GOVERNMENT OF ASSAM
OFFICE OF THE DISTRICT COMMISSIONER:: SONITPUR:: TEZPUR

NOTICE

Comments, suggestions, claims and objections are being invited from all the interested persons, individuals, departments etc., in connection with the draft District Survey Report (DSR), Sonitpur, for minor minerals within 21 days from the date of uploading of the draft DSR of the district, Sonitpur, Assam in the district website (https://sonitpur.assam.gov.in).

Feedback may be sent to the E-mail ID-dc-sonitpur@nic.in of the District Commissioner, Sonitpur, Assam.

Signed by
Deba Kumar Mishra
Date: 11-09-2024 15:30:28
District Commissioner,
Sonitpur, Tezpur.

Memo No.E- 123261/ 542 Date: 11/09/2024
Copy to:

1. The Special Chief Secretary (Forests) to the Govt. of Assam, Environment and Forest Department, Dispur, Ghy- 6 for favour of his kind Information.
2. The Principal Chief Conservator of Forests & Head of Forests Force Assam, Panjabari, Guwahati- 37 for favour of his kind Information.
3. The Addl. Principal Chief Conservator of Forests (T), Upper Assam Zone, Jorhat for favour of his kind information.
4. The Chief Conservator of Forests, Northern Assam Circle, Tezpur for favour of his kind information.
5. The District Development Commissioner, Sonitpur, Tezpur for information and necessary action.
6. All Addl. District Commissioner, Sonitpur, Tezpur for information and necessary action.
7. All Head of the Departments, Sonitpur, Tezpur for information and necessary action.
8. The Divisional Forest Officer, Sonitpur West Division, Tezpur, cum Member Secretary, District Survey Report Committee, Sonitpur, Tezpur for information and necessary action.
9. The Executive Engineer, Water Resources Division, cum Member, District Survey Report Committee, Sonitpur, Tezpur for information and necessary action.
10. The Executive Engineer, PHED, Division-I, cum Member, District Survey Report Committee, Sonitpur, Tezpur for information and necessary action.
11. The Executive Engineer, PHED, Division-II, cum Member, District Survey Report Committee, Dhekiajuli, Sonitpur, Tezpur for information and necessary action.
12. The Executive Engineer, Tezpur Rangapara Division (Irrigation), Tezpur cum

Member, District Survey Report Committee, Sonitpur, Tezpur for information and necessary action.

13. The Regional Officer, Pollution Control Board, Assam, cum Member, District Survey Report Committee, Tezpur Regional Office, Mazgaon, Tezpur for information and necessary action.

14. Mousam Borah, Asstt. Geologist, cum Member, District Survey Report Committee, O/o the Director of Geology and Mining, Dakhin Gaon, Kahilipara, Ghy-19 for information and necessary action.

(e-signed-)
District Commissioner,
Sonitpur, Tezpur.

GOVERNMENT OF ASSAM
ENVIRONMENT AND FOREST DEPARTMENT
OFFICE OF THE DIVISIONAL FOREST OFFICER
SONITPUR WEST DIVISION, TEZPUR

Email: dfo.t.sonitwest@gmail.com

No. FSWT/B/District Survey Report/2024/ 6601-08 **Date: 11-09-2024**

To

The District Commissioner, cum
Chairman, District Survey Report
Sonitpur District, Tezpur

Sub: Submission of draft District Survey Report (DSR) of Sonitpur District

Ref: This office letter No. FSWT/B/District Survey Report/2024/6355-62, dated 06-09-2024

Sir,

In continuation of this office letter mentioned under reference, I have the honour to submit herewith the draft District Survey Report (DSR) of Sonitpur District after making some correction in draft DSR for Sand and River bed mining which is prepared by the knowledge partner M/s CPC Environment Solution Pvt. Ltd. as engaged from this end for your kind perusal. In this regard, the same may be uploaded in the public domain from your kind end.

This is for favour of your kind information and necessary action.

Enclo: As stated above.

Yours faithfully,

11/9/2024

Divisional Forest Officer
Sonitpur West Division, Tezpur, cum
Member Secretary,
District Survey Report, Sonitpur District

Copy to:

1. The Addl. District Commissioner (Forest), cum Member, District Survey Report, Sonitpur, Tezpur for kind information and necessary action.
2. The Executive Engineer, Water Resources Division, cum Member, District Survey Report, Sonitpur, Tezpur for kind information and necessary action.
3. The Executive Engineer, PHED, Division-I, cum Member, District Survey Report, Sonitpur, Tezpur for kind information and necessary action.
4. The Executive Engineer, PHED, Division-II, cum Member, District Survey Report, Dhekiajuli, Sonitpur, Tezpur for kind information and necessary action.
5. The Executive Engineer, Irrigation cum Member, District Survey Report, Sonitpur, Tezpur for kind information and necessary action.
6. The Regional Officer, Pollution Control Board, Assam, cum Member, District Survey Report, Tezpur Regional Office, Mazgaon, Tezpur for kind information and necessary action.
7. Sh. Mousam Borah, Asstt. Geologist, cum Member, District Survey Report O/o the Director of Geology and Mining, Dakhin Gaon, Kahilipara, Ghy-19 for kind information and necessary action.

Divisional Forest Officer
Sonitpur West Division, Tezpur, cum
Member Secretary,
District Survey Report, Sonitpur District

No. FSWT/A/District Survey Report/2024/2861-63 **Date: 11-09-2024**

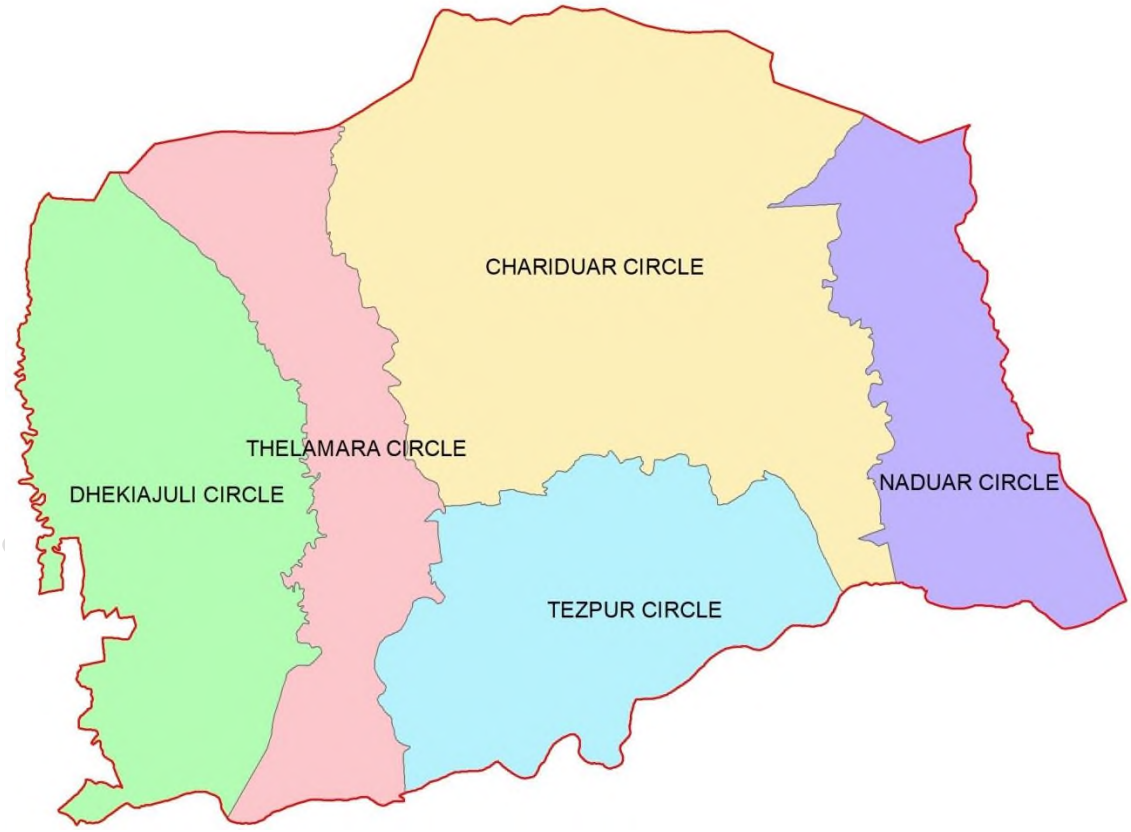
Copy to:

1. The Principal Chief Conservator of Forests & Head of Forests Force Assam, Panjabari, Guwahati-37 for favour of his kind information.
2. The Addl. Principal Chief Conservator of Forests (T), Upper Assam Zone, Jorhat for favour of his kind information.
3. The Chief Conservator of Forests, Northern Assam Circle, Tezpur for favour of his kind information.

Divisional Forest Officer
Sonitpur West Division, Tezpur, cum
Member Secretary,
District Survey Report, Sonitpur District

DRAFT
DISTRICT SURVEY REPORT
OF
SONITPUR DISTRICT, ASSAM

(For sand or river bed mining)



CPC Environment Solution Pvt. Ltd.

(A QCI-NABET Accredited Organization)

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EXECUTIVE SUMMARY

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.

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.

1. Introduction of District Survey Report (DSR) of Sonitpur District

1.1 Introduction

The District Survey Report (DSR) of Sonitpur 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 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.

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 Sonitpur 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 Sonitpur district comes under B-category mining and it is included in sub-category B2. All the available minerals are of Y-schedule.

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.

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.

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:

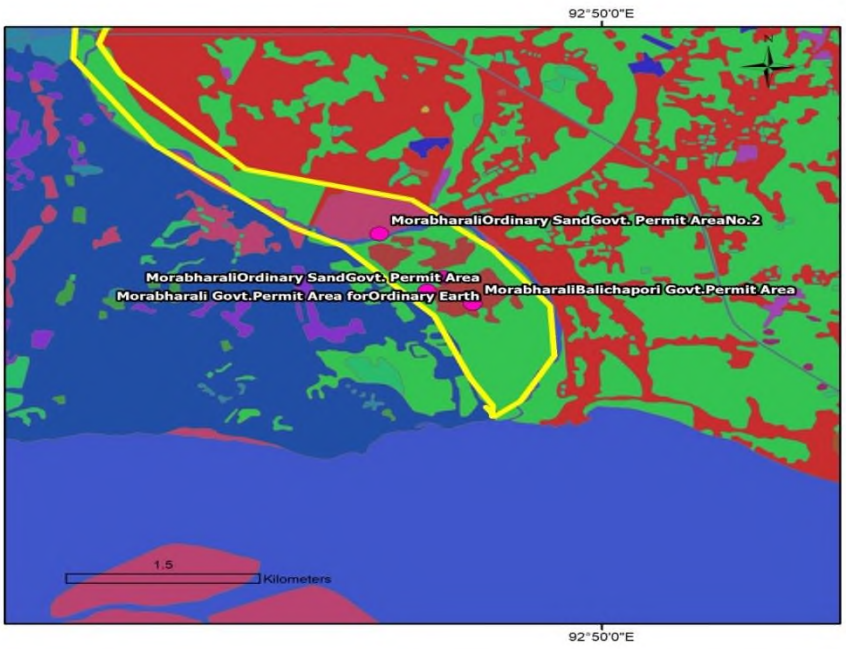
- **General Profile**: A brief overview of the district, including demographics, land use patterns, and economic activities.
- **Geomorphology and Geology**: An assessment of the district's physical landscape, including its geological structure.
- **Mineral Resources**: A detailed account of riverbed 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.

- **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.

2. Overview of mining activity in the district

In the Sonitpur 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.



Proposed Mining Area at Morabharali

Legend

- New Mining Site
- morabharali

Proposed Mining Area at Panchnoi River

Legend

- New Mining Site

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:

Sl. No.	Name of mineral	Name of the lessee	Location and area of mining lease	Period of lease	Status (working/ closed)
1	Panchnoi Sand & Gravel MahalNo.1	Divisional Forest Officer, Sonitpur West Division	Panchnoi River under DhekiajuliRange, Dhekiajuli 4.88 Ha.		Mining Plan & EC has been received from the competent authority
2	Panchnoi Sand & Gravel Mahal No.2	Divisional Forest Officer, Sonitpur West Division	Panchnoi River under Dhekiajuli Range, Dhekiajuli 4.69 Ha.		Mining Plan & EC has been received from the competent authority
3	Panchnoi Sand Mahal No.3	Divisional Forest Officer, Sonitpur West Division	Panchnoi River under Dhekiajuli Range, Dhekiajuli 4.99 Ha.		Mining Plan & EC has been received from the competent authority
4	Morabharali Ordinary Sand Govt. Permit Area		Village Balichapori under Sadar Range, Tezpur 4.98		Mining Plan received, now waiting for EC
5	Morabharali Ordinary Sand Govt. Permit Area No.2		Village No.1 Dolabari under Sadar Range, Tezpur 2.47 ha		Govt. Permit applied by M/s KCC Builcon Pvt. Ltd
6	Morabharali Govt. Permit Area for Ordinary Earth		Village Balichapori under Sadar Range, Tezpur 3.0 ha		Govt. Permit applied by M/s Neccon Power & Infra Limited
7	Morabharali Balichapori Govt. Permit Area		Village Balichapori under Sadar Range, Tezpur 0.49 ha		NOC not received from the DC, Sonitpur
8	Belsiri River Sand & Gravel Mahal No.3		Belsiri River under Central Range, Amaribari 4.50 ha		as per requisition received from M/s MKCIL-RSM (JV), contractor of NHIDCL for 22,000 cum Sand Gravel, this division has been process for issuing govt. permit from this Mahal
9	Gabharu River Silt/Earth Mahal No.2		Gabharu River under Central Range, Amaribari 3.50 ha, 4.81 ha		Under process for issuing permit for Govt. works, waiting for EC.
10	Belsiri Sand & Gravel Mahal No.2		Belsiri River under Central Range, Amaribari		working

			4.86 ha		
11	Gabharu River Silt/ Earth Mahal No.1		Gabharu River under Sadar Range, Tezpur 4.50 ha		Presently nonoperational due to expiry of EC
12	Morabharali River Sand, Gravel & Earth Mahal No. 2		Morabharali River under Sadar Range, Tezpur 3.50 ha		**Closed** due to expiry of EC as well as non deposition of Kist amount.
12	Batamari Sand, Gravel & Earth Quarry	Nurul Hoque	Batamari village, Sonitpur 4.14 Ha.		**Closed** due to non availability of suitable mining area
13	Gotlong Sand, Gravel & Earth Quarry	Babul Husain	Gotlong village, Sonitpur 20.45 Ha	7 years	**Closed** due to non availability of suitable mining area
14	Khalihamari USF Sand, Gravel & Earth Mahal	Khanjan Saikia	Khalihamari village, Sonitpur 22.84 Ha.	7 years	**Closed** due to non availability of suitable mining area
15	Jorasar River Earth Mahal	Tapan Saikia	Jorasar River under Central Range, Amaribari 2.25 Ha.		Closed as Settlement period is over **Has the Potential for Future mining**
16	Dherai Silt Mahal		Dherai River under Dhekiajuli Range, Dhekiajul 2.50 ha		The mahal was **terminated** due to non deposition of due kist money
17	Mansiri River Silt/earth Mahal		Mansiri River under Charduar Range, Charduar 3.50 ha		Presently the mahal is **closed** as no any tender has been received and Sec. 144 Cr. PC has been promulgated by the District Magistrate, Sonitpur to prevent loss of Govt. revenue and illegal pilferage of minor mineral from this mahal.
18	Belsiri River Silt/Earth Mahal No.4		Belsiri River under Central Range, Amaribari 3.5 ha		**Closed** as the mahal area is not suitable for extraction of minor mineral
19	Panchnoi River (Lower) Sand & earth Mahal		Panchnoi River under Dhekiajuli Range 4.5 ha		**Closed** due to public complaint and also the Mahal could not be put on tender sale.
20	Morabharali Sand, Gravel & Earth Mahal		Morabharali River under Sadar Range, Tezpur 9.88 ha		Closed due to non availability of Minor mineral within the mahal area.

List of mining area of Sonitpur Eest Division, Biswanath Chariali under Sonitpur District

Sl. No.	Name of Mining area	Location	Name of settlement holder	GPS Coordinates		Annual Quantity (in cum)	Settlement period	Area (in Ha.)	Remarks
				Latitude	Longitude				

1	Jiabharali Sand Mahal No. 4	Jiabharali River under Diplonga Range	Mr. Saduddin Ahmed	N 26^0 48$^/$ 10.50$^{//}$
				N 26^0 48$^/$ 10.35$^{//}$
				N 26^0 48$^/$ 18.45$^{//}$
				N 26^0 48$^/$ 18.53$^{//}$
					E 92^0 52$^/$ 31.96$^{//}$
					E 92^0 52$^/$ 38.37$^{//}$
					E 92^0 52$^/$ 39.25$^{//}$
					E 92^0 52$^/$ 32.08$^{//}$
						Sand: 10,000	7 Years (From 20-01-2023 to 20-01-2030)	4.67	Running

2	Hatinga Sand, Gravel & Boulder Mahal	Hatinga River under Diplonga Range	Mr. Syamanta Mech	N 26^0 49$^/$ 33.70$^{//}$
				N 26^0 49$^/$ 33.05$^{//}$
				N 26^0 49$^/$ 40.70$^{//}$
				N 26^0 49$^/$ 41.97$^{//}$
					E 92^0 56$^/$ 54.57$^{//}$
					E 92^0 56$^/$ 59.95$^{//}$
					E 92^0 57$^/$ 5.20$^{//}$
					E 92^0 56$^/$ 58.45$^{//}$
						Sand: 1,000
						Gravel: 4,000
						Boulder: 3,000
							7 Years (From 29-10-2016 to 29-10-2022)	4.42	Non-operational

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

Revenue generated for last 3 years in Sonitpur District is furnished in Table.

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

Financial Year	Royalty			Total revenue
	Sand	Gravel	Earth/Silt/Clay	
2022-23				4,05,32,540.00
2021-22				1,67,64,390.00
2020-21				62,94,690.00

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

Sl. No	Financial Year	Production(Cum)
1	2022-23	
2	2021-22	
3	2020-21	

6. Process of Deposition of Sediments in the rivers of the District of Sonitpur

Many rivers originate from the Himalayan and Shivalik regions which supply water in down streams. The greatest sediment yields are generally associated with rivers draining areas of intensive tectonic activity therefore, Himalayan rivers cause tremendous erosion and carry large amounts of sediment. The sediment load of a river is commonly considered to be a pollutant that is aesthetically displeasing and environmentally degrading. Sediment load can be divided into bed load and suspended load based on the mode of transport. Bed load is transported close to the bed where particles move by rolling, sliding, or jumping transport in natural rivers is a complicated phenomenon. Its movement is quite uneven in both the transverse and longitudinal directions, which varies considerably. Some sediment particles roll or slide along the bed intermittently and some others state (hopping or bouncing along the bed).

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.

Geomorphologically, the river Mora Bharali, JiyaBharali, Gabharu, Belsiri, Pachnoi river – all are perennial & influent river. Field investigation depicts that order of all the rivers is of 1st order nature: drainage pattern is dendritic; drainage density is very low. Out of all the above mentioned river, solitary exceptional phenomenon is seem in case of Mora Bharali river. Since last 3 years due to non-flow of water through the river course caused a hiatus in depositional activities of sand and other water-laiden sediments.

Due to this excavation and extraction of river bed sand were closed. But this year due to heavy downpouring huge volume of water passing through the river & ultimately replenishment is going on. So after rainy season from this river bed sand can be picked up with ease.

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

7. General Profile of the district

a) General Information

Sonitpur district is spread over an area of 2076.70 sq. km on north bank of Brahmaputra river. In its North is the state of Arunachal Pradesh, in South is the Morigaon, Nagaon, Jorhat and Golaghat districts, in East is the Biswanath District and in West is the Darrang District. Sonitpur District lies between 26°30'N and 27°01'N latitude and between 92°16'E and 93°43'E longitude. Located between mighty Brahmaputra River and Himalayan foothills of Arunachal Pradesh, the district is largely plain with some hills. The Brahmaputra River forms the south boundary of the district. Pachnoi, Belsiri, Gabharu, Bharali are some of the sub- tributaries of the mighty Brahmaputra.

Sonitpur district attained District status as Darrang District in the year 1835 but bifurcated to Darrang district & Sonitpur District in 1983. In the year 2015 again it was bifurcated to Sonitpur & Biswanath District. Tezpur Sub- Division was named as Sonitpur District. Biswanath and Gohpur Sub- Division was named as Biswanath District.

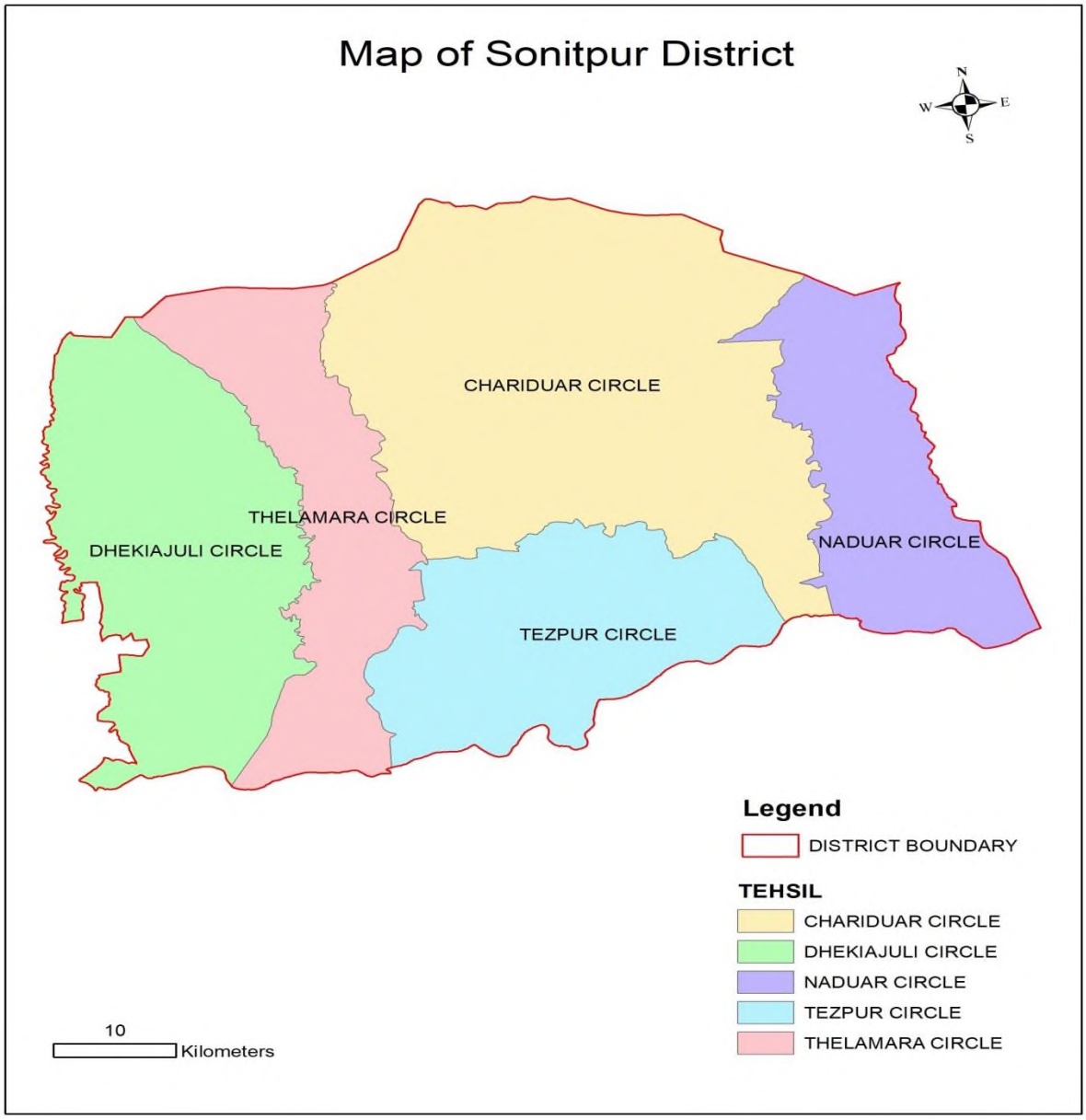
The name `Sonitpur' as well as Tezpur literally means "the city of blood". It reminds of the romantic legend of Usha and Anirudha. The legend revolves around Banasura, the great Asura king of ancient Tezpur, his beautiful daughter Usha and her friend Chitralekha. The princess saw a handsome prince in her dreams and fell in love with him. Chitralekha, a talented artist, not only painted his portrait from Usha's description but recognized him to be Aniruddha, the grandson of Lord Krishna and ruler of Dwarka. Using her magical powers, Chitralekha spirited Aniruddha away to the princess' boudoir where the two married each other according to Gandharva rites, without the knowledge of the king. When Banasura learnt of the clandestine romance, he imprisoned Aniruddha, which led to the arrival of Lord Krishna to rescue his grandson. A fierce battle followed and the entire city was drenched in human blood, hence the name Sonitpur or Tezpur, i.e. 'the city of blood'.

The district is spread around an area of 2076.70 square kilometres and has seven blocks. Earlier it had 14 blocks; Biswanath Chariali is now a separate district (2015) of Assam. The major

industry in Sonitpur district is Tea Processing, Cane product, Food product, Timber sawing, and Tea machinery manufacturer. In Sonitpur, tribal and the other weaker sections of the society are traditionally involved in the pig rearing. In this district, fishing is a tradition rather than a commercial activity, as 90 percent of the fish products are imported. Here, handloom weaving is an important cottage industry. Sonitpur is the trade centre of Bomdilla, Tawang, Seppa and Itanagar of Arunachal Pradesh. In 1998, the Nameri National Park, which is spread over an area of 200 kilometres was included in the Sonitpur district. It is also a home to the Orang National Park (1999), which was earlier with the Darrang district.

Administrative setup-

Head Quarter	Tezpur
No. of Sub-Divisions	1 (Tezpur)
No. of Revenue Circles/ Tehsils	5 (Tezpur, Dhekiajuli, Thelamara, Chariduar & Naduar)
No. of Mouza	16
No. of Cadastral Village	818
No. of Community Development (C.D.) Blocks	7 (Borchalla, Dhekiajuli, Bihaguri, Gabharu, Balipara, Rangapara & Naduar)
No. of Police Stations	7 (Tezpur, Dhekiajuli, Missamari, Thelamara, Chariduar, Jamuguri, Sootea)
No. of Anchalik Panchayats	7
No. of Gram Panchayats	82
No. of Villages	1615 (including 19 under BTAD)
No. of Municipality Board	4 (Tezpur, Dhekiajuli, Rangapara, Jamuguri)
Total Population	1311619



Map: Administrative map

b) Climate Condition

The climate of the district is similar to that in the neighbouring districts of upper Assam and is characterized by the absence of a dry hot summer season. The highest temperatures being experienced during the south-west monsoon season, along with abundant rains and a highly humid atmosphere throughout the year. The cold season is from December to February. This is followed by a season of thunderstorms from March to May. The southwest monsoon season is from June to about the beginning of October. October and November constitute the post-monsoon season.

Temperature: The cold season starts towards the end of November when both day and night temperatures begin to decline. January is the coldest month of the year with the mean daily maximum temperature at about 24°c and the mean daily minimum at 9°c to 11°c. In association with low-pressure waves passing eastwards during the winter season, the district experiences cold spells of a day or two when the minimum temperatures may fall below 5° c. Temperatures begin to rise from the beginning of March. The rise in temperatures continues well into the southwest monsoon season when temperatures are higher than even in the period.

March to May. The highest mean daily values of temperatures experienced in July and August when the mean daily maximum temperature is about 32° c and the mean daily minimum is 25° c. This together with high humidity (highest during the year) makes the southwest monsoon season rather unpleasant, particularly when not raining. With the termination of the monsoon season the weather becomes gradually cooler.

The air is highly humid throughout the year, except during the period February to April when the relative humidity is comparatively less particularly in the afternoons (less than 70 percent). Skies are heavily clouded to over cast in the southwest monsoon seasons. There is a decrease in cloudiness after the withdrawal of the monsoon; and in the period December to April, skies are usually clear or lightly clouded. Winds are light throughout the year except for short spells of strong winds during thunderstorms in the period March to May.

c) Drainage System

The Brahmaputra river controls the main drainage system in the district. The JiaBharali- Gabharu- Mora Bharali- Belsiri- System that debouches in Brahmaputra forms an intricate drainage network in the district. Jia Bharali is the largest tributary of river Brahmaputra originating from the Himalaya. The tributaries are in general meandering as well as braided in nature. Peak discharge is observed during monsoon and generally perennial in nature. However, near the foothills small streams generally dry up during the month of March/ April. The riverbed and the bank materials are stones, silt and sands of various grades with very low clay materials concentration. Many of these surface water sources in the district are used for flow irrigation schemes by creating the diversion head works across the perennial source.

d) Stream 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. Field investigation depicts that order of all the rivers is of 1st order nature: drainage pattern is dendritic; drainage density is very low.

e) Irrigation

Irrigation facilities in the district are not upto the mark. Agriculture mainly depends on rainfall and the farmers are accustomed to raise a single crop only. However, the State Govt. has formulated some irrigation facilities through Irrigation and Agriculture Depts. The Agriculture Dept. has constructed shallow tube wells and encouraged the farmers to utilize the ground water resources through registered Farmers Management Committee (FMC). The Assam irrigation Dept., which is responsible for the implementation of the major/ medium irrigation schemes, has taken up different schemes in the district. But most of the schemes are defunct due to improper planning, poor maintenance etc.

f) Soil resources

Different types of soils are encountered in the Sonitpur district of Assam.
The soils of the district can broadly be classified into the following groups:

1. Red Loamy soils: These are found in the northern border of the district. This soil type develops in the hill slopes under high rainfall condition. This soil is characterized by low nitrogen, low phosphate and medium to high potash. PH is acidic.

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

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

4. Older Alluvial Soil: It develops at higher levels and practically unaltered alluvium representing a broad spectrum of sand, silt and humus rich clay depending on landform. The soils are comparatively more acidic than the newer alluvial soil and hence more crop sensitive.

g) Groundwater prospects in the district

The existing gross ground water draft 376.47 mcm and the stages of development are 16% only. Future provision for domestic and Industrial use is 59.98 mcm and for Irrigation use is 1958.72 mcm. Assessment unit can be categorized into 4 categories as SAFE, SEMI-CRITICAL, CRITICAL, and OVER- EXPLOITED. In Sonitpur district stage of ground water development is 6%, which shows under the SAFE category. As long- term water level trend does not show any major change so the whole district may be considered as SAFE.

CHART OF GROUND WATER RESOURCE ESTIMATION

Net Ground Water Availability	= 5324.04 mcm
Gross Ground Water Draft	= 376.47 mcm
Stage of Ground Water Development	= 16%
Future provision for Domestic & Industrial Use	= 59.98 mcm
Future Provision for Irrigation Use	= 1958.72 mcm

h) Tectonism and seismicity

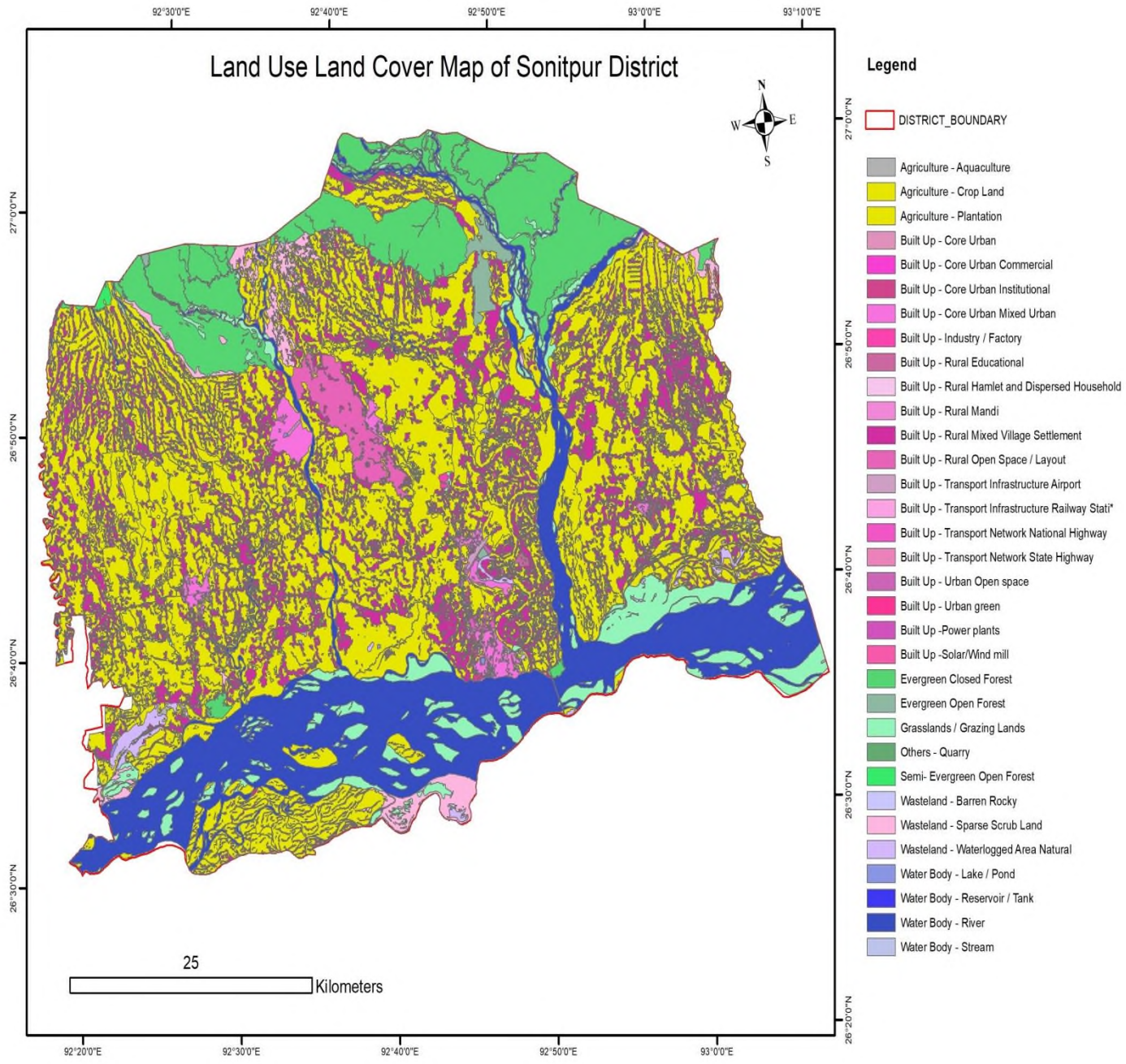
The tectonic activity in the district is moderate to low. It lies in the seismic zone V.

8. Land and land use pattern:

In the district, the area of the government wasteland was very large, till the later part of the 19th century but with waves of influx of immigrants, a large chunk of the virgin soil has been upturned. At the same time, large tracts of wasteland have also been taken up for tea cultivation. However, an analysis of the land use pattern shows that the area of land not available for cultivation is still quite considerable. The following table shows the salient features of land put to different uses and cultivation in the district.

Table: Land use Pattern in Sonitpur District, 2010- 2011

SI. No.	Land put to different uses	Area in hectares
1	Total Geographical area	5,32,298
2	Forest area	1,47,843
3	Land not available for cultivation	1,94,498
a	Land put to non-agricultural uses	1,73,145
b	Barren and un-cultural land	21,353
4	Other non-cultivated land excluding fallow land	18,983
a	Permanent pastures and other grazing land	11,902
b	Land under misc, trees, groves etc. not included in net area	6,854
c	Cultivable waste land	227
5	Fallow land	5,833
a	Fallow other than current fallow	1,907
b	Current fallow	3,926
6	Net area sown	1,65,141
7	Total cropped area	2,65,397
8	Area sown more than once	1,00,256



Map: Land use land cover map of Sonitpur district

9. Physiography of the District

Physiographically the area can broadly be divided into three parts, i.e., the hilly tract, the foothill region and the extensive flood plain created by the river Brahmaputra and its tributaries. The hilly tracts comprise Siwalik sediments of lesser Himalayas. The southern limit of the sub- Himalaya is marked by Himalayan Frontal Fold (HFF). The foothill region is characterized by older terrace deposit. These terrace deposits are characterized by undulating surface comprising boulders, pebbles of quartzitic and gneissic rocks with fine sand, silt and clay act as matrix. The alluvial flood plain consists of younger and older alluvial deposits. It represents various sub- features, viz., palaeochannel, swampy/ marshy land, river terraces, flood plains, point bars, channel bar and river channel. The general slope of the entire district is from north to south.

10. Rainfall

Summer is hot and humid with heavy downpour mainly caused by the moisture-laden South-West Monsoon on striking the Himalayan foothills of the North. In the month of July highest average rainfall was recorded from the district i.e. 368.3 (mm) about 21 rainy days which causes heavy floods in some areas of the district also and at the same time it seems a boon too for the cultivators. Winter experiences cold and dry and temperature ranges between 8 to 23OC and normally December experiences lowest precipitations with about 10mm rainfall [Table 3.1 and Figure 3.1]. Autumns are dry, and warm. Springs are cool and pleasant, occurring in the months of late March and April, when new leaves emerges. During these months Page | 54 (March-April), flash rains and thunderstorms are at times caused by cyclonic winds, known in local parlance as Bordoichila.

Average rainfall of the district explained graphically in the figure.

Table: Annual rainfall (in milimeter) recorded in the District

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F
2018	0	7.3	61.5	120.7	190.4	195.2	343.2	335.9	269.5	30.3	30.9	23.4
2019	1	25.8	34.6	173.4	374.8	331.4	445.9	139.9	255	97.1	9.5	10.3
2020	11.4	35.6	24.8	72.9	288.5	271.1	317.8	204	194.9	139.4	10.9	1
2021	24.2	2.2	34.3	37.3	151.3	384.1	264.5	252.8	183	63.1	6	0
2022	18.5	39	34	271.6	385.8	439.6	178.9	115.6	145.4	146.5	0	0.8

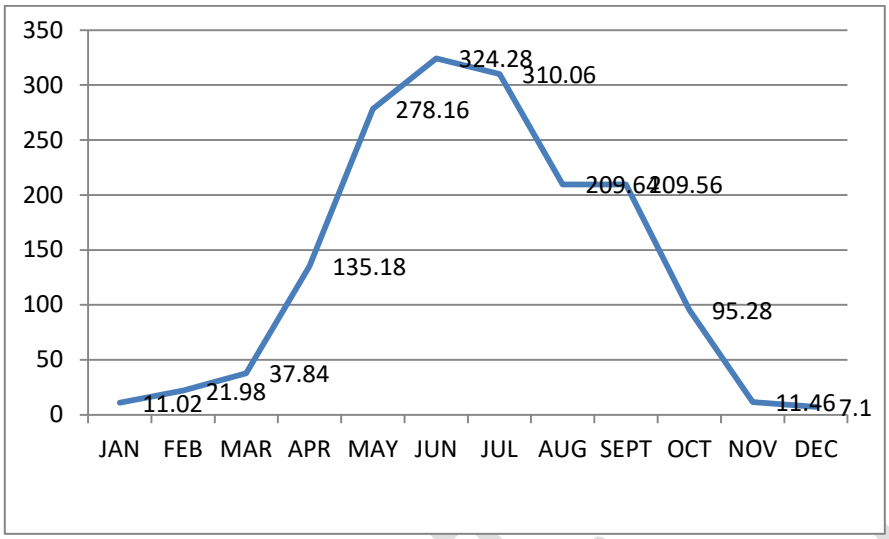


Figure: Graphical representation of the District rainfall

11. a) Geology

i) Regional Geology:

The Shillong Plateau (approx. 47,614 sq. km) is a Precambrian cratonic block in Northeast India, tectonically separated from the Indian Peninsula. It is bordered by:

- Dauki Fault to the south (dextral strike-slip fault),
- Brahmaputra Lineament to the north,
- Garo-Rajmahal Graben and Dhuburi/Madhupur Lineament to the west,
- Belt of Schuppen to the east.

This block is made up of high- to medium-grade Paleoproterozoic basement gneisses and schists, which are classified as the **Basement Gneissic Group (BGG)**. These are overlain by Mesoproterozoic metasediments and metavolcanics of the **Shillong Group**, intruded by Neoproterozoic acidic intrusives such as:

- Myllem pluton
- South Khasi pluton
- Umroi granite
- Nongpoh pluton

The plateau is composed mainly of orthogneiss and paragneiss with the following geological units:

- Banded gneiss (bimodal character)
- Migmatite
- Augen gneiss
- Banded Iron Formation (BIF)
- Amphibolites
- Pyroxene granulite
- Calc granulite
- High-grade sillimanite-bearing metapelite with cordierite, corundum, spinel, sapphirine
- Intrusives like lamprophyre, diorite, granodiorite, mafic intrusions, and pegmatite veins.

Towards the southern boundary of the Shillong Plateau, Cretaceous–Tertiary sedimentary sequences overlay these basement rocks. The plateau also contains an intracratonic basin (approx. 2,500 sq. km) with sedimentary cover.

The Assam Basin to the north represents the cratonic margin with three main tectonic phases:

1. Late Cretaceous to Eocene block faulting and development of a southeasterly dipping shelf.
2. Oligocene uplift and erosion, during which basement faults reactivated.
3. Post-Oligocene phases, marked by sedimentation and structural developments.

The Eocene Sylhet Formation is significant for its varied depositional environments:

- The Lakadong Member (lagoonal environment) contains thin sandstone and interbedded shale and coal.
- The upper part of the Lakadong Formation represents calcareous sandstones formed in a shallow water platform.

ii) Local Geology:

The region falls under the Brahmaputra Basin and consists of Quaternary alluvial sediments. The local physiography can be divided into:

- Hilly tract
- Piedmont zone
- Floodplain
- Monadnock-like remnants

The area's geology ranges from Archaean to Recent formations:

- Archaean Gneissic Complex (Inselberg), including biotite gneiss, granite gneiss, schist, and phyllite.
- Quaternary alluvial deposits overlie these ancient rocks.

Key stratigraphic formations include:

- Namsang Formation, unconformably overlain by the Dihing Group.
- Dhekiajuli Formation, characterized by unconsolidated sands, pebbles, grits, and boulders. It represents the youngest rocks beneath the alluvium and is widespread across the Upper Assam Shelf.

The Dhekiajuli Formation and the Assam Alluvium exhibit high resistivity values and consist predominantly of loose, unconsolidated sands with occasional clay, silt, and pebble bands. The alluvium forms today's floodplains, which support agriculture. Thickness of these deposits varies across the region, ranging from:

- 1,300 m near the Naga Thrust to
- 2,500 m in the Mechaki and Talap areas.

Geochronologically:

- Dhekiajuli Formation is from the Pliocene Series (Zanclean to Piacenzian stages),
- The Alluvium ranges from Pleistocene to Recent (Gelasian, Calabrian, and later stages).

This geological understanding reflects the complex tectonic history and the interactions between ancient Precambrian basement rocks and more recent sedimentary deposits of the region.

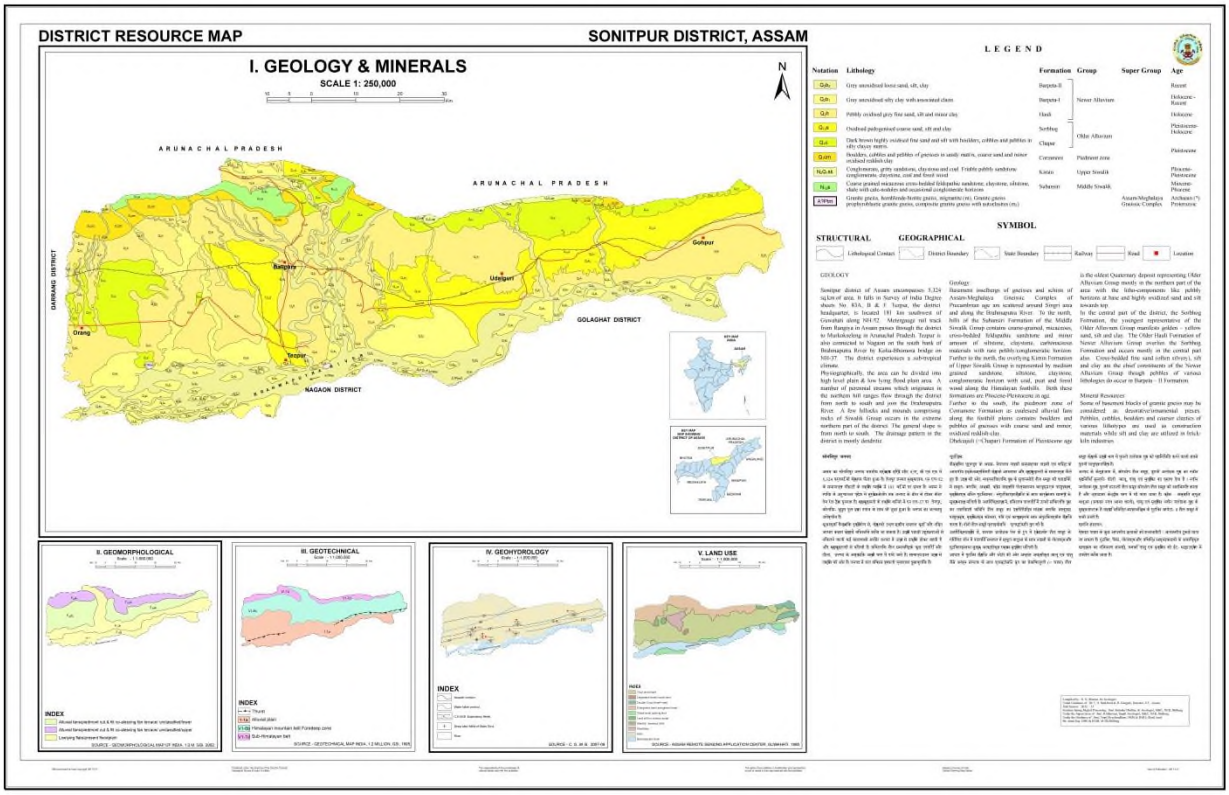


Figure: District Resource Map of Sonitpur (undivided) [District Resource Map, Geological Survey of India, 2001]

11. b) Mineral Wealth

i. Overview of mineral resources:

The geological formation of Sonitpur District indicates the presence of minor minerals.

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.

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

i) Drainage system with description of main rivers

S. No.	Name of the river	Area drained (sq. m)	% Area drained in the district
1			
2			
3			
4			

(data To be collected)

ii) Salient features of important rivers and streams:

S. No.	Name of the river or stream	Total length in the district (in km)	Place of origin	Altitude at origin

(data To be collected)

(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						

(data To be collected)

ii) Mineral potential

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

(data To be collected)

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 data were 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.

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://censusindia.gov.in/nada/index.php

2. https://hydro.imd.gov.in/hydrometweb/(S(c31xot2fu1lahs45tplr2vuh))/DistrictRaifall.aspx

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