GOVERNMENT OF ASSAM

OFFICE OF THE DISTRICT COMMISSIONER: SOUTH SALMARA MANKACHAR DISTRICT

HATSINGIMARI

E File No. TND/187/2023-T&D-SSM DTD. .16./09/2024

PUBLIC NOTICE

It is hereby given notice for general information that the District Survey Report (DSR) for South Salmara Mankachar District has been prepared in accordance with the Sustainable Sand Mining Management Guidelines, 2016, the Enforcement & Monitoring Guidelines for Sand Mining, 2020, and the notifications of the Ministry of Environment, Forest and Climate Change(MOEF&CC) vide no. S.O. 141(E) dated 15th January, 2016 and S.O. 3611(E) dated 25th July, 2018. The report is also in conformity with the Assam Minor Mineral Concession Rules, 2013 (AMMCR, 2013) and other relevant guidelines published by the MOEF& CC.

The Draft District Survey Report has been uploaded on the official website of South Salmara Mãnkachar District.

Public objections or suggestions are invited and can be submitted to the Office of the District Commissioner, South Salmara Mankachar District within 21 days of this publication (from 15.09.2024). All submissions should be made in writing.

District Commissioner cum
Chairman, District Level Committee, District Survey Report
South Salmara Mankachar District

E File No. TND/187/2023-T&D-SSM DTD. ...16../09/2024

Copy to:-

1. The Divisional Forest Officer, Dhubri, i/c South Salmara Mankachar for information and necessary action.
2. The DIPRO, South Salmara Mankachar for wide publicity.

District Commissioner cum
Chairman, District Level Committee, District Survey Report
South Salmara Mankachar District

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DISTRICT SURVEY REPORT
OF
SOUTH SALMARA-MANKACHAR DISTRICT, ASSAM

(For sand or river bed mining)

CPC Environment Solution Pvt. Ltd.

(A QCI-NABET Accredited Organization)

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PREFACE

The need for a District Survey Report (DSR) has been mandated by the Ministry of Environment, Forest, and Climate Change (MoEF&CC) through Notification No. 125 (Extraordinary, Part II Section 3, Sub-section ii), S.O. 141 (E), dated 15th January 2016. This notification introduced amendments to the EIA Notification 2006, aimed at improving legislative control. As part of these changes, district-level committees were introduced, and the preparation of DSRs became a requirement.

Subsequently, Notification No. 3611 (E), dated 25th July 2018, expanded the DSR's scope to include "Minerals Other than Sand" and provided a specific format for its preparation. The DSR's purpose is to identify areas with mineral potential where mining activities can be permitted, as well as to flag areas where mining should be restricted due to proximity to infrastructure, erosion-prone zones, or environmentally sensitive regions.

The preparation of the DSR involves both primary and secondary data collection. Primary data includes site inspections, surveys, and ground truthing, while secondary data comes from authenticated sources and satellite imagery studies. The secondary data covers information such as the district profile, local geology, mineralization, and other relevant activities, often compiled from disparate sources.

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Key Aspects of District Survey Report (DSR)

Assessment of Resources: The DSR provides a comprehensive evaluation of the mineral resources available in riverbeds within the district. It includes detailed data on the quantity, quality, and distribution of sand and other minor minerals, helping to prevent over-extraction and resource depletion through accurate estimation.

Environmental Impact Analysis: The report analyzes the environmental effects of riverbed mining, addressing changes in river morphology, hydrology, and impacts on aquatic ecosystems and biodiversity. This analysis is vital for mitigating harmful environmental impacts and conserving riverine habitats.

Regulation and Compliance: The DSR serves as a regulatory tool for riverbed mining, outlining standards and guidelines to ensure compliance with national and state environmental laws. It helps curb illegal mining activities and promotes regulated, lawful mining operations.

Sustainable Mining Practices: The DSR advocates for sustainable mining practices that reduce environmental degradation. Recommendations may include controlled mining depths, designated extraction zones, and periodic studies to maintain the ecological balance of river systems.

Socio- Economic Considerations: The report addresses the socioeconomic implications of riverbed mining, such as employment generation and local government revenue. It also considers the negative impacts on communities, including displacement and loss of livelihoods.

Data- Driven Decision Making: The DSR provides a scientific foundation for decisions regarding riverbed mining. Incorporating geospatial data, remote sensing images, and field surveys enhances the accuracy and reliability of the report, supporting informed policy-making and resource management.

Stakeholder Involvement: The preparation of the DSR involves consultations with various stakeholders, such as government bodies, local communities, environmentalists, and industry representatives. This inclusive approach ensures diverse perspectives are considered, promoting balanced and equitable mining practices.

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1. Introduction of District Survey Report (DSR) of South Salmara-Mankachar District

1.1 Introduction

The District Survey Report (DSR) of South Salmara Mankachar District has been prepared following the guidelines of the Ministry of Environment, Forests and Climate Change (MoEF&CC), Government of India. This report aligns with the MoEF&CC Notification S.O.-1533(E) dated 14th September 2006 and subsequent notification S.O. 141(E) dated 15th January 2016. It aims to ensure the scientific and systematic utilization of natural resources for the benefit of present and future generations. Furthermore, MoEF&CC's notification S.O. 3611(E) dated 25th July 2018 recommends the format for preparing the DSR.

The main objective of the DSR is to identify areas of aggradation where mining can be allowed, and areas of erosion where mining should be restricted. It also involves the calculation of the annual replenishment rate to maintain ecological balance. Additionally, the DSR includes assessing the development potential of in-situ minor minerals.

Objectives of the DSR:

1. Identification and quantification of minor mineral resources for optimal utilization.
2. Regulation of river bed mining, and reduction of demand-supply gaps.
3. Use of Information Technology (IT) for surveillance of river bed mining activities.
4. Facilitation of environmental clearance for clusters of mines.
5. Restriction of illegal mining.
6. Reduction of flood occurrences in the area.
7. Preservation of aquatic habitats.
8. Protection of groundwater by limiting extraction to above base flow levels.
9. Maintenance of data records related to mineral resources, leases, and revenue generation.
10. Creation of a scientific mining plan, including ultimate pit limit estimation.
11. Development of comprehensive guidelines for mining minor minerals The DSR includes secondary data on the district's geology, climate, mineral resources, and other relevant factors, compiled from published and unpublished reports, as well as government websites.

1.2 Statutory Framework

The MoEF&CC has issued several notifications and guidelines over the years to regulate mining and formulate DSRs for each district. Below is a summary of the legal framework:

Year	Particulars
1994	The MoEF&CC issued the Environmental Impact Assessment (EIA) Notification for major minerals covering areas over 5 hectares.
2006	EIA Notification SO 1533 (E) made it mandatory to obtain environmental clearance (EC) for minor minerals exceeding 5 hectares.
2012	The Hon'ble Supreme Court mandated EC for minor minerals, even for areas under 5 hectares.
2016	"Sustainable Sand Mining Guidelines (SSMG)" introduced, requiring EC for all minor minerals and district-level monitoring.
2018	MoEF&CC issued notification S.O. 3611(E) with a recommended DSR format for identifying aggradation areas, replenishment rates, and protected zones.
2020	The "Enforcement and Monitoring Guidelines for Sand Mining (EMGSM)" introduced for improved regulatory enforcement and technological monitoring of sand mining activities.

Enforcement & Monitoring Guidelines, 2020

These guidelines address illegal mining, directing states to implement monitoring mechanisms like river audits, aerial surveys, and drone- based surveillance.

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1.3 Utilization and Demand of the minerals

River bed minerals like sand, gravel, stone etc. plays an essential role in construction and is widely used in concrete production, glass manufacturing, road base formation, and many more. River bed mining is a prevalent practice in South Salmara Mankachar District, mainly for construction. The rise in real estate and government infrastructure projects has significantly increased the demand for sand and bricks. The minor minerals of South Salmara Mankachar *district* comes under B-category mining and it is included in sub-category B2.

Uses of minerals:

1. **Construction**: Sand, gravel, silt, clay and ordinary earth are key ingredients in concrete, mortar and asphalt.
2. **Industrial**: Used in glass production and abrasives.
3. **Environmental**: The minerals can improve traffic safety by providing grip on icy roads, and it helps in soil conditioning for agriculture.
4. **Decorative**: Sand, gravel and stones are used in candles, aquariums, and for enhancing aesthetic appeal in landscaping.
5. **Flood Protection**: Proper management of sand mining helps maintain river flood discharge capacity, reducing the risk of floods.

This DSR aims to provide a well-rounded, data-driven approach for sustainable mineral resource management, ensuring compliance with environmental guidelines and promoting socio-economic benefits for the district.

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1.4 Methodology of DSR Preparation

The District Survey Report (DSR) preparation follows a systematic methodology to ensure accuracy and comprehensiveness. The steps involved in the preparation of the DSR are illustrated in Figure 2.1 and are described in detail in the following sections.

a. Data Source Identification

The DSR is based on both primary and secondary data collected from reliable and authoritative sources. Identifying authentic data sources is critical for compiling accurate data. The primary data sources for the DSR are collected through field surveys and replenishment studies. Secondary data sources include publicly available information from government publications, reports, and reputable journals.

- **District Profile**: Information related to the district's demographics and basic statistics is sourced from the **District Census Report, 2011** and the **District Statistical Handbook** published by the Government of Assam.
- **Mineral Resources**: The potential mineral resources of the district are described based on reports published by the **Geological Survey of India (GSI)** or other government agencies
- **Mining Data**: Information on mining leases, lease holders, lease areas, resource allocations, and revenue generation is collected from the **Forest Department.**
- **Satellite Images**: Satellite imagery is utilized to prepare maps related to the district's physiography and land use/land cover.

b. Data Analysis and Map Preparation

After collecting data, a detailed analysis is conducted to extract relevant insights. This involves analyzing spatial data and preparing maps that depict:

- Geomorphology of the district
- Topography
- Land use patterns
- Mineral resource distribution

These maps help visualize the key characteristics of the district and identify potential mining areas.

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c. *Primary Data Collection*

Primary data is essential for preparing a comprehensive DSR. Fieldwork is conducted across the district to assess mineral resources. This field study provides a detailed understanding of the mineral composition and their distribution in the area.

d. *Replenishment Study*

A key aspect of sustainable mining is ensuring that the amount of sediment removed from riverbeds is replenished naturally. Therefore, replenishment studies are conducted to assess the annual rate of replenishment of riverbed sand. This helps avoid the adverse impacts of excessive sand extraction.

Physical surveys of the riverbed are carried out using **GPS/DGPS** to define the topography, contours, and offsets.

- The surveys provide a detailed depiction of important features in and around the river, including nearby civil structures and other key landmarks.
- This information helps define the spatial area eligible for sand mining and estimate the sand reserves.

e. *Report Preparation*

The DSR covers various aspects of the district, including:

- **General Profile**: A brief overview of the district, including demographics, land use patterns, and economic activities.
- **Geomorphology and Geology**: An assessment of the district's physical landscape, including its geological structure.
- **Mineral Resources**: A detailed account of riverbed sands and other minor minerals in the district, including their distribution and potential for extraction.
- **Mining Block Delineation**: Identification of potential mining blocks and mineral reserves within the district.

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- **Production Trends**: An analysis of recent trends in the production of minor minerals and the revenue generated from the mining sector.
- **Replenishment Estimation**: The annual replenishment rate of riverbed sand, based on field surveys.
- **Environmental Impact and Mitigation**: An evaluation of the potential environmental impacts of mining activities, along with proposed mitigation measures.
- **Risk Assessment and Disaster Management**: A strategy for managing risks associated with mining and minimizing the impact of any potential disasters.
- **Reclamation Strategy**: A plan for the reclamation of already mined-out areas to restore the ecological balance.

This structured approach ensures that the DSR not only identifies mineral resources but also emphasizes sustainable mining practices and environmental preservation.

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2. Overview of mining activity in the district

In the South Salmara Mankachar district collection of sand, gravel, stone, clay/silt etc. from river- bed is considered as one of the main minor mineral sources of the district. These materials are primarily utilized for construction purpose.

3. List of existing mining leases of the districts

Details of List of existing mining leases of the districts are furnished in the following table:

I. Govt. Mines :

Sl. No.	Name of Mahal	Name of the lessee	Location and area of mining lease	Period of lease	Status (working/ closed)
1	Kalo River Sand MM Unit		Kalo River Mankachar 4.98 Ha		Existing

II. M-Sand Plants with Locations :

Sl. No.	Name of Mahal	Name of the lessee	Location and area of mining lease	Period of lease	Status (working/ closed)
1	M/s Shakil Stone Crusher		Vill- Tangaon Part-I Dist- Mankachar		Existing
2	M/s Shourav Stone Crusher		Vill- Tangaon Part-I Dist -Mankachar		Existing
3	M/s Zubair Stone Crusher Unit		Vill -Manjuri Dist -Mankachar		Existing
4	M/s Joon Moon Stone Crusher		Vill- Tangaon Part-III Dist - Mankachar		Existing
5	M/s Dada Stone Crusher		Vill- Tangaon Part-III Dist - Mankachar		Existing
6	M/s R.Islam Stone Crusher		Vill- Tangaon Part-III Dist - Mankachar		Existing
7	M/s Momirul Islam Stone Crusher Industry		Vill- Tangaon Part-III Dist - Mankachar		Existing
8	M/s Khan Stone Crusher		Vill- Tangaon Part-II Dist - Mankachar		Proposed

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9	M/s S. Islam Stone Crusher		Vill- Tangaon Part-II Dist – Mankachar		Proposed
10	M/s Friendship Stone Crusher		Vill- Tangaon Part-III Dist – Mankachar		Proposed
11	M/s Bhai Bhai Stone Crusher		Vill- Tangaon Part-II Dist – Mankachar		Proposed
12	M/s Jannat Stone Crusher		Vill- Dhapguri Kural Bhanga Part-II Dist – Mankachar		Proposed

4. Details of revenue generated from mineral sector during last three years

Revenue generated for last 3 years in South Salmara Mankachar District is furnished in Table.

Table: District revenue generation from mineral sector (In INR)

Financial Year	Royalty			Total revenue
	Sand	Gravel	Earth/Silt/Clay	
2023-24	5,75,000.00			5,75,000.00
2022-23	5,75,000.00			5,75,000.00
2021-22	0			0

5. Detail of Production of Sand or Bajri or minor mineral in last three years

Sl. No	Financial Year	Production(cum)
1	2023-24	4000
2	2022-23	4000
3	2021-22	0

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6. Process of Deposition of Sediments in the rivers of the District of South Salmara Mankachar

The sediment of a river is commonly considered to be aesthetically displeasing and environmentally degrading. Conversely, part of the sediment (sand and gravel) may represent a natural resource for use by society. The potential usefulness of the sediment is enhanced when it is composed of particle sizes found in deposits on the river- bed that would be replenished by newly transported sediment after mining. As such, river deposits become renewable resources, periodically replaced by sediment transport in the river.

Sediment transport is the movement of organic and inorganic particles by water. In general, the greater the flow, the more sediment that will be conveyed. Water flow can be strong enough to suspend particles in the water column as they move downstream, or simply push them along the bottom of a water way. Transported sediment may include mineral matter, chemical sand pollutants, and organic material. Another name for sediment transport is sediment load. The total load includes all particles moving as bed load, suspended load, and wash load. Sediment deposition is the process of settling down of suspended particles to the bottom of a body of water. This settling often occurs when water flow slows down or stops, and heavy particles can no longer be supported by the bed turbulence. Sediment deposition can be found anywhere in a water system, from high mountain streams, to rivers, lakes, delta, floodplains.

Sediment transport is critical to understanding how rivers work because it is the set of processes that mediates between the flowing water and the channel boundary. Erosion involves removal and transport of sediment (mainly from the boundary) and deposition involves the transport and placement of sediment on the boundary. Erosion and deposition are what form the channel of any alluvial river as well as the flood plain through which it moves. The amount and size of sediment moving through a river channel are determined by three fundamental controls: competence, capacity and sediment supply. Competence refers to the largest size (diameter) of sediment particle or grain that the flow is capable of moving; it is a hydraulic limitation. If a river is sluggish and moving very slowly it simply may not have the power to mobilize and transport sediment of a given size even though such sediment is available to transport. So a river may be competent or incompetent with respect to a given grain size. If it is incompetent it will not transport sediment of the given size. If it is competent it may transport sediment of that size if such sediment is available (that is, the river is not supply-limited). Capacity refers to the maximum amount of sediment of a given size that a stream can transport in traction as bed load. Given a supply of sediment, capacity depends on channel gradient, discharge and the caliber of the load (the Presence of fines may increase fluid density and increase capacity; the presence of large particles may obstruct the flow and reduce capacity).

Capacity transport only occurs when sediment supply is abundant (non- limiting). Sediment supply refers to the amount and size of sediment available for sediment transport. Capacity transport for a given grain size is only achieved if the supply of that caliber of sediment is not limiting (that is, the maximum amount of sediment in stream is capable of transporting is actually available). Because of these two different potential constraints (hydraulic sand sediment supply) distinction is often made between supply-limited and capacity-limited transport.

Much of the material supplied to a stream is so fine (silt and clay) that provided it can be carried in suspension, almost any flow will transport it. Although there must be an upper limit to the capacity of the stream to transport such fines, it is probably never reached in natural channels and the amount moved is limited in supply. In contrast, transport of coarser material (say, coarser than fine sand) is largely capacity limited.

Modes of Sediment Transport: The sediment load of a river is transported in various ways although these distinctions are to some extent arbitrary and not always very practical in the sense that not all of the components can be separated in practice.

The modes are:

1. Dissolved Load.
2. Suspended Load.
3. Intermittent Suspension (Siltation) Load
4. Wash Load
5. Bed Load

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7. General Profile of the district

a) General Information

South Salmara Mankachar district was created by bifurcating Old Dhubri district in 2016. On 15 August 2015 Assam's Chief Minister announced 5 new administrative districts in Assam; South Salmara Mankachar was one among those. On 9 February 2016 Commissioner, Lower Assam and Central Assam Division, IAS inaugurated South Salmara Mankachar as an administrative district. Geographical coordinates of South Salmara Mankachar district is 25° 55' 0" North, 90° 1' 0" East.

The district headquarter is located at Hatsingimari town which is situated at about 245 km from Guwahati. It was earlier a sub-division of the Dhubri District. It shares its borders with Bangladesh in the west and Meghalaya in the south-east. The general topography of South Salmara Mankachar district is plain with patches of small hillocks like Bansali, Rangatari, etc. All these are situated in the southwestern part of the district. Mighty river Brahmaputra is flowing through this district from east to west with its tributaries.

History

South Salmara Mankachar was created by bifurcating the Old Dhubri district in 2016. On 15 August 2015, Assam's Chief Minister Tarun Gogoi announced 5 new administrative districts in Assam; South Salmara Mankachar was one among those. On 9 February 2016 Commissioner, Lower Assam and Central Assam Division Md. Mahtab Uddin Ahmed, IAS inaugurated South Salmara Mankachar as an administrative district at a function in Hatsingimari with the presence of thousands of people. There are few historical sites in the district. However, the famous ones are the tomb of Mir Jumla and Kamakhya Temple at Mankachar.

Culture

The culture of the people in this district is mixed culture. About 95% of the population are Muslims 4% Hindus and 1% Christians. Most of the people speak Goalpariya(Deshee) dialect. This dialect is nowadays regarded as a sub-language of the Assamese Language. But it is a different language having its own vocabulary and grammar. And some people speak the dialect of Mymensingh, Pabna, and Barishal of Bangladesh. The people who speak the Deshi (Goalpariya dialect) are called Ujanee or Deshee people and those who speak the dialects of Mymensingh, Pabna and Barishal of Bangladesh are called Bhatiya. Nowadays the term Bhatiya has been substituted by "Miya ". Though religiously the Dehsis (Ujanee) and Bhatiyas belong to the same group, there are a lot of differences between these two groups. Deshis are the indigenous people who were converted from time to time from the local indigenous groups like Koch, Rajbongshi, Mech, Jogi, Rabha, Napit, Fisherman, Kalitas etc. The Deshis claim that they are the offspring of Ali Mech. Ghoti and Tribal people, who are very few in number have also contributed to the culture of the district. The men of the district wear pants, pyjamas and kurtas as their traditional garments, while the women wear sarees.

Economy

South Salmara Mankachar District is primarily dependent on agricultural and forest products. The main source of income is paddy (both winter and autumn) with surplus production. Jute and mustard seed occupy the major share of cash crops. Wheat, maize, pulses and sugarcane are also grown moderately. From Forests, mainly timber and bamboo add to the income, though boulders and sand are also available. Fish, milk, meat, and eggs have small contributions to the economy. Currently, three tea gardens, whose contribution to the district economy is almost negligible, cover an area of 1362.33 hectares. Land revenue collection is minimal, whereas tax from check gates and excise duty occupies much of the government exchequer. Devoid of major industrial production, the district uses more funds for administration, development, and welfare works than it provides.

Its rich natural wealth is yet to be explored and some believe that proper utilisation of natural resources could provide a boost for the struggling economy.

Transport:

By Road: There is no National Highway in the district. Transportation takes place through state-maintained PWD roads, which are full of potholes. Hatsingimari is in the centre place in the District while one part of Hatsingimari town is attached to the Assam-Meghalaya border. There is no PWD road between South Salmara and Mankachar. The only overland communication from South Salmara to Mankachar is Fulbari–Singimari road through Meghalaya.

By Train: There is no Railway station in the district.

By Air: Nearest airport at Rupshi which is about 72.8 km (45.2 mi) away from the headquarter of Hatsingimari. It was constructed during World War II by the British Govt. mainly for military purposes. Till 1983, Indian Airlines and some private commercial flights operated regularly between Calcutta, Guwahati and Dhubri. Now it is totally closed. However, recently the ministry of DONER, GOI, has taken some initiative to renovate and functionalized the airport.

By Waterway: The town had a very busy river port on the bank of the Brahmaputra, which was used as an international trade centre with the neighbouring countries, especially in the British era. At present, the port is lying idle. However, small ferries transport people to and from Dhubri every day.

Administrative setup-

Head Quarter	Hatsingimari
Division	Lower Assam
Number of Sub-Divisions	1
Number of Revenue Circles/ Tehsils	2
Number of Community Development (C.D.) Blocks	3
Geographical Area	568 sq. km
Literacy	50.76%(2011 Census)
Revenue Villages	152
Panchayats	35
Population	388673(2011 Census)

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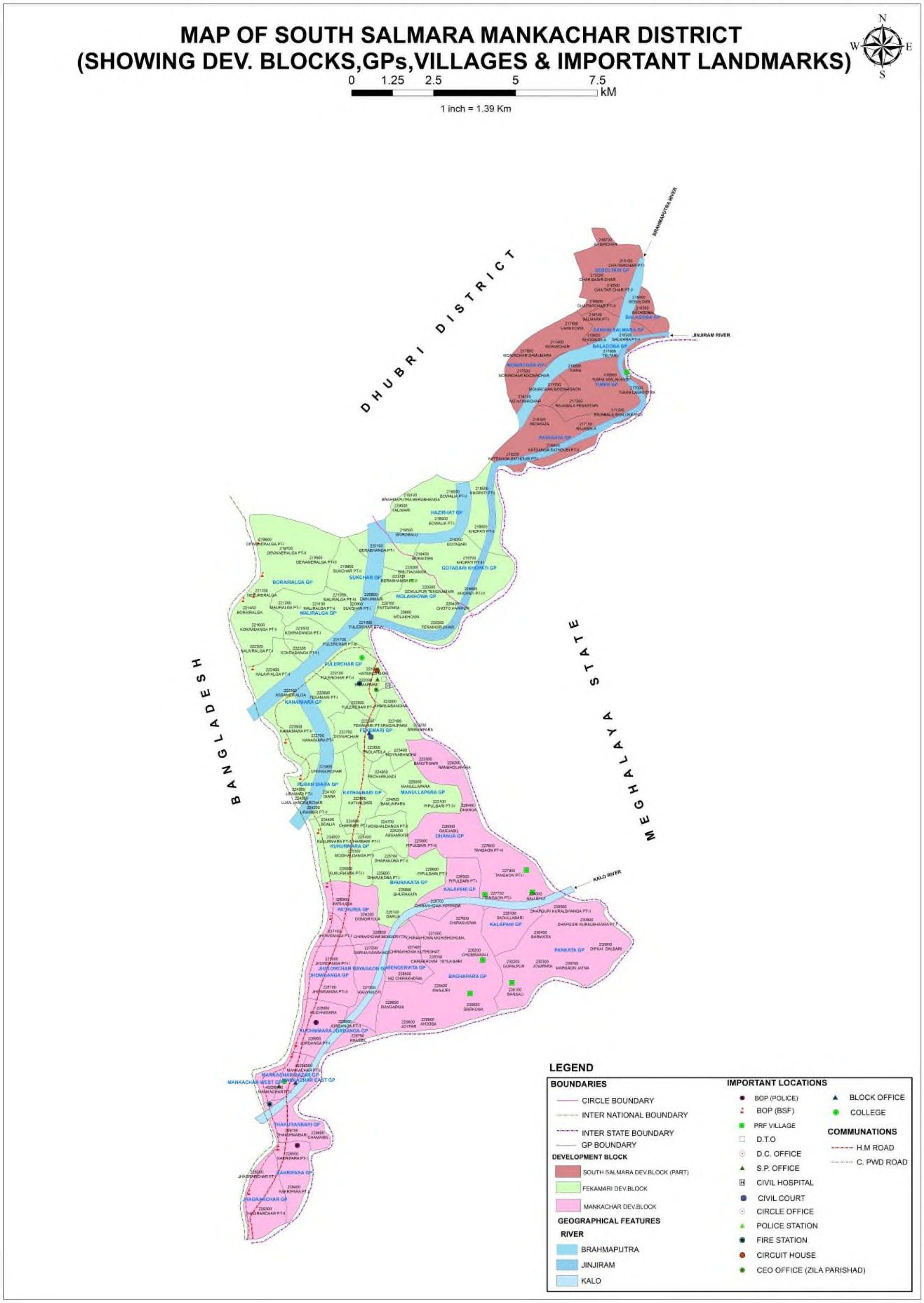

Map: Administrative map of the District

b) Climatic condition

The climate of South Salmara-Mankachar district is typically humid subtropical, influenced by its proximity to the Brahmaputra River and the heavy monsoon rainfall patterns of the region. Here's an overview of the climate:

1. Summer (March to June):

- Temperature: Summers are warm and humid, with temperatures ranging from 25°C to 35°C (77°F to 95°F).
- Humidity: The humidity level is quite high during this period.
- Rainfall: Pre-monsoon showers are common, especially from May onward.

2. Monsoon (June to September):

- Heavy Rainfall: The district experiences heavy rainfall due to the southwest monsoon. The average annual rainfall is 2,500 to 3,000 mm (98 to 118 inches).
- Floods: Due to the low-lying terrain and the proximity to the Brahmaputra River, the district is prone to flooding during the monsoon season, affecting agriculture and local life.
- Temperature: The temperature remains moderate, usually ranging between 25°C and 30°C (77°F to 86°F), but the high humidity makes it feel warmer.

3. Autumn (October to November):

- Post-Monsoon: The rainfall decreases, and the weather becomes more pleasant. The sky is often clear, and the region gets relief from the intense monsoon.
- Temperature: The temperature remains mild, usually between 20°C and 30°C (68°F to 86°F).

4. Winter (December to February):

- Mild Winter: Winters are mild, with temperatures ranging from 10°C to 20°C (50°F to 68°F). The region doesn't experience extreme cold.
- Fog: Morning fog is common during winter, especially in January.

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5. Humidity:

- The overall humidity level remains high throughout the year due to its subtropical nature and the presence of large water bodies like the Brahmaputra River.

In summary, South Salmara-Mankachar district has a tropical climate with heavy rainfall during the monsoon season, mild winters, and a high level of humidity year-round. The district frequently faces the challenge of seasonal floods, especially during the monsoon months.

C Drainage System

The drainage system of South Salmara-Mankachar district is primarily shaped by the presence of the Brahmaputra River and its tributaries. The region is characterized by flat, alluvial plains with numerous water channels and river systems.

1. Brahmaputra River:

The Brahmaputra River is the most significant river influencing the district's drainage. It flows along the northern boundary of South Salmara-Mankachar and plays a crucial role in shaping the district's geography and hydrology.The river provides water for agriculture but also contributes to flooding during the monsoon season.

2. Tributaries and Channels:

The district is crisscrossed by various tributaries and distributaries of the Brahmaputra River, forming a complex drainage network. Jinjiram River: A major tributary that passes through the district, contributing to local agriculture and water availability. Like the Brahmaputra, it can also flood during the monsoon.Numerous small streams and channels, often seasonal, flow into the Brahmaputra or its tributaries, forming a dense network of natural waterways.

3. Wetlands and Floodplains:

The district has extensive wetlands and floodplains that act as natural drainage areas. These wetlands often fill up during the monsoon season, helping to absorb excess water but also making parts of the district vulnerable to prolonged waterlogging.These areas are crucial for maintaining the local biodiversity and supporting livelihoods such as fishing.

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4. Flooding and Drainage Issues:

Due to the low-lying nature of the district and the heavy monsoon rains, flooding is a recurring issue, especially during the peak monsoon months. The Brahmaputra often overflows its banks, inundating nearby areas.Poor drainage infrastructure in some parts of the district exacerbates the problem, leading to waterlogging in both urban and rural areas.Flood management efforts are crucial in this district, with embankments and other infrastructure in place, but the region's proximity to major rivers makes it prone to natural flooding.

5. Role of Embankments:

To mitigate the risk of flooding, embankments have been built along the Brahmaputra and its tributaries. However, these structures can be breached during periods of exceptionally high rainfall, leading to floods.

6. Agriculture and Drainage:

The drainage system is crucial for the district's agriculture, as it helps irrigate fields during the dry season but can cause significant damage when rivers overflow during the monsoon.

D .Sream ordering

The stream order hierarchy was officially proposed in 1952 by Arthur Newell Strahler, a geoscience professor at Columbia University in New York City, in his article "Hypsometric (Area Altitude) Analysis of Erosional Topology". The article, which appeared in the Geological Society of America Bulletin outlined the order of streams as a way to define the size of perennial (a stream with water in its bed continuously throughout the year) and recurring (a stream with water in its bed only part of the year) streams. When using stream order to classify a stream, the sizes range from a first-order stream all the way to the largest, a 12th- order stream.

A first- order stream is the smallest of the world's streams and consists of small tributaries. These are the streams that flow into and "feed" larger streams but do not normally have any water flowing into them. In addition, first and second- order streams generally form on steep slopes and flow quickly until they slow down and meet the next-order waterway.
First through third- order streams are also called headwater streams and constitute any waterways in the upper reaches of the watershed. It is estimated that over 80% of the world's waterways are these first through third- order, or headwater streams. Going up in size and strength, streams that are classified as fourth through sixth order are medium streams while anything larger (up to 12th order)

is considered a river. The world's largest river, the Amazon in South America, is considered a 12th-order stream. Unlike the smaller order streams, these medium and large rivers are usually less steep and flow slower. They do however tend to have larger volumes of runoff and debris as it collects in them from the smaller waterways flowing into them.This method of classifying stream size is important to geographers, geologists, hydrologists and other scientists because it gives them an idea of the size and strength of specific waterways within stream networks- an important component of water management. In addition, classifying stream order allows scientists to more easily study the amount of sediment in an area and more effectively use waterways as natural resources. Stream order also helps people like biogeographers and biologists in determining what types of life might be present in the waterway. This is the idea behind the River Continuum Concept, a model used to determine the number and types of organisms present in a stream of a given size. Different types of plants for example can live in sediment-filled, slower-flowing rivers like the lower Ganges than can live in a fast-flowing tributary of the same river.

d) Irrigation

Irrigation in South Salmara-Mankachar district is crucial for supporting the predominantly agrarian economy. Given the district's proximity to the Brahmaputra River and its tributaries, as well as the region's monsoon-dependent rainfall patterns, irrigation plays a vital role in ensuring stable agricultural output, especially during the dry season. Here's an overview of the irrigation system in the district:

1. Sources of Irrigation:

Brahmaputra River: The Brahmaputra, one of the major rivers in the region, provides a reliable source of water for irrigation. Water is diverted through canals and other systems to support nearby agricultural lands.

Tributaries and Smaller Streams: Tributaries like the Jinjiram River and smaller local streams are also used for irrigation. These water sources are crucial for local farming, especially in areas farther from the Brahmaputra.

Groundwater: In some areas, farmers rely on groundwater for irrigation, using tube wells and hand pumps. However, groundwater extraction is less common compared to river-based irrigation due to the abundance of surface water.

Floodwaters: In some cases, floodwaters are harnessed for irrigation purposes after the monsoon season subsides. Flood recession farming is practiced in areas where floodwaters naturally recede, leaving behind fertile soil.

2. Irrigation Methods:

Canal Irrigation: Small-scale canals and channels are used to divert water from rivers like the Brahmaputra and Jinjiram to agricultural fields. These canals are crucial for supplying water during the dry season or when rainfall is insufficient.

Surface Irrigation: Surface irrigation methods like furrow, border, and basin irrigation are common in the district. This involves distributing water across the surface of the fields, particularly in paddy cultivation.

Pump Irrigation: Water pumps, including diesel-powered and electric pumps, are used to draw water from rivers, ponds, or shallow groundwater sources. Pumps help transport water to fields that may not have access to direct canal irrigation.

3. Crops Irrigated:

Rice (Paddy): The primary crop in the district is rice, which requires a significant amount of water. Irrigation is vital for paddy cultivation, especially during the dry season or in areas where monsoon rains are insufficient.

Jute: Jute is another important crop grown in the district, and irrigation is essential during its early growth stages.

Vegetables and Other Cash Crops: Farmers also grow vegetables and cash crops like pulses, which require controlled irrigation, especially during the post-monsoon season.

4. Challenges in Irrigation:

Flooding: The district is prone to seasonal flooding, particularly during the monsoon. While this brings water, it can also destroy crops and infrastructure, including irrigation systems. Post-flooding, efforts are needed to restore irrigation canals and infrastructure.

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Waterlogging: Excessive rainfall and flooding often lead to waterlogging, which can harm crops and make irrigation management more difficult. Farmers must balance between providing enough water and preventing waterlogging.

Infrastructure Limitations: In some areas, the irrigation infrastructure, such as canals and embankments, may not be well developed or properly maintained. This can limit water availability during critical growing periods.

5. Government Initiatives:

The Assam Government and various central government schemes have been working to improve irrigation infrastructure in the region. Initiatives such as the Pradhan Mantri Krishi Sinchai Yojana (PMKSY) aim to provide financial and technical assistance to farmers for better irrigation management.

Irrigation projects like the construction of new canals, repair of old structures, and promotion of efficient irrigation techniques (like drip irrigation) are being implemented to improve water usage and reduce dependency on unpredictable monsoon rains.

6. Traditional Irrigation Practices:

In rural areas, some farmers still use traditional irrigation methods, such as bamboo pipes and small earthen dams to divert water from nearby streams or rivers. These methods are sustainable and cost-effective but may not be sufficient during prolonged dry spells.

7. Monsoon Dependency:

Agriculture in South Salmara-Mankachar is heavily dependent on the monsoon rains, with irrigation acting as a supplementary system. During the monsoon, farmers rely less on artificial irrigation, but in the dry season, irrigation becomes critical to maintain crop yields.

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e) Soil resources

Soils in greater part of the district are sandy loam, clay loam, sandy soil, red soil and clay soil. It is found to be highly acidic to slightly alkaline in nature and is moderately permeable and characterised by the presence of low organic carbon and low soluble salts. Soils restricted to inselberg areas are more clayey, lateritic and less permeable and are highly acidic in nature. From agriculture point of view, the soils in major part of the area are suitable for all sorts of crops cultivation.

Physiographically, the district constitutes the vast alluvial plains of Brahmaputra River system. The monotony of the flat alluvial tract is interrupted by the presence of Archaean inliers in the form of disconnected hillocks referred to as inselbergs . Terraced alluvial deposits occupy major part of the district with conspicuous occurrence of buried channels, back swamps, etc. Soils in greater part of the district are sandy and silty loam, or clayey loam. It is found to be highly acidic to slightly alkaline in nature and is moderately permeable and characterised by the

presence of low organic carbon and low soluble salts. Soils restricted to inselberg areas are more clayey, lateritic and less permeable and are highly acidic in nature. From agriculture point of view, the soils in major part of the area are suitable for all sorts of crops cultivation.

Groundwater prospects in the district

The district's proximity to the Brahmaputra River and its alluvial plains means that groundwater is generally available at relatively shallow depths. Here's an overview of the groundwater resources in the district:

1. Groundwater Availability:

Shallow Aquifers: The district has abundant shallow aquifers due to the permeable alluvial soils deposited by the Brahmaputra River. These aquifers are typically found at depths ranging from 10 to 30 meters (33 to 100 feet). The groundwater table tends to rise during the monsoon season due to heavy rainfall and river water percolation. However, in the dry season, the water table may drop slightly, especially in areas where groundwater extraction is high.

2. Sources of Groundwater Recharge:

The Brahmaputra River and its tributaries play a significant role in recharging groundwater aquifers through seepage, particularly during the monsoon season when water levels are high.: The district receives heavy monsoon rainfall, which also contributes to groundwater recharge. Rainwater percolates through the soil and replenishes the aquifers.Flooding during the monsoon season also helps recharge the groundwater as the excess water seeps into the soil over time.

3. Groundwater Extraction Methods:

Dug Wells: Traditional dug wells are still used in many rural areas to access shallow groundwater for domestic use and small-scale irrigation.

Tube Wells: Tube wells and bore wells are increasingly common for extracting groundwater, especially for irrigation. These wells can tap into both shallow and deeper aquifers, depending on the local geology and water needs.

Hand Pumps: Hand pumps are widely used for drawing water from shallow aquifers for domestic use, especially in rural areas.

4. Groundwater Quality:

Groundwater in the district is generally of good quality for agricultural and domestic use. The alluvial soils act as a natural filter, ensuring that the groundwater is relatively clean. In some areas, high levels of iron in the groundwater have been reported, which can affect its taste and usability. Iron contamination is a common issue in many parts of Assam, though it is not harmful in small quantities. While arsenic contamination is a concern in some parts of Assam, there is no widespread report of significant arsenic levels in South Salmara-Mankachar's groundwater. However, continuous monitoring is necessary.

7. Land Use Land Cover:

The **Land Use Land Cover (LULC)** of South Salmara-Mankachar district reflects the district's agricultural dominance, forest cover, water bodies, and settlements. Due to its location in the Brahmaputra Valley, the region is characterized by fertile alluvial plains, making it a primarily rural district with extensive agricultural land. The presence of rivers, floodplains, and wetlands also plays a significant role in shaping the land use patterns

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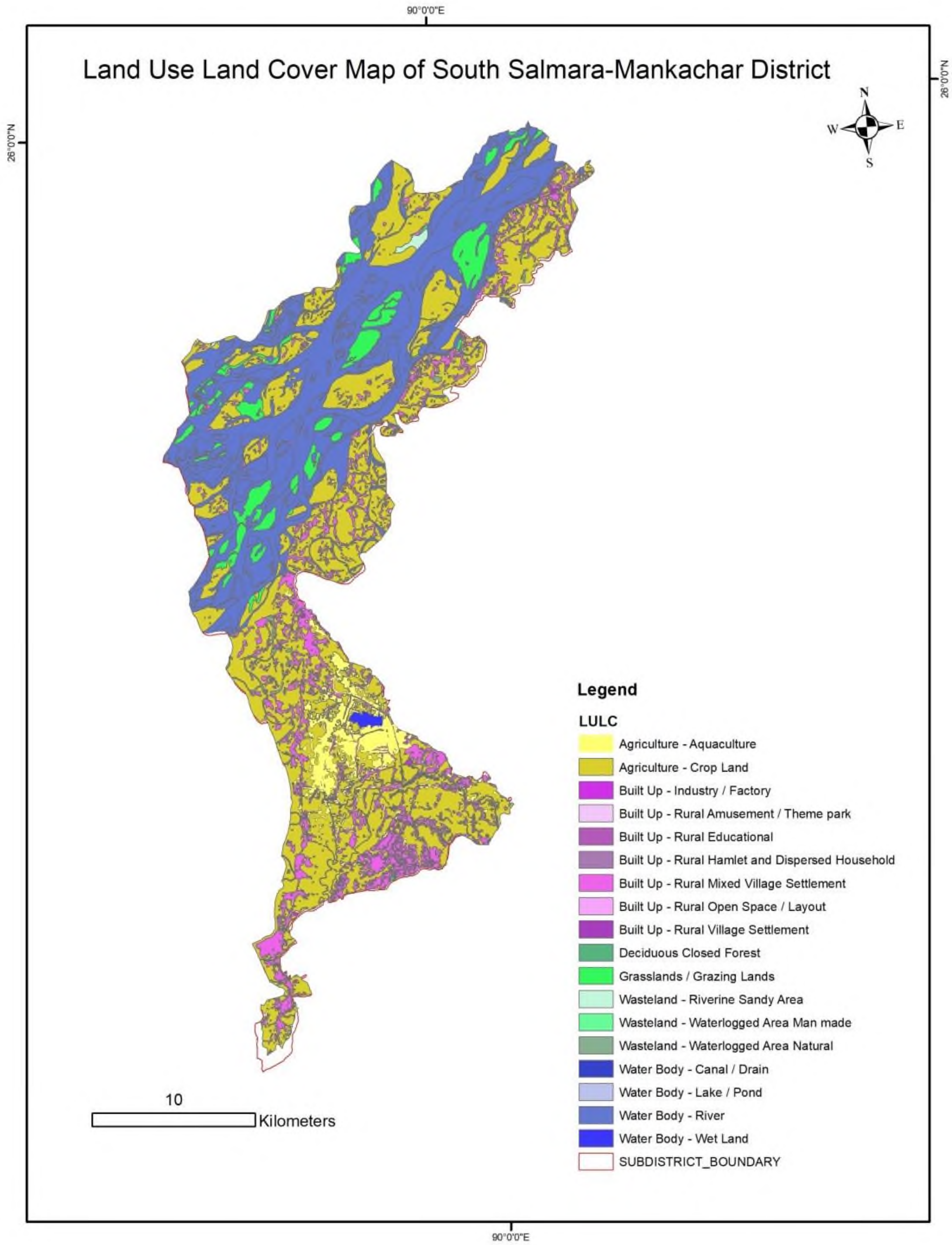

Map: Land Use Land Cover of the District

9. Physiography of the District

The general topography of South Salmara Mankachar district is plain with patches of small hillocks like Bansali, Rangatari, etc. All these are situated in the southwestern part of the district. Mighty river Brahmaputra is flowing in the north of this district from east to west with its tributaries. Other rivers are Jinjiram, Kalonadi (also known as Ganol) etc.

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10. Rainfall

The climate of the District is very damp and humid due to heavy rains and high temperature. June and July are the months with highest rainfall. Generally the period from May- end to October is considered as flood season. The rainfall pattern of South Salmara Mankachar is similar that of Dhubri District. The average annual rainfall of the district is 2,916 mm (114.8 in).

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C	23	26	30	31	30	30	30	30	29	29	27	23	28.2
(°F)	(73)	(79)	(86)	(88)	(86)	(86)	(86)	(86)	(84)	(84)	(81)	(73)	(82.7)
Average low °C	12	13	17	21	23	24	26	26	25	23	18	13	20.1
(°F)	(54)	(55)	(63)	(70)	(73)	(75)	(79)	(79)	(77)	(73)	(64)	(55)	(68.1)

11. Geology

a. Regional Geology:

Shillong plateau (covering approx. 47614 sq. km.) is the singular representative of Precambrian cratonic block of northeast India tectonically detached from the mainland of Indian Peninsula. The cratonic block is girdled by dextrally moving Dauki fault to the south, Brahmaputra lineament to the north, Garo- Rajmahal graben, Dhuburi/Madhupur lineament to the west and belt of schuppen to the east. It consists of high to medium grade Paleoproterozoic basement gneisses and schist designated as Basement Gneissic Group (BGG) overlain by Mesoproterozoic metasediments and metavolcanics of the Shillong Group, both being intruded by Neoproterozonic acidic intrusives such as Myllem pluton, South Khasi pluton, Umroi granite, Nongpoh and a few others enlisted by Mazumdar (76); Ghosh*et. al.* (2005); Devi and Sharma (2006, 2010).

The Paleocene to Eocene continental shelf of the Indian plate which became emergent and which is being over-thrust by the Himalayas on the north-northwest and by the Naga hills on the southeast comes under the upper Assam shelf.

The present-day Assam Basin, a cratonic margin, reflects three distinct tectonic phases. The earliest was Late Cretaceous to Eocene block faulting and development of a southeasterly dipping shelf. Duringthe second phase, in Oligocene time, uplift and erosion occurred north of the many basement faults were reactivated; and many basement-controlled structures became prominent.

The Eocene Sylhet Formation was deposited in a range of environments and was subdivided into the members which generally represents these different depositional environments. The lower Lakadong member was deposited in a lagoonal environment consists of more than 350m of thin sandstones and interbedded shales and coals in it basal parts (Fig. 4 showing the development of Assam Shelf). The environment of the Lakadong member typically consists of the thick sands of barrier- bar. The members of upper part of the Lakadong Formation are calcareous sandstone of a restricted shallow water platform.

The gneissic groups of rocks are well exposed in the western, northern and north eastern part of the Shillong plateau. Towards the southern boundary it is covered by Cretaceous –Tertiary sedimentary sequences and within the plateau about 2500 sq. km. (approx.) area is occupied by intracratonic basin sediments. Orthogneiss and paragneiss are the two major components of basement gneissic complex. The main characteristic features of the banded gneiss are of bimodal character. Other constituents are migmatite, augen gneiss, BIF, amphibolites, pyroxene granulite, calc granulite, high grade sillimanite bearing metapelite with characteristic cordierite, corundum, spinel and sappherine, lamprophyre, diorite, granodiorite, mafic intrusion, pegmatite and other vein rocks.

b. Local Geology:

The geology of South Salmara Mankachar district, like much of western Assam, is characterized by alluvial deposits and riverine landscapes formed primarily by the Brahmaputra River and its tributaries. The proximity to regions like the Singrimari coalfield and the Garo Hills brings in a diversity of geological structures and formations, particularly of Lower Gondwana age. The coal-bearing sequences at the district's margins point to faulted and ancient geological formations that are still under-researched in comparison to other coalfields in India.Singrimari coalfield is located in Dhubri District of Assam at the Meghalaya- Assam border and lies close to Indo- Bangladesh border. Lower Gondwana rocks are exposed to the south- east of the coalfield, around Hallidayganj (Singrimari) village located at the western tip of the Garo Hills, Meghalaya. The strata to the north western part are dipping below a cover of alluvium brought by Brahmaputra River. These Lower Gondwana sequences have earlier been classified into Talchir and Karharbari Formation on the basis of lithological characteristics. The entire sequence forming the south-eastern margin of the Singrimari Gondwana basin rests unconformably over the Precambrian basement.C.S. Fox (1934) reported plant fossils from the Singrimari sandstones of Lower Gondwana age and subsequently it was correlated them to the Barakar series which is similar to the Lower Barakar based on the ratio of volatile matter to fixed Carbon ratio of Jharia Coalfield. Acharya and Ghosh (1968) made a preliminary survey of the area and tentatively grouped the entire sequence in

Karharbari Formation. Goswami and Das (1969) considered the sequence to be of Lower Gondwana Formation. Barooah (1977) mapped the area and assigned an Upper Carboniferous to Permian age to this sequence.

In Singrimari coalfield, the Lower Gondwana rocks have been reported as belonging to Talchir and KaharbariFormations by earlier workers. The sandstone shows good mineralogical maturity, moderate to poor textural maturity and poor sorting. There are three to four pebbly sandstone horizons made up of angular fragments of large feldspars, clasts of shale, gneissic rocks and sub- rounded to highly angular quartz set in a quartzo- feldspathic matrix. These horizons are generally associated with minor syn-sedimentary faults, fractures and slicken sides. The association of gritty quartzose sandstone, grey micaceous shale, carbonaceous shale and coal is more akin to the litho-assemblage of Lower Barakar Formation as recorded in other Indian Peninsular Gondwana coalfields. Lithounits in the upper part of the borehole, are dominated by argillaceous facies. The grey mudstone with profuse carbonized plant remains, leaf impressions indicates typical floodplain deposits, sandstone dominated heterolith with load structure indicates levee facies, while the interlaminated coarse grained sandstone with scoured contact represents crevasse splay deposits.

The rocks are, in general, mineralogically moderately matured and texturally poorly sorted and immatured. Large sub-rounded K-feldspar grains often show saussuritization indicating alteration in a warm, humid condition. Occurrence of anhedral quartz of different sizes associated with other rock fragments indicates sudden deposition with almost no transportation. Cholritization and sericitization of muscovite clearly indicates formation of the minerals in an alkaline and reducing condition within a logged sub- basin controlled by prevailing fault system. All these micro- textural evidences point to the fault controlled deposition of fanglomerates.

So called Karharbari Formation, characterized by dominance of fresh feldspar rich sandstone is absent, instead arenitic channel facies sandstone, more akin to

Lower Barakar litho- assemblage of peninsular Gondwana basins. These pebbly horizons are more possibly formed due to repeated activation/reactivation of basin marginal faults and deposited as fanglomerates in a small fault bounded trough having very little or no transportation at all. Mega- and Microfloral studies (Bharadwaj, 1966, 1974, Tiwari, 1973, Manju et al., 1977, 4th. International Gondwana Symposium) strongly indicate that the Lower Gondwana rocks of Western Garo hills belong to Lower Barakar Formation (Lower Permian).

11. b) Mineral Wealth

i. Overview of mineral resources:

The geological formation of South Salmara Mankachar District indicates the presence of minor minerals.

(To be updated after field survey)

ii. Details of Sand and other riverbed minerals Resources:

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

(To be updated after field survey)

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12. (a) District wise detail of river or stream and other sand source

Drainage system with description of main rivers

S. No.	Name of the river	Area drained (sq. m)	% Area drained in the district
1	Brahmaputra River		
	Jinjiram River		
	Kaladubi River		
	Ganol River		

(b) District wise availability of sand or gravel or aggregate resources

i) Annual deposition

S. No	River/ stream	Portion of the river/ stream recommended for mineral concession	Length of area recommended for mineral concession (in km)	Average width of area recommended for mineral concession (in m)	Area recommended for mineral concession (in sq. m)	Mineable mineral potential (in metric T) (60% of total mineral potential)
Total for the district						

(To be updated after field survey)

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ii) Mineral potential

Boulder (MT)	Bajari (MT)	Sand (MT)	Total mineable mineral potential (MT)

(To be updated after field survey)

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13. Replenishment Study

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

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

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

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

Field data collation:

Secondary datawere collected for pre- monsoon period and during September 2024 post-monsoon data were collected for the river banks. The relative elevation levels were captured through GPS/DGPS. Thickness of the sand bars was measured through sectional profiles.

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To be updated after Field survey

REPLENISHMENT STUDY

Sr No	River Name	Mine Name	Area (Ha)	Pre Monsoon			Post Monsoon			
				Total Area (in Sqm)	Average depth of Sand Deposit (in meters)	Total Quantity of Sediment Load (in cum)	Total Area (in Sqm)	Average depth of Sand Deposit (in meters)	Total Quantity of Sediment Load (in cum)	Mineable mineral potential (in Cubic meter) (60% of total mineral potential)

References:

1. https://dhubri.assam.gov.in/

2. https://southsalmaramankachar.assam.gov.in/about-district/district-glance

3. https://www.researchgate.net/publication/270895196_GEOLOGICAL_SURVEY_OF_INDIA_NORTH_EASTERN_REGION_TECTONO-SEDIMENTARY_EVOLUTION_AND_RECLASSIFICATION_OF_LOWER_GONDWANA_ROCKS_-A_CASE_STUDY_FROM_SINGRIMARI_COALFIELD_DHUBRI_DISTRICT_ASSAM

Photoplates:

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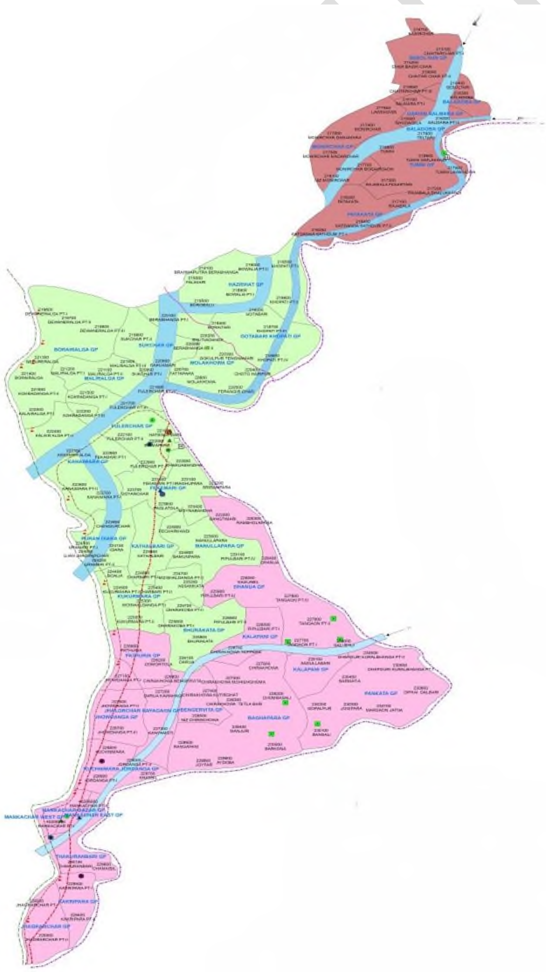
DISTRICT SURVEY REPORT
OF
SOUTH SALMARA-MANKACHAR
DISTRICT, ASSAM

(For Minor minerals other than sand or river bed mining)



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PREFACE

The need for a District Survey Report (DSR) has been mandated by the Ministry of Environment, Forest, and Climate Change (MoEF&CC) through Notification No. 125 (Extraordinary, Part II Section 3, Sub-section ii), S.O. 141 (E), dated 15th January 2016. This notification introduced amendments to the EIA Notification 2006, aimed at improving legislative control. As part of these changes, district-level committees were introduced, and the preparation of DSRs became a requirement.

Subsequently, Notification No. 3611 (E), dated 25th July 2018, expanded the DSR's scope to include "Minerals Other than Sand" and provided a specific format for its preparation. The DSR's purpose is to identify areas with mineral potential where mining activities can be permitted, as well as to flag areas where mining should be restricted due to proximity to infrastructure, erosion-prone zones, or environmentally sensitive regions.

The preparation of the DSR involves both primary and secondary data collection. Primary data includes site inspections, surveys, and ground truthing, while secondary data comes from authenticated sources and satellite imagery studies. The secondary data covers information such as the district profile, local geology, mineralization, and other relevant activities, often compiled from disparate sources.

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Key Aspects of District Survey Report (DSR)

Assessment of Resources: The DSR provides a comprehensive evaluation of the mineral resources available in riverbeds within the district. It includes detailed data on the quantity, quality, and distribution of sand and other minor minerals, helping to prevent over-extraction and resource depletion through accurate estimation.

Environmental Impact Analysis: The report analyzes the environmental effects of riverbed mining, addressing changes in river morphology, hydrology, and impacts on aquatic ecosystems and biodiversity. This analysis is vital for mitigating harmful environmental impacts and conserving riverine habitats.

Regulation and Compliance: The DSR serves as a regulatory tool for riverbed mining, outlining standards and guidelines to ensure compliance with national and state environmental laws. It helps curb illegal mining activities and promotes regulated, lawful mining operations.

Sustainable Mining Practices: The DSR advocates for sustainable mining practices that reduce environmental degradation. Recommendations may include controlled mining depths, designated extraction zones, and periodic studies to maintain the ecological balance of river systems.

Socio- Economic Considerations: The report addresses the socioeconomic implications of riverbed mining, such as employment generation and local government revenue. It also considers the negative impacts on communities, including displacement and loss of livelihoods.

Data- Driven Decision Making: The DSR provides a scientific foundation for decisions regarding riverbed mining. Incorporating geospatial data, remote sensing images, and field surveys enhances the accuracy and reliability of the report, supporting informed policy-making and resource management.

Stakeholder Involvement: The preparation of the DSR involves consultations with various stakeholders, such as government bodies, local communities, environmentalists, and industry representatives. This inclusive approach ensures diverse perspectives are considered, promoting balanced and equitable mining practices.

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1. Introduction of District Survey Report (DSR) of South Salmara-Mankachar District

1.1 Introduction

The District Survey Report (DSR) of *South* Salmara Mankachar District has been prepared following the guidelines of the Ministry of Environment, Forests and Climate Change (MoEF&CC), Government of India. This report aligns with the MoEF&CC Notification S.O.-1533(E) dated 14th September 2006 and subsequent notification S.O. 141(E) dated 15th January 2016. It aims to ensure the scientific and systematic utilization of natural resources for the benefit of present and future generations. Furthermore, MoEF&CC's notification S.O. 3611(E) dated 25th July 2018 recommends the format for preparing the DSR.

The main objective of the DSR is to identify areas of aggradation where mining can be allowed, and areas of erosion where mining should be restricted. It also involves the calculation of the annual replenishment rate to maintain ecological balance. Additionally, the DSR includes assessing the development potential of in-situ minor minerals.

Objectives of the DSR:

1. Identification and quantification of minor mineral resources for optimal utilization.
2. Regulation of river bed mining, and reduction of demand-supply gaps.
3. Use of Information Technology (IT) for surveillance of river bed mining activities.
4. Facilitation of environmental clearance for clusters of mines.
5. Restriction of illegal mining.
6. Reduction of flood occurrences in the area.
7. Preservation of aquatic habitats.
8. Protection of groundwater by limiting extraction to above base flow levels.
9. Maintenance of data records related to mineral resources, leases, and revenue generation.
10. Creation of a scientific mining plan, including ultimate pit limit estimation.
11. Development of comprehensive guidelines for mining minor minerals.

The DSR includes secondary data on the district's geology, climate, mineral resources, and other relevant factors, compiled from published and unpublished reports, as well as government websites.

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1.2 Statutory Framework

The MoEF&CC has issued several notifications and guidelines over the years to regulate mining and formulate DSRs for each district. Below is a summary of the legal framework:

Year	**Particulars**
1994	The MoEF&CC issued the Environmental Impact Assessment (EIA) Notification for major minerals covering areas over 5 hectares.
2006	EIA Notification SO 1533 (E) made it mandatory to obtain environmental clearance (EC) for minor minerals exceeding 5 hectares.
2012	The Hon'ble Supreme Court mandated EC for minor minerals, even for areas under 5 hectares.
2016	"Sustainable Sand Mining Guidelines (SSMG)" introduced, requiring EC for all minor minerals and district-level monitoring.
2018	MoEF&CC issued notification S.O. 3611(E) with a recommended DSR format for identifying aggradation areas, replenishment rates, and protected zones.
2020	The "Enforcement and Monitoring Guidelines for Sand Mining (EMGSM)" introduced for improved regulatory enforcement and technological monitoring of sand mining activities.

Enforcement & Monitoring Guidelines, 2020

These guidelines address illegal mining, directing states to implement monitoring mechanisms like river audits, aerial surveys, and drone-based surveillance.

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1.3 Utilization and Demand of the minerals

River bed minerals like sand, gravel, stone etc. plays an essential role in construction and is widely used in concrete production, glass manufacturing, road base formation, and many more. River bed mining is a prevalent practice in *South* Salmara Mankachar *District*, mainly for construction. The rise in real estate and government infrastructure projects has significantly increased the demand for sand and bricks. The minor mineral of South Salmara Mankachar district comes under B-category mining and it is included in sub-category B2.

Uses of minerals:

1. **Construction**: Sand, gravel, silt, clay and ordinary earth are key ingredients in concrete, mortar and asphalt.
2. **Industrial**: Used in glass production and abrasives.
3. **Environmental**: The minerals can improve traffic safety by providing grip on icy roads, and it helps in soil conditioning for agriculture.
4. **Decorative**: Sand, gravel and stones are used in candles, aquariums, and for enhancing aesthetic appeal in landscaping.
5. **Flood Protection**: Proper management of sand mining helps maintain river flood discharge capacity, reducing the risk of floods.

This DSR aims to provide a well-rounded, data-driven approach for sustainable mineral resource management, ensuring compliance with environmental guidelines and promoting socio-economic benefits for the district.

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1.4 Methodology of DSR Preparation

The District Survey Report (DSR) preparation follows a systematic methodology to ensure accuracy and comprehensiveness. The steps involved in the preparation of the DSR are illustrated in Figure 2.1 and are described in detail in the following sections.

a. Data Source Identification

The DSR is based on both primary and secondary data collected from reliable and authoritative sources. Identifying authentic data sources is critical for compiling accurate data. The primary data sources for the DSR are collected through field surveys and replenishment studies. Secondary data sources include publicly available information from government publications, reports, and reputable journals.

- **District Profile**: Information related to the district's demographics and basic statistics is sourced from the **District Census Report, 2011** and the **District Statistical Handbook** published by the Government of Assam.
- **Mineral Resources**: The potential mineral resources of the district are described based on reports published by the **Geological Survey of India (GSI)** or other government agencies
- **Mining Data**: Information on mining leases, lease holders, lease areas, resource allocations, and revenue generation is collected from the **Forest Department.**
- **Satellite Images**: Satellite imagery is utilized to prepare maps related to the district's physiography and land use/land cover.

b. Data Analysis and Map Preparation

After collecting data, a detailed analysis is conducted to extract relevant insights. This involves analyzing spatial data and preparing maps that depict:

- Geomorphology of the district
- Topography
- Land use patterns
- Mineral resource distribution

These maps help visualize the key characteristics of the district and identify potential mining areas.

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c. *Primary Data Collection*

Primary data is essential for preparing a comprehensive DSR. Fieldwork is conducted across the district to assess mineral resources. This field study provides a detailed understanding of the mineral composition and their distribution in the area.

d. *Replenishment Study*

A key aspect of sustainable mining is ensuring that the amount of sediment removed from riverbeds is replenished naturally. Therefore, replenishment studies are conducted to assess the annual rate of replenishment of riverbed sand. This helps avoid the adverse impacts of excessive sand extraction.

Physical surveys of the riverbed are carried out using **GPS/DGPS** to define the topography, contours, and offsets.

- The surveys provide a detailed depiction of important features in and around the river, including nearby civil structures and other key landmarks.
- This information helps define the spatial area eligible for sand mining and estimate the sand reserves.

e. *Report Preparation*

The DSR covers various aspects of the district, including:

- **General Profile**: A brief overview of the district, including demographics, land use patterns, and economic activities.
- **Geomorphology and Geology**: An assessment of the district's physical landscape, including its geological structure.
- **Mineral Resources**: A detailed account of riverbed sands and other minor minerals in the district, including their distribution and potential for extraction.
- **Mining Block Delineation**: Identification of potential mining blocks and mineral reserves within the district.

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- **Production Trends**: An analysis of recent trends in the production of minor minerals and the revenue generated from the mining sector.
- **Replenishment Estimation**: The annual replenishment rate of riverbed sand, based on field surveys.
- **Environmental Impact and Mitigation**: An evaluation of the potential environmental impacts of mining activities, along with proposed mitigation measures.
- **Risk Assessment and Disaster Management**: A strategy for managing risks associated with mining and minimizing the impact of any potential disasters.
- **Reclamation Strategy**: A plan for the reclamation of already mined-out areas to restore the ecological balance.

This structured approach ensures that the DSR not only identifies mineral resources but also emphasizes sustainable mining practices and environmental preservation.

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2. Overview of mining activity in the district

In the South Salmara Mankachar district collection of sand, gravel, stone, clay/silt etc. from river- bed is considered as one of the main minor mineral sources of the district. These materials are primarily utilized for construction purpose.

3. General profile of the district

- **General Information**

South Salmara Mankachar district was created by bifurcating Old Dhubri district in 2016. On 15 August 2015 Assam's Chief Minister announced 5 new administrative districts in Assam; South Salmara Mankachar was one among those. On 9 February 2016 Commissioner, Lower Assam and Central Assam Division, IAS inaugurated South Salmara Mankachar as an administrative district. Geographical coordinates of South Salmara Mankachar district is 25° 55' 0" North, 90° 1' 0" East.

The district headquarter is located at Hatsingimari town which is situated at about 245 km from Guwahati. It was earlier a sub-division of the Dhubri District. It shares its borders with Bangladesh in the west and Meghalaya in the south-east. The general topography of South Salmara Mankachar district is plain with patches of small hillocks like Bansali, Rangatari, etc. All these are situated in the southwestern part of the district. Mighty river Brahmaputra is flowing through this district from east to west with its tributaries.

History

South Salmara Mankachar was created by bifurcating the Old Dhubri district in 2016. On 15 August 2015, Assam's Chief Minister Tarun Gogoi announced 5 new administrative districts in Assam; South Salmara Mankachar was one among those. On 9 February 2016 Commissioner, Lower Assam and Central Assam Division Md. Mahtab Uddin Ahmed, IAS inaugurated South Salmara Mankachar as an administrative district at a function in Hatsingimari with the presence of thousands of people. There are few historical sites in the district. However, the famous ones are the tomb of Mir Jumla and Kamakhya Temple at Mankachar.

Culture

The culture of the people in this district is mixed culture. About 95% of the population are Muslims 4% Hindus and 1% Christians. Most of the people speak Goalpariya(Deshee) dialect. This dialect is nowadays regarded as a sub-language of the Assamese Language. But it is a different language having its own vocabulary and grammar. And some people speak the dialect of Mymensingh, Pabna, and Barishal of Bangladesh. The people who speak the Deshi (Goalpariya dialect) are called Ujanee or Deshee people and those who speak the dialects of Mymensingh, Pabna and Barishal of Bangladesh are called Bhatiya. Nowadays the term Bhatiya has been substituted by "Miya ". Though religiously the Dehsis (Ujanee) and Bhatiyas belong to the same group, there are a lot of differences between these two groups. Deshis are the indigenous people who were converted from time to time from the local indigenous groups like Koch, Rajbongshi, Mech, Jogi, Rabha, Napit, Fisherman, Kalitas etc. The Deshis claim that they are the offspring of Ali Mech. Ghoti and Tribal people, who are very few in number have also contributed to the culture of the district. The men of the district wear pants, pyjamas and kurtas as their traditional garments, while the women wear sarees.

Economy

South Salmara Mankachar District is primarily dependent on agricultural and forest products. The main source of income is paddy (both winter and autumn) with surplus production. Jute and mustard seed occupy the major share of cash crops. Wheat, maize, pulses and sugarcane are also grown moderately. From Forests, mainly timber and bamboo add to the income, though boulders and sand are also available. Fish, milk, meat, and eggs have small contributions to the economy. Currently, three tea gardens, whose contribution to the district economy is almost negligible, cover an area of 1362.33 hectares. Land revenue collection is minimal, whereas tax from check gates and excise duty occupies much of the government exchequer. Devoid of major industrial production, the district uses more funds for administration, development, and welfare works than it provides.

Its rich natural wealth is yet to be explored and some believe that proper utilisation of natural resources could provide a boost for the struggling economy.

Transport:

By Road: There is no National Highway in the district. Transportation takes place through state-maintained PWD roads, which are full of potholes. Hatsingimari is in the centre place in the District while one part of Hatsingimari town is attached to the Assam-Meghalaya border. There is no PWD road between South Salmara and Mankachar. The only overland communication from South Salmara to Mankachar is Fulbari–Singimari road through Meghalaya.

By Train: There is no Railway station in the district.

By Air: Nearest airport at Rupshi which is about 72.8 km (45.2 mi) away from the headquarter of Hatsingimari. It was constructed during World War II by the British Govt. mainly for military purposes. Till 1983, Indian Airlines and some private commercial flights operated regularly between Calcutta, Guwahati and Dhubri. Now it is totally closed. However, recently the ministry of DONER, GOI, has taken some initiative to renovate and functionalized the airport.

By Waterway: The town had a very busy river port on the bank of the Brahmaputra, which was used as an international trade centre with the neighbouring countries, especially in the British era. At present, the port is lying idle. However, small ferries transport people to and from Dhubri every day.

Administrative setup-

Head Quarter	Hatsingimari
Division	Lower Assam
Number of Sub-Divisions	1
Number of Revenue Circles/ Tehsils	2
Number of Community Development (C.D.) Blocks	3
Geographical Area	568 sq. km
Literacy	50.76%(2011 Census)
Revenue Villages	152
Panchayats	35
Population	388673(2011 Census)

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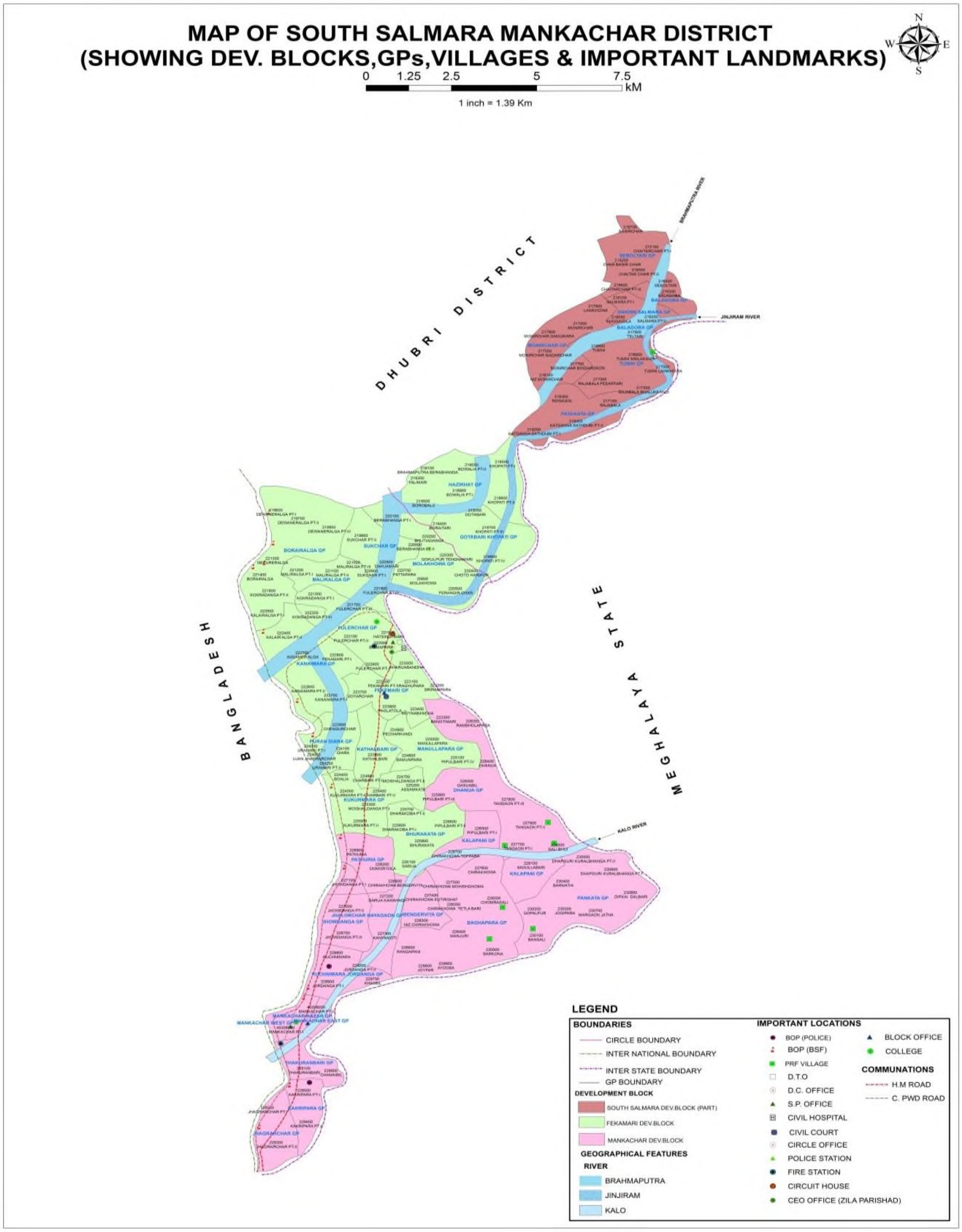

Map: Administrative map

4. a) Geology

(i) Regional Geology:

Shillong plateau (covering approx. 47614 sq. km.) is the singular representative of Precambrian cratonic block of northeast India tectonically detached from the mainland of Indian Peninsula. The cratonic block is girdled by dextrally moving Dauki fault to the south, Brahmaputra lineament to the north, Garo- Rajmahal graben, Dhuburi/Madhupur lineament to the west and belt of schuppen to the east. It consists of high to medium grade Paleoproterozoic basement gneisses and schist designated as Basement Gneissic Group (BGG) overlain by Mesoproterozoic metasediments and metavolcanics of the Shillong Group, both being intruded by Neoproterozonic acidic intrusives such as Myllem pluton, South Khasi pluton, Umroi granite, Nongpoh and a few others enlisted by Mazumdar (76); Ghosh*et. al.* (2005); Devi and Sharma (2006, 2010).

The Paleocene to Eocene continental shelf of the Indian plate which became emergent and which is being over-thrust by the Himalayas on the north-northwest and by the Naga hills on the southeast comes under the upper Assam shelf.

The present-day Assam Basin, a cratonic margin, reflects three distinct tectonic phases. The earliest was Late Cretaceous to Eocene block faulting and development of a southeasterly dipping shelf. Duringthe second phase, in Oligocene time, uplift and erosion occurred north of the many basement faults were reactivated; and many basement-controlled structures became prominent.

The Eocene Sylhet Formation was deposited in a range of environments and was subdivided into the members which generally represents these different depositional environments. The lower Lakadong member was deposited in a lagoonal environment consists of more than 350m of thin sandstones and interbedded shales and coals in it basal parts (Fig. 4 showing the development of Assam Shelf). The environment of the Lakadong member typically consists of the thick sands of barrier- bar. The members of upper part of the Lakadong Formation are calcareous sandstone of a restricted shallow water platform.

The gneissic groups of rocks are well exposed in the western, northern and north eastern part of the Shillong plateau. Towards the southern boundary it is covered by Cretaceous – Tertiary sedimentary sequences and within the plateau about 2500 sq. km. (approx.) area is occupied by intracratonic basin sediments. Orthogneiss and paragneiss are the two major components of basement gneissic complex. The main characteristic features of the banded gneiss are of bimodal character. Other constituents are migmatite, augen gneiss, BIF, amphibolites, pyroxene granulite, calc granulite, high grade sillimanite bearing metapelite with characteristic cordierite, corundum, spinel and sappherine, lamprophyre, diorite, granodiorite, mafic intrusion, pegmatite and other vein rocks.

(ii) Local Geology

The geology of South Salmara Mankachar district, like much of western Assam, is characterized by alluvial deposits and riverine landscapes formed primarily by the Brahmaputra River and its tributaries. The proximity to regions like the Singrimari coalfield and the Garo Hills brings in a diversity of geological structures and formations, particularly of Lower Gondwana age. The coal-bearing sequences at the district's margins point to faulted and ancient geological formations that are still under-researched in comparison to other coalfields in India.Singrimari coalfield is located in Dhubri District of Assam at the Meghalaya- Assam border and lies close to Indo- Bangladesh border. Lower Gondwana rocks are exposed to the south- east of the coalfield, around Hallidayganj (Singrimari) village located at the western tip of the Garo Hills, Meghalaya. The strata to the north western part are dipping below a cover of alluvium brought by Brahmaputra River. These Lower Gondwana sequences have earlier been classified into Talchir and Karharbari Formation on the basis of lithological characteristics. The entire sequence forming the south-eastern margin of the Singrimari Gondwana basin rests unconformably over the Precambrian basement.

C.S. Fox (1934) reported plant fossils from the Singrimari sandstones of Lower Gondwana age and subsequently it was correlated them to the Barakar series which is similar to the Lower Barakar based on the ratio of volatile matter to fixed Carbon ratio of Jharia Coalfield. Acharya and Ghosh (1968) made a preliminary survey of the area and tentatively grouped the entire sequence in Karharbari Formation. Goswami and Das (1969) considered the sequence to be of Lower Gondwana Formation. Barooah (1977) mapped the area and assigned an Upper Carboniferous to Permian age to this sequence.

In Singrimari coalfield, the Lower Gondwana rocks have been reported as belonging to Talchir and KaharbariFormations by earlier workers. The sandstone shows good mineralogical maturity, moderate to poor textural maturity and poor sorting. There are three to four pebbly sandstone horizons made up of angular fragments of large feldspars, clasts of shale, gneissic rocks and sub- rounded to highly angular quartz set in a quartzo- feldspathic matrix. These horizons are generally associated with minor syn-sedimentary faults, fractures and slicken sides. The association of gritty quartzose sandstone, grey micaceous shale, carbonaceous shale and coal is more akin to the litho-assemblage of Lower Barakar Formation as recorded in other

Indian Peninsular Gondwana coalfields. Lithounits in the upper part of the borehole, are dominated by argillaceous facies. The grey mudstone with profuse carbonized plant remains, leaf impressions indicates typical floodplain deposits, sandstone dominated heterolith with load structure indicates levee facies, while the interlaminated coarse grained sandstone with scoured contact represents crevasse splay deposits.

The rocks are, in general, mineralogically moderately matured and texturally poorly sorted and immatured. Large sub-rounded K-feldspar grains often show saussuritization indicating alteration in a warm, humid condition. Occurrence of anhedral quartz of different sizes associated with other rock fragments indicates sudden deposition with almost no transportation. Cholritization and sericitization of muscovite clearly indicates formation of the minerals in an alkaline and reducing condition within a logged sub- basin controlled by prevailing fault system. All these micro- textural evidences point to the fault controlled deposition of fanglomerates.

So called Karharbari Formation, characterized by dominance of fresh feldspar rich sandstone is absent, instead arenitic channel facies sandstone, more akin to Lower Barakar litho- assemblage of peninsular Gondwana basins predominates in lithological architecture .These pebbly horizons are more possibly formed due to repeated activation/reactivation of basin marginal faults and deposited as fanglomerates in a small fault bounded trough having very little or no transportation at all. Mega- and Microfloral studies (Bharadwaj, 1966, 1974, Tiwari, 1973, Manju et al., 1977, 4th. International Gondwana Symposium) strongly indicate that the Lower Gondwana rocks of Western Garo hills belong to Lower Barakar Formation (Lower Permian).

5. Drainage of irrigation pattern

The drainage system of South Salmara-Mankachar district is primarily shaped by the presence of the Brahmaputra River and its tributaries. The region is characterized by flat, alluvial plains with numerous water channels and river systems.

1. Brahmaputra River:

The Brahmaputra River is the most significant river influencing the district's drainage. It flows along the northern boundary of South Salmara-Mankachar and plays a crucial role in shaping the district's geography and hydrology.The river provides water for agriculture but also contributes to flooding during the monsoon season.

2. Tributaries and Channels:

The district is crisscrossed by various tributaries and distributaries of the Brahmaputra River, forming a complex drainage network. Jinjiram River: A major tributary that passes through the district, contributing to local agriculture and water availability. Like the Brahmaputra, it can also flood during the monsoon.Numerous small streams and channels, often seasonal, flow into the Brahmaputra or its tributaries, forming a dense network of natural waterways.

3. Wetlands and Floodplains:

The district has extensive wetlands and floodplains that act as natural drainage areas. These wetlands often fill up during the monsoon season, helping to absorb excess water but also making parts of the district vulnerable to prolonged waterlogging.These areas are crucial for maintaining the local biodiversity and supporting livelihoods such as fishing.

4. Flooding and Drainage Issues:

Due to the low-lying nature of the district and the heavy monsoon rains, flooding is a recurring issue, especially during the peak monsoon months. The Brahmaputra often overflows its banks, inundating nearby areas.Poor drainage infrastructure in some parts of the district exacerbates the problem, leading to waterlogging in both urban and rural areas.Flood management efforts are crucial in this district, with embankments and other infrastructure in place, but the region's proximity to major rivers makes it prone to natural flooding.

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5. Role of Embankments:

To mitigate the risk of flooding, embankments have been built along the Brahmaputra and its tributaries. However, these structures can be breached during periods of exceptionally high rainfall, leading to floods.

6. Agriculture and Drainage:

The drainage system is crucial for the district's agriculture, as it helps irrigate fields during the dry season but can cause significant damage when rivers overflow during the monsoon.

Sream ordering

The stream order hierarchy was officially proposed in 1952 by Arthur Newell Strahler, a geoscience professor at Columbia University in New York City, in his article "Hypsometric (Area Altitude) Analysis of Erosional Topology". The article, which appeared in the Geological Society of America Bulletin outlined the order of streams as a way to define the size of perennial (a stream with water in its bed continuously throughout the year) and recurring (a stream with water in its bed only part of the year) streams. When using stream order to classify a stream, the sizes range from a first-order stream all the way to the largest, a 12th- order stream.

A first- order stream is the smallest of the world's streams and consists of small tributaries. These are the streams that flow into and "feed" larger streams but do not normally have any water flowing into them. In addition, first and second- order streams generally form on steep slopes and flow quickly until they slow down and meet the next-order waterway.

First through third- order streams are also called headwater streams and constitute any waterways in the upper reaches of the watershed. It is estimated that over 80% of the world's waterways are these first through third- order, or headwater streams. Going up in size and strength, streams that are classified as fourth through sixth order are medium streams while anything larger (up to 12th order) is considered a river. The world's largest river, the Amazon in South America, is considered a 12th- order stream. Unlike the smaller order streams, these medium and large rivers are usually less steep and flow slower. They do however tend to have larger volumes of runoff and debris as it collects in them from the smaller waterways flowing into them.This method of classifying stream size is important to geographers, geologists, hydrologists and other scientists because it gives them an idea of the size and strength of specific waterways within stream networks- an important component of water management. In addition, classifying stream order allows scientists to more easily study the amount of sediment in an area and more effectively use waterways as natural resources. Stream order

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also helps people like biogeographers and biologists in determining what types of life might be present in the waterway. This is the idea behind the River Continuum Concept, a model used to determine the number and types of organisms present in a stream of a given size. Different types of plants for example can live in sediment-filled, slower-flowing rivers like the lower Ganges than can live in a fast-flowing tributary of the same river

Irrigation

Irrigation in South Salmara-Mankachar district is crucial for supporting the predominantly agrarian economy. Given the district's proximity to the Brahmaputra River and its tributaries, as well as the region's monsoon-dependent rainfall patterns, irrigation plays a vital role in ensuring stable agricultural output, especially during the dry season. Here's an overview of the irrigation system in the district:

1. Sources of Irrigation:

Brahmaputra River: The Brahmaputra, one of the major rivers in the region, provides a reliable source of water for irrigation. Water is diverted through canals and other systems to support nearby agricultural lands.

Tributaries and Smaller Streams: Tributaries like the Jinjiram River and smaller local streams are also used for irrigation. These water sources are crucial for local farming, especially in areas farther from the Brahmaputra.

Groundwater: In some areas, farmers rely on groundwater for irrigation, using tube wells and hand pumps. However, groundwater extraction is less common compared to river-based irrigation due to the abundance of surface water.

Floodwaters: In some cases, floodwaters are harnessed for irrigation purposes after the monsoon season subsides. Flood recession farming is practiced in areas where floodwaters naturally recede, leaving behind fertile soil.

2. Irrigation Methods:

Canal Irrigation: Small-scale canals and channels are used to divert water from rivers like the Brahmaputra and Jinjiram to agricultural fields. These canals are crucial for supplying water during the dry season or when rainfall is insufficient.

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Surface Irrigation: Surface irrigation methods like furrow, border, and basin irrigation are common in the district. This involves distributing water across the surface of the fields, particularly in paddy cultivation.

Pump Irrigation: Water pumps, including diesel-powered and electric pumps, are used to draw water from rivers, ponds, or shallow groundwater sources. Pumps help transport water to fields that may not have access to direct canal irrigation.

3. Crops Irrigated:

Rice (Paddy): The primary crop in the district is rice, which requires a significant amount of water. Irrigation is vital for paddy cultivation, especially during the dry season or in areas where monsoon rains are insufficient.

Jute: Jute is another important crop grown in the district, and irrigation is essential during its early growth stages.

Vegetables and Other Cash Crops: Farmers also grow vegetables and cash crops like pulses, which require controlled irrigation, especially during the post-monsoon season.

4. Challenges in Irrigation:

Flooding: The district is prone to seasonal flooding, particularly during the monsoon. While this brings water, it can also destroy crops and infrastructure, including irrigation systems. Post-flooding, efforts are needed to restore irrigation canals and infrastructure.

Waterlogging: Excessive rainfall and flooding often lead to waterlogging, which can harm crops and make irrigation management more difficult. Farmers must balance between providing enough water and preventing waterlogging.

Infrastructure Limitations: In some areas, the irrigation infrastructure, such as canals and embankments, may not be well developed or properly maintained. This can limit water availability during critical growing periods.

5. Government Initiatives:

The Assam Government and various central government schemes have been working to improve irrigation infrastructure in the region. Initiatives such as the Pradhan Mantri Krishi Sinchai Yojana (PMKSY) aim to provide financial and technical assistance to farmers for better irrigation management.

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Irrigation projects like the construction of new canals, repair of old structures, and promotion of efficient irrigation techniques (like drip irrigation) are being implemented to improve water usage and reduce dependency on unpredictable monsoon rains.

6. Traditional Irrigation Practices:

In rural areas, some farmers still use traditional irrigation methods, such as bamboo pipes and small earthen dams to divert water from nearby streams or rivers. These methods are sustainable and cost-effective but may not be sufficient during prolonged dry spells.

7. Monsoon Dependency:

Agriculture in South Salmara-Mankachar is heavily dependent on the monsoon rains, with irrigation acting as a supplementary system. During the monsoon, farmers rely less on artificial irrigation, but in the dry season, irrigation becomes critical to maintain crop yields.

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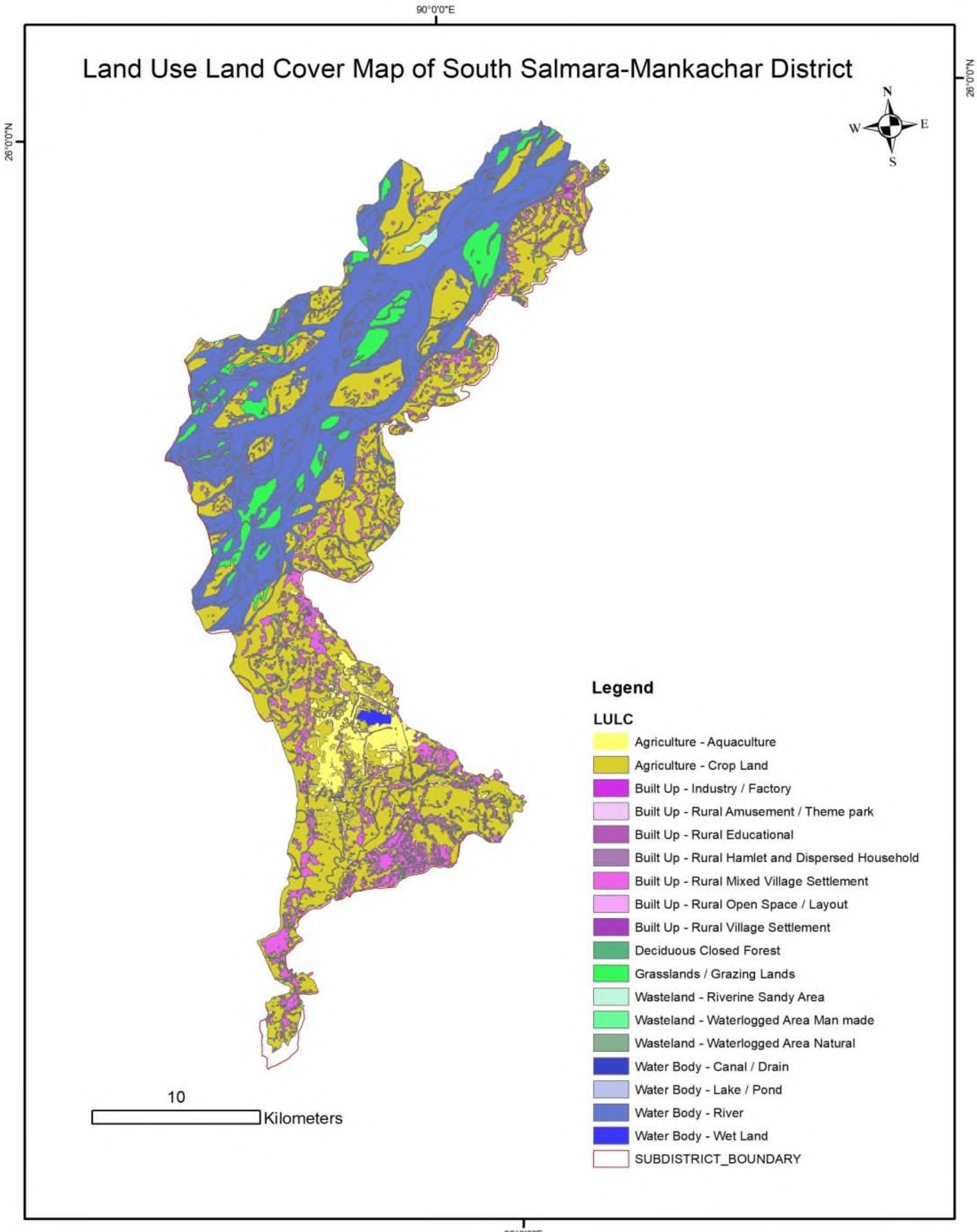
6. **Land utilization pattern in the district:** The **Land Use Land Cover (LULC)** of South Salmara-Mankachar district reflects the district's agricultural dominance, forest cover, water bodies, and settlements. Due to its location in the Brahmaputra Valley, the region is characterized by fertile alluvial plains, making it a primarily rural district with extensive agricultural land. The presence of rivers, floodplains, and wetlands also plays a significant role in shaping the land use patterns. Here's a detailed overview of the LULC in South Salmara-Mankachar district:



Map: Land use land cover map of the district

7. Surface and Groundwater scenario of the district:

The district's proximity to the Brahmaputra River and its alluvial plains means that groundwater is generally available at relatively shallow depths. Here's an overview of the groundwater resources in the district:

1. Groundwater Availability:

Shallow Aquifers: The district has abundant shallow aquifers due to the permeable alluvial soils deposited by the Brahmaputra River. These aquifers are typically found at depths ranging from 10 to 30 meters (33 to 100 feet). The groundwater table tends to rise during the monsoon season due to heavy rainfall and river water percolation. However, in the dry season, the water table may drop slightly, especially in areas where groundwater extraction is high.

2. Sources of Groundwater Recharge:

The Brahmaputra River and its tributaries play a significant role in recharging groundwater aquifers through seepage, particularly during the monsoon season when water levels are high.: The district receives heavy monsoon rainfall, which also contributes to groundwater recharge. Rainwater percolates through the soil and replenishes the aquifers.Flooding during the monsoon season also helps recharge the groundwater as the excess water seeps into the soil over time.

3. Groundwater Extraction Methods:

Dug Wells: Traditional dug wells are still used in many rural areas to access shallow groundwater for domestic use and small-scale irrigation.

Tube Wells: Tube wells and bore wells are increasingly common for extracting groundwater, especially for irrigation. These wells can tap into both shallow and deeper aquifers, depending on the local geology and water needs.

Hand Pumps: Hand pumps are widely used for drawing water from shallow aquifers for domestic use, especially in rural areas.

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4. Groundwater Quality:

Groundwater in the district is generally of good quality for agricultural and domestic use. The alluvial soils act as a natural filter, ensuring that the groundwater is relatively clean. In some areas, high levels of iron in the groundwater have been reported, which can affect its taste and usability. Iron contamination is a common issue in many parts of Assam, though it is not harmful in small quantities. While arsenic contamination is a concern in some parts of Assam, there is no widespread report of significant arsenic levels in South Salmara-Mankachar's groundwater. However, continuous monitoring is necessary.

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8. Rainfall of the district and climatic condition

Rainfall

The climate of the District is very damp and humid due to heavy rains and high temperature. June and July are the months with highest rainfall. Generally the period from May- end to October is considered as flood season. The rainfall pattern of South Salmara Mankachar is similar that of Dhubri District. The average annual rainfall of the district is 2,916 mm (114.8 in).

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C	23	26	30	31	30	30	30	30	29	29	27	23	28.2
(°F)	(73)	(79)	(86)	(88)	(86)	(86)	(86)	(86)	(84)	(84)	(81)	(73)	(82.7)
Average low °C	12	13	17	21	23	24	26	26	25	23	18	13	20.1
(°F)	(54)	(55)	(63)	(70)	(73)	(75)	(79)	(79)	(77)	(73)	(64)	(55)	(68.1)

Climatic condition

The climate of South Salmara-Mankachar district is typically humid subtropical, influenced by its proximity to the Brahmaputra River and the heavy monsoon rainfall patterns of the region. Here's an overview of the climate:

1. Summer (March to June):

- Temperature: Summers are warm and humid, with temperatures ranging from 25°C to 35°C (77°F to 95°F).
- Humidity: The humidity level is quite high during this period.
- Rainfall: Pre-monsoon showers are common, especially from May onward.

2. Monsoon (June to September):

- Heavy Rainfall: The district experiences heavy rainfall due to the southwest monsoon. The average annual rainfall is 2,500 to 3,000 mm (98 to 118 inches).

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- Floods: Due to the low-lying terrain and the proximity to the Brahmaputra River, the district is prone to flooding during the monsoon season, affecting agriculture and local life.
- Temperature: The temperature remains moderate, usually ranging between 25°C and 30°C (77°F to 86°F), but the high humidity makes it feel warmer.

3. Autumn (October to November):

- Post-Monsoon: The rainfall decreases, and the weather becomes more pleasant. The sky is often clear, and the region gets relief from the intense monsoon.
- Temperature: The temperature remains mild, usually between 20°C and 30°C (68°F to 86°F).

4. Winter (December to February):

- Mild Winter: Winters are mild, with temperatures ranging from 10°C to 20°C (50°F to 68°F). The region doesn't experience extreme cold.
- Fog: Morning fog is common during winter, especially in January.

5. Humidity:

- The overall humidity level remains high throughout the year due to its subtropical nature and the presence of large water bodies like the Brahmaputra River.

In summary, South Salmara-Mankachar district has a tropical climate with heavy rainfall during the monsoon season, mild winters, and a high level of humidity year-round. The district frequently faces the challenge of seasonal floods, especially during the monsoon months.

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9. Details of the mining leases in the district as per the following:

Sl No	Name Of the Mineral	Name of the Lessee	Address & Contact No. Of Lessee	Mining lease Grant Order No. & date	Area of Mining lease (ha)	Period mining lease (Initial)		Period of Mining lease 1^{st}/2^{nd}.. renewal)		Date of commencement of Mining Operation	Status Working/ Non-Working/ temp. Working for dispatch etc.)	Captive/ Non-Captive	Obtained Environmental Clearance (Yes/No), If Yes Letter no with date of grant of EC	Location of the Mining lease (Latitude & Longitude)		Method of Mining (Opencast/underground)
						From	To	From	To					Latitude	Longitude	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		16
1	Ordinary Earth	Larsen & Toubro Limited	Brahmaputra River South Salmara		3.77 Ha									25.904134 25.904748 25.902596 25.901930	90.023468 90.024519 90.026157 90.025030	
2	Ordinary Earth	Larsen & Toubro Limited	Brahmaputra River South Salmara		3.85 Ha									25.904748 25.905394 25.903236 25.902596	90.024519 90.025649 90.027271 90.026157]	

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10. Details of Royalty received in last 3 years

Revenue generated for last 3 years in South Salmara Mankachar District is furnished in the following table:

Table: District revenue generation from mineral sector (In INR)

Financial Year	Royalty			Total revenue
	Sand	Gravel	Earth/Silt/Clay	
2023-24			71,02,215.00	71,02,215.00
2022-23			**0**	**0**
2021-22			**0**	**0**

11. Details of Production of minor mineral in last 3 years

Sl. No	Financial Year	Production(cum)
1	2023-24	575000
2	2022-23	7677215
3	2021-22	0

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12. List of Letter of Intent (LOI) Holders in the District along with its validity

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of Letter of Intent Holder	Letter of Intent Grant Order No. & date	Area of Mining lease to be allotted	Validity of LoI	Use (Captive/ NonCaptive)	Location of the Mining lease (Latitude & Longitude)
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
NA								

13. Total Mineral Reserve available in the District:

(To be updated in the final DSR)

14. Quality /Grade of Mineral available in the District

(To be updated after completing survey)

15. Use of Mineral

16. Demand and Supply of the Mineral in the last three years:

(To be updated in the final DSR)

17. Maps showing Mining leases of the district

(To be updated after completing mapping of all mining areas)

18. Details of the area of where there is a cluster of mining leases

(To be updated after completing mapping and proximity analysis)

19. Details of Eco-Sensitive Area, if any, in the District

(To be updated after completing mapping and proximity analysis)

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20. Impact on the Environment due to mining activity

The demand for sand and gravel continues to increase for the construction of roads and buildings. The impact of mining on environment can occur at local, regional, and global scales through direct and indirect mining practices. Impact on Environment due to mining activities varies based on amount of production rate. Mining can cause erosion, sinkholes, loss of biodiversity, or the contamination of soil, groundwater, and surface water by chemicals emitted from mining processes. These processes also affect the atmosphere through carbon emissions which contributes to climate change. The different activities involved before & during mining can impact the environment. The high growth in population speeds- up economic activities. Meanwhile, it also deteriorates environment as for the high level of economic development, plenty of natural resources are exploited. Similarly, mining activities have considerable impacts on environment.

Excessive instream sand- gravel mining causes the degradation of rivers. Instream mining lowers the stream bottom, which may lead to bank erosion. Depletion of sand in the streambed and along coastal areas causes the deepening of rivers and estuaries, and the enlargement of river mouths and coastal inlets. It may also lead to saline- water intrusion from the nearby sea. The effect of mining is compounded by the effect of sea level rise. Any volume of sand exported from streambeds and coastal areas is a loss to the system.

Excessive instream sand mining is a threat to bridges, river banks and nearby structures. Sand mining also affects the adjoining groundwater system and the uses that local people make of the river. River bed mining impacts include bed degradation, bed coarsening, lowered water tables near the streambed, and channel instability. These physical impacts cause degradation of riparian and aquatic biota and may lead to the undermining of bridges and other structures. Continued extraction may also cause the entire streambed to degrade to the depth of excavation. River bed mining can have other costly effects beyond the immediate mine sites. Many hectares of fertile streamside land are lost annually, as well as valuable timber resources and wildlife habitats in the riparian areas. Degraded stream habitats result in loss of fisheries productivity, biodiversity, and recreational potential. Severely degraded channels may lower land and aesthetic values.

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Native species in streams are uniquely adapted to the habitat conditions that existed before humans began large-scale alterations. These have caused major habitat disruptions that favored some species over others and caused overall declines in biological diversity and productivity. In most streams and rivers, habitat quality is strongly linked to the stability of channel bed and banks. Unstable stream channels are inhospitable to most aquatic species. Sand mining generates extra vehicle traffic, which negatively impairs the environment. Where access roads cross riparian areas, the local environment may be impacted.

Degradation of land is one of the significant impacts arising out of mining and quarrying activity which is mainly in the form of alternation of land structure due to excavation, stacking of top soil and loss of the land due to dumping of mine waste and overburden soil. Stone and sand quarrying causes damage to property, depletion of ground water, loss of fertile top soil, degradation of forest land, adverse effect on the biodiversity and public health

Mining and quarrying, either open cast or underground, destroys landscape and forest ecosystems. Air pollution, due to dust from the mines, is a common environmental problem in mines and quarries especially open cast operations.

Immediate impact of stone quarrying is land degradation. It causes landscape alternation due to excavation, water induced soil erosion due to surface runoff water in quarrying site, dumping of waste rock causes loss of land or generation of waste land, over burned soil etc. Soil erosion and soil contamination are common in quarrying sites. In current study area, in many places waste land were generated due to stone quarrying activities. Waste stones are dumped in many places causes blockage of drainage channels. In many sites of the quarry area waste water were stored. This decrease aesthetic value of the site. In many areas, plants are unable to grow and some land completely lost their ability for cultivation because of soil contamination by stone quarrying activities.

Noise pollution occurs due to blasting operation in quarry, noise emitted by stone crusher and transport of stone material by truck, dumper, tractor etc. Loss of peace, fear due to loud noise and vibration, increased heart beat, headache, development of cracks on houses etc. are various effects of quarrying related noise pollution. Stone quarrying activities also goes during night. Stone quarrying occupation is not a suitable alternative livelihood like agriculture, service, business etc.

because of its uncertainty nature. Massive transport of truck and dumper are not safe and there is always chance of accident. Due to short time, seasonal and uncertainty nature, it is not possible to formulate any future planning for employment generation in this field.

Noise pollution is associated with many types of equipment used in mining operations, but blasting is considered as the major source. It also affects stability of infrastructures, building and houses of people living near to these working sites. In this regard, noise pollution may include noise from vehicle engines, power generation, and other sources. Mining operations impact the environment in several ways, and water pollution is a major concern in such operations. For instance quarry dust can change the chemistry of water resources by dissolving in them, it can also settle in water bodies and cause pollution. Furthermore, these operations disrupt the existing movement of surface water and groundwater; they interrupt natural water recharge and can lead to reduced quantity and quality of drinking water for residents and wildlife near or down streams from a quarry site.

As far as impact on surface water is concerned, during mining and transportation, the chances of contamination of surface water resources (pond, well etc.) with dust or by other means.

The labourers working in stone mining come from nearby districts and colonies in the surrounding areas with inadequate facilities for waste disposal. This, in due course, leads to disposal of various things into surface water bodies which in due course of time results into surface water contamination through misuse/mismanagement and decomposition of the trash.

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21. Remedial Measures to mitigate the impact of mining on the Environment:

(To be updated after field study as site specific survey is required))

22. Reclamation of Mined out area

Reclamation entails the re- establishing of viable soils and vegetation at a mine site. Although regulatory agencies may require complex reclamation designs, simple approaches can be very effective. One simple approach depends on adding lime or other materials that will neutralize acidity plus a cover of top soil or suitable growth medium to promote vegetation growth. Modifying slopes and other surfaces and planting vegetation as part of the process stabilizes the soil material and prevents erosion and surface water infiltration. Even this simple approach is likely to cost a few thousand dollars per acre to implement. Where soils have a sustained high acidity, the costs of using this approach can increase, sometimes to tens of thousands of dollars per acre. The challenge to find cost-effective reclamation approaches continues.

Promising reclamation options in the future may include using sludge, "biosolids," from municipal waste water treatment processes as an organic soil amendment, and growing plant species that are more tolerant of acidic conditions.

Soil Treatment

High levels of metals in soils, not just acidity, can be harmful to plants, animals, and, in some cases, people. A common to specially designed repositories. This approach can be very expensive and controversial, but it is sometimes required. With this approach, the volume and toxicity of the soil is not reduced, the soil is just relocated. Effective soil treatment approaches in the future depend upon better understanding of the risks associated with metals in mine wastes. These "natural" metals in minerals may not be as readily available in the biosphere, and therefore, they may not be as toxic as the metals in processed forms, such as lead in gasoline.

Future approaches may include:

- Using chemical methods to stabilize metals in soils, making them less mobile and biologically available.

- Using bacteriacides that stop the bacterial growth that promotes the oxidation of pyrite and the accompanying formation of sulfuric acid.
- Using bioliners, such as low permeability and compacted manure, as barriers at the base of waste piles.

- Permanently flooding waste materials containing pyrite to cut off the source of oxygen, stop the development of acidic conditions, and prevent mobilization of metals.

Water Treatment

The most common treatment for acidic and metal-bearing waters is the addition of a neutralizing material, such as lime, to reduce the acidity. This "active" treatment process, which causes the dissolved metals to precipitate from the water, usually requires the construction of a treatment facility. The ongoing maintenance that such a plant requires makes this treatment technique very expensive.

Aside from the expense, some active treatment plants generate large amounts of sludge. Disposal of the sludge is a major problem. Because of the cost and the physical challenges of dealing with sludge, alternatives to active treatment facilities are needed. Some possible alternatives include:

- Using "passive" wetland systems to treat metal-bearing water. This approach has been successfully used where the volumes and acidity of the water are not too great. Passive wetland systems have the added advantage of creating desirable wildlife habitat.
- Using in-situ treatment zones where reactive materials or electric currents are placed in the subsurface so that water passing through them would be treated.
- Combining treatment with the recovery of useful materials from contaminated water.

23. Risk Assessment & Disaster Management Plan

(To be updated after completing survey as site specific management plan is required)

24. Details of the Occupational Health issues in the District

The negative impacts of dust pollution due to quarrying activities on health revealed by respondent information were respiratory problem, eye infection, cough, sneezing, allergy , chest pain , headache , accumulation of dust on home , and slow growth of fodder for cattle and goats. Negative effects of dust pollution on crop productivity. Two major effects were reduction of agricultural yield due to deposition of dust on crop and secondly availability of ground water and water contamination. Another problem we noticed through interview was many agricultural labour were faced difficulty to work in dusty environment therefore resulting in reduction of agricultural yield indirectly. Many fruit trees also affected by dust pollution resulting in stunted growth and decreased fruit yields. There are also reductions in appearance of insect pollination like butterflies, bees, moths etc. due to dust pollution.

25. Plantation and Green Belt development in respect of leases already granted in the District

Protect natural or semi- natural environments:

- Improve air quality with inurban areas
- Protect the unique character of rural communities that might otherwise be absorbed by expanding suburbs.
- Plants that grow fast should be preferred
- Preference for high canopy covers plants with local varieties
- Perennial and evergreen plants should be preferred
- Plants having a high Air pollution Tolerance Index (APTI) should be preferred.

Greenbelt Development & **Plantation Programme**

Plantation should be developed at **2M**x**2M** spacing, the rate of survival should be aimed at 80% by regular watering & fencing to keep plants safe from animal grazing. Local species will be planted in consultation with local horticulturist. Diseased plants should be replaced by planting new saplings.

Recommendation for green Belt Development

It is strongly recommended to create greenbelt around the project or incase lease failed the authority should take proper action to stop mining operation or Revoke mining permission with necessary action.

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Photoplates:


GPS Map Camera
Shalibharin, Assam, India
JXQ8+QG, Shalibharin, Assam 794105, India
Lat 25.63945°
Long 89.96746°
05/09/24 12:20 PM GMT +05:30
Google


GPS Map Camera
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