. Along the southern foothills of Eastern Himalaya facing the northern border of Assam a narrow strip of Siwalik rocks are exposed, (h) the Quaternary deposits comprising of Older and Newer Alluvium occur in flood plains and terraces of the Brahmaputra valley, Surma valley and other river basins of Assam.

The stratigraphic set-up of Assam geological province is as follows:

Age	Group Name	Formation (Thickness)	Lithology
Holocene	Unclassified	Newer or Low Level Alluvium	Sand, silt and clay
Middle to Upper Pleistocene	Unclassified	Older Alluvium	boulder deposit
---Unconformity/Tectonic------------------------------------			
Pliocene-Pleistocene	Siwalik Group	Kimin Formation	Sandstone with clay stone
		Subansiri	Micaceous sandstone
Pliocene	Dihing Group	Dihing Formation (900m)	Pebble beds, soft sandy clay,
---Unconformity---			
Mio-Pliocene	Dupitila Group	Dupitila Formation (Surma Valley: 3300 m)	Sandstone, mottled clay, grit and conglomerate; locally with beds of coal, conglomerate and poorly consolidated sandstone with layers and pockets of

Age	Group Name	Formation (Thickness)	Lithology
			pebbles
		Namsang Formation	Coarse, gritty, poorly consolidated sandstone and conglomerate of coal pebbles
---Unconformity---			
Mio-Pliocene	Tipam Group	Girujan Clay Formation (1800 m)	Mottled clays, sandy shale and subordinate mottled, coarse to gritty sandstone
		Tipam Sandstone Formation (2300 m)	Bluish grey to greenish, coarse to gritty, false bedded, ferruginous sandstone, clays, shales and conglomerates
---Unconformity---			
Miocene	Surma Group	Bokabil Formation (900 to 1800 m)	shale, sandy Shale, siltstone, mudstone and lenticular, coarse ferruginous sandstone
		Bhuban Formation (1400 to 2400 m)	Alternations of sandstone and sandy shale and thin conglomerate, argillaceous in middle part
---Unconformity---			
Eocene-Oligocene	Barail Group	Renji Formation (600 to 1000 m)	Massive bedded sandstone; its equivalent - the Tikak Parbat Formation in the Upper Assam is marked by thick coal seam in basal part
		Jenam Formation (1000 to 3300 m)	Shale, sandy shale, and carbonaceous shales with interbedded hard sandstone; its equivalent the Bargolai Formation in Upper Assam is marked by

Age	Group Name	Formation (Thickness)	Lithology
			thin coal seams
		Laisong Formation (2000 to 2500 m)	Well bedded compact flaggy sandstone and subordinate shale; its equivalent- the Nagaon Formation in Upper Assam is marked by thin bedded, hard sandstone and interbedded shale.
	Disang Group		Splintery dark grey shale and thin sandstone
Palaeocene -Eocene	Jaintia Group	Kopili Formation	Shale, sandstone and marl.
		Shella Formation	Sylhet Limestone (Fossiliferous Limestone) Sylhet sandstone Sandstone, clay and thin coal seam
		Langpar Formation	Calcareous shale, sandstone-Limestone
-- Unconformity --			
Cretaceous	Alkali Complex of Samchampi		Pyroxenite – Serpentinite with abundant development of melilite pyroxene rock, ijolite, syenite and carbonatite
-- Unconformity --			
Cretaceous		Sylhet Trap (exposed in Meghalaya) (600m)	Basalt, alkali basalt, rhyolite, acid tuff
-- Unconformity --			
Permo-carboniferous	Lower Gondwana	Kaharbari Formation	Very coarse to coarse grained sandstone with conglomerate lense, shale, carbonaceous shale and

Age	Group Name	Formation (Thickness)	Lithology
			coal
		Talchir Formation	Basal tillite, conglomerate with sandstone bands, siltstone and shale
-- Unconformity --			
Neo-Proterozoic - Early Palaeozoic	Granite Plutons		Porphyritic coarse granite, pegmatite, aplite, quartz vein traversed by epidiorite, dolerite
-- Intrusive contact --			
Palaeo-Meso Proterozoic	Shillong Group		Quartzite, phyllite, quartz – sericite schist, conglomerate
-- Unconformity --			
Archaean (?)Proterozoic	Gneissic Complex		Complex metamorphic group comprising ortho and para gneisses and schists, migmatites granulites etc. Later intruded acidic and basic intrusives.

PRECAMBRIAN ROCKS

A. Gneissic Complex:

The crustal material of the Precambrian outcrops in Assam exposed in the Mikir Hills, at the fringes of the Shillong Plateau adjoining Meghalaya State. It also forms isolated inselbergs jutting out of the Quaternary plains, straddling both sides of the Brahmaputra river Valley. Elsewhere, the surface of this Precambrian landmass slopes down into basinal depressions and constitutes the basement for their sedimentary cover. Some of these are very minor and are filled with recent alluvium; the others are major features covered by sediments ranging in age from the Cretaceous to the present day Alluvium.

The Gneissic Complex comprises of gneiss, schist, migmatitic rocks intruded by younger acidic (granite, aplite, pegmatite) and basic (metadolerite, epidiorite, amphibolite) rocks. The rocks of the Gneissic Complex exposed in parts of Goalpara, Kamrup districts and in northern part of North Cachar Hills and Nagaon districts including the isolated inselbergs in the Brahmaputra Basin, mainly consist of biotite, and biotite-hornblende gneisses with bands of granulites and bosses of intrusive granites, pegmatites, quartz veins and minor basic bands.

In the Mikir Hills, the rock types vary from coarse grained, porphyritic granite to foliated biotite-granites and seem to be associated with fine grained banded foliated gneisses, schists and granulites with intrusive pegmatite, quartz veins and basic sills and dykes. The structural framework of the gneissic complex and its history of evolution combined with associated intrusives are complex issues. Effects of polyphase deformation and intrusion are indicated from several places. These rocks have undergone regional metamorphism of amphibolite-granulite facies from place to place and have given rise to gneisses, schists and some granulites.

B. Shillong Group :

The Gneissic Complex is unconformably overlain by the Shillong Group of rocks of Palaeo-Mesoproterozoic age. These rocks mainly comprise of conglomerate and metasedimentaries like quartzite, phyllite, schist association. In Assam, the rocks of Shillong Group are exposed along the western and northern part of the Mikir Hills across the Kopili valley. These rocks are metamorphosed to greenschist facies condition. Intrusion by granite plutons in Shillong Group exhibits contact metamorphism. The continuity of the Gneissic Complex and the Shillong Group across the Kopili valley in a roughly collinear trend suggests the continuity of the rocks from the Shillong Plateau is possibly separated by the Kopili lineament.

C. Granite Pluton:

A number of granite bodies transect both Gneissic Complex and Shillong Group. In Mikir Hills area, two types of granite occur, a) nonporphyritic foliated medium to coarse grained pink granite, occurring in the central part and b) porphyritic granite encircling the non-porphyritic granite. It is seen that these two granites evolved in separate phases of intrusions which is less studied. Also, these granite bodies have been exposed in the central and western part of the Assam covering the northern fringe of the Shillong plateau and few isolated inselbergs jutting out of the Quaternary plains which are straddling both sides of the Brahmaputra basins.

PALEOZOIC-MESOZOIC ROCKS

D. Lower Gondwana Group:

The occurrence of Lower Gondwana rocks are exposed in Singrimari area along the Meghalaya border in the extreme western corner of Assam. Fox (1934) reported plant fossils and coal from these beds, based on which he concluded Gondwana affinity. Acharyya and Ghosh (1968) grouped the entire sequence into Karharbari Formation (Permian). De and Boral (1978) further differentiated these sediments lithostratigraphically into the Talchir and Karharbari Formations.

E. Alkali Complex of Samchampi:

Alkaline mafic-ultramafic-carbonatite complex at Samchampi is emplaced within granitic host rock. The rock types include mainly a variety of syenites which cover large part of the area, mafic rocks which include alkaline pyroxenite, shonkinite, biotite pyroxenite, ultramafics (ijolite, melteigite), apatite-hematite-magnetite rock, carbonatite and cherty rocks. Carbonatite occurs mainly in the northern and eastern peripheral parts of the complex as dykes. At places, they laterally grade into mafics and ultramafic rocks and occasionally contain partly digested xenoliths of syenites and mafic-ultramafic rocks. Carbonatite bodies with associated rhyolite flows have been found along Brik nala, south of Matikhola Parbat in Mikir Hills. This occurrence resembles the carbonatite complex of Sung valley in Meghalaya.

F. Sylhet Trap:

Direct evidence of Cretaceous basaltic lava flows and intrusive from Assam is limited to the Mikir Hills area. Sylhet traps are well exposed in the Um Sohringknew and a no. of places of Shillong Plateau. Patchy occurrences of basaltic lava flows presumably belonging to Sylhet suite of Meghalaya have been reported from vicinity of Koilajan and its neighborhood, and in the Puja Nala in Mikir Hills of Assam. The outcrop shows highly weathered and altered chert/olive green trap rocks overlying the gneisses. About 67m of lava flows, with thin intertrappean bed has also been encountered in the Barapathar oil well drilled by Oil and Natural Gas Corporation (ONGC). Palynofossils obtained from the section suggests an early Cretaceous age.

TERTIARY ROCKS

The Tertiary rocks, rest over the weathered platforms of Precambrian rocks, these comprise of both shelf and geosynclinal facies sediments of Palaeocene-Eocene age represented by the Jaintia and Disang Groups respectively. The overlying Barail (Eocene-Oligocene), Surma (Lower Miocene), Tipam (Mio-Pliocene), Dupitila (Mio-Pliocene) and Dihing (Pliocene) Groups also represent both shelf and geosynclinal facies. The Tertiary sedimentary history of Assam is an integral part of the tectonosedimentary setting of the Tertiary sediments of the North East India and is influenced by the prominent ‘Brahmaputra Arch’ running parallel to Brahmaputra River. The thickness of Tertiary rocks is seen to increase towards southeast whereas the thickness of Quaternary sediments of Brahmaputra Basin increases towards north and northwest.

In the Early Tertiary sediments there is a sharp distinction between a geosynclinal facies and a shelf facies. In the Late-Tertiary sediments, there are minor differences in lithology, except that the shelf sediments are much thinner. The geosynclinal sediments are very thick where deposition took place in a sinking basin.

G. Jaintia Group:

The Jaintia Group (shelf facies sediments) of Eocene age is calcareous and abundantly fossiliferous. They differ markedly from the Eocene shales of the geosyncline (Disang Group) facies. Jaintia Group comprising Shella and overlying Kopili Formations is seen around Garampani area of the North Cachar Hills. It also extends north-easterly along the southern and eastern slopes of the Mikir Hills. These rocks are exposed from the vicinity of Selvetta in west through Dilai Parbat in the east and then through Doigrung further north-east. Workable seams of coal are present in the Sylhet Sandstone Member at Selvetta, Koilajan and Sylhet Limestone Member in Selvetta, Jarapgaon, Koilajan and Nambar areas.

The Shella Formation is well developed with three limestone bands alternating with three interbedded clastic sandstone units. The underlying unit, Lower Sylhet Sandstone Member in Assam exposed in Garampani area rests unconformably over the Precambrian basement. It is about 60 m thick and includes thick beds of sandstone with interstratified shale, carbonaceous shale and thin (0.3 m) coal seam, which overlies 2 to 3 meters thick basal conglomerate bed. The Shella Formation is conformably overlain by Kopili Formation, consisting mainly of greyish, usually ferruginous, splintery shales with interbedded sandstone and calcareous marl of variable thickness. Northeast of Lumding, Kopili Formation is overlapped by beds of Surma Group.

H. Disang Group:

Disang Group in Assam is represented by monotonous sequence of dark grey, splintery, shale with thin sandstone interbands. The shale is usually limonite coated. The Disang are predominantly arenaceous in the upper part and exhibit vertical as well as lateral facies change to its overlying Barail Group of rocks. In Assam, Disang Group is exposed along a narrow strip southwest of Haflong-Disang thrust in the central part of North Cachar Hills. This sequence is exposed from Jatinga valley eastward upto the headwaters of Dhansiri. In Upper Assam, Disang Group comprises of a thick sequence of alternating splintery shale with thin partings of hard greyish flaggy sandstone and sandy shales.

I. Barail Group :

Barail Group represents a sequence of lithology belonging to the geosynclinal facies. Rocks of this group are exposed along two different strips, in the south-eastern part of North Cachar Hills, i.e. to the South of Haflong-Disang Thrust and secondly in parts North of the Cachar and Mikir Hills i.e. to the north of Haflong-Disang Thrust in Upper Assam.

The unclassified shelf facies rocks of Barail Group which overlie the Kopili Formation cover a large area with a gross thickness of about 1000 m. Lithologically, they consist of fairly coarse sandstone, shale and carbonaceous shale with streaks of minor seams of coal. Outcrops of Barail Group in this part of the area are seen near Mupa, Langling, Latikhali, Chota Langher along the exposure of Lumding-Badarpur railway cuttings as well as along road section between Haflong and Garampani-Kopili. The geosynclinal facies of Barail Group in Surma valley and North Cachar Hills are subdivided into Laisong, Jenam and Renji Formations. But in upper Assam, the equivalent formations have been classified as Nagaon Formation, Bargolai Formation and Tikak Parbat Formation, respectively.

Laisong Formation consists of thin bedded greyish sandstone with interbedded thin sandy shale, rare massive sandstone, carbonaceous shales and streaks of coal. Laisong Formation gradationally passes into argillaceous Jenam Formation comprising mainly of shale, sandy shale, carbonaceous shale with streaks of coal and interbedded hard sandstone.

Renji Formation comprises of hard massive sandstone with rare beds of shale and sandy shale. The Renji Formation is distinguished from the former two by the increased frequency of microfauna and palyno-fossil. The thickness of Barail Group in southeastern part of Upper Assam Valley decreases in a north-westerly direction.

J. Surma Group:

Barail Group is unconformably overlain by Lower Miocene Surma Group, which covers a large area in Surma valley and North Cachar Hills. This group is divided into a lower arenaceous facies (Bhuban Formation) and an upper argillaceous facies (Bokabil Formation). Bhuban Formation consists of sandstones, sandy shales and conglomerate intervened by shale, sandy shale and lenticular sandstone. Bokabil Formation is represented by shale, sandy shale, siltstone, mudstone and fairly thick lenticular, coarse grained, ferruginous sandstone. Surma Group as a whole is well exposed as inliers in the southern part of the Surma valley and also occupies a strip in the northern part of the valley. In the North Cachar Hills, the rocks of Surma Group occupy a large tract in the vicinity of Maibong and further northeastward upto Lumding. These rocks further continue northwards and are exposed in the south-eastern part of the Mikir Hills, as a narrow strip over the eastern base of the Mikir Hills. Surma Group in Upper Assam is represented by about 30 to 60 m thick estuarine sandstone, shale and conglomerate unconformably overlying the Barails.

K. Tipam Group:

Tipam Group comprises a lower arenaceous facies Tipam Sandstone Formation and an upper argillaceous facies Girujan Clay Formation. Tipam Sandstone consists of fairly coarse to gritty false-bedded, ferruginous sandstone interbedded with shale, sandy shale, clay and conglomerate. Whereas The Girujan Clay Formation consists of lacustrine mottled clay, sandy mottled clay, sandy shale and subordinate mottled, coarse to gritty, ferruginous sandstone. Tipam Group has a general strike of ENE–WSW with a northerly dip varying from 50º-70º.

The rocks of Tipam Group are exposed in many areas in the Surma valley. Upper part of the Tipam sequence at many places is found to be eroded away, prior to the deposition of overlying Dupitila Group. However, Girujan Clay is exposed in the hills between Chargola and Longai valleys and the low hills to the east of Jatinga and Cachar district. Rocks of this group are present also in the Labak-Diksha and

Darby-Dwarband areas. In Assam valley, Tipam Group occupies a 300 km long strip from Langting to Digboi interrupted by small patches of alluvium cover. Tipam Group also includes several oil-sand horizons in Upper Assam.

L. Dupitila Group:

Tipam Group is unconformably overlain by the Mio-Pliocene Dupitila Group consisting of coarse, loose and ferruginous sand, clay, mottled clay, mottled sandstone and poorly consolidated sand with layers and pockets of pebbles. These beds are well exposed at intervals, as patches over Tipam Group in Cachar and Karimganj districts, forming low mounds in valley areas.

The rock of Dupitila Group is exposed in Surma valley attaining a thickness of 3300 m and is named as Dupitila Formation. It comprises of sandstone, mottled clay, grit and conglomerate, locally with beds of coal, conglomerate and poorly consolidated sand with layers and pockets of pebbles. In Upper Assam, Dupitila Group is represented by fluviatile Namsang Formation, which consists of coarse, gritty, poorly consolidated sandstone, mottled clay and conglomerate, which at places, is almost entirely composed of pebbles of coal derived from Barail Group. Namsang Formation overlies Girujan Clay Formation with an unconformable contact at places and is well exposed in Dihing river section near Jaipur.

M. Dihing Group:

Lithology of Dupitila Group are unconformably succeeded by fluvial Pliocene Dihing Group consisting of thick pebble beds alternating with coarse, soft sandstone, clay, grit and conglomerate containing half decomposed plant remains. The unconformable relationship between Dihing and underlying Namsang Formation is well exposed along Dihing river section near Jaipur in Upper Assam. In Makum coalfields, this group comprises alternating pebble beds, sandstone and clays. The sandstones are gritty to coarse grained, loose ferruginous and generally greyish in colour. Along Margherita thrust, Tipam Sandstone is seen in juxtaposition with the Dihing beds. In Surma valley, Dupitila Formation is conformably overlain by a sequence of conglomerate, grit, sandstone and clay corresponding possibly to Dihing Group of Upper Assam. These beds, with steep dip are seen near Bishramkandi and Nagar Tea Garden. Dihing Group is correlated with the Kimin Formation of Siwalik Group exposed in the foothill of Arunachal Himalayas.

N. Siwalik Group:

Middle and Upper Siwalik rocks designated as Subansiri and Kimin formations are exposed in Sonitpur district of Assam, along the foot hills of Arunachal Himalaya. The Subansiri Formation is represented in the area by micaceous massive fine to medium grained pale brown sandstone while the Kimin Formation in the area comprises soft, grey sandstone with bands of claystone.

Quaternary Period

O. Alluvium:

The tectonic movements that took place after the deposition of the Kimins and the Dihings were the last major folding events in the Assam Valley region. Thereafter, all movements have been primarily concerned with the further uplift of already raised mountain masses. In the process, these have helped raise and give minor tilts to erosional surfaces, earlier flood plains and river built terraces. There have also been minor movements along earlier joints, faults and thrust planes.

Dihing Group is unconformably overlain by Quaternary sequence which has been described variously in the Upper Assam like “Terrace Deposits” or “Older or High Level Alluvium” etc.. It consists of indurated, yellow, brown or red clay with sand, gravel and boulder deposits. These deposits do not belong to the typical fluvial Quaternary deposits of the Brahmaputra Basin and are possibly weathered derivatives of the underlying older rocks. On the other hand, a major part of the area flanking the Brahmaputra River in Lower and Upper Assam is covered by thick Quaternary fluvial sequence.

Regional structure and tectonics

The Gneissic Complex of Assam, in continuity with Meghalaya’s geological framework, consists of Peninsular crystalline rocks that exhibit evidence of deformation, characterized by intricate folding and deep-seated fracture lineaments trending E-W and NE-SW. These fractures are possibly connected to sub-crustal movements, which have divided the region into several blocks. The present-day configuration of the Brahmaputra Valley is a result of the uplift and subsidence of different blocks of Precambrian crystalline autochthon, remnants of which are now seen in the Mikir Hills and the Shillong Plateau. This mass forms a "foreland spur" (Mathur and Evans, 1964), which has been overthrust from the northwest by the Eastern Himalayas, from the northeast by the Mishmi Hills, and from the southeast by the Naga-Patkai range during the Tertiary geotectonic cycle.

In Northeast India, four distinct geotectonic provinces have been identified:

1 The comparatively stable shield area of the Shillong Plateau and Mikir Hills.
2 The platform area peripheral to the shield, now covering the Brahmaputra Valley, North Cachar Hills, and Bangladesh plains.

3 The Naga-Patkai and Eastern Himalayan mobile geosyncline belt.
4 Transitional zones between the platform and the geosyncline, likely with narrow pericratonic downwraps marginal to the shield.

These geologic provinces are bounded by major tectonic lineaments that have been active throughout various tectonic cycles, influencing the area since the cratonization of the Gneissic Complex. This was followed by the deposition of the Shillong Group of rocks in intracratonic basins and sedimentation continuing up to Pleistocene times. The major lineaments include the E-W Dauki Fault along the southern margin of the Shillong Plateau, a suspected E-W fault along the Brahmaputra Valley, and the NW-SE Mishmi Thrust along the Lohit foothills.

The Upper Assam oil fields' subsurface geology reveals that the Tertiary sediments overlying the basement are folded into domes and anticlines, with faults trending NE-SW, NNE-SSW, NW-SE, and E-W. Fields like Naharkatiya, Moran, Rudrasagar, and Lakwa display complex fault patterns, some of which involve tensional faults and reverse faults. Faulting, which occurred intermittently from the Eocene to the Pleistocene, played a significant role in basin subsidence and sedimentation. The intricate fault patterns likely originated during Precambrian intrusive movements, with later tectonic reactivations affecting the overlying sediments.

The Schuppen belt, located over the northern part of the Naga-Patkai range, exhibits a series of imbricate thrusts with the Naga Thrust marking the boundary of the Quaternary valley fill of Assam. This belt consists of six thrusts, with the Disang Thrust being a prominent feature. The Cenozoic rocks in the Schuppen belt show a greater thickness of sediments compared to the Assam shelf, indicating a different depositional environment. The Surma Group, for instance, is thin and discontinuous in Upper Assam but well-exposed in the Schuppen belt. Similarly, the Barail coal seams are thicker and more persistent in the Schuppen belt.

The NW-SE Mishmi Thrust, which marks the youngest tectonic feature in the region, causes the metamorphic rocks of the Mishmi Hills to override younger Tertiary and Quaternary deposits in the frontal Himalayan thrust belt and the Naga-Patkai belt. The Surma Valley, partly extending into the Cachar district of Assam, displays N-S to NE-SW asymmetrical folding, with broad synclines intervening faulted anticlines. Unlike the Schuppen belt, this region does not show overthrusting.

The tectonic evolution of Assam has been a complex interplay of uplift, subsidence, and faulting, with ongoing tectonic movements shaping the Brahmaputra basin and adjacent regions throughout geological history.

Mineral resources

Assam is rich in a variety of mineral resources, some of which play a significant role in the state’s economy. The state is part of the larger Assam-Arakan Basin, which stretches across northeastern India and into parts of Myanmar, making it one of the major oil and gas-bearing regions in India. Petroleum and natural gas being the most significant natural resources of Assam, especially in the Assam-Arakan Basin, where fields like Digboi, Duliajan, and Naharkatiya have driven India's oil industry since the late 19th century. These fields are part of the Assam Shelf, a rich oil-bearing region. Natural gas is another key resource in Assam, often found alongside oil in the Assam-Arakan Basin. The production of natural gas has grown considerably, especially in fields like Lakwa, Duliajan, and Tengakhat. The coal occurrences in Assam are reported from two geological horizons viz., Gondwana and Tertiary of which Tertiary coal deposits of Makum, Mikir Hills and Dilli-Jeypore are the most important coalfields. The Gondwana coal deposits in the westernmost part of Garo Hills of Meghalaya are extending into the Hallidayganj area of western Assam known as the Singrimari Coal deposits. Assam's coal is known for its high sulfur content but has a low ash content whch supports local industries such as tea processing and brick manufacturing. Limestone deposits are found mainly in the Karbi Anglong district and in parts of the North Cachar Hills, is crucial for cement production. Assam has deposits of various types of clay, including china clay and fire clay used in pottery and ceramics. These are found in districts like Nagaon, Kamrup, and Goalpara. In the Namdang-Ledo area, the fire clay bands occur below the coal seams. Also, in karbi-Anglong district, fire clay bands of 3-5 m thickness in association with coal occur at Koilajan Colliery. Other minerals include silica sand (for glass manufacturing), and smaller deposits of iron ore, granite, gypsum, base metal, beryl, building stone, clay, sillimanite, salt and radioactive minerals which contribute to local construction and industrial activities.

17. Water Environment at Lakhimpur district.

Ground Water (survey carried out at Lower Subansiri River)

Ground water occurs in the pore spaces of the unconsolidated alluvial sediments in the zone of saturation. Sediments at the near surface are predominantly sandy clays. Ground water samples were taken from hand pumps during the period November 2022to January 2023 at six stations i.e. at project site and around 1km of it. The physico-chemical characteristics were analyzed as per IS: 10500 – 2012 (drinking water standards)

The range of dug wells range from 6m to 15 m.

The study area has a very good source of aquifers.

Ground water from Hand pumps, Open dug wells and Tube wells is meant for

domestic needs and irrigation purposes.

The ground water analysis data is enclosed herewith (Table – A).

Surface water

The samples of surface water have been collected from Subansiri River, at Project

site both upstream and downstream.

The same was analyzes as per guidelines laid down by CPCB for Inland Surface

water. Period of analysis was November 2022 to January 2023.

Sample collection was done strictly as guidelines prescribed in relevant Indian Standards.

The surface water quality does not indicate any industrial contamination.

Results of analysis is enclosed herewith (Table - B).

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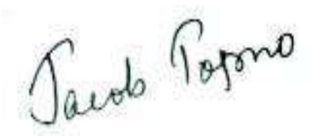
Ground Water Analysis Report (TABLE – A) Dated : 05.04.2023

Project Site: Lower Subansiri sand MCA, Lakhimpur District, Assam.

Sl. No.	Parameters	Units	Near Project Site	Around I km of Site	Remarks
			Nov'22. Dec'22. Jan'23	Nov'22. Dec'22. Jan'23	
01	Turbidity	NTU	<1.0 <1.0 <1.0	<1.0 <1.0 < 1.0	Within norm
02	pH	-	7.23 7.41 7.32	7.25 7.18 7.44	Neutral
03	TDS	mg/l	412 .0 453.0 472.0	420.0 432.0 434.0	Within norm
04	Temperature	^{o}C	27.30 25.30 24.50	26.40 25.6 24.6	Normal
05	Conductivity	µs/cm	742.0 758.0 744.0	694.0 736.0 721,0	Normal
06	Alkailinity as $CaCO_3$	mg/l	134.0 164.0 172.0	118.0 160.0 157.0	Within norm
07	Iron as Fe	mg/l	<0.06 < 0.06 <0.05	<0.05 <0.06 <0.05	-do-
08	Potassium as K	mg/l	6.82 7.40 7.34	5.90 6.85 7.20	-do-
09	Sodium as Na	mg/l	39.20 41.60 40.20	44.20 45.60 43.50	-do-
10	Calcium as Ca	mg/l	50.60 47.80 49.20	49.60 52.70 47.90	-do-
11	Hardness as $CaCO_3$	mg/l	160.0 174.0 182.0	176.0 168.0 183.0	-do-
12	Chloride as Cl	mg/l	82.60 90.50 97.30	69.20 78.50 74.70	-do-
13	Fluoride as F	mg/l	0.54 0.42 0.59	0.65 0.58 0.55	-do-
14	Magnesium as Mg	mg/l	18.0 22.0 20 3	20.2 16.5 17.5	-do-

15	Sulphate as SO_4	mg/l	71.0 67.0 76.2	66.2 59.8 62 .0	-do-
16	COD	mg/l	9.20 8.90 9.45	8.30 8.80 9.52	-do-
17	Cadmium	mg/l	<0.001 <0.001 <0.001	<0.001 <0.001 <0.001	-do-
18	Phosphate as PO_4	mg/l	<0.1 <0.1 < 0.1	<0.1 <0.1 <0.1	-do-
19	Free Residual Chlorine	mg/l	<0.1 <0.1 < 0.1	<0.1 <0.1 < 0.1	-do-
20	Lead as Pb	mg/l	<0.01 <0.01 <0.01	<0.01 <0.01 <0.01	-do-
21	Nitrate as NO_3	mg/l	4.86 5.42 6.65	4.82 5.60 6.32	-do-
22	Chromium as Cr^{+6}	mg/l	< 0.01 <0.01 <0.01	< 0.01 <0.01 <0.01	-do-
23	E-Coli	MPN	NIL NIL NIL	NIL NIL NIL	Good

Manager



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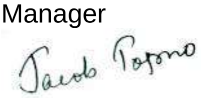
Surface Water Analysis Report(TABLE – B) Dated : 06.04.2023

Sl. No.	Parameters	Units	Chaprai no.2			Gogamukh near NH-52			Remarks
			Nov'22.	Dec'22.	Jan'23	Nov'22.	Dec'22.	Jan'23	
01	Turbidity	NTU	2.9	2.2	3.1	2.8	3.2	3.5	Within norm
02	pH	-	7.29	7.50	7.48	7.35	7.41	7.38	Neutral
03	BOD	mg/l	7.5	8.5	9.2	6.9	7.4	7.7	Within norm
04	Temperature	^oC	29.30	28.30	27.50	27.80	26.6	25.8	Normal
05	Conductivity	µs/cm	475.6	492.5	487.5	520.3	494.6	488.2	Normal
06	COD	mg/l	35	39	45	43	50	39	Within norm
07	Iron as Fe	mg/l	0.2	0.18	0.16	0.22	0.28	0.25	-do-
08	Potassium as K	mg/l	6.20	5.40	4.34	5.28	6.28	6.20	-do-
09	Sodium as Na	mg/l	29.20	36.60	33.20	34.20	25.60	23.50	-do-
10	Calcium as $CaCO_3$	mg/l	52.60	49.80	44.20	49.60	52.70	47.90	-do-

11	Total Hardness as $CaCO_3$	mg/l	178.0 172.0 180.0	175.0 174.0 173.0	-do-
12	Chloride as Cl	mg/l	62.60 85.50 74.30	69.20 78.50 64.70	-do-
13	Fluoride as F	mg/l	0.52 0.42 0.49	0.55 0.48 0.45	-do-
14	TDS	mg/l	400 385 364	375 355 386	-do-
15	Sulphate as SO_4	mg/l	51.0 47.0 36.2	36.2 39.8 32 .0	-do-
16	Dissolved Oxygen (DO)	mg/l	7.20 7.90 8.45	7.30 7.80 8.52	-do-
17	Cadmium	mg/l	<0.01 <0.01 <0.01	<0.01 <0.01 <0.01	-do-
18	Phosphate as PO_4	mg/l	0.62 0.58 0.66	0.74 0.67 0.56	-do-
19	Total Coliform	MPN	80.0 100.0 95.6	66.0 65.0 95.0	-do-
20	Lead as Pb	mg/l	<0.01 <0.01 <0.01	<0.01 <0.01 <0.01	-do-
21	Nitrate as NO_3	mg/l	4.86 5.42 6.65	4.82 5.60 6.32	-do-
22	Chromium as Cr^{+6}	mg/l	<0.01 <0.01 <0.01	<0.01 <0.01 <0.01	-do-
23	Faecal Coliform	MPN	29.0 48.0 35.0	36.0 39.0 40.0	-do-

Manager



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PAN NO. AAECR-3828C

18. Ambient Air Environment:

Ambient air quality was monitored with a frequency of two days per week at eight locations. Sampling was carried out at a height of approximately 1.5 m from the ground level. Standard methods as specified under "National Ambient Air Quality Standards" notification G.S.R. 176(E) was adapted for sampling and analysis. Locations within the study area were selected scientifically, considering the following factors:

a) Meteorological condition

b) Topography of the study area

c) Direction of the wind

d) Representation of the area for establishing baseline status

e) Representation with respect to likely impact area.

Climate in this area indicate four seasonal variations, namely:

Winter	:	December to February
Summer	:	March to Mid- June
Monsoon	:	Mid- June to September
Post-monsoon	:	October - November

Data was collected from November'22 to January '23, two to three days per week at specified locations for PM2.5, PM10 particulate matters and SO2, NO2 gases, using Respirable Dust Samplers with filters.

Equipment were duly certified by NABL approved laboratory.

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AMBIENT AIR TEST REPORT

Report no.	**Reliant/ Eco / Air/ 22-23/16**
Laboratory	**Reliant Foundations Private Limited**
Issued to	**EcoRescue Consulting Services Private Limited**
Types Of Sample	**Ambient Air**
Mode of Collection	**By Laboratory**
Sampling Location	**Chaprai and Gogamukh**
Date of Sampling	**As indicated below**
Sampling Protocol	**155182 (P-14) 2000, PCB Guidelines**
Testing Protocol	**NATIONAL AMBIENT AIR QUALITY STANDRED**

Sample No.	**Date**	**$PM_{2.5}$ (µg/m^3)**	**PM_{10} (µg/m^3)**	**SO_2 (µg/m^3)**	**NO_2 (µg/m^3)**
01	**12.11.2022**	**26.25**	**52.24**	**25.42**	**18.84**
02	**12.11.2022**	**25.64**	**62.68**	**18.84**	**25.42**
03	**20.11.2022**	**32.26**	**74.24**	**22.64**	**22.76**
04	**20.11.2022**	**28.48**	**66.52**	**24.22**	**24.64**

05	**24.11.2022**	**29.62**	**71.64**	**22.42**	**18.98**
06	**24.11.2022**	**31.28**	**61.65**	**20.84**	**21.52**
07	**10.12.2022**	**26.49**	**58.52**	**18.82**	**23.64**
08	**10.12.2022**	**29.54**	**69.94**	**27.21**	**15.92**
09	**17.12.2022**	**25.28**	**61.98**	**26.28**	**19.43**
10	**17.12.2022**	**24.83**	**70.53**	**22.96**	**26.22**
11	**04.01.2023**	**21.92**	**66.56**	**18.55**	**17.58**
12	**04.01.2023**	**22.74**	**59.76**	**19.95**	**23.42**
13	**10.01.2023**	**24.65**	**69.43**	**25.42**	**28.22**
14	**10.01.2023**	**22.83**	**79.20**	**21.89**	**16.76**

Manager

Jacob Topno

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PAN NO. AACER-3828C

19. Noise Environment:

Noise is something which as per human perception, is unpleasant and unwanted. Three types of sound field are generally identified i.e.

a) Free Field: The sound waves that propagate from source without obstruction to the receiver. Such waves comply with the inverse square law i.e. if the distance is doubled than sound pressure level decreases by 6 dB (A).

b) Near Field: Such a field is located within a few wavelengths of the source andinfluenced by dimensions of the source. In this case, the inverse square law does not apply.

c) Far Field: Such a field has two parts i) free part II) reverberation part.

In the free part of far field, the inverse square law is obeyed and propagate to the receiver without any obstruction. The reverberant part of far field exists only for enclosed situation where the reflected sound waves get superimposed on the incident sound waves.

Occasionally, a diffuse sound field exists when there are many reflected waves from all possible directions. The intensity of sound energy is measured in the logarithmic scale and is expressed in dB scale with A-weigher and denoted as dB(A).

Noise level was measured using sound level meters (SLM), and monitored during 6.00 AM to 10 PM (day) and 10 PM to 6.00 AM (night) hours at specified locations i.e. at project site and around 2 km around core area (marked as L1 to L8).

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NOISE LEVEL MEASUREMENT

Study Area: Core area and Buffer area (around 2 km from core area)

Serial no.	Location no.	Values in dB(A)	Values in dB(A)	Test Method
		Day time (6 AM to 10.00 PM)	Night time (10PM to 6 AM)	IS : 9989 (Rev. 2001)
01	L 1 (Project site)	66.5	62.2	
02	L 2	49.1	35.2	
03	L 3	47.2	34.6	
04	L 4	45.4	32.8	
05	L 5	48.2	32.4	
06	L 6	45.6	37.2	
07	L 7	44.7	36.4	
08	L 8	47.8	32.6	

Manager

Jacob Topno

20. Soil Environment:

As indicated earlier, the soils in Lakhimpur district can be classified into four categories:

1) Red loamy soil: Found in the northern border of the district, developed in the hill slopes under persistent rainy condition. This type of soil has low nitrogen, low phosphate and medium to high potassium hydroxide content.
   In general, the soil is slightly acidic.
2) Lateritic soil: These are the product of high leaching and visible in hilly region. pH of soil is acidic. This is attributed to heavy leaching of bases and formation of ferric hydroxide and clay minerals. This type of soil is poor plant nutrient and characterized by brick red to brownish red colour.
3) New Alluvial soils: These are found in flood plain area. Once the flood recedes, considerable silt deposit are found. These are admixtures of sand, silt and clay in different proportions. Soil pH is slightly alkaline. This type of soil is rich in plant nutrient.
4) Older Alluvial soil: This type of soil is developed at higher levels and depending on landform, represents a broad spectrum of sand, silt and humus rich clay. this type of soil is comparatively more acidic and crop sensitive.

   Soil sample was collected from Chapri, Ghoaghat and Dal Basti up to depths of30cm, 60cm and 90 cm and then packed in plastic bags. Prior to analysis, samplesfrom various depths are properly mixed-up.

RELIANTFOUNDATIONSPVT.LTD.

A NABL Accredited Laboratory andISO9001:3O15Certified

RELIANTHOUSE

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Soil Quality Analysis Report

Locations		Chapri	Ghogaghat	Dhal Basti
Parameters	Units			
pH	-	7.8	7.62	7.9
Bulk Density	gm / cm^3	1.4	1.56	1.38
Conductivity	µS / cm	137.4	128.6	130.8
Moisture	%	2.5	1.9	2.8
Sand	%	70	74	68
Silt	%	12	12	14
Gravel	%	9	5	8
Clay	%	9	9	10
Sodium	meq /100 gm	4.9	3.42	4.2
Potassium	mg /100 gm	3.8	2.9	3.6
Magnesium	meq /100 gm	0.9	0.72	1.1
Organic Matter	%	0.7	0.6	0.67
Calcium	meq /100 gm	1.65	1,42	1.53
Nitrogen	mg /100 gm	5.6	6.2	6.8
Phosphorous	mg /100 gm	68.2	72.5	63.9

Manager

Jacob Topno

Geotechnicalinvestigation. materialtesting,surveying,structuraldesign, water testing, Non-destructivetesting,PiletestingGST1N:

PAN NO. AAECR-3828C

21. Remedial measures in order to mitigate the impact of sand mining

Air Environment:

The only source of air pollution during mining is excavation, transportation, loading and handling of minerals. Following measures are suggested to mitigate the negative impact of the mining activities to control the spreading of pollutants by plantation of trees along the haul roads, especially near settlements, planning transportation routes of mined mineral by shortest routes and regular water sprinkling on unpaved roads.

A. Air Emissions:

Probable Impact	Mitigation Suggested
1) Dust and air emission particularly due to excavation, construction and movement of vehicles leading to air pollution	1) Provision for spraying water to reduce dust emission on unpaved roads, particularly near existing settlements, (> 2 L per m^2) 2) Excavated topsoil to be preserved and reused for landscaping 3) Amount of exposed ground stockpiles to be minimized so that re-suspension due to wind and following dust fall may be prevented.

	4) Care should be taken in making arrangement of the soil in such a manner such that the existing drainage pattern, even if altered, will still ensure that runoff does not carry away topsoil but reaches the water bodies with which it is connected. 5) To ensure that all generators, vehicles, compressors are regularly serviced and well maintained.

Other measures to be adapted:

** Transportation of material must be carried out during day time only.

** To plan multiple transportation routes in different direction to minimize the dust generation. Planned paved roads outside the mining lease area will minimize dust generation. in order to minimize transportation over unpaved roads, it is advised to plan transportation so as to each the nearest paved road by shortest route.

** All the workers are to be provided with Dust mask at points like excavation and loading.

** Plantation of trees along haul roads.

** Speed of trucks to be limited to 20km/hr.

**The loaded material should be covered with tarpaulin during transportation.

B Movement of Traffic :

Probable Impact	Mitigation Suggested
1) Due to mining activity, number of vehicles per hour will increase in the existing traffic leading to undesired sound resulting in impact in human health.	1) Truck drivers to be instructed to make minimum use of horns in the village area and sensitive zones. It is advisable to plant local species of trees (fruit bearing and medicinal) along the haul road, in consultation with Forest Department.
2) Increase in number of vehicle movement will lead to air pollution affecting the health of local villagers with respiratory system, asthma, breathing problems etc.	2) All vehicles must possess proper ad up-to-date PUC Certificate. Plantation of trees, as stated earlier will minimize the effect of air pollution. Moreover, Regular health check-up camps should be organized.
3)Vehicles moving with over-speed can lead to accidents.	3) Vehicle speed should be limited to 20 km/hr. Nearby medical facilities must be available in case of any mishap.

C. Noise Pollution

Probable Impact	Mitigation Suggested
1).Impact of noise due to mining activities	1) Noise generated from the equipment like generators must be within prescribed limit of 75 dB. The noise must not be continuous.
2) Prolonged exposure of noise from the machinery can cause hypertension, hearing loss, sleep disturbances etc.	2) Noise measurement should be done at specified intervals and the data must adhere to permissible limits as per National Ambient Noise Quality Standards.
3) Increase in number of transports will lead to more noise and discomfort.	3) Truck drivers to be instructed to make minimum use of horns. Plantations along the approach roads will minimize noise propagation.

D, Water Environment:

Probable Impact	Mitigation Suggested
1). Flow pattern might get changed due to river bed mining.	1) Diversion of flow pattern should be avoided. Thus there will be no change in flow pattern, surface hydrology and ground water regime.
2) Increase in mining depth will result in increase in flow velocity	2) Mining activities must be restricted to 3m depth which will not affect the flow pattern.
3). Change in qualities of ground water and surface water.	3) Mining should not be done below the water levels. Water samples should be tested at regular basis as a precautionary measure. Mining will be done as per approved Mining Plan and approved Rules and Regulations e.g. mining should be restricted to central 3/4th width of the river and should not be less than 7.5 meters etc.
4) Mode of waste water discharge	4) It is advised to use portable bio-toilets so that no sewage or liquid effluent will contaminate the ground water due to percolation.

E

E. Soil Environment:

Probable Impact	Mitigation Suggested
1) Mining activity may lead to increase of soil erosion and degradation which results in adverse impact in soil quality.	1) Plantation of local species trees on regular basis along the haul roads, outer periphery within the mining area will help to enhance the binding property of the soil and check erosion. Water to be sprinkled on unpaved roads.
2) Extraction of top soil from outside riverbed may affect the soil fertility and productivity	2) Of course, if it is a river bed, then top soil will not be generated.
3) Soil erosion takes place during the flood.	3) To construct dams for protection of river banks. No bank cutting is permitted.

F. Land Use

Probable Impact	Mitigation Suggested
1) In case mining activity is carried out outside riverbed, a pit will be formed which will cause soil erosion.	1) In such a case, proper reclamation to be implemented either by planting of trees or converting the pit into a fishery project.
2) Mining in riverbed may lead to a change in complete land use pattern and even land geometry, sediment transportation capacity, bed elevation etc. leading to a change in flow pattern of the river and erosion in the downstream.	2) Mining should be carried out only during non-monsoon seasons so that the excavated area is replenished naturally during the subsequent rainy season. Pre and post-monsoon survey for sedimentation in the riverbed should be carried out regularly. Dams to be constructed at required places for protection of banks. Safety distance from the bank inwards to be maintained not to disturb the channel geometry.

G. Hydrogeology :

Probable Impact	Mitigation Suggested
1) Ground water contamination is very much susceptible for mining in river beds, due to intersection with water table.	1) Proper analysis and monitoring must be done so that intersection with water table is avoided. Moreover, depth of mining should not exceed 3 m.
2) Any change in topography will divert the river flow.	2) Mining activity should not involve any diversion or modification of topography.

3) Any change in slope of mining area will lead to soil erosion and rain water run-off channel may get diverted.	3) Maximum depth permissible for riverbed mining is 3 m, which must be adhered to.

H. Biological Environment:

Probable Impact	Mitigation Suggested
1) Transportation of minerals in trucks or dumpers will hamper the movement of wild animals like jungle ca, jackal and other reptiles. Moreover, Fugitive emission from vehicle movement will form a layer on plant leaves leading to reduction in gaseous exchange process. This will ultimately affect the growth of plants (stomatal index may get minimized) There is also a possibility of collision with wildlife as and when they attempt to cross the road.	1) Movement of vehicles should be limited during day time only. Access roads should never encroach into the riparian zone. Water to be sprinkled on unpaved roads which will minimize dust generation.
2) Human settlement in the	2) Human settlement not to be

mining area will destroy the vegetation cover and disturb the reptiles. 3) Adverse effects on benthic fauna which inhabits the bottom sandy substratum in case indiscriminate mining is carried out. Extraction of excessive sand from riverbed will affect the eco-biology of many terrestrial insects whose initial life begins in aquatic environments.	permitted in the mining lease area or nearby. 3) Mining should be carried out as per principles laid down by the authorities. As such, there will be no impact on benthic fauna.

I. Socio-economical effect :

Probable Impacts	Mitigation Suggested
1. Mining and t5ransportation activities will generate small shops, dhabas, garage, restaurants, vegetable shops etc. along the roadscreating direct employment.	1. Positive impact, welcome
2. Local people will get employment in the mining activities.	2. Positive impact, welcome.
3. There will be generation of solid wastes along the roads due the shops opened.	3. Garbage bins to be provided at proper places.
4. Deep pits created in the channel can lead to accidents for villagers	4. Proper reclamation procedure to be adapted in the mined out areas. Mining

who goes to collect river water for their own domestic purposes.	must be carried out in non-monsoon period so the excavated portion gets replenished during the subsequent rainy season.
5. There is huge possibility of accidents due to rash driving of dumpers carrying the materials through the village roads.	5. Shortest and safe roads to be used to reach the nearest paved roads. It will be better if graveled roads are constructed between mine lease area and the nearest paved road.
6. Generation of dust due to traffic movement will be injurious to health for the villagers.	6. Water to be sprinkled regularly on unpaved roads to minimize dust generation. Speed of vehicles carrying the material to be controlled within limit. Moreover, materials being carried to be covered properly with tarpaulin.

22. Remedial Measures for Land Environment

1) The Mining activities must be carried out within the lease area only.
2) The surface run-off from the lease area should be retained within the lease area and to be used for plantation, dust suppression etc. so that there is no erosion of soil from the lease area and surroundings on account of mining activity.
3) Retaining wall and garland drains for the proposed waste dump to be constructed to arrest wash offs from the dumps. The dump must have inner slope with catch drains at inward side of the terrace and the catch drain of the individual terrace is to be connected to the garland drain outside to periphery of the dump.
4) The waste materials are to be used for construction of road.
5) Maintenance and repair work of vehicles and machineries should be carried out outside the mining area.

23Remedial Measures for Waste Management

1) Solid waste to be dumped systematically with proper repose angle.

2) Solid waste is to be stabilized in the following manner:

   a) Stabilization of dump with top soil and tree plantation shall make the dump stable.

   b) Dump should be terraced for every 5 m height.

   c) Gradation of the dump should be done automatically as coarse materials go down to the bottom at finer at the top. As such the drain of rain water will flow freely to the bottom without hampering the stability of the dump

   d) 1 m height parapet should be constructed for dumps more than 6 m height.

24. Risk Assessment and Disaster Management

Most of the accidents occur during transportation by trucks / dumpers and movement of mining equipment. Following mitigation measures to be adapted :

a) Regular training of all vehicle / machinery drivers / operators to be ensured.

b) Regular maintenance and testing of all mining equipment according to manufacturer's guidelines.

c) All safety precautions and provisions of MMR 1961 shall be strictly followed.

d) Broad sign to be provided at each and every turning point of vehicles.

e) All transportation activities within the main working area should be carried out under direct supervision and control of the management.

f) At the embankment and tripping points, reversing lorries should be made man-free, have proper indication lamps and warning horns.

25. Hazard Identification and Risk Assessment (HIRA)

Hazard Identification and risk Assessment are two processes necessary for maintaining a high level of safety and efficiency in the workplace. These processes aim to identify potential risks and hazards, assess their severity, and put the management team in a better position to put controls and take preventive and corrective actions.

It is desired that the entire mining operation is carried out under the supervision of the Mining Engineer or Mines Manager having second classmine's manager's certificate of competency to take adequate measure during following circumstances :

1) Slope failure at mine faces
2) Accident due to sliding of dumps
3) Accident due to storage of fuel
4) Accident due to fly-rock generation
5) Accident due to transportation or movement of heavy machineries
6) Accident due to use of explosives
7) Mishandling of mining equipment

It is advisable that a 5 x 5 risk assessment Matrix is prepared on day-to-day basis.

In this matter, Likelihood (Probability) is put along the x-axis and pertains to the extent how likely the risk may occur. The 5 risk rating levels under this component are….

Rare – unlikely to happen and/or have minor or negligible consequences.

Unlikely – possible to happen and/or will have moderate consequences.

Moderate – likely to happen and/or have moderate consequences.

Likely – almost sure to happen and/or to have major consequences.

Almost certain – sure to happen and have major consequences.

Impact which is also called severity, is placed along the y-axis to determine the level of effects that the hazard can cause to workplace, health and safety.

The levels are

Insignificant – won’t cause serious injuries or illness.

Minor – can cause injuries or illness only to a mild extent.

Significant – can cause injuries that may require medical treatment but limited one.

Major -- can cause irreversible injuries that require constant medical attention.

Severe – can cause fatality.

25.1. Risk and Mitigation Measures :

A. Over Burden Risk : The overburden dumps is susceptible to landslides. If the dump is very high, it may slide down at the quarry edge or may cause failure of the pit slope due to excessive loading. This may lead to loss of life and property. Siltation of surface water may also cause run-off from overburden dumps.

Mitigation: I) Height of overburden dump should be restricted.

2) Proper garland drain and bund to be constructed around the dump. This will prevent slippage.

3) No loose rock or stone or loose tree to be allowed within 3 meters of the edge of the quarry.

4) In order to prevent siltation of surface water, it is necessary to construct retaining wall on the downside of each overburden dump.

B Fuel Storage: Major storage of fuel in the mining lease area is strictly prohibited.

C Water Logging: In case mine pit gets filled up with rainwater, adequate number of pumps of proper capacity should be arranged well in advance Garland drainage should be properly maintained to prevent inflow of rain water into the pit.

25.2 Disaster Management

.Disaster is an event, natural or manmade, sudden or progressive which impacts with such severity that the affected community or workers must respond by taking exceptional measures. It is a sudden or progressive occurrence of such magnitude as to effect normal working conditions or pattern of life.

Types of Disaster : Fire and explosion, Large oil spillage, Toxic gas release, Flood, Cyclone, Equipment failure, Transportation of hazardous material, improper storage of debris etc. etc.

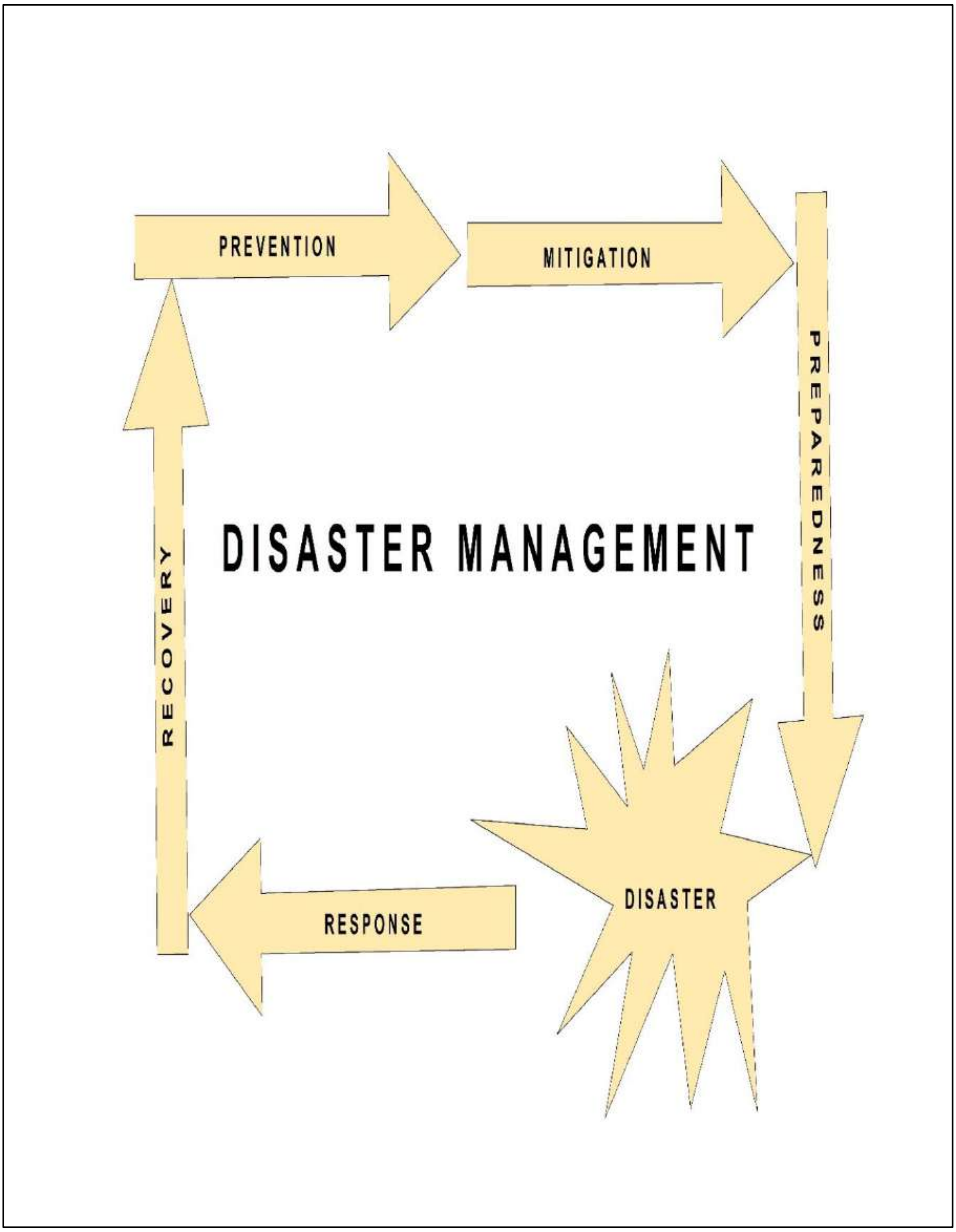
Phases of Disaster : 1) Warning Phase : Many disasters are preceded by some sort of warning. During any industrial operation, a detection and alarm system to be installed in such cases.

2) Impact phase – This is the period when the disaster actually strikes and very little can be done in order to lessen the effects of it.

3) Rescue phase : This phase starts after the impact phase and to be continued till the situation becomes under control.

4) Relief and Rehabilitation phase.

As such, during mining activities, the workforce must be made aware of all the above factors and proper responsibilities to be assigned to each individual or coordinators in the organization about each phases of disaster and make preparatory work before the emergency, implement operational plan during the emergency and carry out investigation of the causes of disaster after the emergency.


PREVENTION
MITIGATION
PREPAREDNESS
DISASTER MANAGEMENT
DISASTER
RESPONSE
RECOVERY

.

26.Joint Inspection Photographs by Office of TheDistrict Commissioner, Lakhimpur and Office of TheDivisional Forest Officer, Lakhimpur:

Image 1: 1.2 Ha. Ranganadi MPA

Image 2: 1.5 Ha. Ranganadi MPA

Image 3:1.91 Ha. Durpang (Lower) MPA

Image 4:1.67 Ha. Ranganadi MPA

Image 5: 2 No. Chenimora MPA 2.64

Image 6 :2Ha. 5 No. Pithaguri MPA

Image 7:5 No. Pithaguri MPA 2 Ha.

Image 8:5.2 Ha. Durpang MCA

Image 9:Bagan Nalla MPA 1.82Ha.

Image 10: Bogoli MCA

Image 12: Dhinabari MPA 5.03Ha.

Image 13: Dhunabari MPA 3.68Ha.

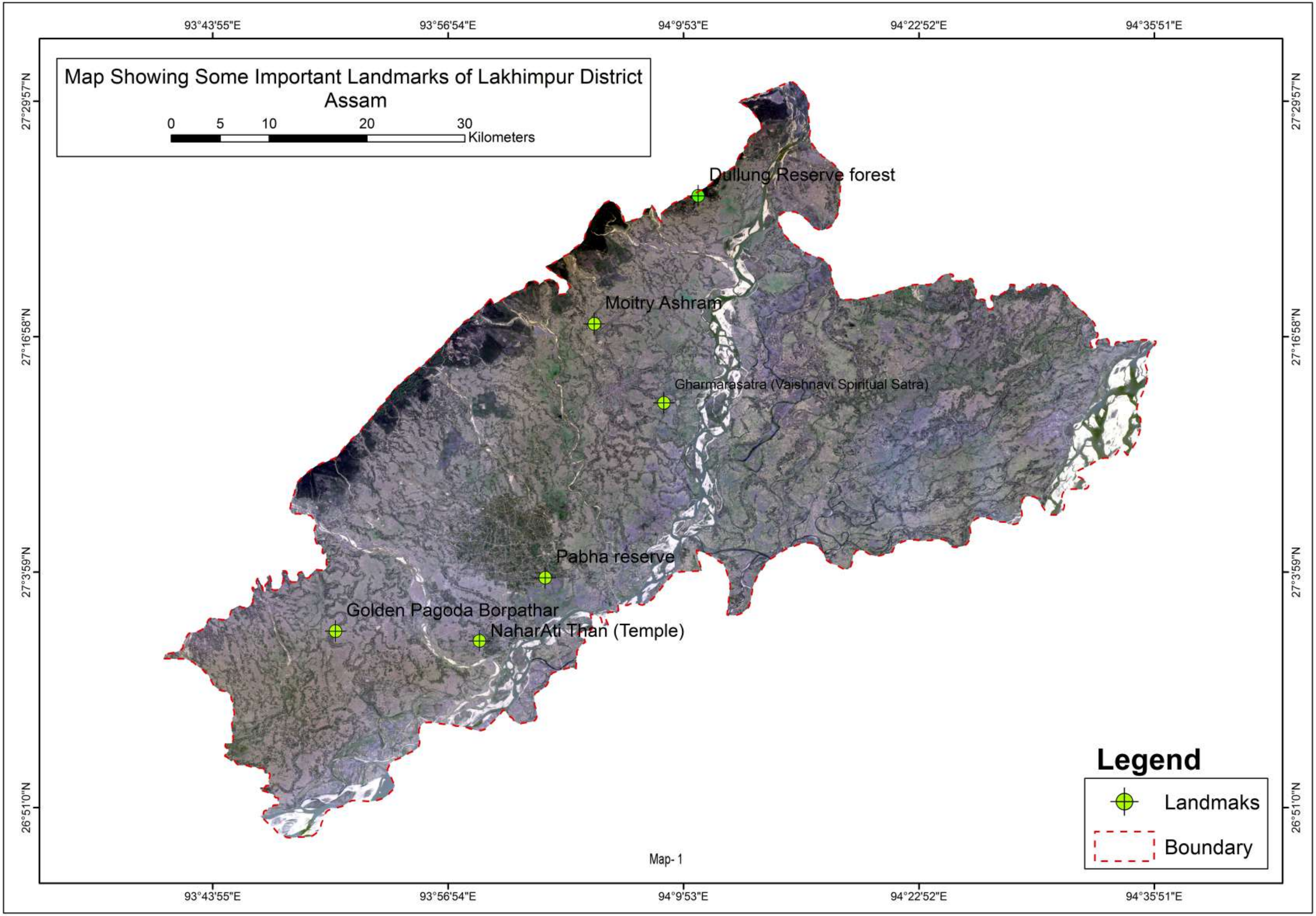
Image 14: Durpang (Lower) MPA 1.91 Ha.

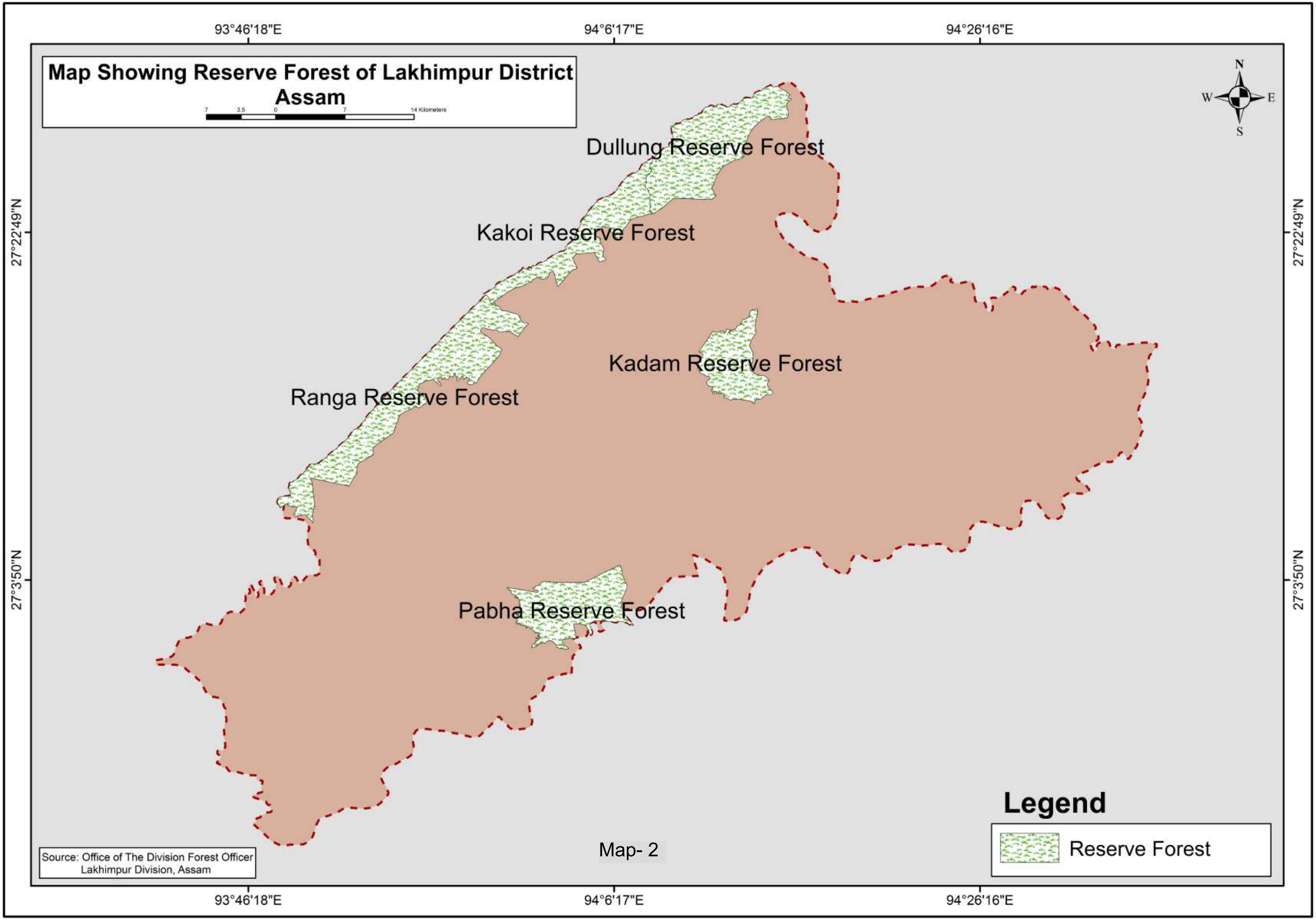
Image 15: Subansiri river MPA 21.58Ha.

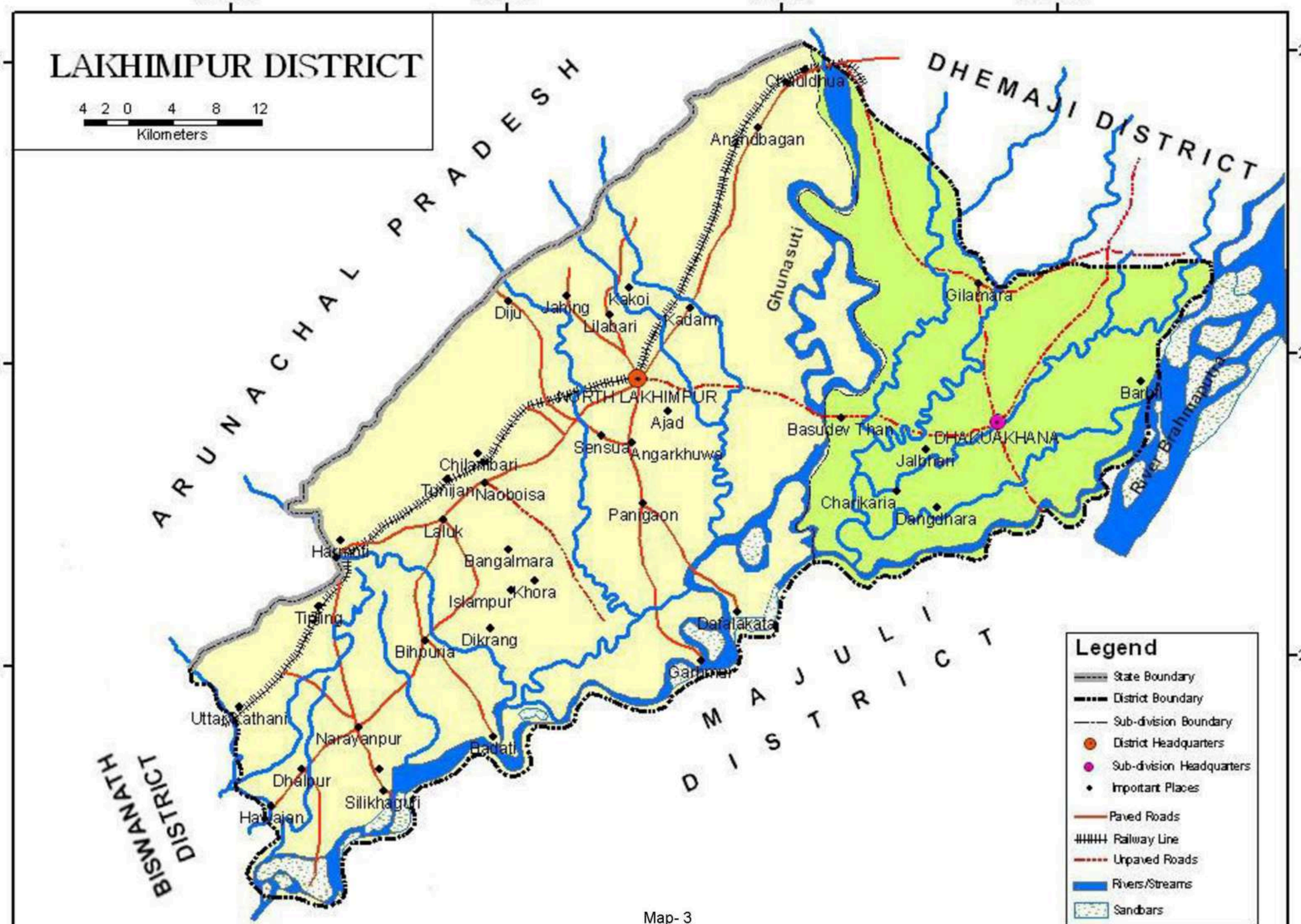
Image 16: Ranganadi MCA

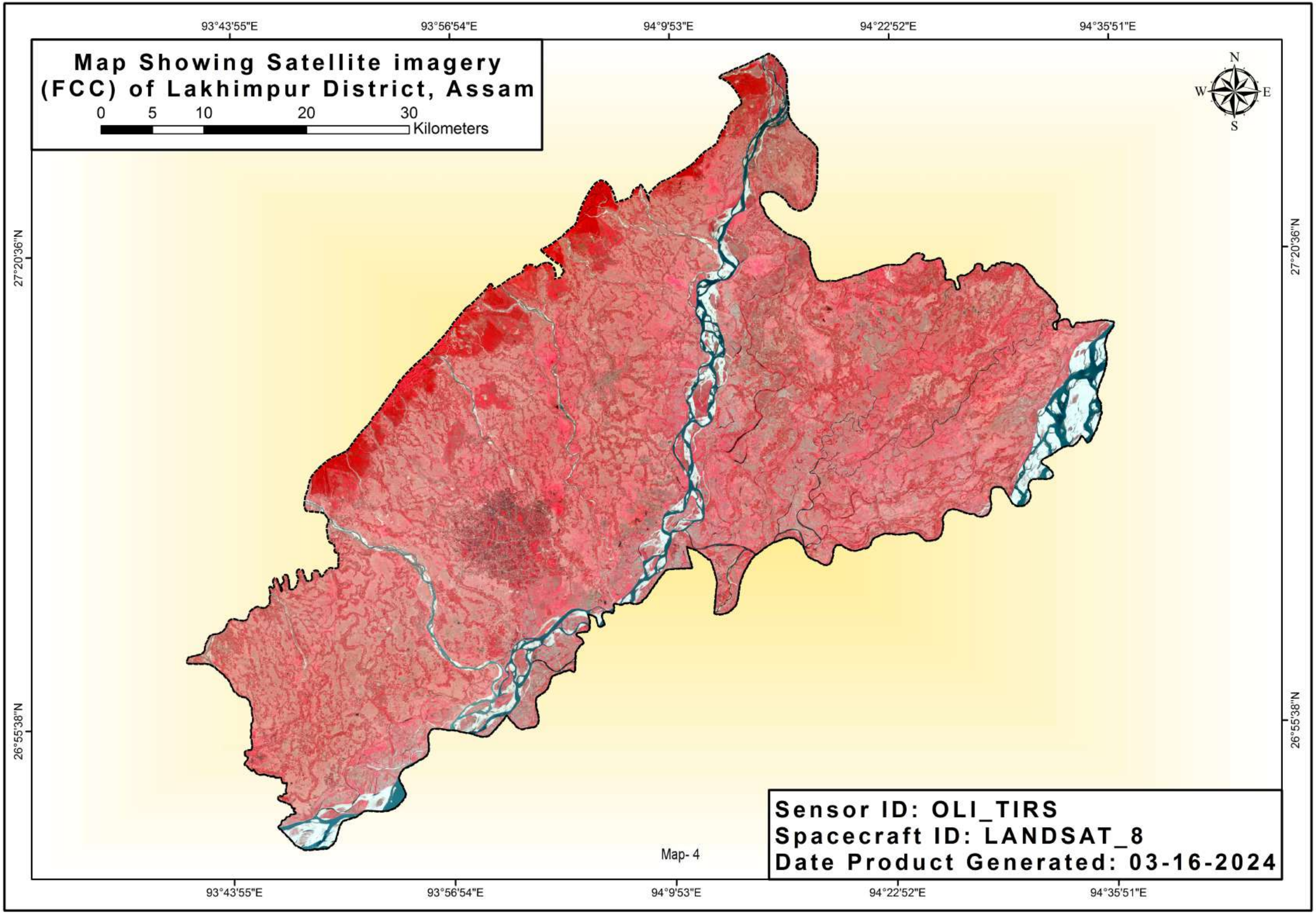
Image 17: Lower Subansiri MCA

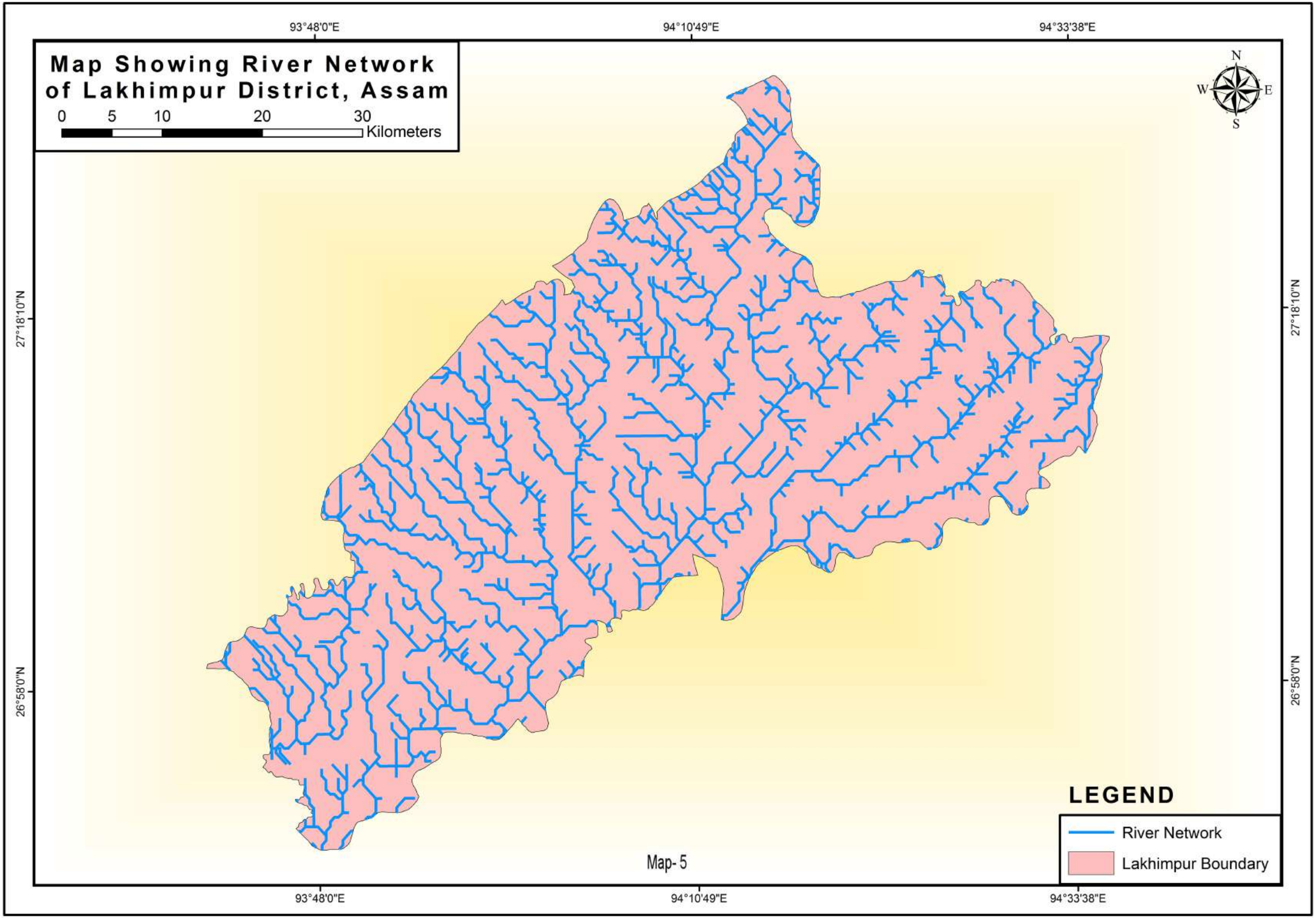
Image 18: Joyhing MCA


Map Showing Some Important Landmarks of Lakhimpur District
Assam
0 5 10 20 30
Kilometers
93°43'55"E
93°56'54"E
94°9'53"E
94°22'52"E
94°35'51"E
27°29'57"N
27°16'58"N
27°3'59"N
26°51'0"N
Dullung Reserve forest
Moitry Ashram
Gharmarasatra (Vaishnavi Spiritual Satra)
Pabha reserve
Golden Pagoda Borpathar
NaharAti Than (Temple)
Legend
Landmaks
Boundary
Map- 1


Map Showing Reserve Forest of Lakhimpur District
Assam
7 3.5 0 7 14 Kilometers
N
W
E
S
93°46'18"E
94°6'17"E
94°26'16"E
27°22'49"N
27°3'50"N
Dullung Reserve Forest
Kakoi Reserve Forest
Kadam Reserve Forest
Ranga Reserve Forest
Pabha Reserve Forest
Legend
Reserve Forest
Source: Office of The Division Forest Officer
Lakhimpur Division, Assam
Map- 2

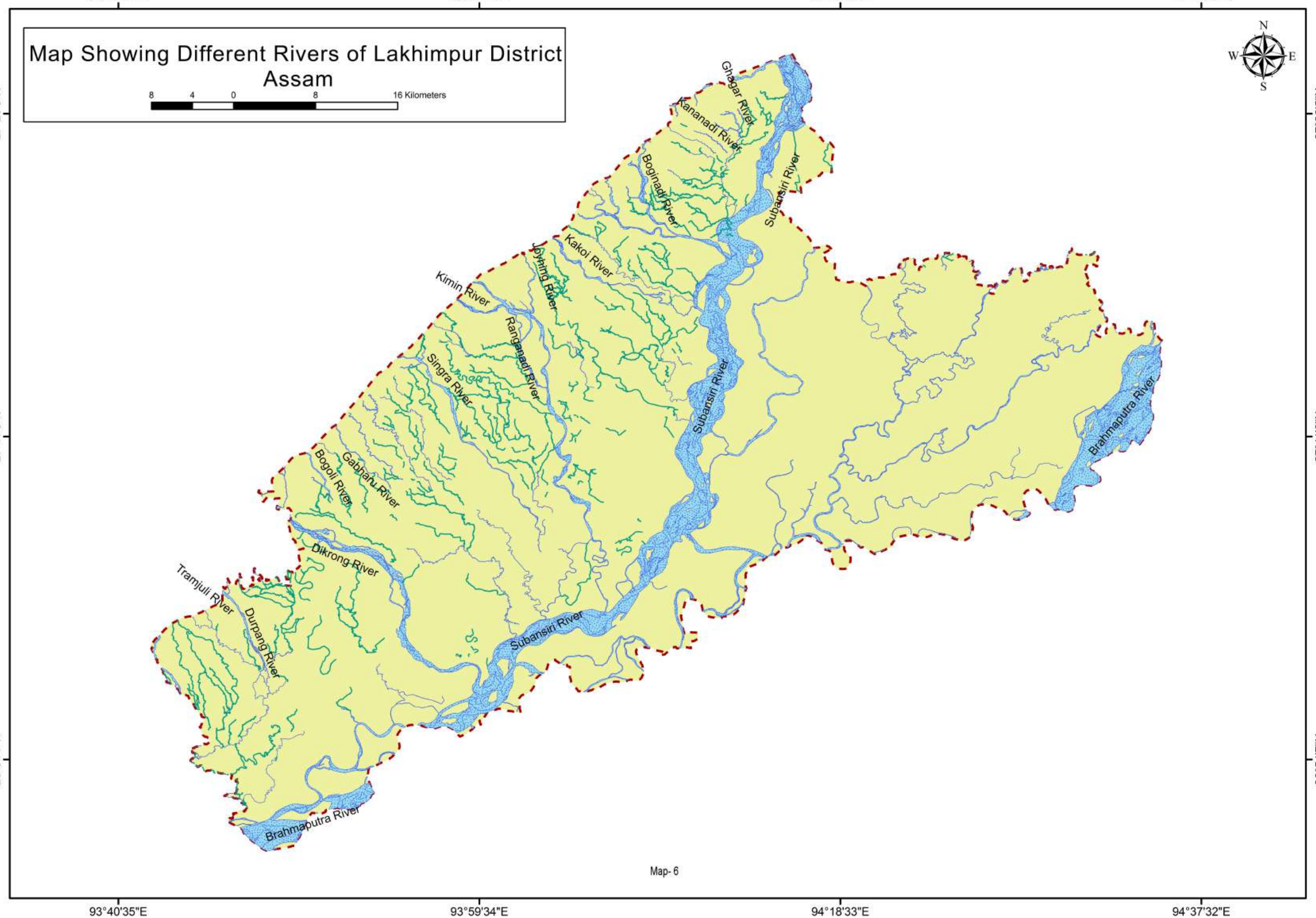

LAKHIMPUR DISTRICT
4 2 0 4 8 12
Kilometers
ARUNACHAL PRADESH
DHEMAJI DISTRICT
MAJULI DISTRICT
BISWANATH DISTRICT
NORTH LAKHIMPUR
DHAKUAKHANA
Anandbagan
Ghunasuti
Gilamara
Diju
Jahing
Kakoi
Lilabari
Kadam
Ajad
Basudev Than
Sensua
Angarkhuwa
Jalbhari
Chilambari
Tunijan
Naoboisa
Panigaon
Charikaria
Dangdhara
Laluk
Bangalmara
Khora
Islampur
Dikrang
Tiding
Bihpuria
Dafalakata
Garumar
Uttarkathani
Narayanpur
Badati
Dhalpur
Silikhaguri
Harhajan
Barpi
River Brahmaputra
Legend
State Boundary
District Boundary
Sub-division Boundary
District Headquarters
Sub-division Headquarters
Important Places
Paved Roads
Railway Line
Unpaved Roads
Rivers/Streams
Sandbars
93°45'0"E
94°0'0"E
94°15'0"E
94°30'0"E
27°30'0"N
27°15'0"N
27°0'0"N
Map- 3


Map Showing Satellite imagery
(FCC) of Lakhimpur District, Assam
0 5 10 20 30 Kilometers
93°43'55"E
93°56'54"E
94°9'53"E
94°22'52"E
94°35'51"E
27°20'36"N
26°55'38"N
N
W
E
S
Sensor ID: OLI_TIRS
Spacecraft ID: LANDSAT_8
Date Product Generated: 03-16-2024
Map- 4

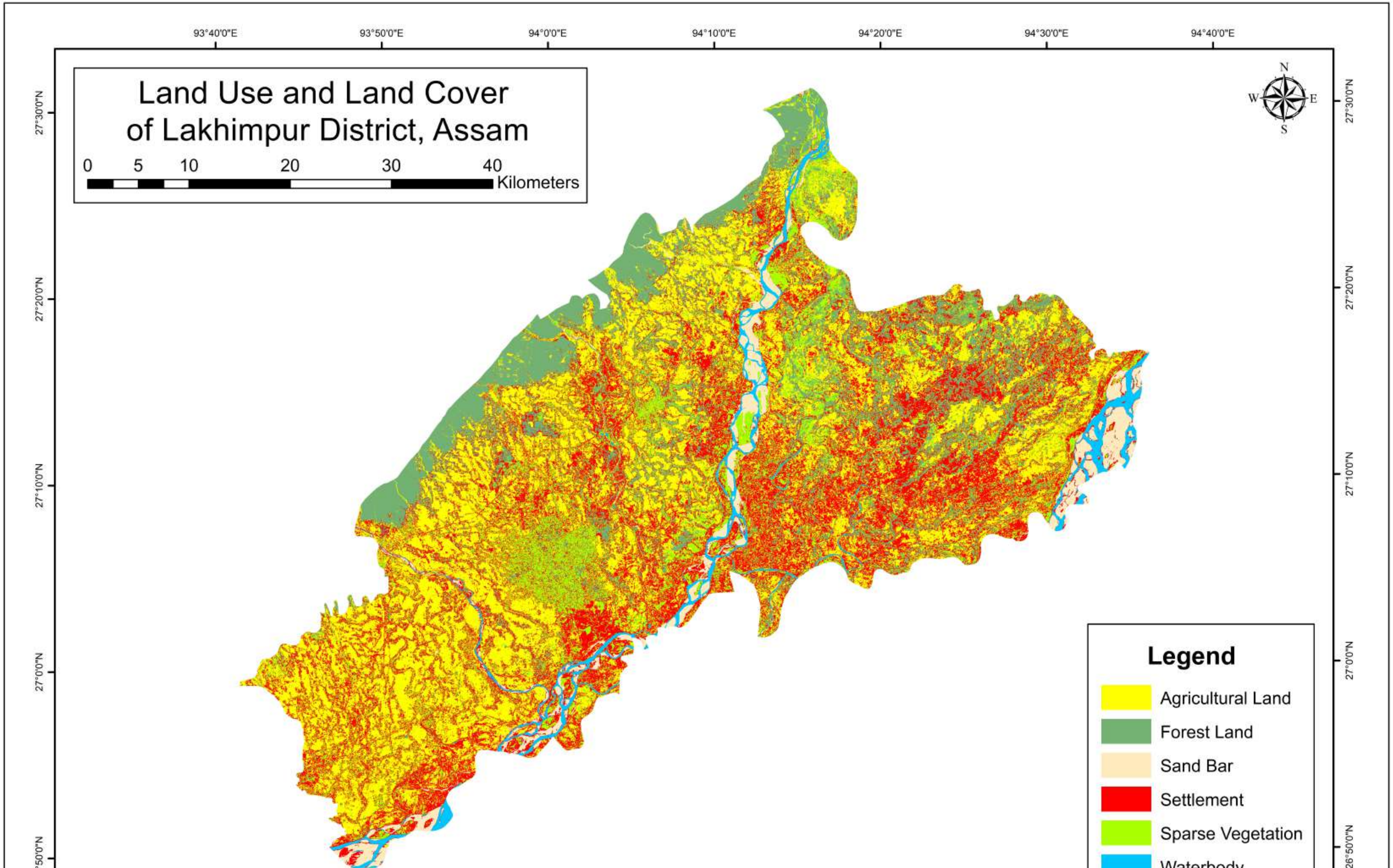


Map Showing River Network
of Lakhimpur District, Assam
0 5 10 20 30 Kilometers
93°48'0"E
94°10'49"E
94°33'38"E
27°18'10"N
26°58'0"N
N
S
W
E
LEGEND
River Network
Lakhimpur Boundary
Map- 5

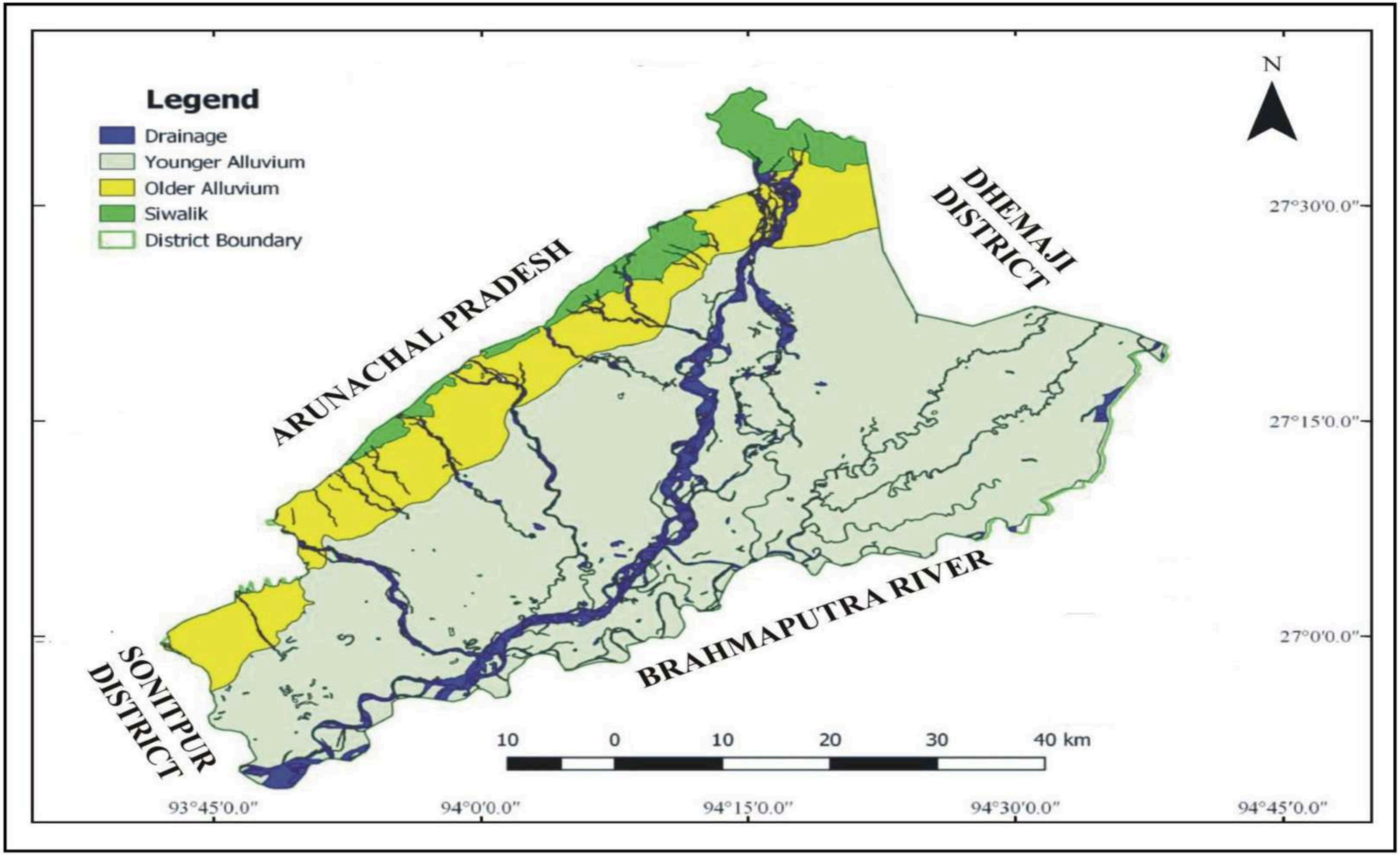
Map Showing Different Rivers of Lakhimpur District Assam



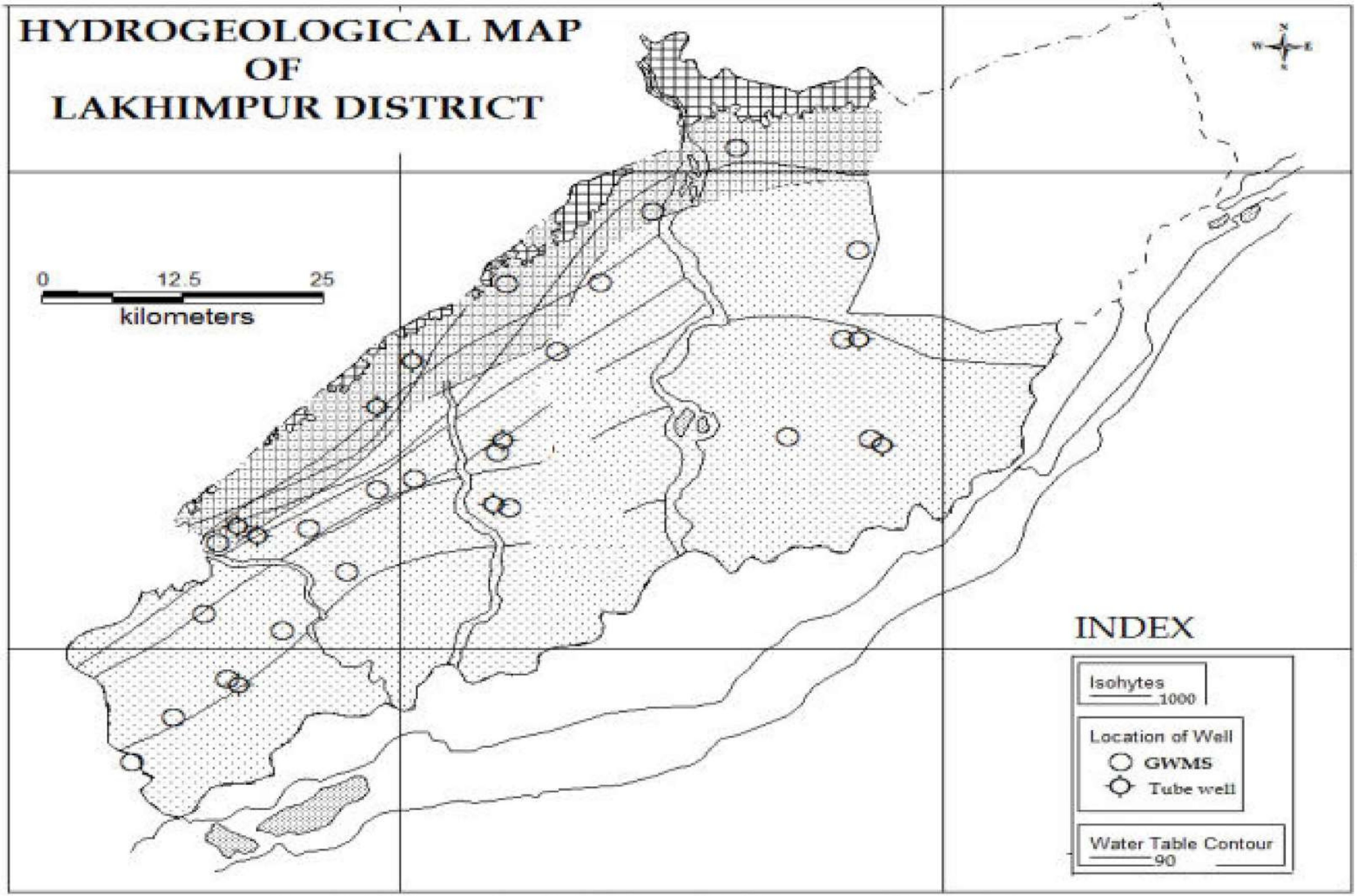
Map- 6


Land Use and Land Cover
of Lakhimpur District, Assam
0 5 10 20 30 40
Kilometers
N
W
E
S
93°40'0"E
93°50'0"E
94°0'0"E
94°10'0"E
94°20'0"E
94°30'0"E
94°40'0"E
27°30'0"N
27°20'0"N
27°10'0"N
27°0'0"N
26°50'0"N
Legend
Agricultural Land
Forest Land
Sand Bar
Settlement
Sparse Vegetation
Waterbody

Map- 7


Legend
Drainage
Younger Alluvium
Older Alluvium
Siwalik
District Boundary
N
DHEMAJI DISTRICT
ARUNACHAL PRADESH
BRAHMAPUTRA RIVER
SONITPUR DISTRICT
10 0 10 20 30 40 km
27°30'0.0"
27°15'0.0"
27°0'0.0"
93°45'0.0"
94°0'0.0"
94°15'0.0"
94°30'0.0"
94°45'0.0"

Map- 8


HYDROGEOLOGICAL MAP
OF
LAKHIMPUR DISTRICT
0
12.5
25
kilometers
N
W
E
S
INDEX
Isohytes
1000
Location of Well
GWMS
Tube well
Water Table Contour
90

Map- 9