INLAND WATERWAYS AUTHORITY OF INDIA

IDENTIFICATION OF POTENTIAL WATERWAYS IN NORTH EAST INDIA

FINAL REPORT
JULY 2011

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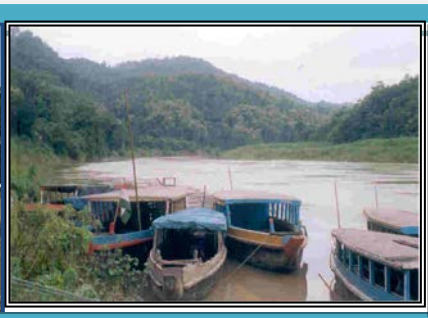
THE INFRASTRUCTURE PEOPLE

IDENTIFICATION OF POTENTIAL WATERWAYS IN THE NORTH EAST INDIA

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EXECUTIVE SUMMARY

The north east region of India consists of eight states viz., Assam, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya and Sikkim. The north east region is endowed with enormous natural resources such as coal, limestone, minerals, boulders, oil, tea, ginger, cashew nuts, beetal nuts, forest products etc and the huge potential of the Brahmaputra River, the Barak River and their tributaries. These resources are fully untapped due to multitude of factors and the important one is poor transport infrastructure facilities in the region. Regardless of various inhibiting factors, it is clear that a sustainable development of this region cannot be achieved without the development of transport net work including inland waterways. Many of the inland waterways in the north east region are international waterways across the borders of Bangladesh and Myanmar to develop border trade also.

BACKGROUND

Inland Water Transport (IWT) is operationally cheaper, high in fuel efficiency and environment friendly. It has a vast potential to act as an alternate and supplementary mode of transportation in certain conditions. India has large number of inland waterways consisting of rivers, canals, backwaters, creeks, and lakes etc. which have the potential for development of efficient waterways transport network. However, development of inland water transport has remained dormant for a long time.

Inland Waterways Authority of India hereinafter referred to as IWAI (or Authority), an autonomous organization under Department of Shipping (DoS), Govt. of India was constituted in October 1986 for development and regulation of inland waterways of the country for shipping and navigation. Waterways which are declared as National Waterways (NWs) are developed, maintained and regulated by IWAI for shipping and navigation.

So far, five waterways namely (i) the Ganga-Bhagirathi-Hoogly river system from Haldia to Allahabad (1620 km),(ii) the Brahmaputra from Dhubri to Sadiya (891 km), (iii)West Coast canal from Kottapuram to Kollam along with Champakara and Udyogmandal canals (205 km), (iv) Kakinada - Pondicherry canals integrated with rivers Godavari and Krishna (1095 km) and (v) East Coast canals along with river Brahmani and Mahanadi delta (621 km), have been declared as National Waterway No. 1,2,3,4 & 5 respectively. IWAI is planning and implementing various developmental works on above waterways.

OBJECTIVE OF THE STUDY

The objective of the study is to identify and prioritise potential projects for inland navigation in the 8 North Eastern states (including Sikkim) of India to facilitate systematic follow up actions for planning and implementing developmental works to harness such potential to the best benefit of the region.

The Govt. of India has a policy to declare and develop major navigable waterways of the country as National Waterways (N.W.) for the purpose of shipping and navigation. With specific reference to N.E Region, the river Brahmaputra in the State of Assam from Dhubri to Sadiya (891 kms) has already been declared as National Waterway. The Inland Waterways Authority of India (IWAI) is implementing various developmental works on this waterway. Lakhipur-Bhanga stretch (121 kms) of river Barak is also under process for declaration as another N.W. Apart from the development maintenance and management of National Waterways implemented with central funding, the Govt. of India also extends 100% financial assistance for undertaking Inland navigation developmental works in smaller waterways (State waterways) in the NE states. For this, there is an exclusive Central Sector Scheme (CS) available for NE states only.

The guidelines for this scheme in the IWT sector for NE states including Sikkim have been issued by the Ministry of Shipping, Govt. of India vide its letter dated 27.08.2008 (copy enclosed as Annexure-1, Section.6). It is stated at the outset of above guidelines that the objective of the scheme is to encourage the State Governments of North Eastern States namely – Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura for taking up various projects for development of Inland Water Transport in North Eastern Region.

The activities of IWT development that will qualify for getting assistance under the scheme may be seen listed under para-3 of the guidelines. It is envisaged that all the projects under this scheme will be formulated and executed by the respective State Govts. through their Deptartment responsible for IWT development. However, even after 2 years since the scheme / guidelines were issued, there is hardly any scheme submitted to the Central Govt. by any of the NE states to draw benefit of the scheme.

The principal reason for lack of proposals has been identified as non-availability of suitable technical organisations and expertise with the various State Govts. to prepare proposals and seek sanction of Central Govt. The matter has been reviewed at highest levels and a decision has been taken that such short comings on the part of State Govts. should not be allowed to become a reason for not harnessing potential for IWT in the NE states. It has been decided that IWAI which is the apex organisation in matters of Inland navigation will extend its assistance to the State Govts. to facilitate identification of potential IWT projects and also in preparing specific project proposals to be implemented by the various States. The state governments will also set up separate IWT organisations to look after / execute various IWT projects

ASSAM

Assam has largest inland waterway net work in India. The Assam's navigable inland waterways extend to 1,983 km out of India's total 14, 544 km comprising of 44 rivers, the longest being the Brahmaputra followed by the Barak river system. While the Brahmaputra from Sadiya to Dhubri (891 km) is already functioning as National Waterway No. 2, the Barak River is under active consideration for declaration as

National Waterway. Besides these two main waterways, the other potential waterways identified for development of inland water transport are listed below:

1. River Dhaleswari / Kathakal from Bairabi to Barak confluence at Kathakal (125 km)
2. River Jia Bharali from Bhalukpung to Brahmaputra confluence (60 km)
3. River Buridihing from Joyapur to Brahmaputra confluence (80 km)
4. River Dikhow from Sibsagar to Brahmaputra confluence (40 km)
5. River Dhansiri from Numaligarh to Brahmaputra confluence (25 km)
6. River Kopili / Kolong Jagibhaktagaon to Brahmaputra confluence (50 km)
7. River Disang from NH 37 crosssing at to Brahmaputra confluence (25 km)

The river Dhaleswari is an interstate river between Mizoram and Assam. After travelling 280 km in Mizoram, the river enters in Assam at Bairabi and travels 126 km within Assam and confluences with river Barak at Kathakal. Since, the river Barak is an international river flows through Bangladesh along protocol route and hence has direct connectivity to Kolkata. The river Dhaleswari is navigable during monsoon season for about 6 to 7 months for about 2 to 3 tons vessels. The food grains, fertilizers, iron, steel and cement are the major items for movement by IWT from Kolkata to the Karimganj / Silchar in Assam then to the feeder system of waterways viz., Dhaleswari / Tut / Tlawng up to Aizawl in Mizoram.

The other potential waterways Jiabharali, Buridihing, Dikhow, Kopili, Dhansiri and Disang are suitable to ply about 100 tons vessels during monsoon season of 6 to 7 months in a year. Since many of these waterways are traversing through the industrial areas and north east oil fields and coal fields, there is a possibility for movement of industrial and mines based cargo besides local ferry services.

ARUNACHAL PRADESH

Many tributaries of Brahmaputra originate in hilly terrain of Arunachal Pradesh and enter into plains along Assam border and confluence with the river Brahmaputra. Hence, the river reaches in Arunachal Pradesh are suitable for hydroelectric power projects and the river reaches in Assam are suitable for navigation. There are series of several hydel power projects are either under construction or under proposal in the rivers Dibang, Lohit, Subansiri and Siang. These rivers are extensively used by the people of Arunachal Pradesh due to typical topography. The river reaches of these waterways in Assam are fairly navigable to ply 200 to 300 tons vessels with a draft of about 1.0 to 1.2 m. These waterways have further connected to National Waterway No. 2 (Brahmaputra) and hence cargo movement is feasible right from Kolkata / Haldia in West Bengal up to the proposed power project sites through protocol route in Bangladesh. The potential waterways identified in Arunachal Pradesh to develop inland water transport are:

1. River Dibang from Anpum to Brahmaputra confluence (50 km)
2. River Lohit from Parasuramkund to Brahmaputra confluence (100 km)

3. River Siang from Pasighat to Brahmaputra confluence (50 km)
4. River Subansiri from Gerukamukh to Brahmaputra confluence (111 km)

Besides the above the river development for the following ferry services on the above rivers are also required:

Ferry services on River Dibang:

1. Circuitus navigation route from Anpum – Paglam – Dholla – Sadia – Christian Basti – Anupam (80 km)
2. Between Malek and Bamjur (10 km) for better connectivity between Roing and Dambuk
3. Between Bizari and Jiai (10 km)

Ferry services on River Lohit:

1. Saikhowa Ghat to Parsuram Kund via Alubari Ghat for connecting Tezu to Dimwe (75 km)
2. Tezu to Medo
3. Digaru to Alubari
4. Shivaji nagar to Tezugham

Ferry services on River Siang

1. Sika Bamin to Namsing
2. At Komilighat

MIZORAM

The rivers of Mizoram constitute a major part of the topography of Mizoram State. The potential waterways identified for further studies to develop inland water transport in the state are:

1. The river Khawthlangtuipui from Rajiv Nagar to Tlabung (180 km)
2. The river Tuichawng from Kawrpuichhuah to Tuichawng (135 km) and
3. The river Tut from Dapchhuah to Tlangkhang (55 km)

The river Khawthlangtuipui runs from north to south of Mizoram along Bangladesh border and the river Tuichawng traverses from south to north of Mizoram and meet each other at Tuichawng chowk and the combined flow enters into Bangladesh as Karnofuli river at Demagiri Land Customs Station. The Karnafuli River flows through Rangamati and the port city of Chittagong. The Karnafuli River is the large and most important river in Bangladesh. The commodities such as Bamboo, Ginger, Sesamum, Chillies, Teak, Cotton, Citrus furits, Rice, Sugar and Cement flow from Indian side to Bangladesh and India import commodities like Electronic goods, Garlic, Potato crackers, Cooking oil,

Blankets, Speed boat engines, Condensed milk etc. across the border. These waterways are navigable for 6 months period during rainy season for 2 to 3 tons vessels.

The river Tut is a tributary of river Tlawng / Daleswari and hence will serve the interstate trade between Mizoram and Assam. The river Daleswari has a water transport link to river Barak and then to Bangladesh protocol route viz., Karimganj. The river is navigable only during flood season for about 6 months (July to November / December) for 2 to 5 tons vessel. The development of this waterway is important from the point of view of socio-economic upliftment of the local tribals living in these remote areas for transportation of the local products to the nearby market areas. As per the local information obtained during site visit there are no rapids present in the watyerway. However for the verification of the local inputs the detailed hydrographic surveys are required.

MEGHALAYA

The Meghalaya State is blessed with many rivers and out of which some of the rivers are navigable to some extent. The Meghalaya State is further blessed with lot of mineral resources for economic use and export purpose and earns foreign revenue. The coal mines, lime stone mines and bolder quarries are ideally located along the river banks of Simsang and Kynshi/ Jadukota River to facilitate transportation of these materials by inand water transport. Bangladesh import these material across the several Land Custom Stations located all along the Meghalaya border. It is quite interesting to notice that the Bangladesh import the above minerals by barges of 10 tons capacity ply on Simsang and Kynshi rivers besides by trucks. On an average about 3, 30,000 tons of coal, limestone and boulders per annunm are exported to Bangladesh from in and around Siju mines located along Simsang River and 2, 20,000 tons per annum are exported from mines located along Kynshi River.

Besides the roads at border trade points, a wider multimodal transportation linkages like development of water transportation across the north eastern region and Bangladesh in general, and Meghalaya and Bangladesh in particular needs to be put in place for the promotion of trade across these two regions.

The other important potential waterway is Jingiram located on the west Garo hills at Phulbari. The Jingiram is a tributary of Brahmaputra, confluences at Phulbari in Meghalaya. Regular ferry services are there between Phulbari and Dhubri which is located on the right bank of Brahmaputra. The Phulbari Ghat in Meghalaya is the transport hub for export and import of goods to and from Dhubri in Assam. The major goods exported from Meghalaya through Phulbari Ghat are consumable goods, cashew, ginger, spices, pine apples and other fruits, brooms, bamboo products etc. Hence, the development of IWT terminal at Phulbari on River Jingiram plays a vital role for transportation of about 65,000 tons of goods per annum, 40,000 tons per annum of boulder, bricks to Bangladesh and regular daily passenger services being operated to and from Phulbari in Meghalaya and Dhubri in Assam. Therefore, the potential waterways for development in Meghalaya are placed as stated below:

1. River Kynshi from Mawet mines to Borsora (35 km) and
2. River Simsang from Siju mines to Baghmara (35 km)
3. River Jingiram from Phulbari to Dhubri (20 km)

While the rivers Simsang is navigable for about 6 months during flood period for about 10 tons vessels, the river Kynshi is suitable for 50 tons during lean period and 100 tons during flood period and the ferry services on river Jinjiram are feasibile round the year.

TRIPURA

The potential waterways idenfied in Tripura to develop inland water transport within the state are:

1. The River Gumti from Maharani barrage at Amarpur to Bangladesh border at Sonamura (80 km) and
2. The River Hoara from Barmura to Indo-Bangladesh border (46 km)

The rivers Gumti and Hoara are narrow and shallow and navigable only during rainy season from June to Novemeber / December (6 to 7 months). These two rivers cross the Bangladesh border and finally confluence with Meghana river system. It is learnt that cross border inland water transportation exists on these two rivers since early ages. About 2 to 5 tons vessel only can able to ply on these two rivers. The export cargo from Tripura to Bangladesh and other nearby areas in Tripura is rubber, orange, rice and tea products. Inland Waterways Authority of India (IWAI) has already carried out hydrographic surveys on these rivers and also initiated Detailed Project Report study.

NAGALAND

Nagaland is the origin of several rivers which are ultimately tributaries of Brahmaputra. The potential waterways identified for development of inland water transport are listed below:

1. The river Tizu from Longmatara to Indo – Myanmar border near Abankhu (42 km)
2. The river Dhansiri from Samjuran in Nagaland to Numuligarh in Assam (110 km)
3. The river Dikhow from Yangnyu to Naginimara (52 km)

The River Tizu is the important waterway in Nagaland has potential to develop inland water transport. The river Tizu is a transboundary river between India and Myanmar. The river Tizu after crossing Nagaland border enters into Myanmar and joins with Chindwin – Airwady river system. The river will serve as international waterway since the Chindwin – Airwady river system in Myanmar is a well established water transport system in Myanmar. The river Tizu is navigable during rainy season of about 6 to 7 months in a year. If the river is developed by dredging and other river conservancy measures, it is navigable round the year. About 10 to 15 tons vessels can ply on this

waterway. This area is enriched by minerals like marbles, tiles, magnetites etc. This area also has the good lime stone deposit. One medium size cement factory and one mega cement plant (near Laluri) is going to be commissioned in the command area of Tizu river soon. The Inland Waterways Authority of India (IWAI) has already initiated Detailed Project Report Studies on this river.

The river Dhansiri passes through the heart of Dimapur city in Nagaland. This river can be taken up for further studies as potential waterway from Samjuran (Nagaland) to Numuligarh (Assam) so that Dimapur will have direct connectivity to Brahmaputra River via Numuligarh. The command area of this river is having best quality of sand, granite, bamboo, boulders, cattles, and cement to export to other states through Dhansiri - Brahmaputra River system if developed. This river is navigable for 10-15 ton vessel in monsoon period only.

The river Dikhu / Dikhow is also an interstate state river which flows through Nagaland and meets Brahmaputra in Assam. The reach between Yangnyu and Naganimura (approx 52 km) can be taken up for further studies as potential waterway to establish connectivity from Naginimara to Brahmaputra confluence via Sibsagar. The command area in Nagaland is full of minerals like coal, building stones; building materials, bamboos and timbers etc. This river is well connected by road. This river is navigable during monsoon for 10 tonne vessel only.

MANIPUR

The river Barak is the potential waterway in Manipur. The river Barak is an inter state river between Manipur and Assam. The river Barak is also a transboundary river between India and Bangladesh. The river enters into Bangladesh at Karimganj in Assam and joins with Kushiyara and Surma river system. There is a proposal to construct multipurpose dam on river Barak at Tipaimukh in Manipur. The down stream of the river reach from Tipaimukh to Karimganj has already been considered for DPR study by IWAI. The Barak river reach in the upstream of Tipaimukh up to NH 53 crossing at Nungba (60 km) has also potential to develop river navigation in Manipur and hence may be considered as Barak extension. The river is navigable round the year with 10 tons vessel during lean period and 50 tons vessels during flood period.

1. River Barak extension from NH 53 crossing at Nungba to Tipaimukh (60 km)

Besides the river Barak, the water transport can also be developed in Loktak Lake in Manipur. The Inland Waterways Authority of India has already sanctioned some schemes for development of terminal facilities on Loktak Lake. The Manipur government also desires to conduct DPR studies on the following ferry services on Loktak lake during second phase.

(i) From Takmu to Sendra: For promotion of torurism
(ii) Toupoki to Sendra via., Ninghoukhon
(iii) Sendra to Komlakhong via., Thanga

(iv) Komlakhong to Phaibakcho via., Karang island
(v) Phaibakcho to Mayang to Imphal via., Karang island
(vi) Mayang to Imphal to Toupokpi via., Ningthoukhong

SIKKIM

In Sikkim, there are two important rivers namely Teesta and Rangit. These rivers in Sikkim traverses in hilly terrain and the river bed is rocky with rapids, boulders and sudden falls. The rivers are flashy, turbulent and violent during flood period. During the lean period the rivers flow like small streams and the flow regime is interspersed by boulders and exposed rock out crops. The rivers are suitable only for river rafting. In view of the hilly terrain and rocky bed, these rivers are not suitable for navigation.

CONOLUSIONS AND RECOMMONDATIONS

Based on the study conducted, it is concluded that the following rivers are identified as potential waterways in each of the seven north eastern states. The Sikkim state does not have any navigable waterway. The identified waterways are shown in Fig.1.

Assam

1.Dhaleshwari/Katakhal
2.Jia Bharali
3. Buri Dihang
4.Kopili/Kalang
5. Disang
6. Dhansiri
7. Dikhow

Arunachal Pradesh

1.Dibang
2.Lohit
3.Subansiri
4.Siang

Meghalaya

1.Kyanshi
2.Simsang
3.Jingiram

Mizoram

1.Khawthlangtuipui
2.Tuichawng
3.Tut

Tripura

1. Gumti
2. Haora

Nagaland

1. Tizu

Manipur

1. Barak river extension
2. Loktak lake

The identification of potential waterways is based on detailed discussion with the concerned state Governments, information collected during site visits, certain information available with consultant and through internet. The preparation of project reports/ detailed surveys & investigations are required to arrive on final conclusion before implementing the scheme/actual development of these waterways.

Among identified waterways some of the waterways are interstate waterways, before developing these waterways the detailed discussion and opinion of the concerned states are taken into account.

The prioirity of the undertaking of the waterways has to be decided by the Inland Waterways Authority of India (IWAI) and the concerned state. It will be appropriate to decide the priority of development of the selected potential waterways with concerned state.

Table 1: The salient navigation features of the waterways

The potential waterways to be considered under CSS scheme priority wise in each state are:

River / Waterway	State	Approximate Navigable reach	Navigable period	Possible draft and capacity of the vessel	Cargo potential
ASSAM					
Dhaleswari / Katakhal	Mizoram / Assam	Bairabi to Barak confluence (125 km) Bairabi to Sairang (90 km)	6 months (Flood season)	0.6 m 10 tons (Katakhal) 0.3 m 2 tons (Tlawng)	Tea and other forest products, passenger ferries

Jia Bharali	Arunachal Pradesh / Assam	Bhalukpung to Brahmaputra confluence (60 km)	6 to 8 months	1.0 m 200 tons	Ferry services for local cargo / passengers and Construction material for proposed power projects
Buridihing	Arunachal Pradesh / Assam	Joyapur to Brahmaputra confluence (80 km)	8 to 10 months	1.2 m 200 tons	Industrial cargo, ferry services
Dikhow	Nagaland / Assam	Sibsagar to Brahmaputra confluence (40 km)	6 to 8 months (Flood season)	0.8 m 100 tons	Industrial cargo, ferry services
Dhansiri	Nagaland / Assam	Numaligarh to Brahmaputra confluence (25 km)	6 to 8 months (Flood season)	1.0 m 100 tons	Industrial cargo, ferry services
Kopili / Kolong	Assam	Jagibhaktagaon to Brahmaputra confluence (50 km)	6 to 8 months (Flood season)	0.8 m 100 tons	Industrial cargo, ferry services
Disang	Nagaland / Assam	NH 37 crossing to Brahmaputra confluence (25 km)	6 to 8 months (Flood season)	0.8 m 100 tons	Industrial cargo, ferry services
Manas - Beki - Aie	Assam	Only ferry services	6 months (Flood period)	0.6 m 50 tons	Not feasible
Gaurang	Assam	Not navigable	Not feasible	Not feasible	Not feasible
ARUNACHAL PRADESH					
Dibang	Arunachal Pradesh / Assam	Anupam village to Brahmaputra confluence (50 km	Round the year	1.2 m 300 tons	Construction material for proposed power projects and local cargo

Lohit	Arunachal Pradesh / Assam	Parasuramkund to Brahmaputra confluence (100 km)	Round the year	1.2 m 300 tons	Construction material for proposed power projects and local cargo
Siang	Arunachal Pradesh / Assam	Pasighat to Brahmaputra confluence (50 km)	Round the year	1.2 m 200 tons	Ferry services for local cargo / passengers
Subansiri	Arunachal Pradesh / Assam	Gerukamukh to Brahmaputra confluence (111 km)	6 to 8 months	1.0 m 200 tons	Ferry services for local cargo / passengers and Construction material for proposed power projects

MIZORAM					
Karnafuli / Khawthlangtuipui	Mizoram/ Bangladesh	Tlabung to Rajiv Nagar (180 km approx)	6 months (monsoon period)	0.6m 2-5 tons	Border trade and local cargo
Tuichawng	Mizoram	Kawrpuichhuah to Tuichawng (135 km approx)	6 months (monsoon period)	0.6m 2-5 tons	Ferry service and local cargo
Tut (Tlawng / Dhaleswari)	Mizoram/ Assam	Dapchhhuah to Tlangkhang (55 km approx)	6 months (monsoon period)	0.6m 2-5 tons	Ferry service and local cargo
MEGHALAYA					
Kynshi / Jadukota	Meghalaya	Borsora / Ranikor to Mawet (30 to 35 km)	2 to 10 m (lean season) 5 to 15 m (flood season)	50 tons (lean season) 100 tons (flood season)	Export of coal / limestone / boulders 2,20,000 tons (Borsora LCS);

Simsang	Meghalaya	Baghmara to Siju (32 to 35 km)	0.3 m to 0.6 m (lean period) 3 m to 4 m (flood period)	10 to 15 tons (lean season) 50 to 100 tons (flood period)	Export of coal / limestone / boulders 30,000 tons (Bagmara LCS); 3,00,000 tons (Gauspara LCS);
Jingiram	Meghalaya / Assam	Phulbari to Dhubri (20 km)	0.5 m to 10 m	10 tons (lean season) 100 to 200 tons (flood season)	64,000 tons (Phulbari – Dhubri) 40,000 tons (Phulbari – Bangladesh) 1,00,000 Passengers
Umngot	Meghalaya	0.2 m	Not feasible	Not navigable	Not feasible
TRIPURA					
Gumti	Tripura	Amarpur to Sonamura (80 km)	6 months (monsoon period)	0.6m 2-5 tons	Border trade and local cargo
Hoara	Tripura	Barmura to Indo-Bangladesh border (46 km)	6 months (monsoon period)	0.6m 2-5 tons	Border trade and local cargo
NAGALAND					
Tizu	Nagaland	Longmatara to Abankhu (42 km)	6 months (monsoon period)	0.6m 2-5 tons	Border trade and local cargo
Dhansiri	Nagaland /Assam	Samjuran to Numaligarh (110 km)	6 months (monsoon period)	0.8 m 10 – 15 tons	Minerals, cement, local cargo
Dikhu / Dikhow	Nagaland /Assam	Yangnyu to Naginimara (52 km)	6 months (monsoon period)	0.8 m 10 – 15 tons	Minerals, cement, local cargo

MANIPUR					
Barak Extension	Manipur / Assam	Nungba to Tipaimukh (60 km)	6 months (monsoon period)	0.8 m 10 – 15 tons	Local cargo
Loktak lake	Manipur	Ferry services	Round the year	0.8 m 2-5 tons	Passengers and local cargo

1.0 INTRODUCTION

Inland Waterways Authority of India (IWAI) proposes to promote Inland Water Transport (IWT) in the potential waterways in the eight north eastern states viz., Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. RITES LTD has been assigned the consultancy services of "Identification of Inland Water Transport (IWT) projects having potential for development" vide letter of award No. IWAI/CS Scheme (tender)/2009, dated 18.1.2011 and signed the agreement on 23rd February, 2011.

The northeast region of India is endowed with enormous natural resources such as coal, limestone, minerals, oil etc and the huge potential of Brahmaputra river and its tributaries. These resources notwithstanding, this part of India remains woefully underdeveloped have been untapped. The current state of low development of the northeast region can arguably be attributed to a multitude of factors and the important one is poor transport infrastructure. Regardless of various inhibiting factors, it is clear that a sustainable development of this region cannot be achieved without the development of transport infrastructure including waterways.

Detailed discussions were held with the authorities and officials of recently formed IWT cells in various north east states. Based on the discussions, site visits, primary and secondary data collection, the potential waterways have been identified and the details are furnished in this report.

2.0 IWT ACTION PLAN FOR NER VISION 2020

The action plan of Ministry of Development of North Eastern Region (DONER) for developing the Inland Waterways sector in the North Eastern Region as part of NER vision 2020 has identified the following rivers:

Table 2.1: Waterways identified for action plan in NER Vision 2020

Sl.No.	River	Navigable length of the river (km)
1.	Buridhing	161
2.	Disang	129
3.	Gangadhar	113
4.	Subansiri	143
5.	Kopili	103
6.	Kolodyne	112
7.	Kolong	121
8.	Katakhal	161
9.	Panchas	105
10.	Others	1967

3.0 FORMATION OF IWT CELLS IN NORTH EASTERN STATES

The details of the notified IWT departments so far by various State Governments are as follows:

Table 3.1: Details of IWT cells in various State Governments

Sl.No.	State	Department identified for Inland Water Transport (IWT)	Officials concerned	Designation in IWT Cell	Notification Details
1	Mizoram	Transport Department	(i) Joint Secretary, Transport (ii) Under Secretary, Transport (iii) Dy. Commissioner, S.T.A (iv)S.D.O. (PWD) Transport (v) A.S.A (STA) (vi) R. Lalthanfeli, Assistant	Chairman Member Member Secretary Member Member	No. B. 11015/3/10-TRP/Loose; Dated 1.11.2010
2	Tripura	Office of the Special Secretary, Transport, Civil Secretariat, Capital Complex, Agartala	(i) Joint Secretary, Transport (ii) Representative of PWD (W/R) Department (iii) Joint Transport Commissioner (iv) Sr/ MVI, Office of the Joint Transport Commissioner	Chairman Chairman Member Member	No.34(2)/Transport/2010 Dated: 13.10.2010

Sl.No.	State	Department identified for Inland Water Transport (IWT)	Officials concerned	Designation in IWT Cell	Notification Details
3	Manipur	Transport Department	(i) Director (Transport), Manipur (ii) Additional Secretary / Deputy Secretary (Transport), Government of Manipur (iii) Project Director, Loktak Development Authority (LDA) (iv) Superintendent of Engineer, Loktak Development Authority (LDA)	Chairman Member Secretary Member Member	No.1371/1/2001-T(CSS); Dated 18.11.2010
4	Meghalaya	Transport Department	State Transport Department		No. TPT.10/96/Vol.I/1086; dated 11.03.2011
5	Assam	Office of the Director, Inland Water Transport	Director Ulubari, Guwahati FAX: 0124 2571617	Director	
6	Nagaland	Transport Department	(i) Secretary (Transport), Nagaland (ii) GM, NST (iii) Dy. Secretary (Transport) (iv) Executive Engineer, NST	Chairman Member Secretary Member Member	No. TPT/WATER – 1 /2000(Pt); dated 05.05.2011

7	Arunachal Pradesh	Transport Department	(i) Secretary (Transport) (ii) Secretary (Planning) (iii) Chief Engineer, Zone – I (iv) Chief Engineer Zone – II (v) Chief Engineer, IFC	Chairman Member Member Member Member	No. TPT(N)16/97(Pt)/699; Itanagar Dated: 22 November, 2001

4.0 POTENTIAL WATERWAYS IN ASSAM

A. TRIBUTARIES OF RIVER BRAHMAPUTRA

The Brahmaputra river known as Tsangpo in Tibet enter the Indo-China border near Monku at an elevation of 660 m and flows for 5 km as the international boundary to arrive at Korbo in Arunachal Pradesh of India. In Arunachal Pradesh the river is known as the Siang or Dihang (**Fig. 4.1**). The Dihang having a length of 282 km, descends from the hilly terrain into the Assam valley and is joined by the combined flow of two majestic rivers viz., the Lohit and the Debang, near east of Kobo and north of Laikaghat. Downstream of meeting point of these three rivers viz., Dihang, Debang and Lohit, near Sadia, the river is known as Brahmaputra.

The Brahmaputra River receives innumerable tributaries flowing down the northern, northeastern and southern hill ranges. Within the valley reach of Assam from Kobo to the Indo-Bangladesh border, nineteen (19) of the major tributaries originating from Himalayan mountain ranges join the Brahmaputra river on its north bank (right bank) and thirteen (13) of the major tributaries originating from the southern hill ranges join the Brahmaputra river on its south bank (left bank). The mighty Brahmaputra along with the well knit network of its tributaries controls the geomorphic regime of the entire region especially the Brahmaputra valley (**Fig. 1**).

Assam's navigable inland waterways extend to 1,983 km out of India's total 14,544 km comprising 44 rivers, the longest being the Brahmaputra, the National Waterway No. 2 (891 km from Sadiya to Dhubri) whose share is about 14% (**Fig. 1**). The next largest river is the Barak, under active consideration for declaration as National Waterway.

Nearly 30% of India's water resources potential and 41% of the country's total hydropower potential are found in river Brahmaputra and its tributaries. Many hydroelectric power projects are coming up in the tributaries of river Brahmaputra. Hence, the development of river Brahmaputra and its feeder waterways as a total grid net work is the need of the hour to create transport infrastructure for movement of over dimensioned cargos and bulk construction material for the proposed power projects.

Till 1950, the Joint Steamer Companies were operating regular services between Kolkata and Sadiya throughout the year. In addition, they operated the following services on the Feeder Rivers:

1. Subansiri River for a distance of 130 km from the point of confluence with Brahmaputra
2. Buri Dihing River for a distance of 35 km
3. Disang River for a distance of 75 km
4. Dikhow River for a distance of 30 km
5. Dhansiri River for a distance of 40 km
6. Kopili-Kolong River for a distance of 90 km

It is reported that many of the Brahmaputra tributaries are navigable for varying distances from their mouths. The Subansiri, Dihang, Buri-Dihing, and Dibang rivers are important among these.

The earthquake of 1950 caused considerable changes in the regime of the Brahmaputra, resulting in deterioration of the navigable channels, particularly in the upper reaches. However, the inland water transport between 1950 and 1965 continued to carry 80% of tea and 90% of jute, and considerable quantities of POL from Assam to Kolkata, and carried maximum river traffic of 8.5 million tons in 1951 and a minimum of 5.25 million tons in 1962.

Unfortunately, after the outbreak of war in 1965 with erstwhile East Pakistan the Inland Water Transport in Assam received another setback. Even then the river traffic carried by the Central Inland Water Transport (established in 1966), after the liquidation of the Joint Steamer Companies, was not very discouraging.

The Inland Water Transport Directorate, Assam was established by the Assam Government in 1959, in pursuance of the recommendations of the Gokhale Committee (1959) to look after the development of waterways, ferried, and for the training of Inland Water Transport personnel. Since then the directorate has been doing useful work, running as many as 66 ferry services in Assam (42 on the Brahmaputra and 24 on the Barak) as well running a commercial service within Assam, other north eastern states, and with Bangladesh and Kolkata since 1974.

It is reported that with the ferry service network, Assam IWT has been carrying nearly about 60,000 passengers, 2,000 metric tons goods every day by different ferry routes. It is not only the people of Assam who are benefited by ferry operations of Assam IWT, but also people from adjoining states like Meghalaya, Nagaland, Manipur and Arunachal Pradesh are also enjoying the benefit.

Some of the major ferry services connecting Assam with the neighbouring states are as below:

Table 4.1: Assam IWTD operated ferry services with neighboring states of north eastern region

Sl.No.	Ferry Service	States Connected
1	Sadia-Saikhowa	Assam with Arunachal Pradesh directly
2	Saikhiya-Pagalam	Assam with Arunachal Pradesh directly
3	Neamati-Kamalabari Lohit -Khabalu	Assam with Arunachal Pradesh and Nagaland
4	Dhansiri-Gamiri	Assam with Arunachal Pradesh and Nagaland
5	Jaleswar-Dhubri	Assam with Meghalaya
6	Dhubri-Fakirganj	Assam with Meghalaya
7	Phulbari-Dhubri	Assam with Meghalaya

Hydrological characteristics of Brahmaputra tributaries

The hydrological characteristics of some of the important North Bank and South Bank tributaries of Brahmaputra are as follows:

Table 4.2: Hydrological characteristics of some important Right (North) Bank tributaries of river Brahmaputra river (Source: The Brahmaputra Basin Water Resources, 2004)

Sl.No.	Rivers	Catchment Area (Sq.km)	Length (Km)	Average Annual Discharges (m^3s^{-1})	Average Annual Suspended Load (ha.m)	Sediment Yield (ton/km^2)/ year
1.	Subansiri	28,000	442	7,55,771	992	959
2.	Ranganadi	2,941	150	74,309	186	1,598
3.	Buroi	791	64	20,800	16	529
4.	Bargang	550	42	16,000	27	1,749
5.	Jia Bharali	11,716	247	3,49,487	2,013	4,721
6.	Gabharu	577	61	8,450	11	520
7.	Belsiri	751	110	9,300	9	477
8.	Dhansiri (N)	1,657	123	26,577	29	463
9.	Noa Nadi	907	75	4,450	6	166
10.	Nanoi	860	105	10,281	5	228
11.	Barnadi	739	112	5,756	9	323
12.	Puthimari	1,787	190	26,324	195	2,887
13.	Pagladiya	1,674	197	15,201	27	1,883
14.	Mans-Aie-Beki	41,350	215	307,947	2,166	1,581
15.	Champamati	1,038	135	32,548	13	386
16.	Gaurang	1,379	98	22,263	26	506
17.	Tipkai	1,364	108	61,786	31	598
18.	Gangadhar	610	50	7,000	0.21	272

Table 4.3: Hydrological characteristics of some important Left (South) Bank tributaries of river Brahmaputra river (Source: The Brahmaputra Basin Water Resources, 2004)

Sl.No.	Rivers	Catchment Area (Sq.km)	Length (Km)	Average Annual Discharges (m^3s^{-1})	Average Annual Suspended Load (ha.m)	Sediment Yield (ton/km^2)/ year
1	Burhi Dihing	8,730	360	14,11,539	210	1,129
2	Disang	3,950	230	55,101	93	622
3	Dikhow	3,610	200	41,892	34	252
4	Jhanzi	1,130	108	8,797	16	366
5	Bhogdoi	920	160	6,072	15	639
6	Dhansiri (S)	10,242	352	68,746	146	379
7	Kopili	13,556	297	90,046	118	230
8	Kulsi	400	93	11,643	0.6	135
9	Krishnai	1,615	81	22,452	10	131
10	Jinari	594	60	7,783	3	96

Potential tributaries of rivers Brahmaputra and Barak

The potential waterways of the tributaries of rivers Brahmaputra and Barak as identified in consultation with Assam Inland Water Transport Directorate are as follows **Table 4.4**:

Table 4.4: Potential waterways in Assam

S.No.	Rivers	Present Status	Remarks
1	Lohit	Interstate river of Arunachal Pradesh & Assam, round the year navigable	Channel Survey & Marking are required
2	Dibang	Interstate river of Arunachal Pradesh & Assam, round the year navigable	Channel Survey & Marking are required
North bank tributaries (Brahmaputra)			
3	Subansiri	Only 3 to 4 places ferry service are required. Dam under Construction at Arunachal Pradesh	Channel Survey & Marking are required
4	Jia Bharali	Navigable, shallow draft speedy boat	Channel Survey & Marking are required
5	Manas	Navigable in flood season up to National Highway	Channel Survey & Marking are required

6	Beki	Navigable up to National Highway in flood season	Channel Survey & Marking are required
7	Gaurang	Navigable during flood season	Channel Survey & Marking are required
South Bank tributaries (Brahmaputra)			
8	Buri Dihing	Navigable during flood season	Channel Survey & Marking are required
9	Dikhow	Navigable up to Gamman bridge , National Highway only in flood season	Channel Survey & Marking are required
10	Dhansiri	Navigable in flood season up to National Highway, Ro-ro jetty of NRL	Channel Survey & Marking are required
11	Kopili/Kolang	Navigable up to Jagi Bhakat gaon only in flood season shallow draft boat	Channel Survey & Marking are required
Tributary of Barak			
12	Dhaleswari/Katakhal	From Mizoram border to Barak river confluence , navigable only in flood season	Channel Survey & Marking are required

Detailed discussion on each waterway from the navigation point of view based on the information collected at site through various discussions held with the officials concerned and field visits is furnished in this report.

4.1 RIVER JIA BHARALI

The river Jia Bharali is known as Kameng in Arunachal Pradesh originates in the upper Himalayan ranges at an elevation of about 4800 m and has a total length of about 200 Km up to its confluence with River Brahmaputra. The river system is characterized by steep gradient of the order of 1:8 to 1:10 in its initial length of about 40 km from its origin and a much gentle gradient of the order of 1:200 or less in the lower reaches of about 140 km before joining River Brahmaputra. The river acquires the name Jia-Bharali in the last 50 km before it joins River Brahmaputra upstream of Kaliabhomora bridge near Tezpur (**Fig.4.1**).

Fig.4.1: River Jia Bharali in Assam

Bharali II H.E. Project is proposed in the lower reaches of Kameng River near village Tippi in Bhalukpong Circle of district West Kameng at Assam and Arunachal Pradesh border. At this site, the river presents typical characteristics of pre-confluence stage of Himalayan rivers. The river carries high discharges and passes through a wide valley. The river flow is laminar and calm with no major rapids/ falls in the river bed level in the vicinity. The proposed dam site is about 50 km upstream of river's confluence with Brahmaputra. Due to flat gradient and absence of natural drop, a lift dam is proposed to harness the hydro potential.

The 77 m high concrete gravity type Bharali II H.E. Project will have its deepest foundation level at EL 140 m and the top at EL 217 m. The length of the dam at top will be around 340 m with an overflow section of 165 m. To pass the design flood of 23,607

cumecs, ten numbers of radial gates of size 12 m x 12 m. will be provided. Crest level of the spillway is proposed at EL 180 m. Diversion arrangements are proposed on the left bank through 2 nos. of 8.25 m diameter diversion tunnels. Discharge from the dam is proposed to be carried through five penstocks of 7.4 m diameter each into the power house, on the non-overflow section. Planned on the right side of the spillway block, the proposed length of power house is 136 m to accommodate five generating units of 120 MW each with a spacing of 22 m between adjacent units. The layout of the power house is planned in such a way that the tail race discharge through the power house is parallel to the river flow.

The proposed Hydro Electric Project will ensure downstream releases and thereby improve navigable depths in Jia Bharali River in Assam reach particularly during lean period. The construction material for the proposed dam may be transported by waterway from Guwahati and Kolkata since the Jia Bharali has direct link to National Waterway No. 2 (Brahmaputra River).

Hydrology of river Jia Bharali

The water levels in Jia Bharali are low from January to March and start rising from April. The flood water occurs from July to September / October. The water level rise from lean period to flood period is about 3.5 to 4.0 m. During lean period from January to March the discharges are low of the order of about 125 to 150 cumecs. The high discharges are of the order of 2500 to 3000 cumecs during flood period which normally prevails from July to September.

4.2 RIVER MANAS – BEKI - AIE

The Manas River is a transboundary river in the Himalayan foothills between southern Bhutan and India. It is the largest river system of Bhutan, among its four major river systems; the other three are Amo Chu or Torsa, Wong Chu or Raidak, Mo Chu or Sankosh. It is met by three other major streams before it again debouches into India in western Assam. The total length of the river is 376 km, flows through Bhutan for 272 km and then through Assam for 104 km before it joins the mighty Brahmaputra River at Jogighopa. Another major tributary of the Manas, the Aie River joins it in Assam at Bangpari (**Fig. 4.2**).

The river Aie originates from Bhutan hills and outfalls at river Manas. It is situated in 26°13’ North latitude and 90°46’ East longitude. The Aie basin extends to the Western part of Barpeta district, the Eastern part of Bongaigaon district and Bhutan border. The catchment area of the river is about 3,276 sq. km.

The river Beki originates from mountain reserve forest at Mathenguri and joins the river Manas after traversing a length of about 85 KM. It is situated in $26^0 18'$ & $26^0 48'$ North latitude and $90^0 53'$ & $91^0 02'$ East longitude. It drains an area of about 26,243 Sq.K.M.

The satellite imagery of the Mans – Beki – Aie river system is shown in **Fig. 4.3**

Navigability of Manas River

Low water levels prevail in the river from October to April and the flood occurs with two to three peaks. Maximum flood occurs in August. The water level rise from lean season to flood season is about 3.5 m. The predominant water level rise is only about 1 m. The water level rise is only about 1 m from lean season to flood season except the peaks. Round the year navigability of the river is difficult to assess without any hydrographic survey data and detailed analysis of hydrological data.

The discharges during lean period in river Manas from January to April are less than 20 cumecs with a predominant discharge of 10 cumecs. Even during flood period, the predominant discharges of the river are of the order of about 40 to 60 cumecs with occasional peaks of around 100 to 120 cumecs of discharge. Since the discharges are low even during flood period, the navigability of the river system is difficult to assess unless detailed hydrographic surveys supported by long period data analysis are carried out during feasibility and DPR studies.

Fig. 4.2: Manas – Beki – Aie river system

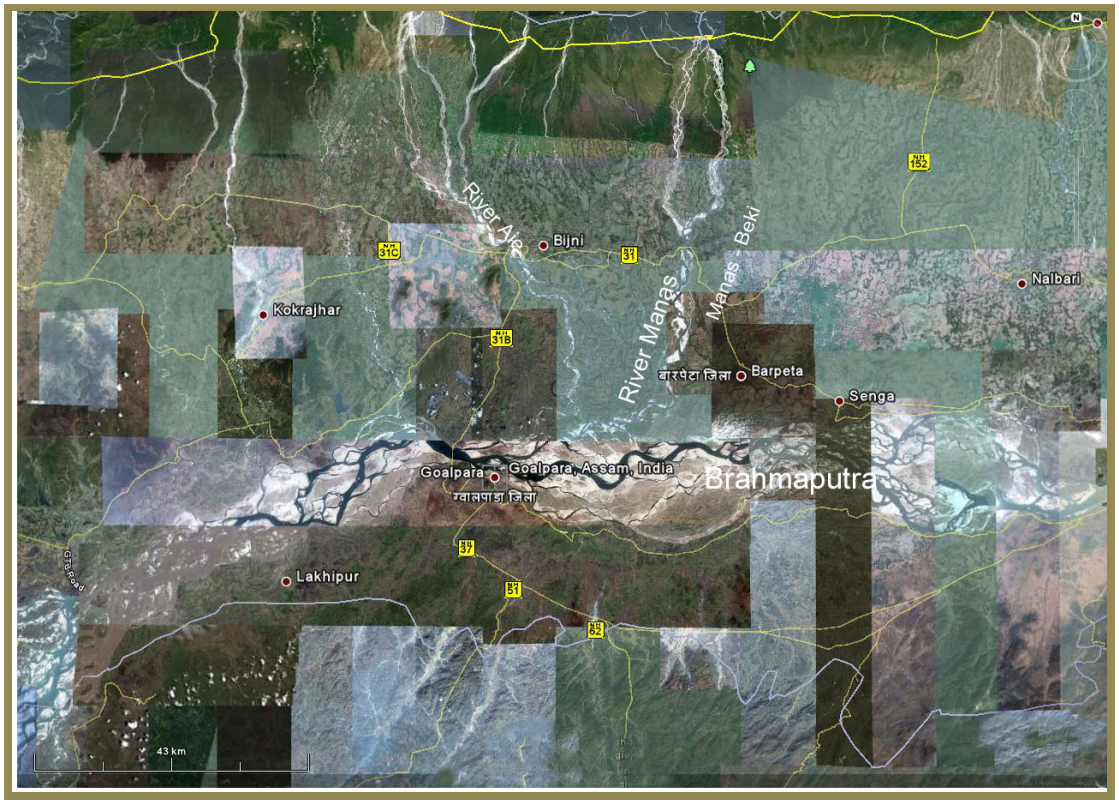

Fig: 4.3 . Satellite imagery of Mans – Beki – Aie river system

4.3 RIVER GAURANG

The Gaurang river originates in Bhutan and traverses in Kokrajhar district of Assam and confluences with river Brahmaputra (**Fig. 4.4**). The Gaurang river is also known as Saralbhanga river. The major rivers and streams in Kokrajhar district are Saralbhanga, Champamati, Gaurang, Bhur, Dholpani, Laopani. The Saralbhanga and Bhur emerge from the Bhutan hills.

Kokrajhar, one of the 27 districts of Assam, located on the north bank of river Brahmaputra shares the international boundary with Bhutan in the north and interstate boundary with West Bengal in the west.

Champamati, the Gaurang, the Tipkai and the Sonkosh are the rivers which flow down from north to south.

The water level throughout the year the water levels are low and there is no adequate water for navigation.

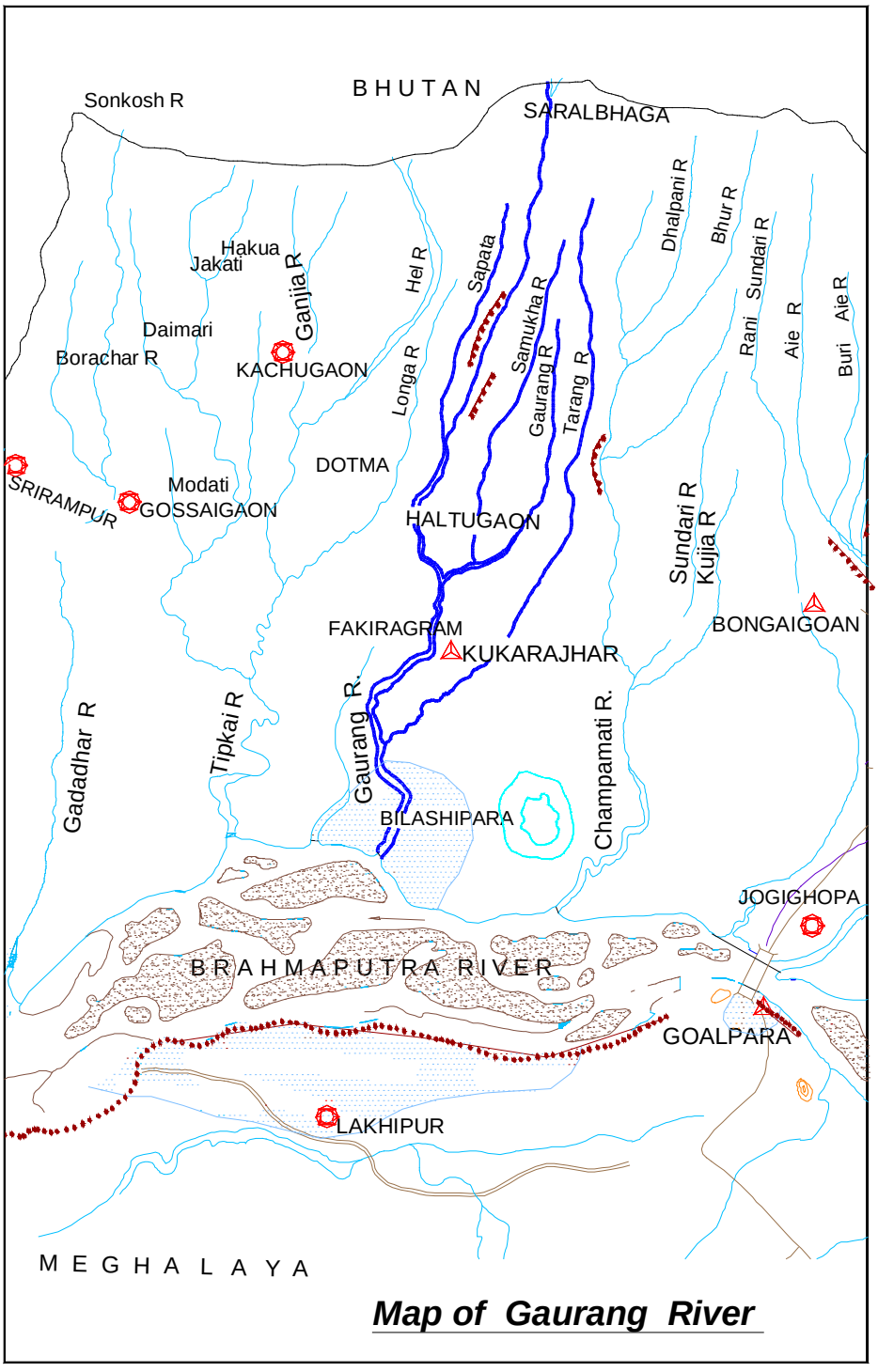

Fig. 4.4: River Gaurang

4.4 RIVER BURI DIHING

River Buri Dihing is one of the major south bank tributaries of river Brahmaputra in Upper Assam. The river originates in the Eastern Himalayas (the Patkai Mountain Range) in Arunachal pradesh and flows through Tinsukia and Dibrugarh Districts in Assam (**Fig.4.5**). It is formed by combination of two rivers Namphuk and Magaton, both having their source in Tirap District of Arunachal Pradesh. The river runs almost east-west direction and has its confluence with Brahmaputra at Dihingmukh about 25 km south west of Dibrugarh. It flows through hilly terrain surrounded by forests on both sides up to Joyapur, beyond which it flows through an alluvial plain. The river bed is rocky with boulders in the reaches between its origin and Joyapur and sandy bed with banks of clay and silt between Joyapur and Dihing mukh. The Disam is a tributary of the Dihing in its southern bank. The Joy-Dihing Rainforest, numerous petroleum fields, wet-paddy fields, bamboo orchards and tea gardens provide a unique landscape along its course. Ledo, margherita, Digboi, Duliajan and Naharkatia are the small towns in its valley.Dihing is the one of the most important contributor to the Brahmaputra river. The total length of Buridihing is 360 km. including Namphuk which is considered as its origin. The catchment area of Buridehirig basin is 5456 Sq. Km.

It is reported that the river is perennial almost in its entire reach. Two principal sources of Buridihing river are Namchilk, Namphuk and Khaikhee which combine into Magonton river. The Tirap river also combines with Magonton river at Lidu from where the river is known as Buridihing. In the lower reaches the river is fed by Digboi, Tipling, Tingrai and Sessa river in the plain. The Dihing has created number of oxbow lakes in the area.

The river passes through areas comprise forests, tea gardens, cultivable land and mineral oil installations. Some of the important towns on the bank of the river are Khowang, Jaipur, Naharkatia, Margherita, Lekhapani and Jagum in Assam and Dagpi in Arunachal Pradesh.

Digboi where Assam oil company has its refinery is 12 km away from the river and Duliajan where Oil India has its installations is within 2 km of the river. There are a number of coal fields in Margherita, Ledo areas.

Infrastructure:

There are pucca roads running parallel to the river both on north and south banks from Khawang to Naharkatia, NH 37 crosses river at Khawang. Pucca road on north bank continues beyond Naharkatia also to Digboi beyond which it is graveled. In the upper reaches the NH crosses the river near Margherita and runs parallel on south bank to Burma border touching Lekhapani and Jugun.

The main line of railway line from Tinsukia to Guwahati crosses the river near Naharkatia. The branch line from Tinsukia to Lekhapani crosses the river at Margherita and thereafter runs parallel on south bank up to Lekhapani. This carries essentially coal and stone as freight traffic.

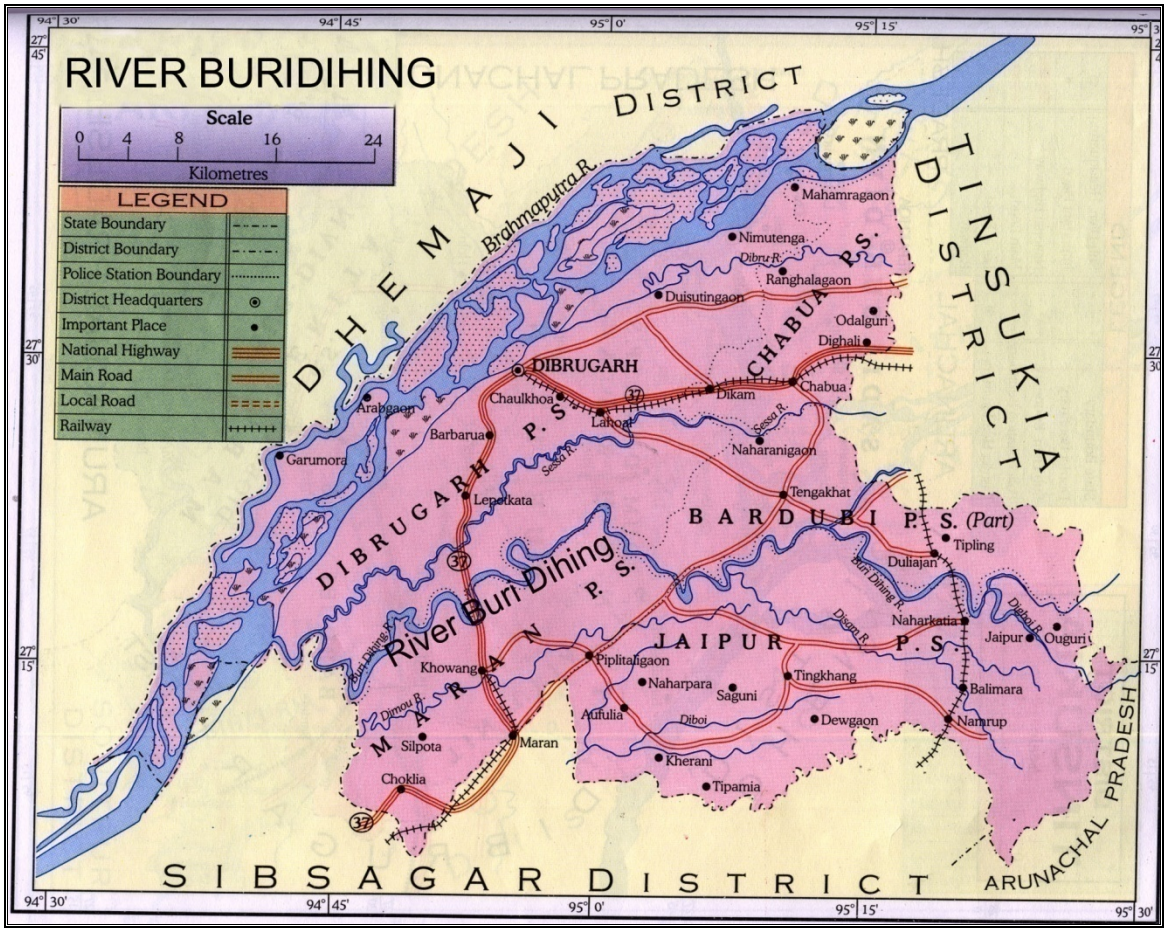

Fig. 4.5 : River Buri Dihing

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Navigability:

It is reported that the depth of water generally about 4 m in the dry season up to Khawang beyond which it reduces to 2.3 m up to khendugeri Ghat and 2 m up to Joyapur. The width of the river varies from 120 m at low water level to 470 m at flood level in the lower reaches and reduces to 190 and 60 m. There are certain bridges across the river at Khawang road bridge, Gamman Road Bridge, Tipling road bridge and Tipling rail bridge. There are number of places where ferries are available for transporting traffic across the river.

4.5 RIVER DIKHOW

The river Dikhow originates from Naga Hills hi Sema-Naga area in between latitude 26°05′ North and longitude 94°32′ East. The river at the upper most reach is known as Longa river, and after travelling 45 KM towards the plain, takes the name as Dikhow at Tozale. The river then moves further North and emerges from the hill near Naginimara. During its journey in the plains of the Sibsagar district the river meanders through the alluvium of the basin and moves in acute menders and outfall in the Brahmaputra (**Fig. 4.6**). The total length of the river from its origin to outfall is 200 km and its average width is 115 M. The total catchment area of the basin is 43.72 sq km.

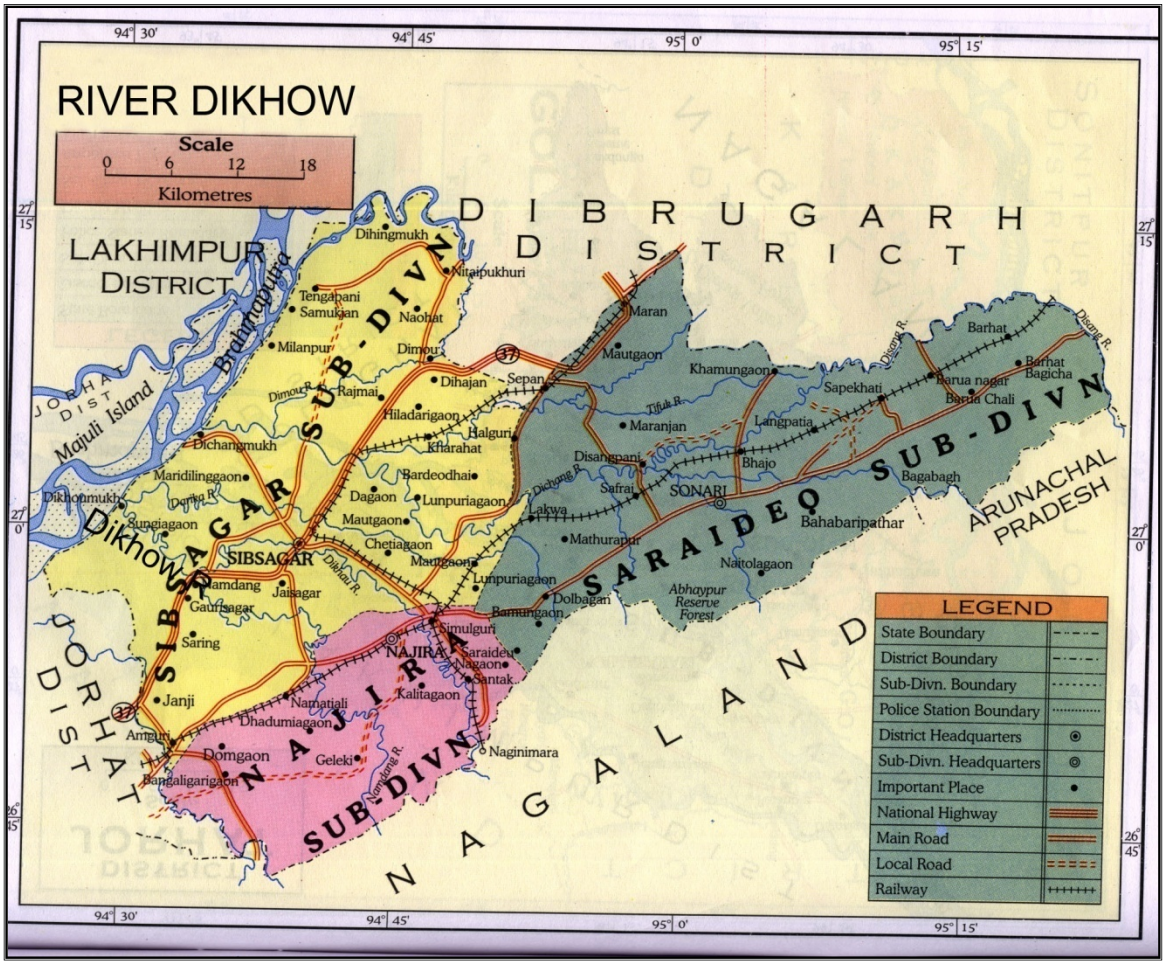


Fig. 4.6 : River Dikhow

Navigability

The water level rises by about 6 m from May to July during flood period with multiple peaks. It is reported that the river Dikhow is navigable from its confluence with Brahmaputra to Sibsagar, a distance of about 30 to 40 km.

4.6 RIVER DHANSIRI

The river Dhansiri is a major south bank tributary of river Brahmaputra. It originates in the Naga Hills north of Kohima in Nagaland at an altitude of about 800 m above MSL. It runs through the hilly areas, rapids and rough terrain in Nagaland and enters in to alluvial plains of the Dhansiri sub division in Assam (**Fig. 4.7**). It confluences with the river Brahmaputra at Dhansirimukh, about 15 km downstream of Numaligarh road bridge. The river traverses a total length of about 255 km from its origin to confluence and meanders at many places on its way. The river flow is augmented by inflowing tributaries namely Dayang, Diphupani, Khora, Langlong, Beopani etc.

The river from Numaligarh refinery to Brahmaputra confluence (about 25 km) has potential for development to transport Numaligarh refinery material and other local movement.

Navigability of River Dhansiri

It is reported that the high and low discharge of the river at the Numaligarh gauging station (10.3 km from confluence) is 2092 cumecs maximum and 15 cumecs minimum. The mean minimum discharge may be considered as 18 cumecs. The main tributaries which contribute to its discharge are Dayang, Diphupani, Khora, Langlong, Beopani etc.

The water level variation is about 6 m at Dhansirimukh and 3 m at Gutimari Ghat which is 103 km away from confluence. The width of the river at low water (lean season) varies from 30 to 90 m and 90 to 150 m at flood level. The depths may vary around 0.5 to 0.8 m. The discharges during lean period are around 50 to 165 cumecs. The water levels and discharges during lean period may be adequate to ply about 100 tons vessels. After implementation of river training measures the possible draft of the vessel would be increased.

Fig. 4.7: River Dhansiri

The width of the river Dhansiri during flood period varies from 125 m to 500 m with 150 m being the predominant river width. During lean period the river flows like a petty stream and the flow channel widths are of the order of 50 m to 75 m. Local enquiries revealed that during floods the water over tops the bank and inundate the adjoining low lying areas. During dry season water flows like a small stream within the valley.

Infrastructure

The river runs fairly close to important towns of Dimapur, Bokajan, Barpather, Jamguri, Golaghat and Numalighat. It runs for some distance as boundary between Nagaland and Assam and within Assam it passes through Mikhir hills and plains in Sibsagar district. It passes mostly through forest land, tea gardens, and farmland.

There are some Katcha roads running parallel to the river from the Mukh up to Kumarbari where it joins National Highway 37 which runs parallel to this river up to Kumargaon 16 km upstream. From there NH 39 branches off from NH 37 and runs parallel to the river on the north bank up to Golaghat (73 km from confluence) where it crosses over to south and runs parallel up to Barapather.

The Jorhat Farkating branch line of North Frontier Railway runs close and parallel to the river from Hautley ghat to Golaghat and the Gawahati-Tinsukia main line runs parallel and close the river from Barapathar to Farkating.

4.7 RIVER KOPILI / KOLONG

The Kopili River originates from the Burai range in the North Cachar hills. From its origin it travels about 127 km through hilly terrain in North East direction passing through several steep gorges, rapids and falls etc. Then the river enters in the plains of Nagaon district and flows in North West direction for 135 km and flows almost west for a length of 35 km at the end of which it meets the river Kolong at Jagibhakatgaon (**Fig. 4.8**). The combined river beyond this point is known as the Kollong river system and it flows in the North West direction till meets the Brahmaputra at Kajalimukh.

The length of the river from origin to Jagibhakatgaon (meeting point of Kollong) is 197 km and corresponding catchment area of the basin is 15,072 sq km. The river length from Jagibhakatgaon to its Brahmaputra confluence is about 40 to 50 km which is navigable during flood period.

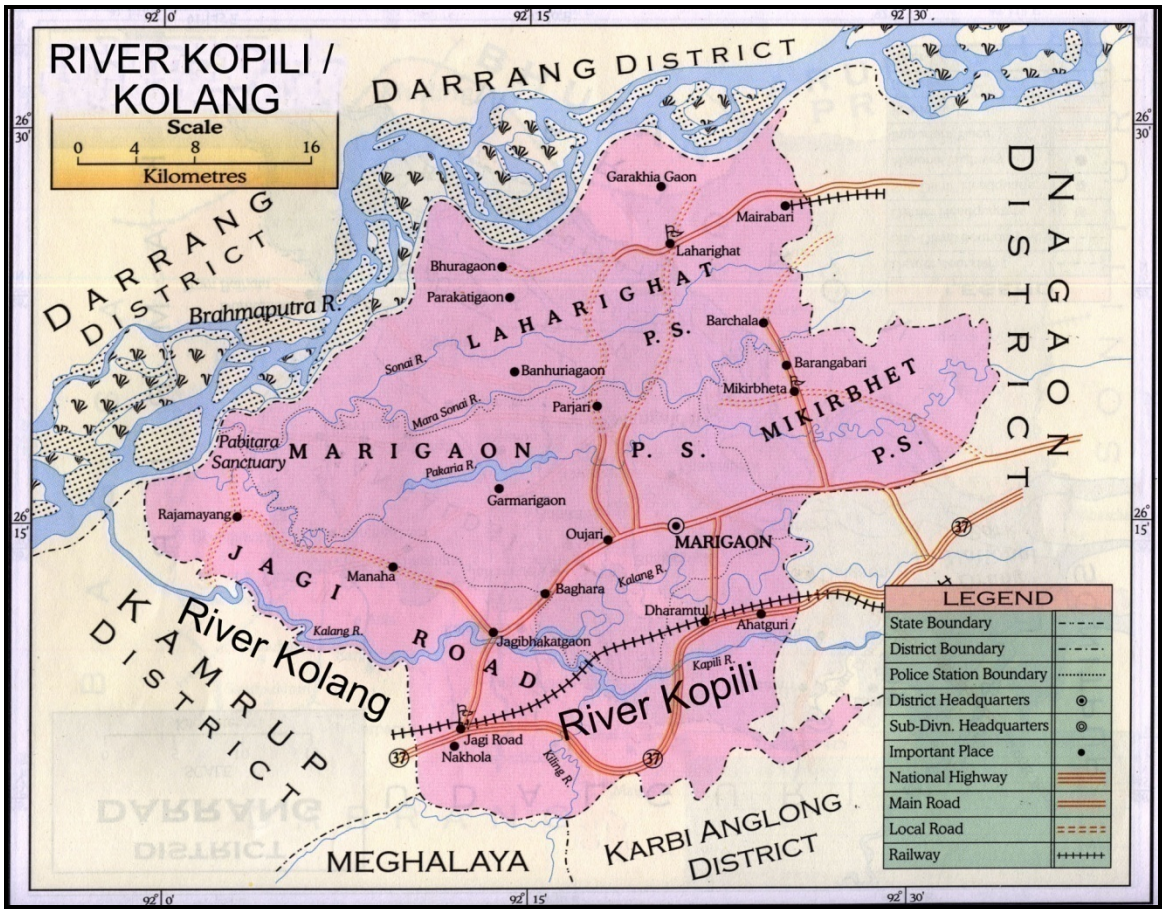


Fig. 4.8 : River Kopili / Kolong in Assam

The water level in Kopili / Kolong is low from November to May and then rises during June. From June to October flood water prevails. The water level rise is about 3 m from lean period to flood period.

There is a hydroelectric power plant located on the River Kopili in the North Cachar Hills District of Assam. The Kopili Hydro Electric Project was the maiden venture of North Eastern Electric Power Corporation Ltd (NEEPCO) when it came into existence in 1976. The power plant is at Umrongso, District-North Cachar Hills, in Assam. The approach by road is 140 Km from Shillong and 70 Km from Lanka Railway Station in Assam. The project was commissioned in 2004.

4.8 RIVER DISANG

River Disang is a major tributary confluencing with the River Brahmaputra at its south bank and its basin covers the catchment area of ONGC Ltd. activities in Sibsagar District (**Fig. 4.9**). The Disang River originates from Patki Bunn (Naga Hills). The maximum altitude near the source is 2594.15 m. The Tisa (original name of the river) after moving 60.8 km towards north, meets its first tributary Towaizo. The combined flow moves further north and meets tributary Tiratjo.

Moving further north, the river appears in the plains near Namrup, a place of historic as well as of industrial importance (Nam means water and rup means silver). The name refers to water shining like silver. From Namrup, the River flows towards north – western direction through the plains of Dibrugarh District. The River flows through the alluvial plains of Dibrugarh and Sibsagar District. After flowing further in west-south-west direction to about 86.4 km, the River meets another tributary Bor Timak Nadi, which originates from the foothills, on the left bank. After crossing a distance of about 22.4 km towards south-west, the River meets, with main tributary Safrai then passes through Nangala – maraghat and turns north. Following a further course, river meets the Diroi and the Dimou tributaries on its right bank. Finally, the river meets Brahmaputra, after a total course of 572 km (including the course of tributaries) near Disangmukh at a distance of 11.2 km from the sub-divisional town Sibsagar.

Navigability of river Disang

Low water levels are noticed during November and December in river Disang. Water level rise is observed from April and continues till October with multiple peaks and variations. The water level rise from lean period to flood period is about more than 5 m.

During flood period the discharges are around 700 to 800 cumecs. The discharges are low from December to March of the order of 100 to 200 cumecs.

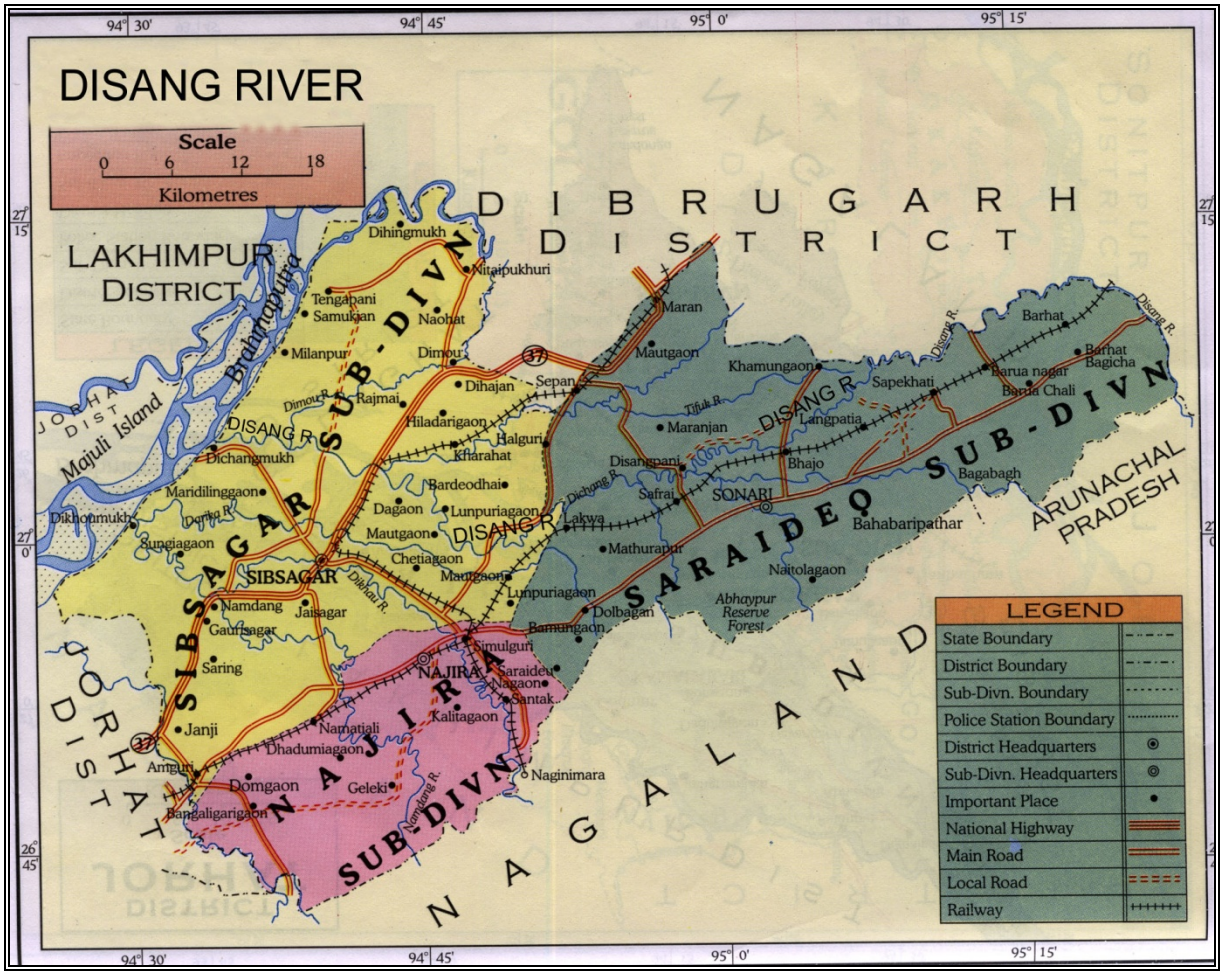


Fig. 4.9 : River Disang

B. TRIBUTARIES OF RIVER BARAK

The river Barak originates from Kohima in Nagaland near Nagaland – Manipur border. After flowing through hilly terrain in Manipur state it reaches Lakhipur in Assam (**Fig. 4.10**). From here it flows through the plains of Cachar and Karimganj district of Assam till it reaches Bhanga where it bifurcates into two branches known as Surma and Kusiyara.

The river Barak and its tributaries are the second largest river grid system in North East India (900 km). The river Barak system is a part of the Ganga-Brahmaputra-Meghna system. The length of the river Barak from the source to the Indo-Bangladesh border along Kushiyara is 564 km and out of this length within the state of Assam is 143 km. The barak river and its branches Kushiyara and Surma are fed by a number of tributaries. The tributaries joining within Indian territory are Jiri, Chiri, Badri, Madhura, Jatinaga, Banaimullaz, Gumrah, and Baleswar on the north bank and Sonai, Ghagra, Katakhal,

Dhaleswari, Loongai, and Kachna on the left bank. Out of these tributaries, the Dhaleswari and Katakhal river system has some navigation potential.

A good number of tributaries, Kushiyara and Surmalso, join the river Barak during its course through Bangladesh. The Kushiyara river flows 338 km from the Indo-Bangladesh border up to Bhairab Bazar where the river combines with the Surma river and the combined river flows as Meghana river up to a place near Rajabari-Mohanpur, and confluences with the Ganga-Padma river system. Hence the tributaries of Barak river with its main course have a direct link to the Bangladesh protocol navigation route up to Kolkata.

Tipaimukh dam

Tipaimukh Multipurpose Project is proposed to be developed on Barak river near Manipur- Mizoram border, 500 m downstream of the confluence of the river Barak with river Tuivai, in Churachandpur district of Manipur. The project envisages construction of 162.80 m high rockfill dam with annual estimated generation of 3805.74 MU in 90% dependable year with an installed capacity of 1500 MW (6x 250 MW). The project is estimated to cost Rs 8,138 crore. NHPC will pick up a 69 per cent stake in the joint venture, while 26 per cent will be held by SJVN and the remaining 5 per cent by the Manipur government.

By regulating excess water, the Tipaimukh project is expected to help control floods in Sylhet, western Manipur and southern Assam.

It will also open a new waterway from Haldia / Kolkata ports in West Bengal to the Northeast via Bangladesh (**Fig. 4.11**).

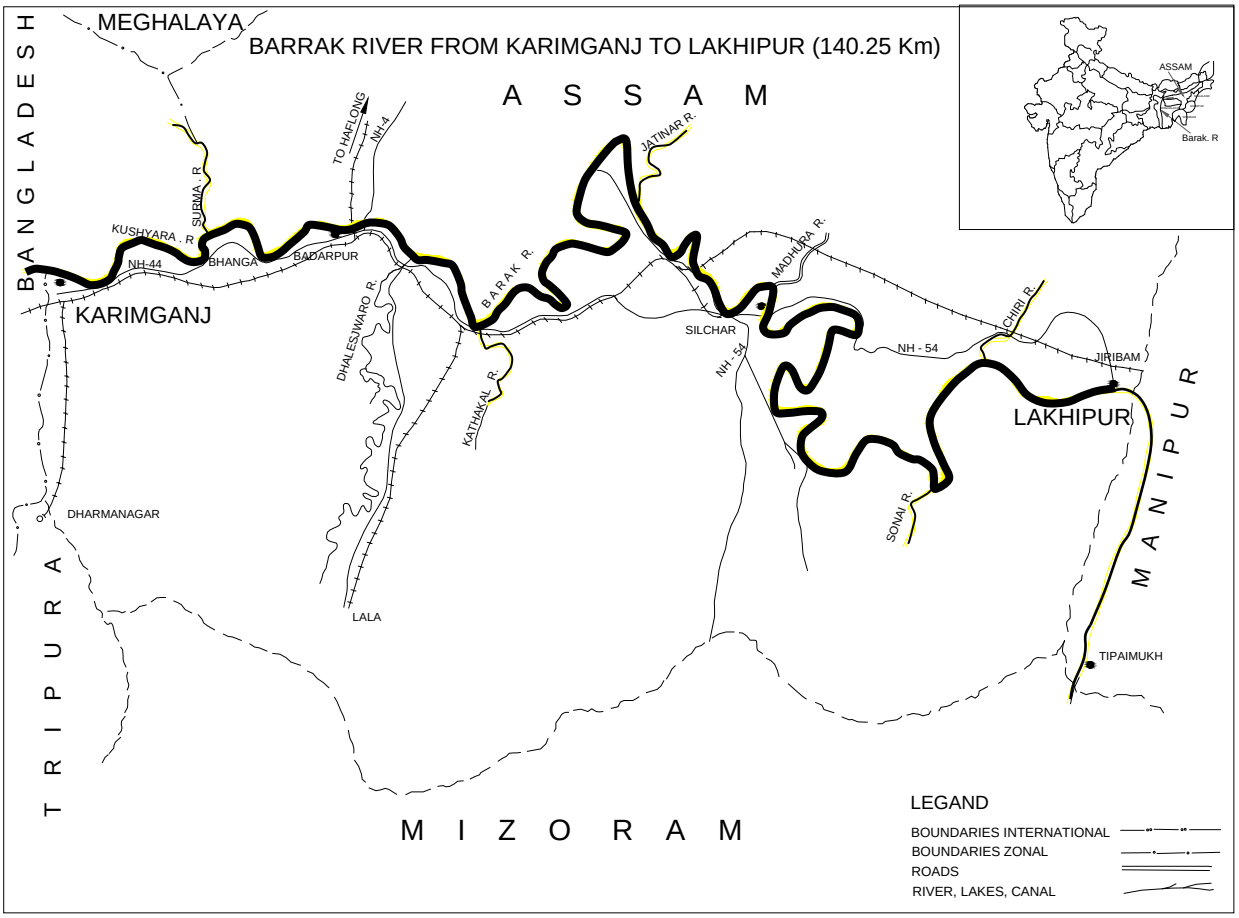


Fig. 4.10: River Barak system

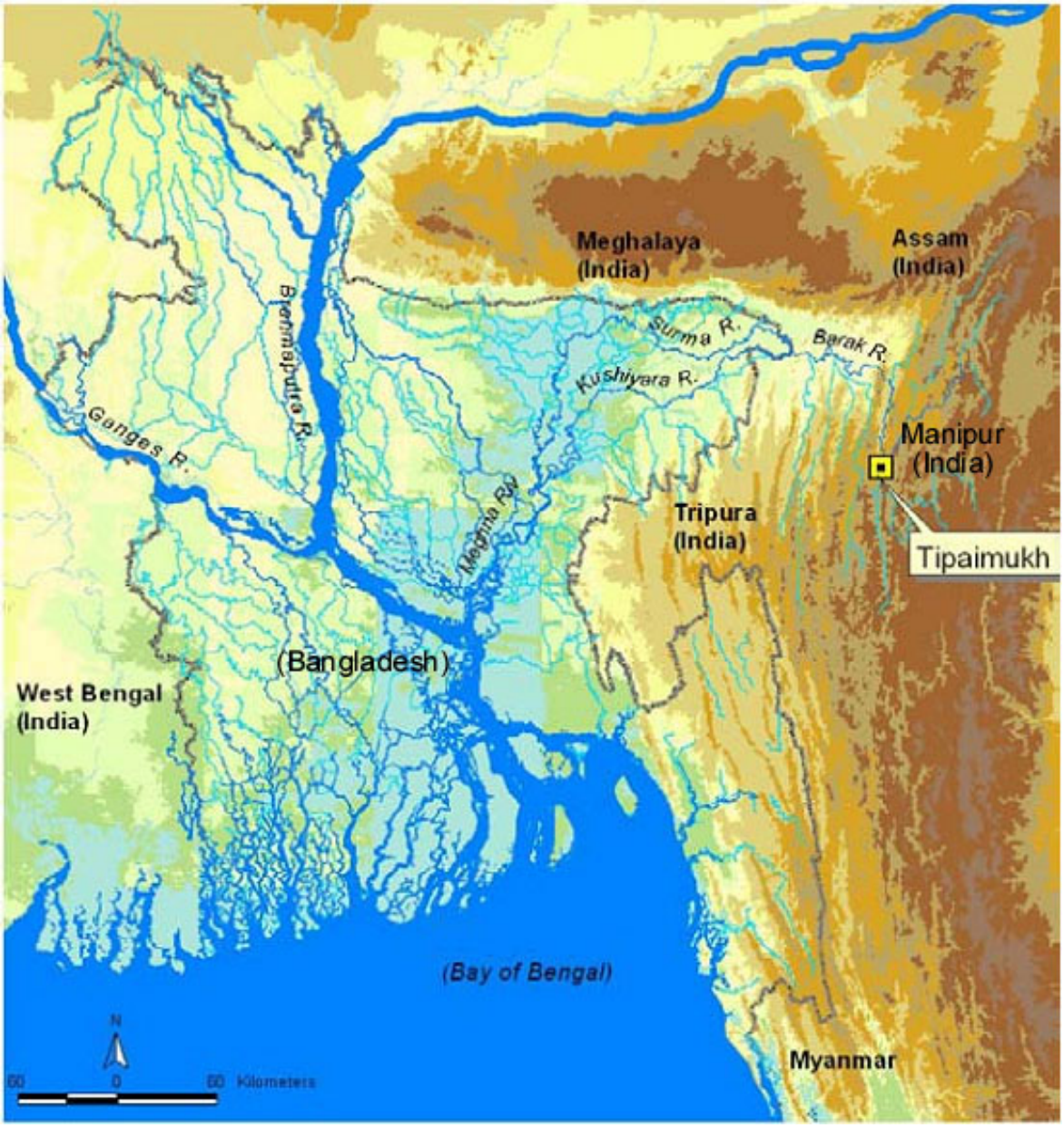


Fig. 4.11: Waterway connectivity from Barak river system to Haldia/Kolkata ports via Bangladesh

4.9 RIVER DHALESWARI / KATAKHAL

River Dhaleswari: The Dhaleswari is an inter-state river originating in Mizoram and confluences with Barak river near Katakhal. The river Dhaleswari is a south bank tributary of river Barak in the Surma valley. It originates in Mizo hills, Mizoram near Lugleh at an altitude of about 500 m above MSL. It flows almost south to north and most of its passage is through the hills where it flows through a deep valley. It flows for about 280 km in Mizoram entirely in hilly areas and for about 126 km within Assam. It has a well defined channel though of meandering nature in the plains. At Katlichara, the river branches off into two channels namely, Dhaleshwari and Katakthali, former having more or less dead and the latter being active (**Fig. 4.12**). The river is known as Tlawang in Mizoram area.

River Katakhal: The river Katakhali is one of the major left bank tributaries of the river Barak (**Fig. 4.12**). The river originates at Dhaleswari from Mizo Hills and flows mainly in the north direction for about 165 km up to the diversion point at Ganjakhauri near village Krishnapur near Katlichara in the plains where a blind dam across the river Dhaleswari is provided and the main course is diverted by excavating an artificial channel named Katakhal during British period in order to provide water transportation facility to the tea plantation areas as there was no good road communication to the tea gardens at the time. The word 'Katakhal' means cut out channel/river. In course of time this artificial channel developed into river Katakhal and flows south to north direction almost parallel to the old Dhaleswari River and the present length of Katakhal River is 85 km from Ganjakhauri to confluence with the river Barak at Kalinagar area. The course of Dhaleswari from Ganjakhauri to its outfall near Panchgram is called dead Dhaleswari and acts as a local drainage channel for a part of the plains of Hailakandi district. The main river Dhaleswari from its source in Mizo Hills upto foot Hills at Gharmurah a little upstream of Ganjakhouri flows through the mountains terrain in a steep gradient. The river Katakhal in a much flatter gradient from Ganjakhouri to its out falls in the plains average gradient of the river Katakhal from Ganjakhauri to Matijuri is 1 in 7500 and from Matijuri to confluence for a length of 27 km it is about 1 in 10,000.

Navigability of river

The river Katakhal / Dhaleswari can be developed for facilitating country boat movement up to Bairabi (Assam – Mizoram border) from confluence with Barak. Beyond this point, the river becomes narrow and shallow.

The water level variation from lean to flood season is around 8m to 10 m. The river enters into plain near Katlichara in Assam about 80m to 100 km from the confluence point. The river width in this reach is about 100m to 125m during flood season and about 30m to 50m during lean season.

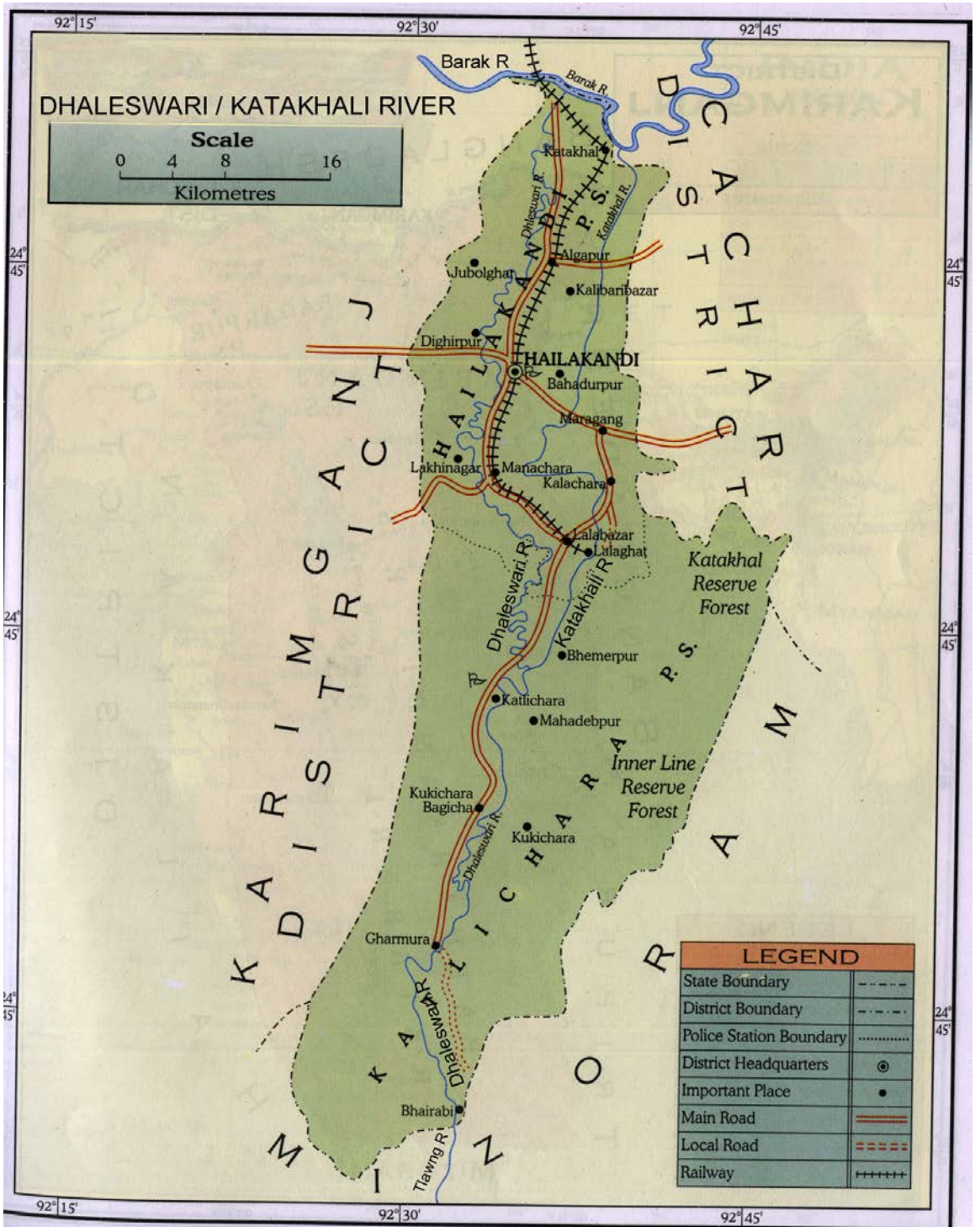


Fig.4.12: Dhaleswari / Katakhali river

It is reported that at present only small country boats having capacity of about 2 tons ply occasionally from the confluence of the river right up to Sairang in Mizoram. There is very little habitation on the bank of the river excepting at places like Sairang and Hartoki in hilly areas of Mizoram. Sairang is well connected with a road leading from Aizawl, capital of Mizoram.

On either side of the river, the hilly tract comprises mostly forests and some minor cultivation by the local inhabitants. Once the river reaches the plains in Assam, it passes through or close to the townships of Katlichara, Lala bazaar, Hailakandi and Badarpur . The advantages of developing the waterways is the river is an interstate river between Mizoram and Assam and the vessels ply through Barak river and then enters in to Bangladesh at Karimganj and waterway has further connectivity to Haldia / Kolkata.

In the existing conditions of the river, boats with loaded draft of about 0.6 m can ply for most part of year up to Jamira Ferry Ghat that is 102 km from confluence but beyond this ghat upstream up to Sairang the river is very shallow which will restrict the size of the craft. Surveys are required to be carried out to assess the present status of the waterway. Upstream of Phualrang (192 km from confluence) up to Sairang (215 km from confluence) the river passess through reaches having rock out crop and rapids. The river is also narrow and shallow with sharp bends. It is expected that the river can be made navigable for a draft of 0.8 m up to Sairang and should be confirmed after hydrographic surveys and investigations.

Traffic Potential

The food grains, fertilizers, iron, steel and cement are the major items for movement by IWT from Kolkata to the Barak valley and then to the feeder system of waterways viz., Dhaleswari / Katakhal to Assam and further up to Mizoram.

Local products such as oil seeds, ginger, tea, chilies, vegetables, cane etc., can be transported by boats. The intra state traffic across Mizoram and Assam border can also be moved by boats.

4.10 CARGO POTENTIAL

Inland Waterways Authority of India is keen to support transport infrastructure needs of the north eastern region for the ongoing/proposed power projects by developing navigation on river Brahmaputra grid system (Brahmaputra and its tributaries) and river Barak grid system (Barak and its tributaries) (**Fig.4.13**). Both the rivers (Brahmaputra and Barak) have direct connectivity to Kolkata / Haldia ports and the river navigation is well established and Ministry of Shipping has entered into a Protocol with Bangladesh (**Fig.4.14**). The inland water transport is the most ideal solution for the over dimensioned cargo and other construction material for the ongoing/proposed power projects.

There are several private / public entrepreneurs viz., Reliance Energy, NHPC, Athena Energy, Jindal Power, Velcor Energy, NEEPCO, KSK, Energy, Mountain Falls, JP

Associates, GMR, Soma Enterprises, Bhilwara Energy and DS Construction etc are involved in the development of power projects in the north eastern states. Most of the power projects are coming up in Arunachal Pradesh. The status of some of the power projects are given in **Table 4.5**.

Table: 4.5 Status of various Hydroelectric projects in North East

Hydroelectric Project	River	State	Installed Capacity (MW)	Dam Height (m)	Status / Remarks
Tawang - I	Tawangchu	Arunachal Pradesh	750	90	Under investigation by NHPC
Tawang - II	Tawangchu	Arunachal Pradesh	750	32	Under investigation by NHPC
Subansiri (Lower) at Gerukhamukh	Subansiri	Arunachal Pradesh	2000	116	Near completion (Schedule commissioning (Dec. 2012)
Subansiri (Upper)	Subansiri	Arunachal Pradesh	2000	230	Under investigation by NHPC
Subansiri (Middle)	Kamala	Arunachal Pradesh	1600	195	Under investigation by NHPC
Dibang	Dibang	Arunachal Pradesh	3000	288	Awaiting clearance from GOI
Siang (Upper)	Dihang	Arunachal Pradesh	1100	-	Under investigation by NHPC
Siang (Middle)	Dihang	Arunachal Pradesh	1000	-	Under investigation by NHPC
Siang (Lower)	Dihang	Arunachal Pradesh	1600	-	Under investigation by NHPC
Ranganadi - I	Dikrong / Ranga	Arunachal Pradesh	405	68.5	Operation since 2002 (NEEPCO)
Ranganadi - II	Ranga	Arunachal Pradesh	130	123	Under approval by GOAP (NEEPCO)
Pare	Kikrong	Arunachal Pradesh	110	78	MOU Signed (NEEPCO)
Kameng	Kameng / Bichom /Tenga	Arunachal Pradesh	600	72	Under construction
Kameng - I	Kameng	Arunachal Pradesh	1120	123	DPR under preparation (NEEPCO)
Kopili	Kopili	Assam	150		Commissioning (NEEPCO)
Kopili - I	Kopili	Assam	100		Commissioning (NEEPCO)
Kynshi - I	Kynshi	Meghalaya	450		DPR under preparation (NEEPCO)
Tipaimukh dam	Barak	Manipur	1500		MOU signed SJVN / NHPC in 2010

The locations of the power projects of NEEPCO, the major player in the development of power projects are shown in **Fig. 4.15**.

The transport requirement of power projects cargo as per the assessment of IWAI is given in **Table 4.6**. The requirement would be there up to 2035 or so.

Table: 4.6. Cargo projection for the proposed power projects (Source: IWAI)

Power Project	Requirement of Cargo in lakh tons		
	Cement	Steel	Total
XII Plan (10,000 MW)			
NHPC	40	2.4	42.4
Others	94	7.3	101.3
XII Plan (16,735 MW)			
Athena	40	3.6	43.6
JP Associates	25	2.0	27
Others	120	10.8	130.8
XIV Plan (4500 MW)			
Jindal Power	31	2.4	33.4
Total	350	28.5	378.5

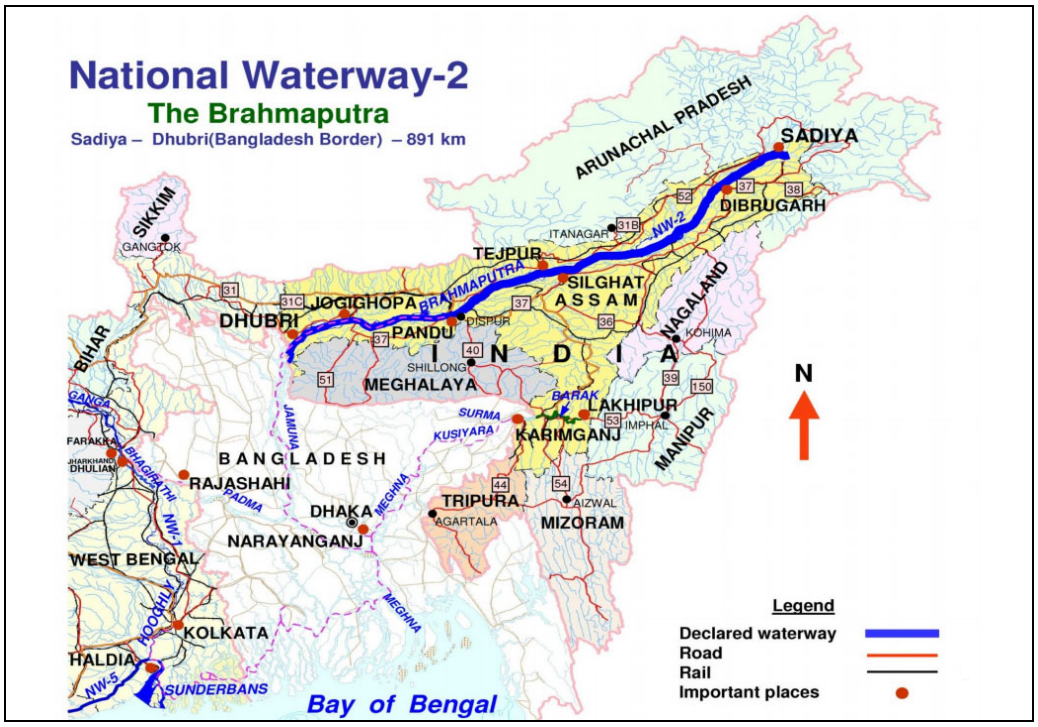


Fig. 4.13 : The National Waterway No. 2 for transportation power projects cargo (Source: IWAI)

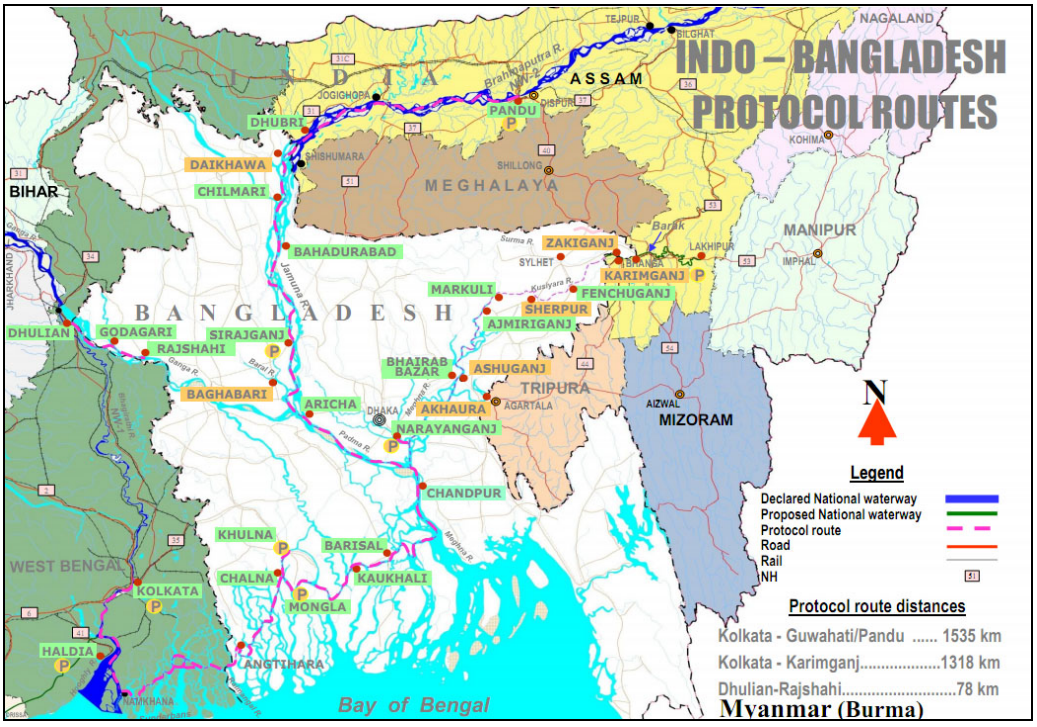


Fig.4.14: The Indo-Bangladesh protocol route for transportation of power project cargo (Source: IWAI)

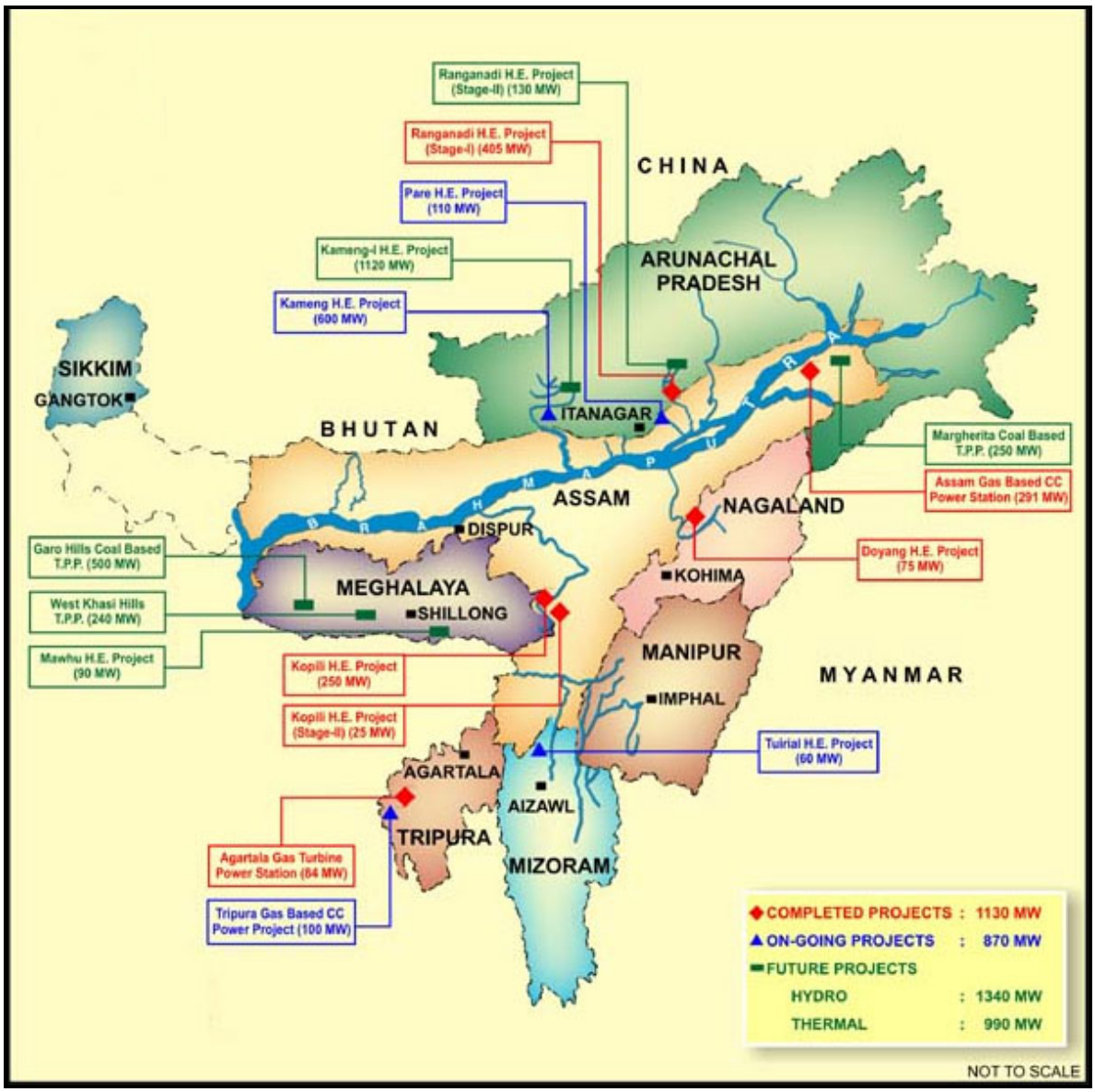


Fig. 4.15: Power projects by NEEPCO including hydroelectric projects on rivers

5.0 POTENTIAL WATERWAYS IN ARUNACHAL PRADESH

Many tributaries of Brahmaputra originate in hilly terrain in Arunachal Pradesh and enter into plains along Assam border and confluence with Brahmaputra. Hence the river reaches in Assam are suitable for navigation and river reaches in Arunachal Pradesh in hilly terrain are suitable for hydroelectric power projects. There are series of several power projects are either under construction or under proposal in the rivers Lohit, Dibang, and Subansiri. The river reaches of these waterways in Assam are fairly navigable to ply 200 to 300 tons vessels with a draft of about 1.0 to 1.2 m. These waterways have further connected to National Waterway No. 2 (Brahmaputra) and hence cargo movement is feasible right from Kolkata / Haldia in West Bengal up to the proposed power project sites.

The rivers Dibang, Lohit, Subansiri and Siang are largely used by Arunachal people for transportation purpose due to typical terrain of Arunachal state bordering with Assam. Hence, the development of these rivers is more beneficial to Arunchal Pradesh. In view of this these river have been considered under Arunachal Pradesh for navigation purpose.

5.1 RIVER DIBANG

The river Dibang originates from the snow covered southern flank of the Himalayas / Trans Himalayas close to the Tibet border at an elevation of more than 5000 m. The Dibang River is snow as well as rain fed. At its upper reach, it is known as River Mathun, River Dri and River Tangon in chronological descending order. It is known as River Dibang from the confluence point with River Ahi. The river Dibang cuts through deep gorges and difficult terrains in its upper reach through the mountains of the Dibang Valley and Lower Dibang Valley districts of Arunachal Pradesh. The total length of Dibang from its source to its confluence with Lohit river at Sadia in Assam is 195 km. The major tributaries of Dibang river are Mathun, Tangon, Dri, Ithun and Emra. A number of small tributaries i.e. Ahi, Ari Pani, Ilu Pani, Ashu Pani, Ephi Pani, Deo Pani etc also join the river. The important feature is that all the tributaries barring Ephi Pani & Deo Pani join Dibang in its hilly catchment. The three major tributaries viz Tangon, Dri and Mathun are almost equal in size because of which the shape of the Dibang catchment is comparatively wide in its upper reach.

There are several Hydroelectric projects are under planning stage in River Dibang and its tributaries. Two hydroelectric projects (Emra I and Emra II) are under proposal on River Emra which is a major right bank tributary of River Dibang (**Fig. 5.1**). The length of the Emra river from its source to confluence point is 102 km.

Dibang Multipurpose Project (3000 MW) is being conceived on river Dibang (**Fig.5.1**) The river emerges from the hills and enters sloping plain area near Nizamghat in Arunachal Pradesh, from where the river flows for a distance of 50 km to meet the river Lohit. The total catchment area of Dibang up to the dam site is 11276 sq km which lies entirely in India.

The project is located in Lower Dibang Valley district of Arunachal Pradesh. The Dam site is located about 1.5 km upstream of the confluence of Ashu Pani and Dibang rivers and about 43 km from Roing, District Headquarter. The reservoir created due to the project will provide flood moderation benefits in the downstream. The back water in the reservoir will travel up to a length of 43 km in Dibang river and its various tributaries - Airi Pani, Ilu Pani, Imu Pani, Ahi river, Ithun river, Emra river etc. which will facilitate promotion of navigation by connecting inaccessible upstream villages/areas. The project after construction will be one of the biggest projects in terms of generation of hydropower in India. In addition, the project would moderate floods in the downstream areas of the Dibang Dam during the entire monsoon period to the extent of 3000 cumecs.

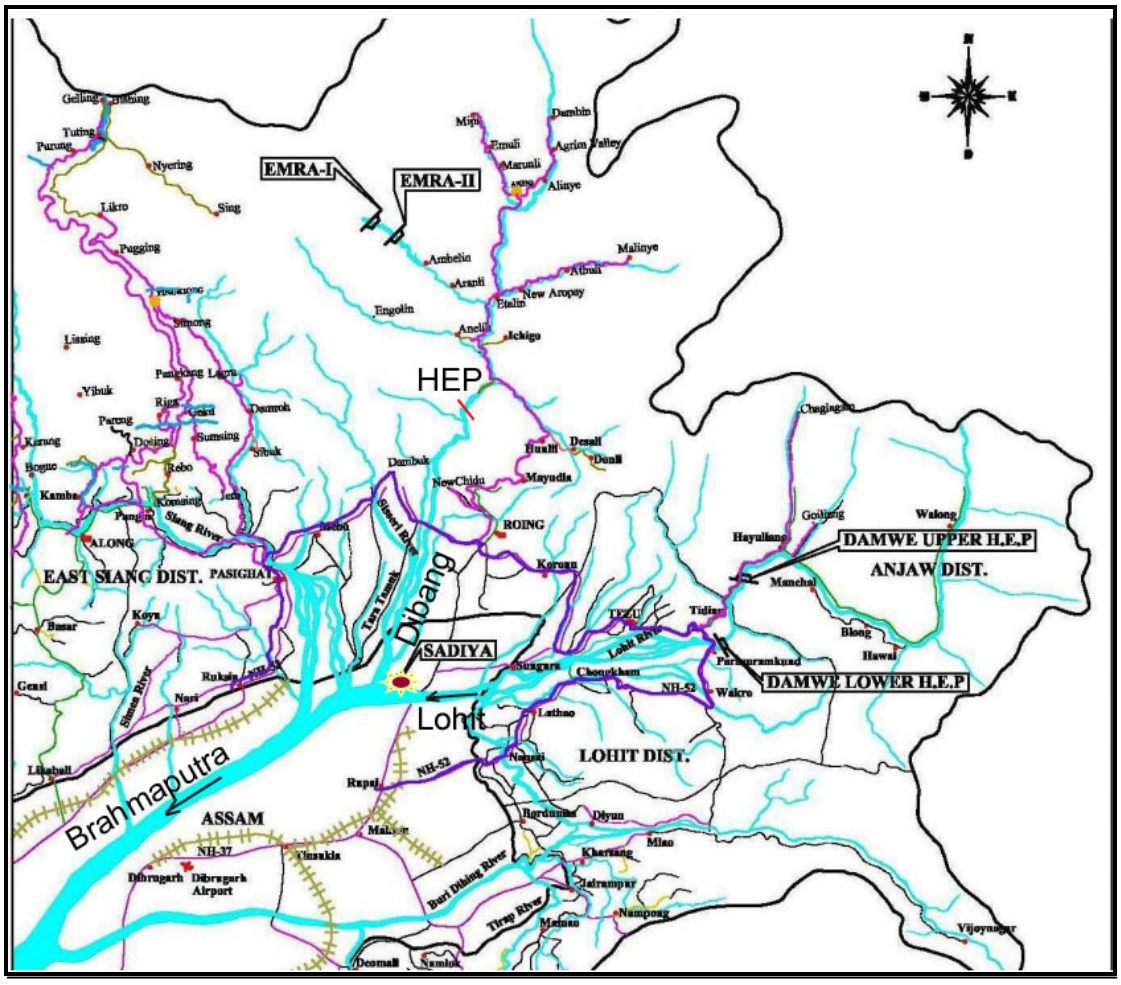


Fig. 5.1: Index map of river Dibang

The project has a poor connectivity from the railhead and the nearby towns (viz. Tinsukia, Dibrugarh, Pasighat, Itanagar, Tezpur etc.). The project is located about 43 km

from Roing which is situated at a distance of 110 km from Tinsukia, the nearest railhead. Airport at Mohanbari (Dibrugarh) is further 45 km from Tinsukia. Hence, the transportation of construction material by waterway would be the ideal solution. Large work force will be required during peak construction period of the project. Therefore, local population will get enough work and business opportunities. The work experience and expertise gained by the local people enable them to set up commercial establishments, small-scale industries, agro-based processing units in the project area and outside where the demand for these ventures continuously increases. Hence, the development of the waterway will provide transport access to the local community and thereby to help social development of the tribal community.

Brahmaputra Board had carried out investigation works of Dibang Multipurpose Project in 2001-02 and the Pre-Feasibility Report (PFR) was prepared by them in March, 2002. Subsequently NHPC and WAPCOS have also carried out certain investigations. The diversion discharge at the proposed dam is 8680 cumecs while the design flood discharge of the river is 19000 cumecs. The design discharge through the tail race tunnel is 237.8 cumecs. Release from the reservoir has been restricted to 3000 cumec, which was considered as the safe carrying capacity of the downstream channel reach.

Due to poor transport infrastructure available at the Hydro electric project sites, the NHPC has studied various alternatives viz., road, rail and waterway for transportation of material to project site as furnished below (**Fig. 5.2**):

Alternative–I: Guwahati-Tinsukia-Dangri-Dholla-Sadiya-Shantipur-Roing- Project Site (637 Kms)

Alternative – II: Guwahati-Dangari-Rupai-Parasuram Kund-Tezu-Paya-Koronu-Roing-Project site (800 Kms)

Alternative – III: Guwahati-Tezpur-NLP-Gogamukh-Akajan-Jonai-Pasighat-Mebo-Dambuk-Project Site (710 Kms)

The waterway route on river Brahmaputra from Guwahati to Sadiya near the confluence point of river Dibang is 531 km. From confluence point of Brahmaputra to Dibang HEP site on river Dibang near Anpum is about 50 km. The waterway route appears to be more ideal since there is direct connectivity. Detailed surveys and investigations followed by feasibility and DPR studies are required to carry out to assess the viability aspects of waterway transportation.

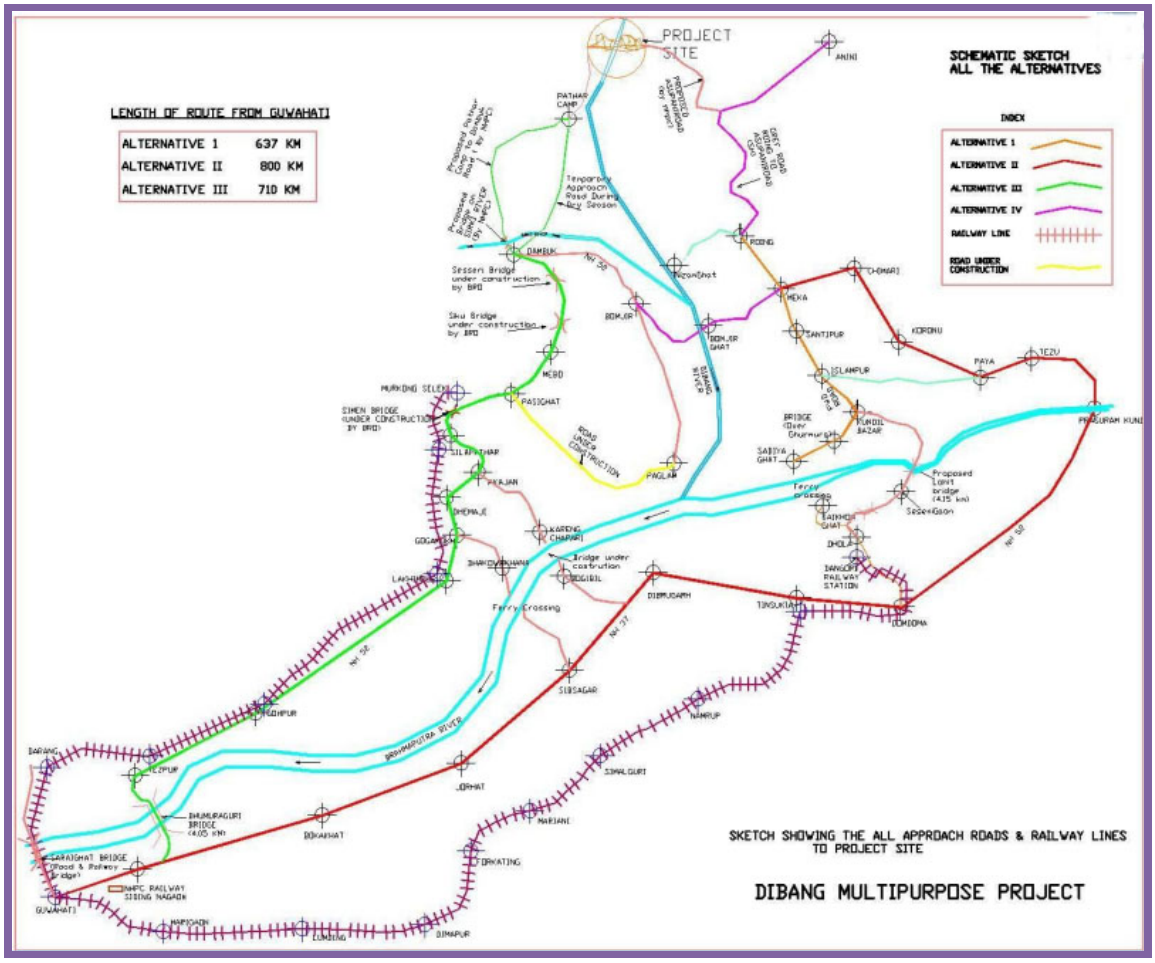


Fig.5.2: Various alternate routes for transportation of material to Dibang Hydro Electric Project site (Source: NHPC)

Ferry Services

Besides the river transport on Dibang from Anpum to Brahmaputra confluence, the river is being actively used for cross ferry and circuit ferry services by Arunachal Pradesh people as stated below:

1 For connectivity of Roing to Dambuk towns

Near Malek / Bomjur town Ferry Service is required on Dibang River. At present there is a ferry service to cross the river by only country boats. If mechanized boats are introduced considerable time will be saved. At present 4 nos of country boats are operational at Bomjir town. The distance from Bomjir town to Paglam town (near Assam Border) is about 70 to 80 km.

The river at this place is in braided condition hence to cross the river 3 to4 places ferry service is operating at present, if a navigable channel is constructed it can save considerable time.

This area is largest producer of ginger in the country, the navigable ferry service can enhance the economic condition of local farmers producing ginger which can be exported to other parts of India as well as other countries.

2 For connectivity of Roing to Dambuk towns

Near Jia / Bizari town Ferry Service is required on Dibang River. At present there is a ferry service to cross the river by only country boats. If mechanized boats introduced considerablr time will be saved.

3. Dibang River can be developed from Paglam village to Anupum village (approx 35 km.) for the round the year navigation, for socio economic upliftment of local population.

4. Ferry service from Sadiya to Dholla to Paglam (Arunachal Pradesh) over Brahmputra mainly used mainly by Arunachal Pradesh local people. The cargo mainly consists of food items, construction materials and agricultural products.

5. Ferry service From Dholla to Paglam (Assam –Arunachal Border) on On Brahmputra and on Dibang River

6. Ferry service from Sadiya to Paglam (Assam –arunachal Border) on On Brahmputra and Dibang River

7. Christian Basti to Amarpur Ferry Service (Arunachal Pradesh) over Dibang River

8. Amarpur to Paglam Ferry service over Dotung River (a Tributary of Dibang River)

9. Dambuk to Aholi via Bomjir over Sisiri River (a Tributary of Dibang River)

10 At Sissiri River (A tributary of Dibang River) one Hydel plant of the capacity of 200 MW is proposed

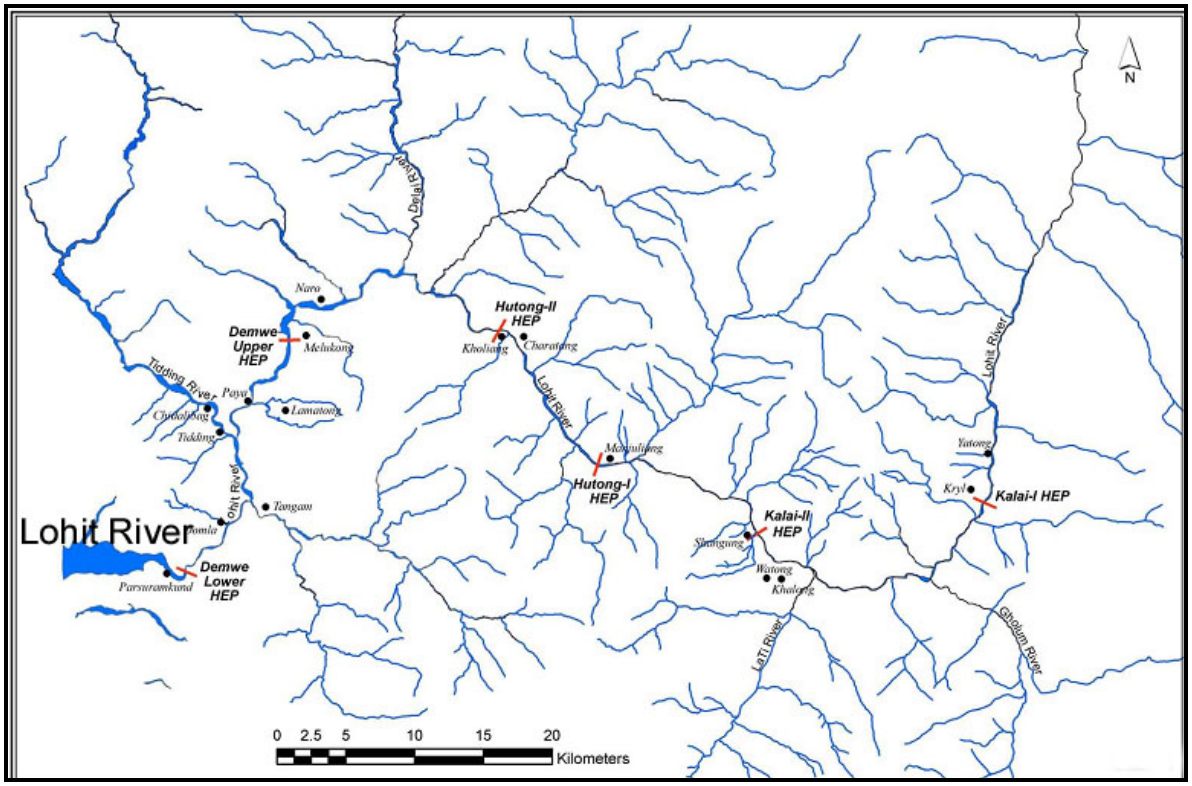
5.2 RIVER LOHIT

The Lohit originates in the snow-clad regions of eastern Tibet. It has a catchment area of 29,487 square kilometers, of which 14,453 square kilometers are in India, and it has India's easternmost river basin. In India the river flows across the states of Arunachal Pradesh and Assam and contributes an average 44,243 million cubic meters of water annually to the Brahmaputra river system.

The Lohit rises in the mountain ranges of eastern Tibet at an elevation of about 6,190 meters. In its upper reaches the river flows west and is known as the Krawnaon, after which it becomes known as the Tellu. The river flows southwards following its confluence with the Delai and Lang rivers; it then turns westwards and emerges from its gorge at Brahmakunda, entering Lohit District in Arunachal Pradesh and thereafter the fertile plains of Sadiya in Assam, where it is known as the Lohit. On emerging from Sadiya it is joined by the Dibang. The combined flow meets the Siang at Kobo, where after the combined system flows by the name of the Brahmaputra. The total length of the river is 413 kilometers, of which 243 kilometers are in India. The 132-kilometer stretch of the river in the plains only appears to be navigable during the winter season with country boats at present.

There are several hydroelectric projects are under proposal viz., Demwe (3,000 megawatts), Kalai (2,600 megawatts), and Hutong (3,000 megawatts) on river Lohit (**Fig. 5.3**). Demwe Lower Hydro Electric Project is located on Lohit river near Parasuram Kund in Lohit district of Arunachal Pradesh. Demwe Upper Hydro Electric Project is located on Lohit River near Mompani, Anjaw district of Arunachal Pradesh. The releases from Demwe lower Hydroelectric project would ensure downstream navigation in Assam reach of river Lohit navigation depths particularly during lean period.

The construction material for the above proposed dams can be transported from Guwahati or even from Kolkata since the Lohit River is a main branch of Brahmaputra River, the National Waterway No. 2 and the entire waterway system is navigable round the year. There is steady flow during lean period from January to May and the water level rises by about 2 to 2.5 m during flood from June to October. The water level starts falling from November to December. The river Lohit is navigable round the year.



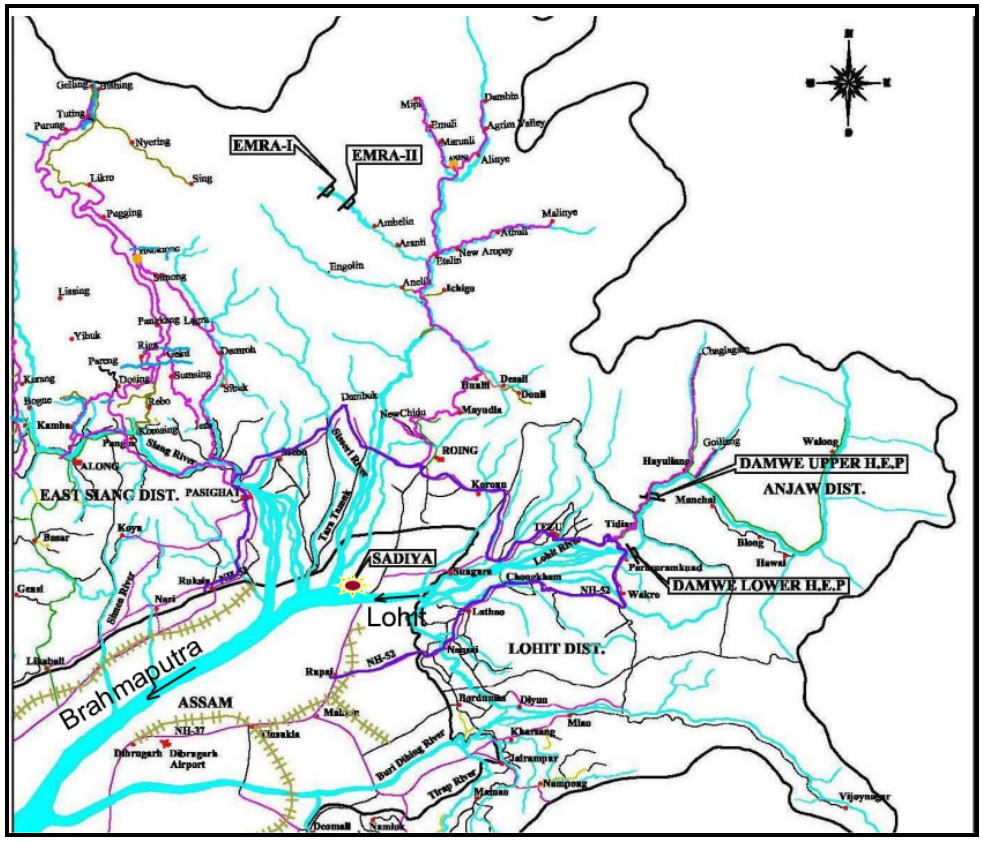


Fig. 5.3: Lohit River

Ferry Services:

1. Ferry service from Saikhowa Ghat to Parsuram Kund via Alubari Ghat for connecting Tezu to Dimwe (approx 75 km). By developing this waterway will reduce the Tinsukia by 145 km. as by road Tinukia is approx 250 km. however by waterway it is 105 km approx. Tinsukia is nearest business centre to this area.
2. Ferry service from Tezu to Medo, presently Medo is connected by NH52 Tezu (District head quarter of Lohit District). However by ferry service it will be approx 14 km. This proposal will benefit the people of Tezu, Hucheliang, Pomeliang, Koraliang,Loliang, Lohitpur,Sunpura,Medo,Manyuliang,wakro and Chowkham circle.
3. Digaru to Alubari ferry service for connecting Tezu to Namsai town, this will reduce travelling distance between two towns by 120 km (approx). The temporary ferry service exists at this location.
4. Ferry service between Shivaji nagar to Tezugham to benefit the local people

5.3 RIVER SUBANSIRI

The Subansiri River, one of the major north bank tributaries of the Brahmaputra, originates in the Great Himalayan range in Tibet at an altitude of about 5,000 meters above mean sea level (**Fig. 5.4**). The total length of the river is 468 kilometers, with a catchment area of 37,000 square kilometers. Its average width is 447 m. It is a perennially snowfed Trans-Himalayan river which is formed by the association of the Lokong Chu (Char Chu), Chayal Chu and Tsdri Chu in Tibet. The Kamala, Ghagar and Sampara are its major tributaries in India.

The principal stream is known as the Nye Chu, which travels a distance of about 170 kilometers eastwards before receiving an important right bank tributary, the Loro Chu. The combined flow then travels a further 208 kilometers eastwards before receiving a left bank tributary, the Yume Chu. Before the confluence point with the Yume Chu the river is known as the Chayal Chu. The Chayal Chu crosses the international boundary near Karutra and is then known as the Subansiri. A small left bank tributary, the Sang Chu, joins the river Subansiri 23 kilometers eastward of the confluence point of the Chayal Chu and the Yume Chu. The river then flows eastwards for a distance of 38 kilometers before meeting an important left bank tributary, the Tsari Chu. From this point, the river travels a distance of about 27 kilometers to the boundary of the hill catchment near Gerukamukh. Here, the river again receives left bank tributaries, including the Sichi, Situ, and Sigen at distances of 27, 93 and 111 kilometers respectively from the confluence point of the Tsari Chu. Right bank tributaries joining the river include the Singen, Kamala, and Sipu at distances of 71.5, 101, and 129 kilometers respectively from the aforesaid confluence point (**Fig. 5.5**).

After Gerukamukh the river enters the plains of Assam and receives such important right bank tributaries as the Boginadi, at a distance of about 449 kilometers from the hill catchment boundary. A few left bank tributaries, including the Dirpai, New Chaulkhowa, and Old Chaulkhowa, meet the Subansiri just after Gerukamukh. A view of river

Subansiri in Assam downstream of Gerukamukh can be seen in **Fig.5.6**. The river traverses 468 kilometers from the hill catchment boundary line to its outfall into the Brahmaputra at Subansirimukh.

This river has tremendous potential for inland navigation, if properly planned. It is fed with both snowmelt and rainwater, offering the possibility of perennial inland navigation throughout the sub-basin. Presently the waterway is used for communication by the village communities of Arunachal Pradesh, plying country boats for marketing in the plains of Assam. The waterway is also used for the commercial carriage of timber, logs, firewood, and bamboo from Arunachal Pradesh to the plains of Assam during the period July to September. It is also used by fishing boats for occasional fishing. During summer, when the river is in full spate, stacks of bamboo and firewood timber are carried from the upper reaches to the plains. The lower and middle reaches could easily be developed as waterways even for mechanized boats and barges.

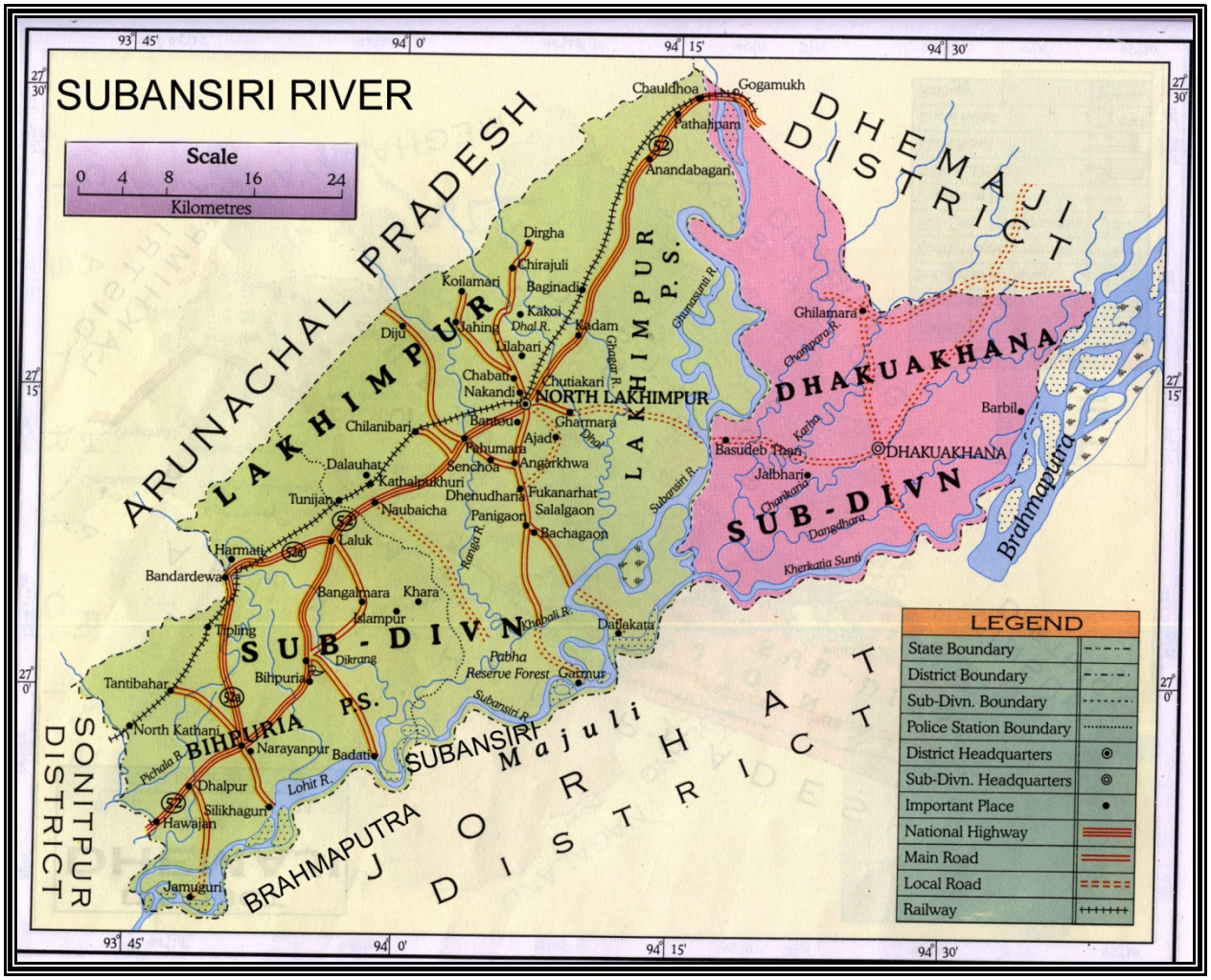


Fig.5.4: Index map – Subansiri River in Assam

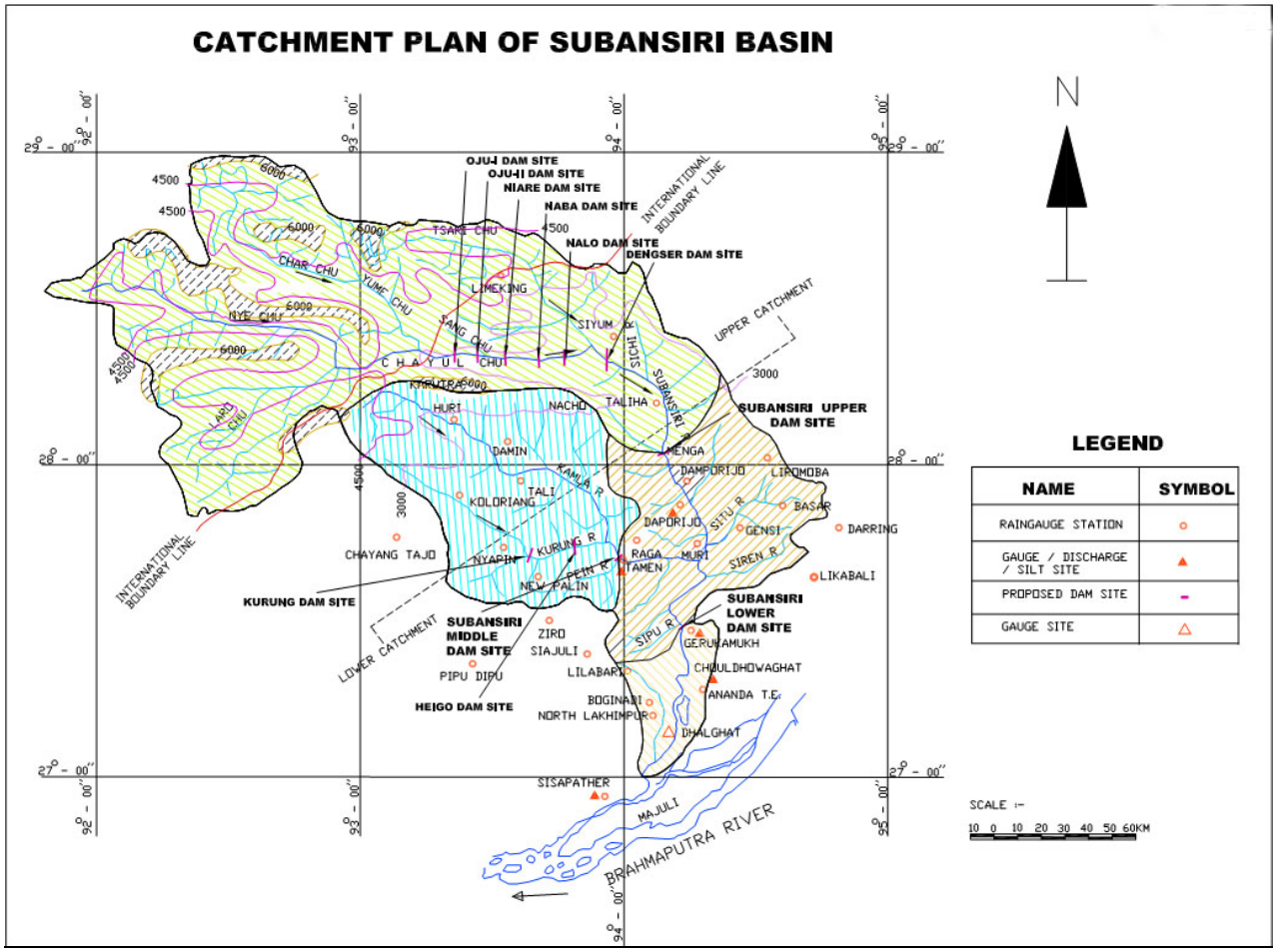


Fig. 5.5 : Subansiri River - catchment map

Fig. 5.6: Subansiri River, a view from NH52 at Balijangoan

As per the available information from IWAI report, the maximum and minimum observed discharge at Gerukamukh is 9,919 and 134 cubic meters per second. It is reported that a study was carried out to explore the possibility of developing an inland water transport route between the Brahmaputra confluence (Subansirimukh) and Gerukamukh (111 kilometers) through the Subansiri River. The study indicates that a major portion of the river appears to be navigable except at a few locations (approx 5 kilometers length) where observed depth is less than 2 meters. The depth can be improved by appropriate river conservancy measures such as dredging. A series of dams are under proposal for construction for hydel power general as shown in **Fig. 5.5**. The depth may also be improved following dam construction by water regulation.

From the water level hydrograph of Subansiri at Dhal ghat it can be seen that the water level is almost same lowest from January to May and starts rising from June and peak flood is during July and August. The water level rise is about 5 m from lean season to flood season. From September to December the water level is about 2 m more than the lean season water level. It can generally be attributed that the river is navigable from June to December, about seven months in a year. On the Lower Subansiri River a major dam is being constructed at Gerukamukh in Arunachal Pradesh close to Assam border for hydel power generation. The releases of the Dam during lean period may ensure adequate depths in the downstream reaches and improve the navigable conditions. The construction of the dam may require transportation of huge quantities of construction

materials from various parts of the country. Since the entire NW-2 and a substantial part of the Subansiri are navigable particularly from June to December, the possibility of moving such cargo by inland water transport to the proposed dam site is under consideration by the National Hydroelectric Power Corporation (NHPC).

5.4 RIVER SIANG

The river Siang is the main river of Brahmputra called Tsangpo in Tibet (China). The River is navigable from Pasighat (Arunachal Pradesh) to Brahmputra confluence near Kobo (Assam) as shonw in Fig.5.7. The feasibility and DPR studies may be undertaken to develop Inland water transport on this river reach (approx 40 km) as it is perennial round the year. The ginger can be transported through IWT mode, as the area between Dambuk and Mebo town is largest producer of ginger in the country. River width varies 200m (near Pasighat) to 800m (Brahmputra Confluence). The depths are around 2 to 3 m during lean period and around 5 m during flood period.

Ferry Services:

Ferry services exist near Komilighat to benefit the people of Sigar, Ngopok Borguli villages.

Ferry service between Sika Bamin, Ranaghat and Namsing for the benefit of local people of villages Sika Tode, Sika Bamin, Oyan and Namsing.

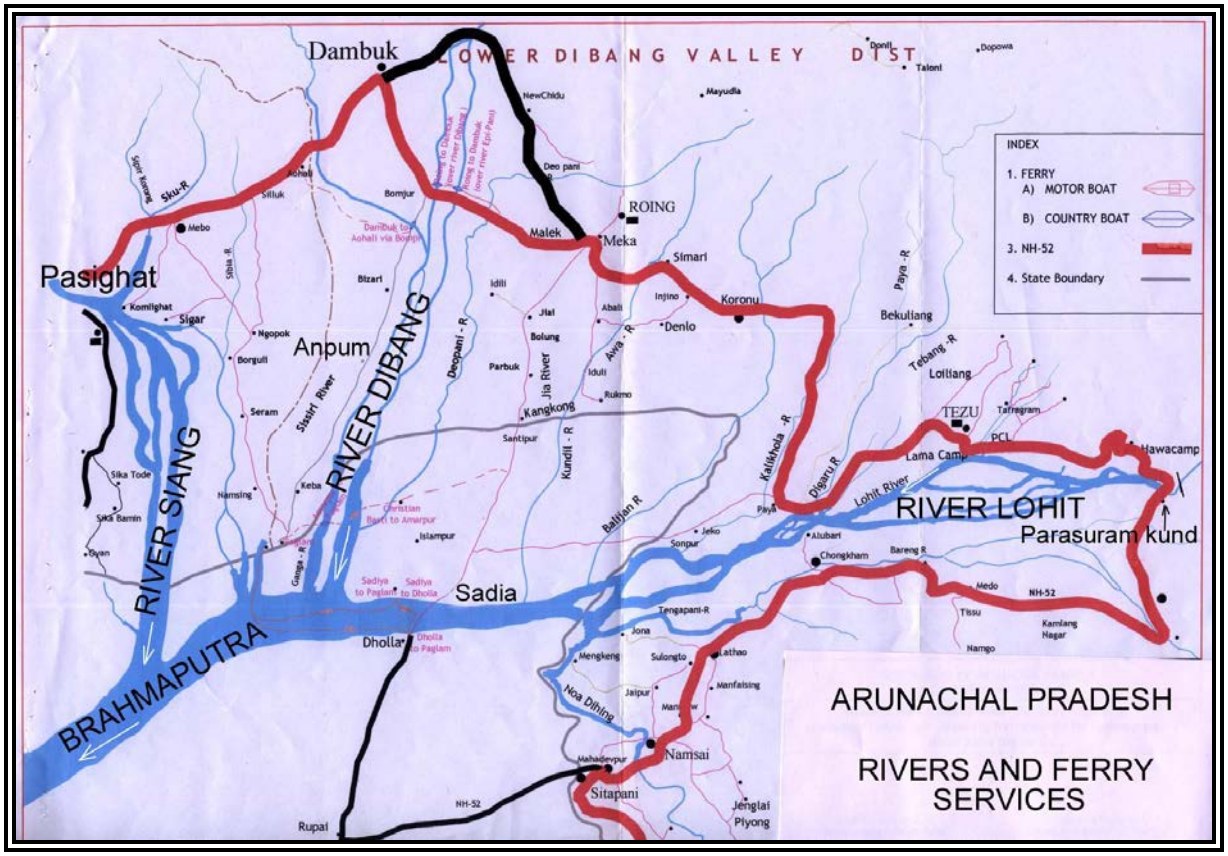


Fig.5.7: Rivers and Ferry services in Arunachal Pradesh (Dibang, Lohit and Siang)

6.0 POTENTIAL WATERWAYS IN MIZORAM

6.1 RIVERS IN MIZORAM

The rivers of Mizoram constitute a major part of the topography of Mizoram. Aided by heavy rainfall during the rainy seasons and occasional rainfall throughout the year, most of the Mizoram Rivers are perennial in nature.

Some of the rivers flowing through Mizoram are:

Table 6.1: Rivers in Mizoram

Sl. No	Name of River	Length in Kms
1	Tlawng (Dhaleswari)	186
2	Tiau	160
3	Chhimtuipui (Koladyne)	138
4	Khawthlangtuipui (Karnafuli)	128
5	Tuichang	120
6	Tuirial (Sonai)	118
7	Tuichawng	108
8	Tut	90
9	Tuipui (Khawchhak)	87
10	Tuivawl	72
11	Teirei	70
12	Tuirini	60
13	Serlui	56

The river systems in Mizoram are discussed below in detail. The map of the rivers in Mizoram is shown in **Fig 6.1**.

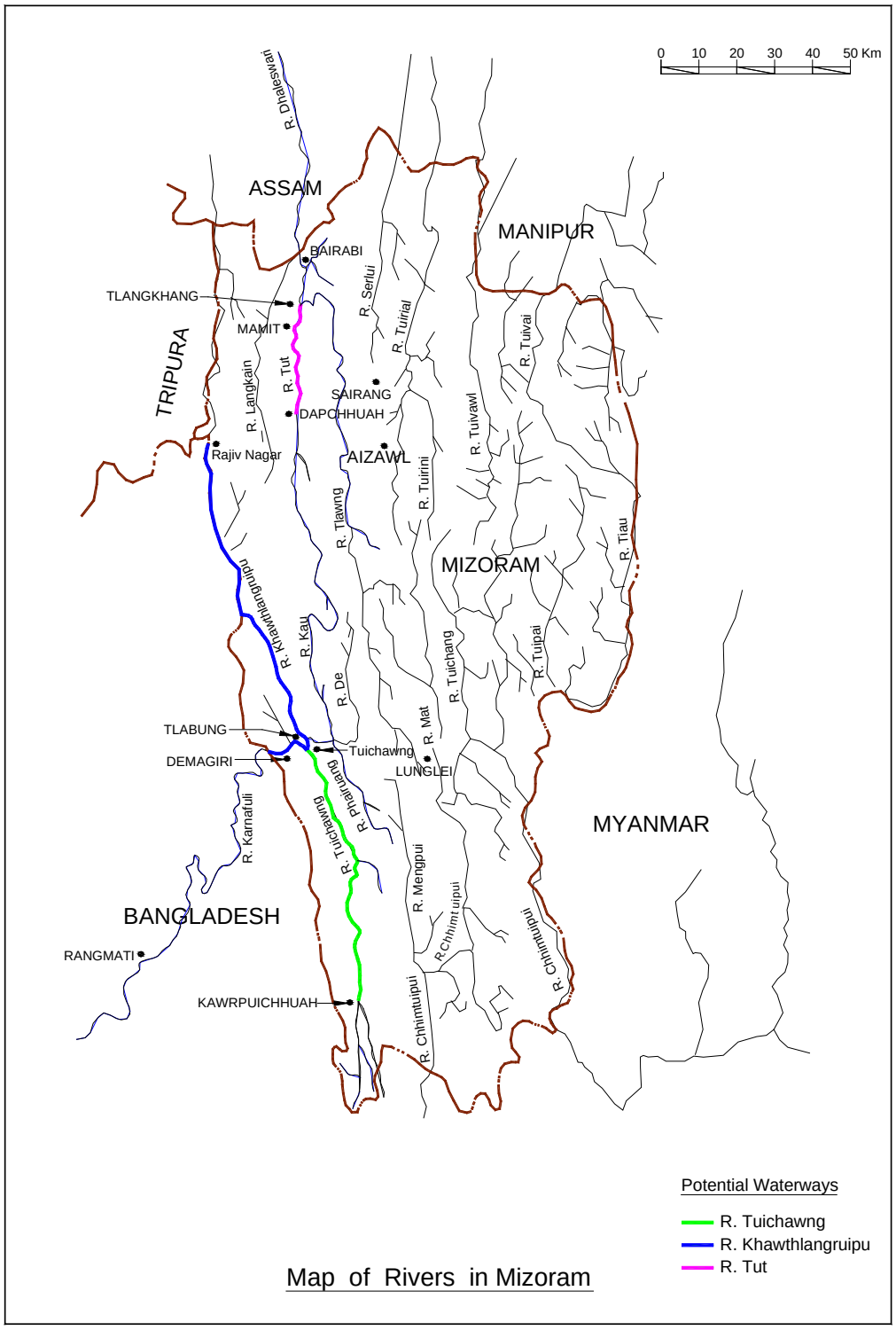


Fig. 6.1: Potential Waterways in Mizoram

6.2 POTENTIAL WATERWAYS IN MIZORAM

6.2.1 River Karnafuli / Khawthlangtuipui

Karnaphuli is known as Khawthlangtuipui in Mizoram. The river Karnafuli originates in the Lushai hills in Mizoram State of India and enters Bangladesh at Demagiri. The Karnafuli River flows through Rangamati and the port city of Chittagong and discharges into the Bay of Bengal near Patenga. Karnafuli River is the largest and most important river in Chittagong in Bangladesh (Fig.6.1). It travels through 180 km of mountainous wilderness making a narrow loop at Rangamati and then follows a zigzag course before it forms two other prominent loops, the Dhuliachhari and the Kaptai. A number of streams flow upstream of Rangamati. The streams are: one originating near Thekamukh in Mizoram-Bangladesh border flowing through Harina, Barkal and Sublong; one originating at Marishwa through Myanmukh and Langadu till reaching Subhalong; one flowing through Dangumura to Myanmukh; and one flowing through Mahalchhari to Rangamati. The streams meet near Rangamati and their combined flow is known as Karnafuli. The river is flashy and its length is about 131 km. Rainkhiang, Sublong, Thega, Kasalong, Ichamati and Halda are its main tributaries. Its major distributaries are Saylok and Boalkhali.

The hydropower station was built in Bangladesh territory of the river by constructing a dam on this river at Kaptai. The Karnafuli is navigable at Barkal and Kaptai but above Barkal it is shallow. With the construction of the Kaptai dam in 1962, this river has been blocked, and a large artificial lake has been created, and the bed of the river has also been much widened. This man-made lake provides a network of all-weather navigable routes in the area. An earth-filled dam on the Karnaphuli River, the Kaptai Dam created the Kaptai Lake, which acts as the water reservoir for the hydropower station. The power plant produces a total of 230 megawatts of electricity.

Downstream of the dam the Karnafuli receives very little water in the dry season. The opening of the sluice gates of the dam creates water movement from the lake downstream. The river finally discharges into the Bay of Bengal. The port city of Chittagong is situated at the mouth of the river.

The maximum depth of the Karnaphuli River at Patenga where it meets the bay is about 20 metres (66 ft) during extreme high tides. This river experiences more than 5 metres (16 ft) tidal variation. Therefore, the depth which should be reported as Below Chart Datum (CD) should be at least 5-6 meter less than the maximum at high tide.

The potential waterway of river Karnafuli / Khawthlangtuipui is shown in **Fig 6.2**.

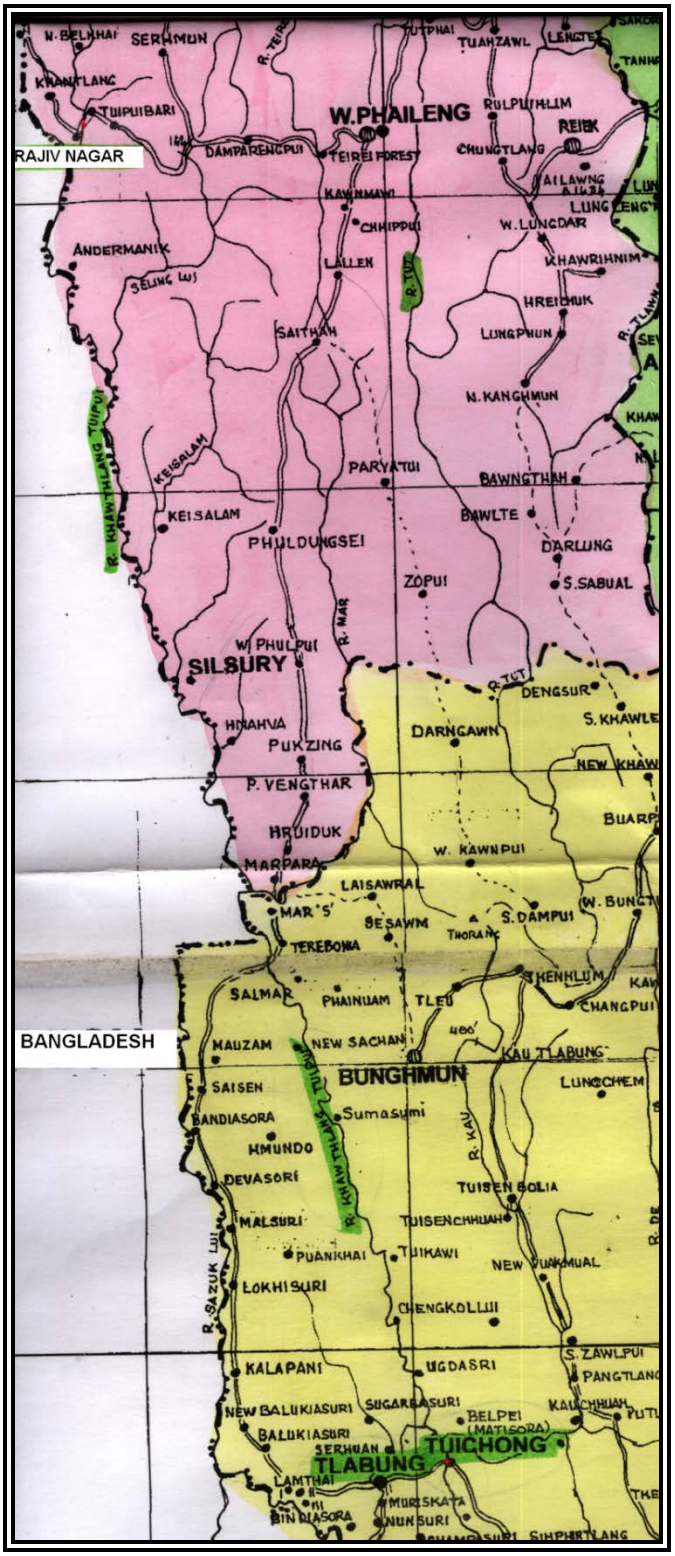


Fig 6.2: River Karnafuli / Khawthlangtuipui

6.2.1.1 Navigability of Khawthlangtuipui / Karnafuli River

The river Khawthlangtuipui from Rajiv Nagar to Demagiri via., Tuichong and Tlabung is about 180 km in length is considered for development of navigation (Fig. 6.2). The river Khawthlangtuipui itself is a border between Bangladesh and India from Rajivnagar to Terebown village of about 100 km length. From Terebown village downstream the river having a length of about 80 km traverses in Mizoram state. The river runs from north to south from Rajiv Nagar to Tuichong and takes a turn towards west and passes through Tlabung and crosses the Bangladesh border at Demagiri village. A view of the river Khawthlangtuipui at Tlabung can be seen in **Fig. 6.3**.

The Inland Waterway on the Karnafuli River between Chittagong and Demagiri in Mizoram was in much use during the British rule and became virtually unused after the partition of India. After the construction of the Kaptai Dam on the Karnafuli in Bangladesh, a huge area around Demagiri has been submerged. This created a good potential for Inland Water Transport in the area. The water depths in the Demagiri area in the India-Bangladesh border area are around 5 to 10 m.

Demagiri is a small border town, in Lunglei District of Mizoram. It is situated in South West of Mizoram. It is situated on the bank of river Karnafuli. The local name of the city is Tlabung. Demagiri is about 235 Kms from Aizwal, the state Capital and about 90 Kms from Lunglei. It is a riverine border with Bangladesh. The Chittagong divisions of Bangladesh fall on the other side of Border. It is also close to Sylhet Division of Bangladesh. Dhaka is just about 110 Km from Demagiri.

Fig 6.3: View of River Karnafuli at Tlabung

In past, Mizoram had two river trade routes to Bangladesh namely Kolodyne River and Karanafuli River route. The Kolodyne River enters Akyab Port and river Karnafuli enters Chittagong port. Closure of these waterways had affected the economic life of people living in Mizoram. The border trade is revived recently at Demagiri Land Custom Station. The NER Vision 2020 has noted that almost all of India's trade with Bangladesh is water borne and thus has little relation to NER which has no port links. The port links to NE States are only through border Nations viz., Bangladesh and Myanmar which are properly to establish through river links.

Demagiri is well connected to District Headquarter and State Capital by road. It is connected to Lunglei via Lungsen. Lunglei is connect to Aizawal and Silchar (Assam) By NH – 54. Demagiri being connected to Assam and other regional centers of trade by National highway and its nearness to important places of Bangladesh like Commila a Sylhet, it can be developed as an important trade route between India and Bangladesh.

At present there is a small ferry ghat in operation at Tlabung (Demagiri) in river Karnafuli as shown in **Fig 6.4**.

Fig 6.4: Ferry ghat on river Karnafuli at Demagiri in India

The basic infrastructure is not there at Demagiri to meet the growing trend of trade. There are not very good/proper roads either on the Indian side or on the Bangladesh side. This has to a great extent created a lot of hardships to traders of both sides. The whole of the

terrain is undulating and hills in nature. Therefore the situation becomes more difficult during rainy season. Under the circumstances the trade through Karnafuli waterway route would be the ideal. A view of Karnafuli river in Banglacdesh is given in Fig.6.5

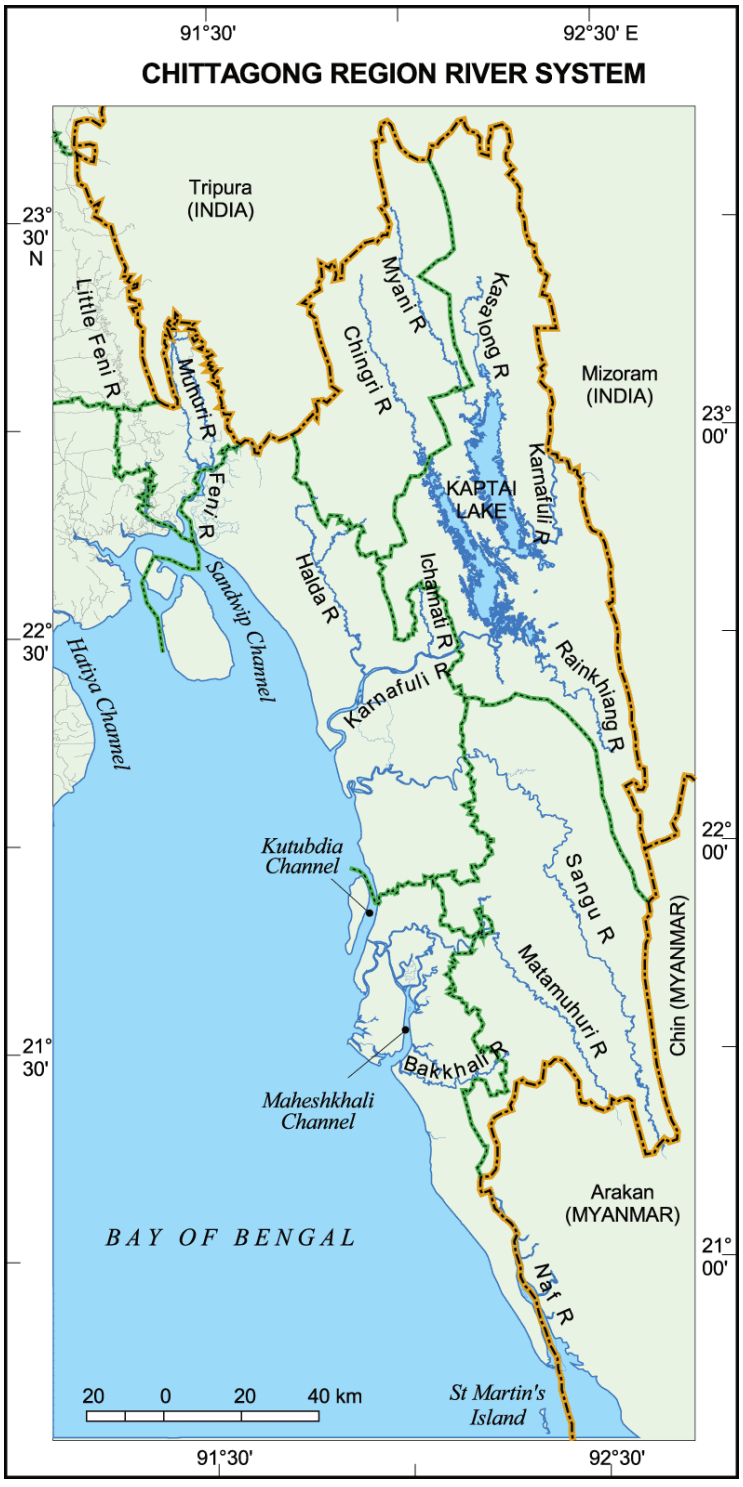


Fig.6.5: Karnafuli River in Bangladesh

Traffic Potential

Since there is no legalized trade traffic through Demagiri , it is not possible to assess the existing traffic moving through Demagiri. However, based on the local enquiries the commodities smuggled to and from Bangladesh are as follows **Tables (6.2 & 6.3)**:

Table 6.2: LIST OF COMMODITIES FLOWS FROM INDIA

Sl.No.	Items
1.	Bamboo
2.	Ginger
3.	Sesamum
4.	Chillies
5.	Teak
6.	Cotton
7.	Citrus fruits
8.	Rice
9.	Sugar
10.	Cement

Table 6.3: LIST OF COMMODITIES FLOWS FROM BANGLADESH

Sl. No.	Items
1.	Different varieties of washing and bathing soap
2.	Electronic goods
3.	Cane and plastic cold drinks
4.	Garlic
5.	Potato crackers
6.	Cheese balls
7.	Cooking oil
8.	Azinomote

9.	Tooth brush, teeth paste and powder
10.	Water purifier
11.	Blanket
12.	Red Cow butter
13.	Dining set
14.	Tea sets
15.	Different varieties of cigarettes
16.	Generator
17.	Speed beat engine
18.	Track suits
19.	Sport wears
20.	Condensed milk
21.	Video cassettes
22.	Red Cow powder
23.	Cosmetics
24.	Aqua catching net
25.	Fresh fish
26.	Dried fish
27.	Fermented fish (Dangpuithu)
28.	Water melon
29.	Rice muri
30.	Shoes
31.	Biscuits
32..	Garments
33.	Jackets

6.2.2 RIVER TUICHAWNG

The river Tuichawng originates from the central part of Aizwl district. The river traverses from south to north and meet the Khawthlangtuipui river (flows from north to south) at Tlabung as shown in Fig. 6.6. Discussions had with local experts Dr. L.H. Chhuanawma, Lecturer in University College of Mizoram revealed that the rivers Tuichawng and Khawthlangruipu are run in plains and there may not be any rocky terrain and hazards for navigation. In fact Dr Chhuanawma had traveled the entire waterway of Tuichawng by country craft and there are no navigational hazards were encountered except a sandy shoal and boat had to be lifted at this location. The sandy shoal can be removed by dredging. The rivers Tuichawng and Khawthlangruipu join at Dimagiri and the combined flow is known as Karnafuli river which enters in to Bangladesh. The Karnafuli is one of the important waterways in Bangladesh. Navigation is possible in river Tuichawng only in monsoon period for 2-5 tonne vessel having draft 0.6m. The development of the waterway can be viewed from the point of socio-economic up liftment of the area.

Traffic Potential

Local products such as oil seeds, chilies, vegetables, cane etc., can be transported by boats.

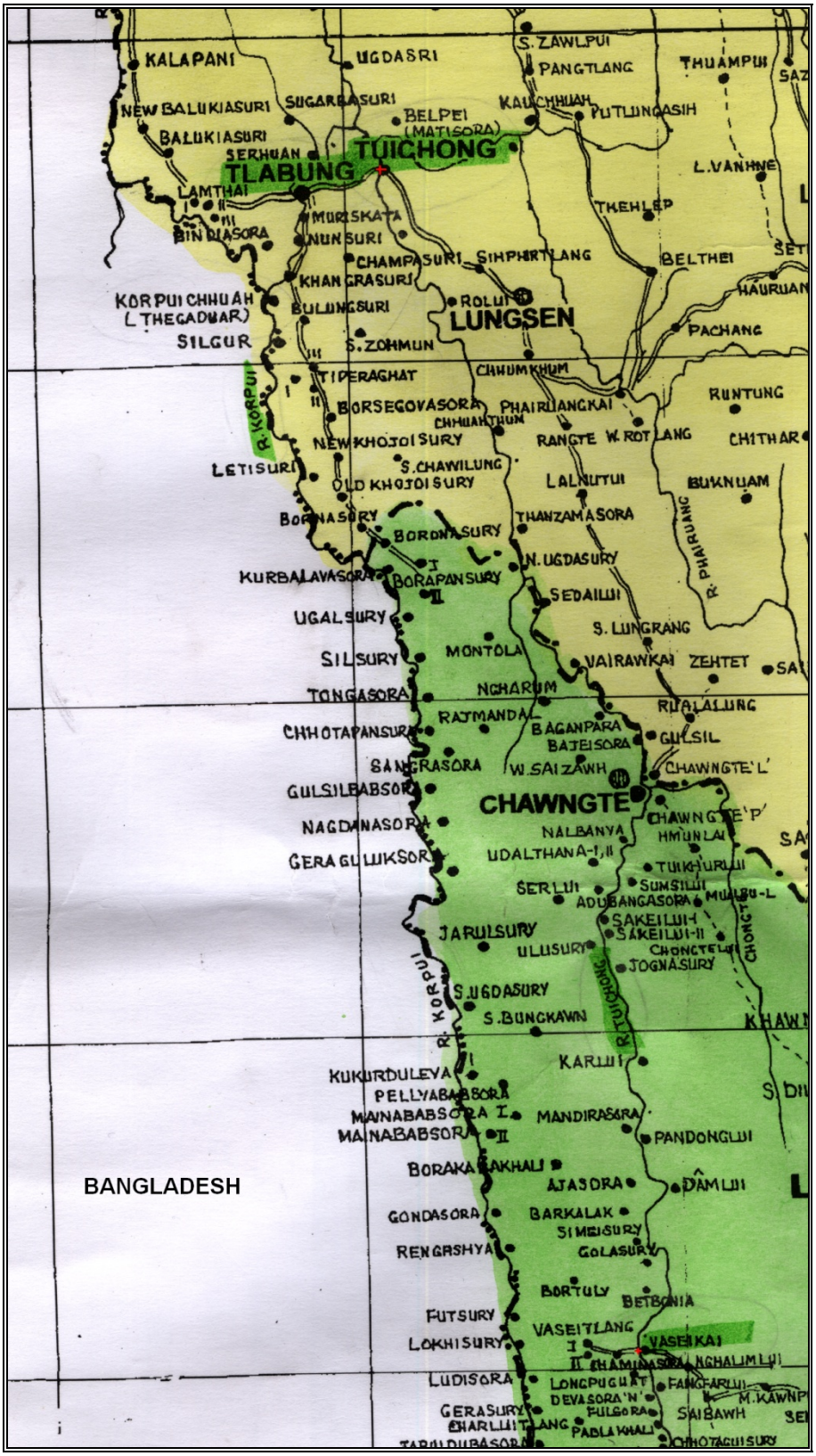


Fig 6.6: Potential waterway of river Tuichawng

6.2.3 RIVER TUT (TLAWNG / DHALESWARI)

River Tut: River Tut originates in the Mizo hills, southern part of Mizoram and runs to Dapchhhuah. From Dapchhhuah it flows about 55 km to meet river Tlawng at Tlangkhang. From the confluence the river Tlawng flows about 25 km upto Bhairabi and enters Assam. In Assam the river is renamed as Dhaleswari. It flows about 126 km in Assam. Therefore, Tut- Tlawng-Dhaleswari River system will serve the interstate trade between Mizoram and Assam. Potential waterway for navigation in this river system is considered from Dapchhhuah to confluence of river Tlawng near Tlangkhang of about 55 km. The potential waterway of river Tut is shown in **Fig 6.7**.

The river Tut is navigable only during monsoon season for about 6 months in a year. The capacity of the vessel can ply on this waterway is about 2 to 3 tons. Local products such as oil seeds, ginger, tea, chilies, vegetables, cane etc., can be transported by boats on river Tut. The intra state traffic across Mizoram and Assam border can also be moved by boats. The local agricultural products are transported during the season to local market using this waterway. The development of this waterway is helpful for local remotely located tribal people.

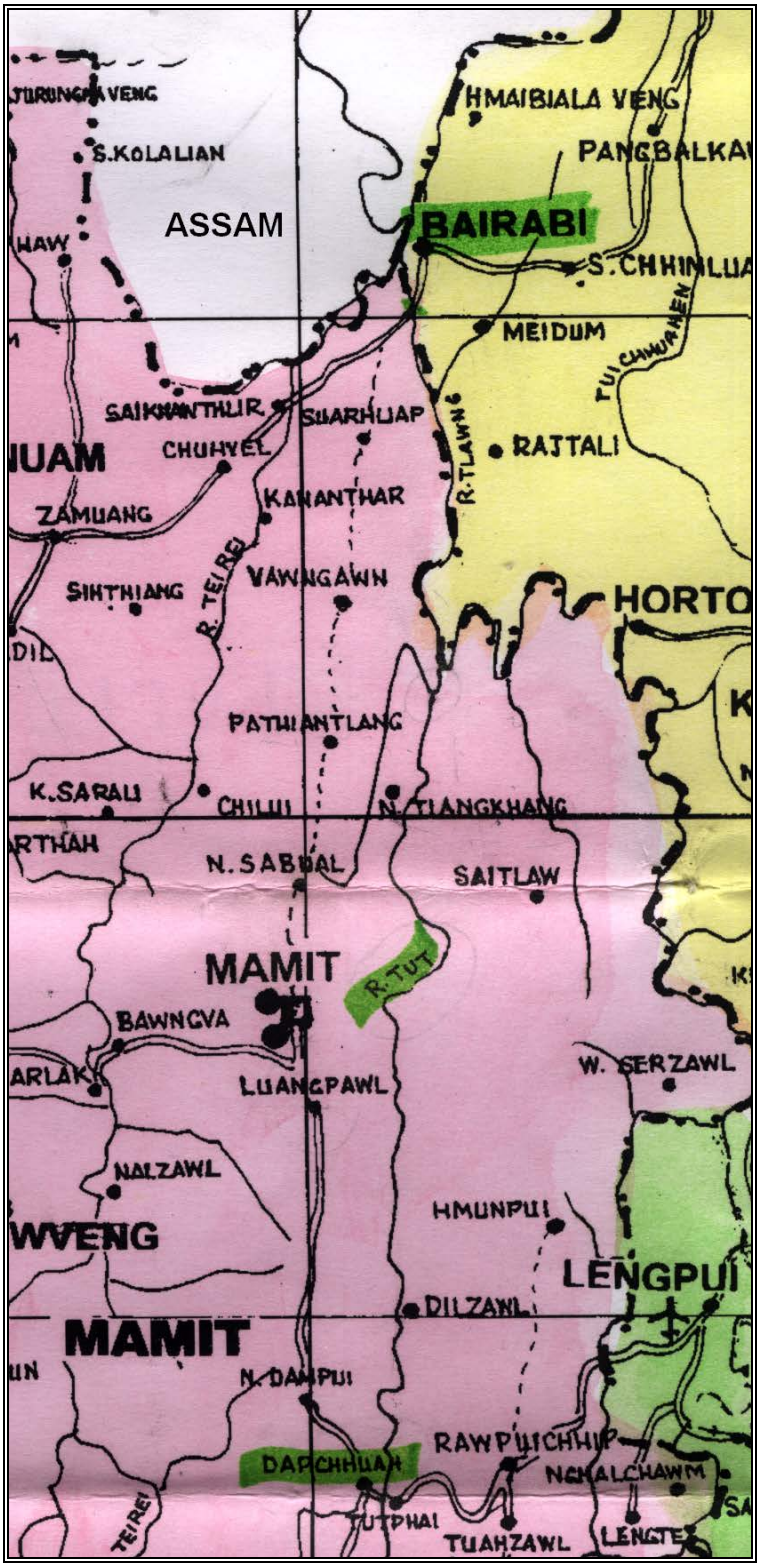


Fig 6.7: Potential waterway of River Tut

7.0 POTENTIAL WATERWAYS IN MEGHALAYA

7.1 MINERAL WEALTH OF MEGHALAYA

Meghalaya with its wealth of mineral deposits has tremendous industrial potential. There are extensive deposits of coal, limestone, granite, clay and other minerals **Fig. 7.1**.

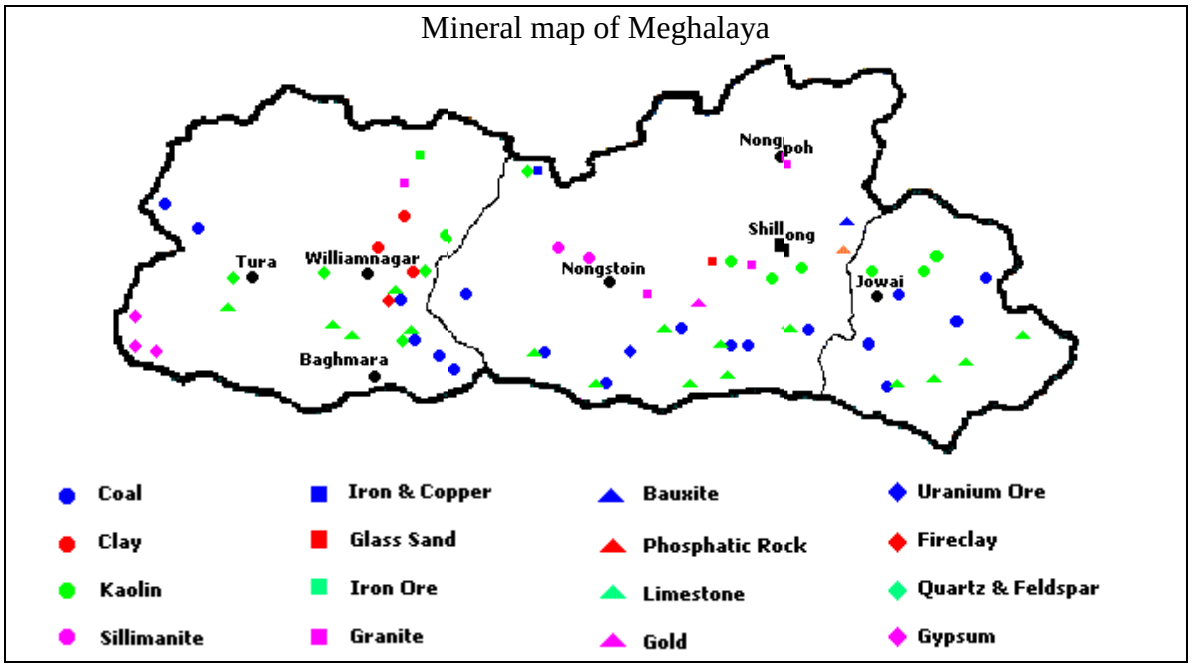


Fig. 7.1: Mineral map of Meghalaya

Bangladesh imports large quantity of coal from the private mines of Meghalaya. The Meghalaya coal exported to Bangladesh was also canalised through Minerals and Metals Trading Corporation (MMTC). But from 29.9.89, export of Meghalaya coal to Bangladesh was exempted from canalisation through MMTC and was canalised through Meghalaya Mineral Development Corporation (MMDC). Again from July 1991, the export was fully decanalised as a result of which private exporters were allowed to export coal. However, the export was subjected to a minimum export price (MEP) of US$ 56 per tonne with effect from 5/2/1992. This restriction of MEP was further removed from 1.4.93 and all coal from Meghalaya is freely exportable.

Besides, Coal and Limestone are also exported to Bangladesh, earning a good amount of foreign exchange. The State earned total revenue of Rs. 3980.32 lakh from mineral sector during 1997-98.

7.2 MINERAL FIELDS

Mineral map of Meghalaya is shown in Fig. 7.1.

Coal

Some prominent coalfields in the State are west Dadenggiri, Siju, Balpakram, Pyndengrei, Langrin, Mawlong-Shella, Laitryngew and Bapung. The total estimated inferred reserve of coal in Meghalaya is of the order of about 640 million tonnes, out of which, Garo Hills alone contains 359 million tonnes. The total production of Coal in the State during 1997-98 was 32.34 lakh tonnes.

Coal fields in the vicinity of Simsang River in South Garo Hills

Siju Coalfield

It is reported that in Simsang gorge about 1.8m thick coal seam near Siju-Songmong was observed which in all possibility continues over a strike length of 19.3 kms to the west of Simsang, but the decrease in thickness is noticed while proceeding in that direction. At Rakmanggiri ($25^0$23' N: $90^0$31' E) the thickness of the seam becomes only 60cms. There was no means of ascertaining the behavior of the seam in that direction of the dip. The average thickness of the seam is about 1.4m for a length of 6.4 kms between Siju-Songmong and Dapsi Garogithim (25022' N: $90^0$38' E). Further west of the area, the average thickness of the coal seam is taken to be 76cms for a length of 14.4 kms. Thus, the estimated reserve of coal for the area between Siju-Songmong and Dapsi-Garogithim for 3.2 kms down the dip, assuming an average thickness of 1.4m will be about 26 million tonnes. The estimated reserve for a similar area between Dapsi-Khosgiri (25023' N: $90^0$38' E) and Table Nala ($25^0$24' N: $90^0$29' E) assuming an average thickness of 76 cms will be 45.7 million tonnes. The recent estimation of probable reserve of coal in Siju Coalfield by G.S.I is 125 million tonnes, assuming the lower coal seam to be 1.5m thick, along a strike extension of 11 kms. (from Simsang river to Barsaura), with a depth of 300m. The analysis of coal from Siju coalfield is given below:

- Moisture - 3.30%
- Ash - 4.16%
- Volatile matter - 38.58%
- Fixed carbon - 53.36%
- Sulphur - 1.8%
- Calorific value - 12,450 B.Th. U/lb
- Coking properties - Coking

Coal fields in Khasi Hills

It is reported that there are 12 coal fields in this hills. They are:

1. Laitryngew,
2. Cherrapunjee,
3. Laitdoh,
4. Mawbehlarkar,
5. Mawsynram,
6. Lumdidom,

7. Langrin,
8. East Darranggiri,
9. Bossora,
10. Pynurella - Thanjinath,
11. Langkyrdem,
12. Mawlong Shella

Coal fields in the vicinity of Kynshi/Jadukota River

Langrin Coalfield

The Langrin Coalfield is situated in the south-western extremity of the Khasi Hills and extends over a large area from Kynshiang (jadukata) river in the east to Moheskhola river in the west.

The eastern extension of the coalfield is up to Goabari and Barsaura. The southern boundary is more or less a straight line from Barsaura to the east to Mangokhor on the bank of Moheshkhola river in the west. The Um Mawblei river and its tributary Um Bytit river flowing from west to east, form the northern boundary of the coalfield, tough exposures of coal are found further north near Nongjismir village in the Um Mawblei river section. Although the Maheshkhola river is the western boundary of the coalfield, the field extends further westwards and is exposed in the Pendengru - Balphagram area.

The reserve of coal around Barsaura and Goabari areas is 2.26 million tonnes, taking thickness of the four seams and 0.6m, 1.21m, 0.9m and 1.16m respectively.

The hydroelectric projects are in planning stages on rivers Simsang (135 MW) and Kynshi (900 MW), Umngot (60 MW) rivers.

Limestone

An extensive belt (approximately 200 Km. Long) of good quality Limestone (cement grade to chemical grade), having 3 (three) brands of Limestone, occurs along the southern border of Meghalaya. Some prominent Limestone deposits are Cherrapunjee, Mawlong-Ishamati, Komorrah, Shella, Borsora in Khasi Hills, Siju and Nangwalbibra in Garo Hills, Lumshnong, Sutnga, Nongkhlieh, Syndai and Lakadong in Jaintia Hills. Total inferred reserve of Limestone within the State has been estimated at about 5,000 million tonnes**.** The utility of limestone is in the steel, fertiliser and chemical industries besides in the production of cement.

The existing cement plants, one at Cherrapunjee in Khasi Hills (Public Sector) and other at Damas in Garo Hills (Private Sector) have been using the Meghalaya Limestone. Besides these, Limestone of Meghalaya will also be utilised in the 2 (two) proposed cement plants, one at Garo Hills (1,000 TPD) and the other one at Jaintia Hills (1,200 TPD), both in the Public Sector.

The total production of Limestone in the State during 1997-98 was 3.95 lakh tonnes.

Granite

Deposits of multi-coloured Granite suitable for use as dimensional and decorative stones have been located in the area around Nongpoh, Mylliem and Mawkyrwat as well as in the area around Mendipathar - Songsak road. A possible reserve of about 25 million cubic metres of Granite deposits have been estimated by the Directorate of Mineral Resources at Nongpoh, Mawkyrwat and Mendipathar - Songsak.

Black Granite (Dolerite) suitable for making polished blocks and slabs are also found in eastern and northern part of West Garo Hills district. Jenjal and Hallidayganj appear to be two promising areas of Black Granite deposit in the State at present.

Quartz & Feldspar

Both Quartz & Feldspar are components of ceramic industry. These minerals are found to occur side by side in *Pegmatite Veins* in several localities of Khasi and Garo Hills of Meghalaya. These minerals have been used in pottery industries in Meghalaya and Assam. Total indicated reserves of Quartz & Feldspar deposits in Meghalaya are estimated at 0.076 and 0.096 million tonnes respectively.

Gypsum

Gypsum, one of the ingredients in cement manufacture is reported to occur in Mohendraganj and Harigaon in West Garo Hills. It occurs as minute crystals in the gypsiferous shale. The concentration of Gypsum in shale is 0.07%. No detail works were carried out and no reserves were estimated so far, as the concentration of Gypsum in the host rock is uneconomic.

7.3 COAL RESERVES

Coal resources of the four North-Eastern States - Arunachal Pradesh, Assam, Meghalaya and Nagaland - have been estimated at 889.81 million tonnes by the Geological Survey of India (GSI).

According to an official document of the Union Ministry of Coal, of the total reserve of 889.81 million tonnes, 398.28 million tonnes under inferred category, 411.86 million tonnes under proved category while 80.11 million tonnes are under indicated category.

Of the total coal reserve in the four states, Meghalaya topped the list with 459.43 million tonnes followed by Assam with 320.21 million tonnes, Arunachal Pradesh with 90.23 million tonnes and Nagaland with 19.94 million tonnes.

The brick kiln plants in Bangladesh prefer Meghalaya coal, which has low ash content, but it is high on sulphur. Meghalaya exports around five lakh MT of coal per annum.

7.4 INFRASTRUCTURE FOR EXPORT OF MINERALS

As Meghalaya shares an international boundary of 443 km with Bangladesh in the south and west, therefore, improvement of the transportation net work such as road and waterway net work in the border areas is very important for trade and commerce and also form strategic point of view. Meghalaya has eight land custom stations for exporting goods to Bangladesh. The land custom stations are at:

1. Mahendraganj
2. Gausapara
3. Baghmara
4. Borsora
5. Shella Bazar
6. Bholaganj
7. Dawki and
8. Ryngku

The value of export from Meghalaya for the year 2005-06 is Rs. 211.77 crores which is about 48.37% of the total exports from the NE region. Most of the exports are coal, limestone and boulders and some fruits. Coal accounted for over 87% of the State's total exports. Upto March 2008, Meghalaya had exports worth US$ 61.4 million. The State Government is therefore very keen to develop the infrastructure in the land custom stations. Further, the State Government has requested Government of India to include Borsora and Gasuapara in the list of Integrated Check Posts as the Meghalaya exports from these two LCSs was worlth of Rs. 84.63 crores and Rs. 23.36 crores respectively during 2005-06.

The State Government's Mineral policy is to promote necessary linkages between mining and mineral industry / exports.

This is the right time to realize that creation of new infrastructural facilities such as waterways wherever possible to augment the road net work to the Integrated Check Posts (ICP) and Land Custom Stations (LCSs) will facilitate export activity and act like a catalyst for the all round infrastructure development.

Bangladesh is the destination for the majority of goods produced in the state. This is due to the complementary relation between the resource base of Meghalaya and the demand structure of Bangladesh.

Besides the roads at border trade points, a wider multimodal transportation linkages like development of water transportation across the north eastern region and Bangladesh in general, and Meghalaya and Bangladesh in particular needs to be put in place for the promotion of trade across these two regions.

Presently, Meghalaya's exports base mainly consists of minerals like coal and limestone. The exporters remain handicapped due to inadequate transport net work. In order to

enable the exporters to maximize their profits and the Government to optimize the social benefits, the cheapest mode of water transport shall be promoted as a supplementary mode to the existing road net work.

7.5 WATERWAYS IN MEGHALAYA

There are many rivers in Meghalaya. Some of them are navigable, while some are not. The Meghalaya Rivers are an inherent part of the state of Meghalaya.

The main rivers of Meghalaya in the Garo hills that form the northern system and flow from west to east are the Chagua, Ajagar, Kalu, Dudnai, Didram, Ringgi, Krishnai and Jingiram. The main rivers that form the southern system are Bhogai, Daring, Sanda, Dareng, Bandra and Simsang. The biggest of all the rivers of the Garo hills is the Simsang, which is partially navigable (for about 30 to 35 kms). Some other rivers of the region that are suitable for navigation are Bhupai and Nitai.

The main rivers of the eastern and central regions of Meghalaya plateau that flow towards the north are Umiam, Umkhri and Digaru and some major rivers of the eastern and central regions of Meghalaya plateau that flow towards the south are the Barapani or Umiew, Mawpa, Kynchiang (Jadukata), Myntdu and Myngot.

Some of the northern system rivers are the tributaries of the Brahmaputra. Many of the south flowing rivers enter into Bangladesh and continue to run into its territory (**Fig. 7.2**).

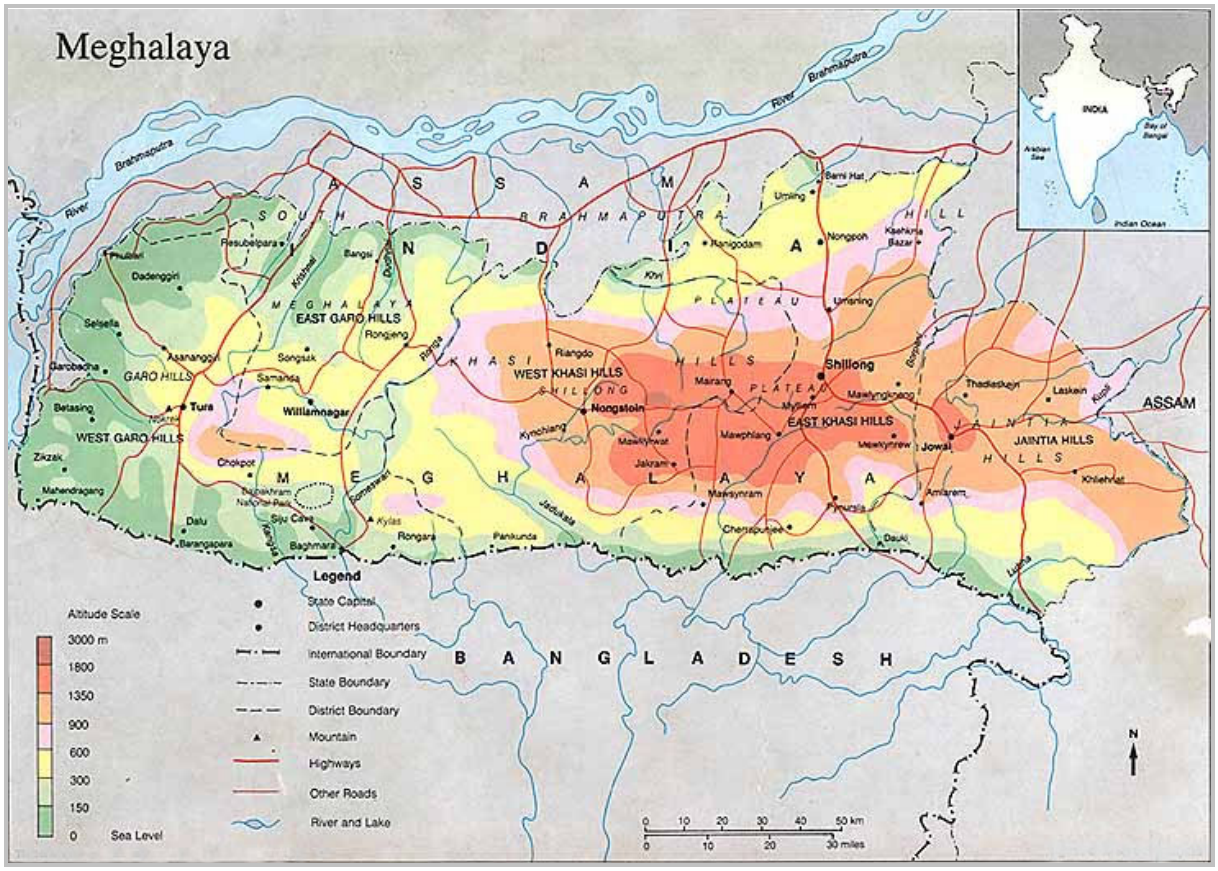


Fig. 7.2: Index Map of Meghalaya

The details of the potential rivers for development of Inland Water Transport are furnished below:

7.6 RIVER SIMSANG

The Simsang River is the second longest and the biggest of all the rivers at Meghalaya (**Fig. 7.3**). It originates from the Nokrek mountains and moves eastwards through Williamnagar, which is the East Garo Hills district headquarters, Nongalbibra, Rongrenggre, Siju, Rewak and finally Baghmara, the headquarters of South Garo Hills district. The chief tributaries are Chibok, Rongdik, Rompa and Ringdi rivers.

Simsang River is known as Someshwari in Bangladesh is a major river in the Garo Hills of Meghalaya and Netrakona District of Bangladesh. It divides the Garo Hills into two parts.

Fig. 7.3: Simsang River

In Bangladesh it flows through the Susang-Durgapur and other areas of Netrakona District till it flows into the Kangsha River. A branch of the river flows towards Kalmakanda and meets the Balia River. Another branch of the river flows into the haor areas of Sunamganj District and flows into the Surma River. It is one of Bangladesh's trans-boundary rivers.

7.6.1 Navigability of Simsang River

A site visit was undertaken to Baghmara village located on the banks of Simsang River to assess the navigability of the river based on first hand information obtained through local enquiries. Baghmara is located on the right bank of river Simsang at Indo-Bangladesh border. There is a Land Custom Station (LCS) at Baghmara and other Land Custom Stations near to Baghmara are Gasuapara and Dalu. Coal and other minerals are exported to Bangladesh through these LCSs.

The salient features of the river Simsang at Baghmara based on site visit and local enquires are as follows:

- Width of the river at Baghmara is about 500 m
- Depth of the river vary between 0.3 m and 1.0 m
- Water level variation from lean season to flood season is about 4 to 5 m

- Expected depths during flood season from June to October are around 3 to 4 m
- Width of the river at road bridge is about 1000 m
- The river flows in a wide channel interspersed by sand bars and shoals

The river Simsang meanders its course from one bank to other with formation of lateral sand bars along the banks and at the centre of the river. The river Simsang descends down the South Garo hills and runs in a transition area between hilly terrain and plains from Siju to Bagmara. The Siju is located at about 32 km upstream of Baghmara. From Siju to Baghmara (32 km) the river runs in a valley bounded on either side by hills. The river almost enters into plains at Baghmara. The river carries considerable sediment load during monsoon season from the catchments area and deposit the silt near Baghmara where it enters into plains due to sudden slow down of the flow particularly during post monsoon period. Thus huge shoals and sand bars are formed and exposed during lean period in the river. The shoals and sand bars get submerge during monsoon flow.

Capital dredging is required to be carried out in the design channel followed by river conservancy measures to maintain the navigation channel in Simsang river particularly during lean period from January to April as per the recommendations of the Feasibility / DPR studies to be carried out.

The road bridge on river Simsang upstream of Baghmara has adequate horizontal and vertical clearances for navigation.

It is reported that the river in Bangladesh territory in Netrakona district runs in a almost similar terrain up to about 10 km downstream of the Indo-Bangladesh border. Further downstream the river is quite deep and navigable. From the Photograph it can be seen that the river runs in plains and has good fairway for navigation.

Export of coal

The land adjacent to the Simsang River and in and around areas has rich in coal mines and other mineral resources like lime stone and boulders as discussed above.

Details of Export of Coal

The details of export of coal from Land Custom Station at Baghmara and other nearby LCS viz. Dalu and Gasuapara are furnished below.

- The coal export is by trucks of 6 to 8 tons capacity
- The coal export is generally from November/December to May (7 to 8 months in a year)
- No coal production and export during rainy season from June to October
- Export price of the coal is US$ 51

- The shipment cost of coal by trucks is Rs 4,500 per truck from Siju to Banghmara (32 km), thus the average freight rate per ton per km is Rs 20/-. The shipment cost of coal from Jangkhre to Gasuapara (70 km) is Rs. 7,500/-, thus the freight rate per ton per km is Rs. 15/-.
- If the coal exporters have their own trucks, the shipment cost is Rs 500 per ton for a lead of 60 km, thus the freight cost becomes Rs 8 to Rs 9 per ton per km.
- Coal is dumped by trucks in Bangladesh territory within in 1 km from the border
- About 50 to 75 coal export companies export coal; M/S Good Luck Export Company is the largest and oldest exporter of coal from Gasuapara LCS. Other important coal exporters are – Axim Jalan Company, Dosi Tourism, J.C. Construction, Surekha etc
- The reserves of coal and limestone will lost for a minimum period of about 60 to 75 years

Coal Export / Import details at Baghmara LCS

- About 20 to 25 trucks of coal is transported per day from coal mines located in Masi Ghat, Ghoka and Siju along the Simsang River
- Considering an average truck load of 7 tons, about 140 tons of coal is exported per day and 4,200 tons per month and 29,400 tons in a season of 7 months (December to May)
- Actual export of coal during March, 2011 was 3,300 tons
- Besides coal, other raw materials exported are limestone and boulders
- **The imported coal is transported by barges in Bangladesh from the coal dumping grounds in Bangladesh territory to Durgapur (10 km from the border) and further on Simsang River**
- The import duty paid by Bangladesh Government is Taka 1100 (Rs 700/-) per ton
- The capacity of the barges plying on Simsang River on Bangladesh side vary between 10 and 15 tons each
- The coal is imported by Bangladesh using about 10 to 12 barges plying on Simsang River from coal dumping grounds in Bangladesh territory at Netrakona
- The road net work on the Bangladesh side at Baghmara LCS is poor and hence the coal export through this LCS is low
- Since the export / import of coal at Baghmara is low due to poor infrastructure, most of the coal from Siju mines is exported through Gasuapara LCS which is about 50 km away from Baghmara LCS along the border road
- About 80 to 90 trucks of coal from Siju coal mines are transported to Gasuapara LCS by M/s Good Luck exporters only due to poor transport infrastructure at Baghmara LCS
- **If the infrastructure is improved at Baghmara LCS, the entire coal from Siju coal belt need not be exported through Gasuapara LCS by traveling additional 50 km distance which results a saving of freight charges of about Rs 600 per ton @ Rs 12 per ton per km**

Coal Export / Import details at Gasuapara LCS

- About 200 trucks of coal is transported per day from coal mines
- Considering an average truck load of 7 tons, about 1400 tons of coal is exported per day and 42,000 tons per month and 2,94,000 tons in a season of 7 months (December to May)
- The road net work on the Bangladesh side at Gasuapara LCS is better and hence the coal export through this LCS is high
- Halwaghat is the coal unload point in Bangladesh. Further distribution of coal in Bangladesh side is by road net work

Coal Export details at Dalu LCS

- About 30 trucks of coal is transported per day from coal mines located in Chok Pot
- Considering an average truck load of 7 tons, about 210 tons of coal is exported per day and 6,300 tons per month and 44,100 tons in a season of 7 months (December to May)

7.7 KYNSHI / JADUKOTA RIVER

Kynshi River, also known as Jadukata, is one of the important rivers in Meghalaya (**Fig. 7.4**). This 143 km long river irrigates over 2000 sq km of area. The main tributaries of Kynshi are Umrilang (60 km long) and Um-mawblei (71 km long). Kynshi River is known as Kynshiang at the confluence with Umkyrtha.

Nongkhnum Island, the biggest river island in Meghalaya, has been formed by the bifurcation of the Kynshi River into two rivers namely- Phanliang River and Namliang River. At the point of bifurcation, there is a charming sandy beach called Wei-Phanliang, about 100 sq m in area. Kynshi is an important river for angling.

Kynshi flows towards the southern part of the West Khasi Hills of Meghalaya. Finally, this river flow further south into Bangladesh.

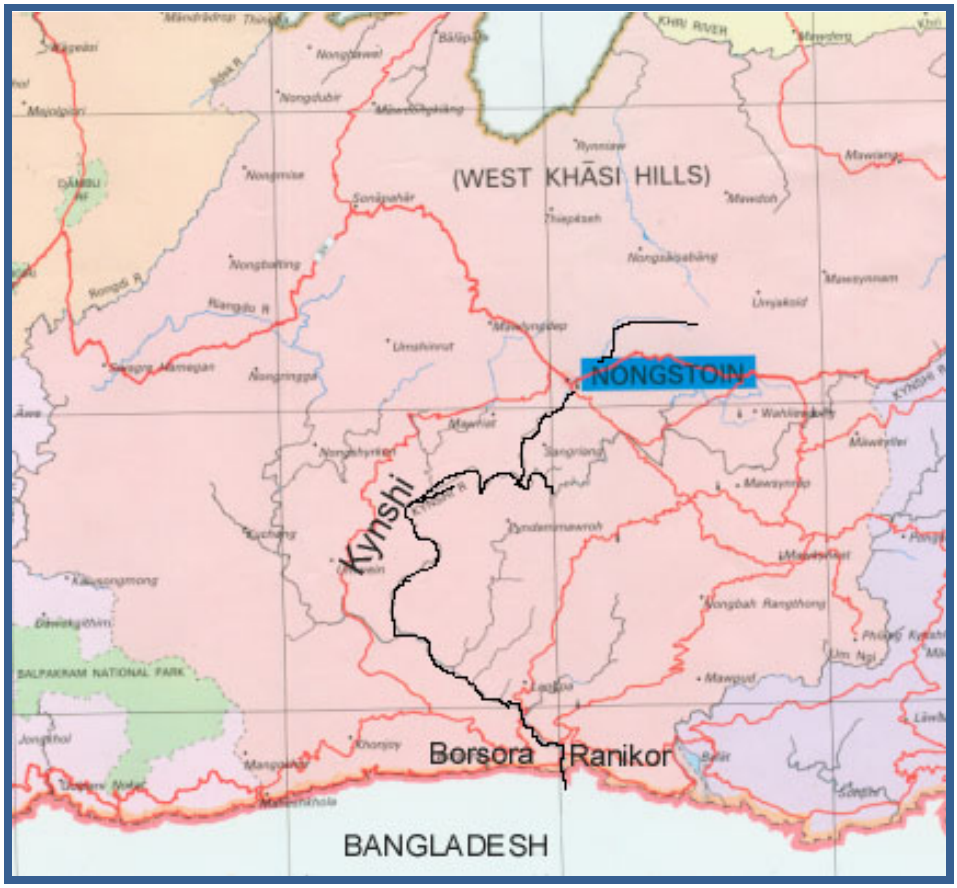


Fig. 7.4: Kynshi River

7.7.1 Navigability of Kynshi River

A site visit was undertaken to Ranikor village located on the banks of Kynshi River to assess the navigability of the river based on first hand information obtained through local enquiries. Ranikor is located on the left bank of river Kynshi at about 4 km upstream of Indo-Bangladesh border. There is a Land Custom Station (LCS) at Borsora. Borsora is located on the opposite bank of Ranikor i.e., on the right bank of river Kynshi. Coal and other minerals are exported to Bangladesh through Borsora LCS.

The salient features of the river Kynshi at Ranikor based on site visit and local enquires are as follows:

- Width of the river at Ranikor is about 300 to 400 m
- Depth of the river is about 15 m
- Water level variation from lean season to flood season is about 5 to 6 m
- Expected depths during flood season from June to October are around 20 m
- Width of the river at road bridge is about 150 m
- The river flows in a gorge with deeper depths

.

The coal is transported from Nongstoin coal mines by trucks and dump in Bangladesh territory within 1 km from the border along the banks of river Kynshi at Borsora LCS. From there the coal is loaded into 10 to 15 tons barges and transported on river Kynshi into Bangladesh territory.

Coal Export / Import details at Borsora LCS

- About 150 trucks of coal is transported per day from coal mines located in Nongstoin – Mawet region
- Considering an average truck load of 7 tons, about 1050 tons of coal is exported per day and 31,500 tons per month and 2,20,500 tons in a season of 7 months (December to May)
- Besides coal, other raw materials exported are limestone and boulders
- **The imported coal is transported by both trucks and barges in Bangladesh from the coal dumping grounds in Bangladesh territory at Borsora LCS on Kynshi River**
- The capacity of the barges plying on Kynshi River on Bangladesh side vary between 10 and 15 tons each
- During monsoon season when the water levels are high, Bangladesh imports coal and other minerals on Kynshi river using 500 tons barges.
- The Kynshi river in Bangladesh side is navigable even for higher draft vessels even up to Dhaka and beyond. The distance between Borsora (India-Bangladesh border) to Dhaka is about 400 km. The shipment cost for transportation of coal and other minerals is Taka 400 for a lead of 400 km from Borsora to Dhaka. Thus the transport cost by IWT mode using large capacity vessel of 500 tons would be about 65 paise (Rs 0.65) per ton per km. In case smaller capacity vessels of 10 to 15 tons are used, the transport cost may be around Rs. 5 per ton per km.

7.8 UMNGOT RIVER

Umngot River is a major south-flowing river originating from the eastern part of the Shillong Peak near a village called Smit in East Khasi Hills of Meghalaya. Starting from an altitude of about 1,800 m above sea level, it forms the boundary between East Khasi Hills District and Jaintia Hills District and emerges through a gorge at Shnongpden (**Fig. 7.5**). This 82 km long river irrigates (including its tributaries) over 800 sq km and is famous for angling.

Umngot continues in its less turbulent form to flow by the fine gorge near Dawki and finally enters into the plains of Bangladesh. Dawki Bridge, the motorable suspension bridge built across Umngot, forms the link of National Highway 40 (Guwahati-Shillong-Dawki Road).

Fig. 7.5: Umngot River

7.8.1 Navigability of Umngot River

A site visit was undertaken to Dawki village located on the banks of Umngot River to assess the navigability of the river based on first hand information obtained through local enquiries. Dawki is located on the left bank of river Umngot and the river is a boundary between India and Bangladesh for about 4 to 5 km. There is a Land Custom Station (LCS) at Dawki. Coal and other minerals are exported to Bangladesh through Dawki LCS.

The salient features of the river Umngot at Dawki based on site visit and local enquires are as follows:

- Width of the river at Dwaki is about 2000 m
- Depth of the river is about 0.5 m
- Water level variation from lean season to flood season is about 8 m
- Width of the river at suspension road bridge is about 150 m

- The river up to suspension bridge flows in a gorge and the depth is about 10 m
- The river upstream of road bridge is navigable only up to 2 to 3 km; beyond this point, the river bed is with rapids, boulders and rock out crops

The Bangladesh also transports the imported coal only by trucks. The coal comes from Jaintia Hills and directly enters into Bangladesh through Dawki LCS and also further transported by trucks in Bangladesh.

The export details of coal and other minerals at Dawki LCS are as follows:

Export of Minerals	Quantity in tons	
	2009-10	2010-11
Coal	2,81,073	42,810
Limestone	40,000	87,353
Boulders	87	2930

The sale price of minerals is as follows:

- Coal is US$ 50
- Limestone is US$ 8
- boulders is US$ 6

Actual Export of minerals from various LCSs is furnished below:

Land Custom Station	**Coal (Tons)**		**Limestone (Tons)**	
	2009-10	2010-2011 (April – January)	2009-10	2010-2011 (April – January)
Dawki	3,07,421	2,56,348	84,689	1,94,260
Borsora	1,22,297	1,68,878		
Cherragoan	1,00,027			
Gasuapara	3,24,411	1,55,750		
Shella			17,90,045	38,553

7.9 JINGIRAM RIVER

It originates from the Derek village. Upot Lake is the origin of its major tributary. It moves eastwards, through the Goalpara border and the Goalpara district. Jinjiram is the longest river of the two districts of the Garo Hills.

Jingiram, a tributary of the Brahmaputra, formed the natural boundary between Meghalaya's West Garo Hills and Assam's Dhubri districts **Fig. 7.6**. The river has drifted about 400 m southwards in to Meghalaya over a period of 40 years

Navigability of Jingiram River

A site visit was undertaken to Phulbari village located on the banks of Jingiram River to assess the navigability of the river based on first hand information obtained through local enquiries. Phulbari is located on the right bank of river Jingiram at about 1 to 1.5 km upstream of Brahmaputra confluence point.

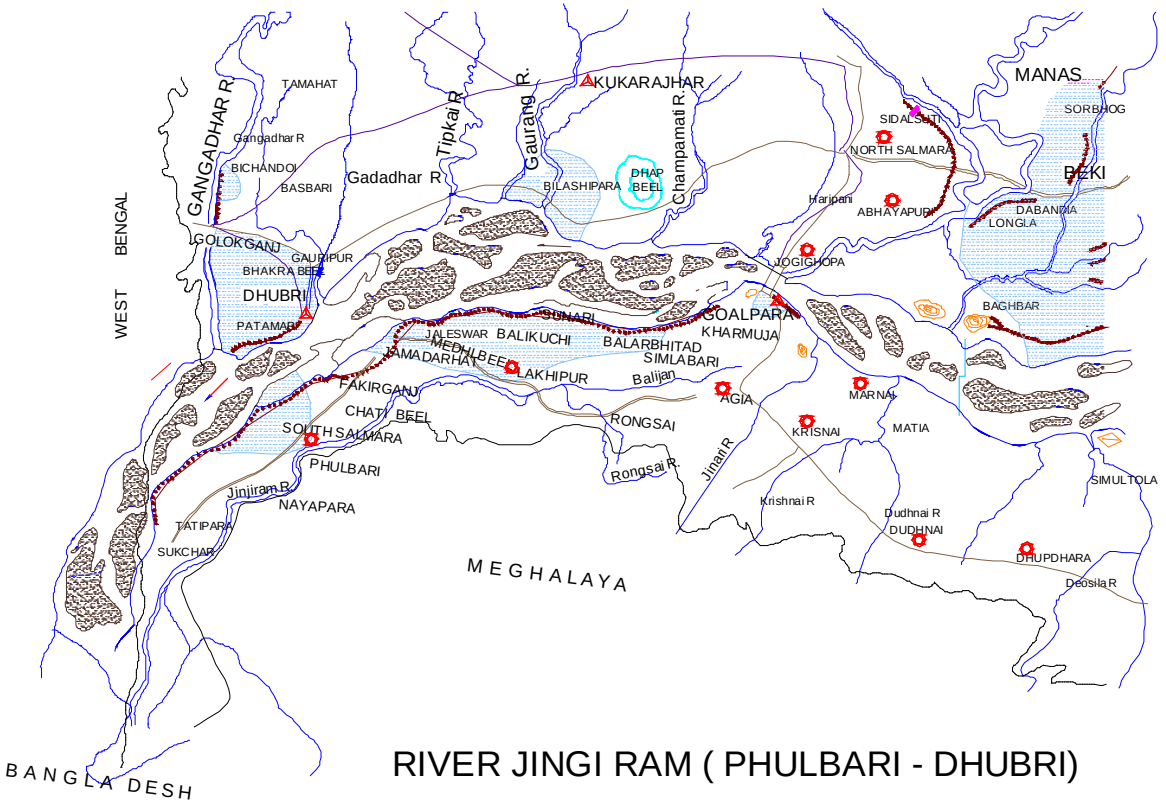
The salient features of the river Jingiram at Phulbari based on site visit and local enquires are as follows:

- Width of the river at Phulbari Ghat is about 300 to 400 m
- Depth of the river is about 10 m
- Water level variation from lean season to flood season is about 3 to 4 m
- The Phulbari Ghat is used as a terminal for loading and unloading of cargo / passengers due to availability of natural depths in the river at this location and proper road approaches to trucks
- The river down stream of Phulbari Ghat up to Brahmaputra confluence is shallow and choked with sand bars and shoals and hence navigation problems are encountered by boats particularly during lean period
- Expected depths during flood season from June to October are raised by about 3 to 4 m.

Export / Import details at Phulbari Ghat

- The Phulbari Ghat is the transport hub for export and import of goods from Dhubri in Assam to Meghalaya
- All the domestic consumable goods for the entire West Garo Hill districts of Meghalaya up to Tura are imported from Dhubri and hence Phulbari Ghat plays as a vital role for transportation of goods and passengers

FIG. 7.6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BASBARI
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Tipkai R
Gaurang R.
KUKARAJHAR
Champamati R.
BILASHIPARA
DHAP BEEL
MANAS
SORBHOG
SIDALSHTI
NORTH SALMARA
BEKI
Haripani
ABHAYAPURI
DABANDIA
LONGLA
GOLOKGANJ
GAURIPUR
BHAKRA BEEL
DHUBRI
PATAMARI
JOGIGHOPA
GOALPARA
BAGHBAR
SUNARI
JALESWAR
BALIKUCHI
BALARBHITAD
KHARMUJA
MEDHLBEEL
SIMLABARI
JAMADARHAT
LAKHIPUR
Balijan
AGIA
MARNAI
FAKIRGANJ
CHATI BEEL
KRISNAI
MATIA
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SOUTH SALMARA
PHULBARI
Rongsai R.
Jinari R
SIMULTOLA
Jinjiram R.
NAYAPARA
Krishnai R
Dudhnai R
DUDHNAI
TATIPARA
SUKCHAR
DHUPDHARA
Deosila R
MEGHALAYA
WEST BENGAL
BANGLA DESH
RIVER JINGI RAM (PHULBARI - DHUBRI)

- Every day at 8 am one passenger ferry service is operated from Phulbari to Dhubri with a carrying capacity of 300 passengers and the same ferry returns by evening
- The charges for passenger by ferry is Rs. 13/-; Otherwise the passengers have to reach Dhubri via Goalpara bridge on river Brahmaputra which cost about Rs 80/- in a round about route consuming time as well
- Dhubri is located on the right bank of river Brahmaputra across the confluence point of Jingiram at about 20 km distance
- The major goods exported from Meghalaya through Phulbari Ghat are Cashew, Ginger, Spices, Pine apples and other fruits, Brooms, Bamboo products etc
- Boulders are exported to Bangladesh from Phulbari Ghat and imported cargo from Bangladesh are cement, bricks, mosquito nets etc as return cargo
- About 10 trips are made by the barges in a day for export and import of goods at Phulbari terminal
- Round the year ferry service is operated
- Considering an average barge load of 9 tons and 10 trips a day, about 90 tons of goods are exported from Phulbari and 90 tons of goods are imported from Dhubri per day and 5,400 tons per month and 64,000 tons in a year
- About 20,000 tons of boulder are exported to Bangladesh from Phulbari terminal and the same barges will import about 20,000 tons of bricks, cement and mosquito nets etc from Bangladesh as return cargo

8.0 WATERWAYS IN TRIPURA

The potential waterways (Fig. 4.1) in Tripura are:

- River Gumti
- River Hoara

It is reported that Inland Waterways Authority of India had carried out detailed hydrographic surveys on rivers Gumti and Hoara.

8.1 River Gumti

The catchment area of Gumti River with in the Indian Union is 2492 Sq km and it is the largest sub basin among the rivers in Tripura. It is surrounded by Bangladesh on its east and west. It originates from the hill ranges connecting Atharamura & Longtharai on the north-east boundary of South Tripura district and flows down through Sonamura sub division across the Bangladesh border to out fall into the river Meghna. The total length of the river is about 167 km. A view of river Gumti at Udaipur is shown in Fig.8.1. Maximum discharge observed at Sonamura was 992 cumec and the minimum discharge is only 2 cumec. The width of the river varies from 50 m to 150 m and depth available is about more than 2 m except at few places. At present the river is navigable for 6-7 months in a year only in the lower reach by country boats. A barrage for Gumti medium irrigation project was constructed across river Gumti at Maharani.

8.2 River Hoara

Hoara is a small river having length of 46 km with in the state of Tripura from its source at Barmura hill range to Indo- Bangladesh border. Its catchment area is 488 Sq km in the Indian territory. After flowing through the Indian Territory the river crosses Bangladesh border near Agartala town and falls into river Titash. A view of river Hoara at Agartala can be seen in Fig. 8.2. The river is over flooded during high spate in summer season while during winter the depth is very low. The maximum and minimum discharge observed at Bordowali GD site was 233.5 cumec and 0.435 cumec respectively. The depth in this river varies between 0.3 and 1.5 m and width 25-80 m.

Fig. 8.1: A View of river Gumti at Udaipur

Fig. 8.2: River Hoara at Agartala

9.0 WATERWAYS IN NAGALAND

The potential waterways (Fig. 4.1) in Nagaland are:

- River Tizu
- River Dhansiri and
- River Dikhu

9.1 River Tizu

Tizu river of Nagaland flows into Myanmar, draining an area of about 5500 km^2 in Nagaland. It originates near Longkhim (2253m) Tuensang district, and flows for about 115 km and joins Lanyie – Thetsiru River. It flows another 35 km north- easterly upto Longmatratizu River and joins Chindwin river near Myingan Town in Myanmar.

The river Tizu after crossing Nagaland border in India enters into Myanmar. In Myanmar the river joins with Chindwin – Airwady river system. The river serves as international waterway since the waterway link in Myanmar has lot of IWT potential.

The catchment area of river Tizu is of about 9625 km^2 falls within Kiphire, Phek and Zunheboto districts of Nagaland and Ukhrul district of Manipur. It is the second largest and longest rivers of Nagaland roughly covers one – third area of the state and is located within the innermost high mountain range bordering Myanmar. It is situated at Latitude $25^0 30'$ N to $25^0 50'$ N and Longitude $94^0 45'$ E to $94^0 55'$ E.

The Least Available Depth (LAD) of Tizu river from Longmatra to Avangkhu (India) to Tamanthi (Myanmar) running 112 km length varies from 1.0 to 10.0m with a width about 30 to 115 m. As per existing LAD, A CLASS-1 type inland waterway can be developed and a medium size vessel can easily navigate throughout the season. Larger vessels can move during monsoon period only.

It is understood that the State Government has already enrusted the job of conducting feasibility study / DPR study on river Tizu to a local firm.

9.2 Dhansiri River:

The river Dhansiri passes through the heart of Dimapur. A view of river Dhansiri at Dimapur bridge can be seen in Fig. 9.1. This river can be taken up as potential waterway from Samjuran (Nagaland) to Numuligarh (Assam). The traffic originates from Samjuran, Dimapur in Nagaland will move by IWT on this river and reach Brahmaputra River via Numuligarh. The command area of this river is having best quality of sand, granite, bamboo, boulders, cattles, and cement to export to other states through Brahmaputra River. River width varies from 30-40 m to about 150m in different locations. This river is navigable for 10-15 tonne vessel in monsoon period only. Dredging may be required in some areas to get adequate depth. The riverine length from Samjuran to Dimapur is of about 75 km and from Dimapur to Numuligarh is of about 35 km.

Fig. 9.1: River Dhansiri at Dimapur

9.3 Dikhu River:

Dikhu is also an interstate river which flows through Nagaland and meets Brahmaputra in Assam. The river in Assam is known as Dikhow. The reach between Yangnyu and Naginimara (approx 52 km) In Nagaland can be taken up as potential waterway to link Naganimura to Brahmaputra confluence via Sibsagar. The command area in Nagaland is full of minerals like coal, building stones; building materials, bamboos, timber etc. This river is well connected by road. This river is navigable during monsoon for 10 tonne vessel only.

10.0 WATERWAYS IN MANIPUR

The Manipur State has two river basins namely the Barak river basin and the Manipur river basin. The Barak River originates from the hills of the northern part of the state. It does not enter the Manipur valley. However it flows for some distance towards south and runs northwest and thereafter towards south through the hills of the Tamenglong district. The Manipur River arises in the north at Karong. It flows southwards of Imphal and is known as Imphal River. Along its course through the valley, downstream of Imphal, the riverbed of Manipur River slopes very gently. The river has been regulated by two barrages for irrigation and hydropower. The Imphal Barrage downstream of Lilong regulates the flow for irrigation purposes while the second barrage at Ithai, diverts the river flow into the Loktak Lake for lift irrigation and hydropower project.

10.1 WATERWAY ROUTES IN THE LOKATAK LAKE

Loktak Lake is situated 38 km south of Imphal city, the capital of Manipur State. The lake covers an area of about 286 sq. km at the elevation of 768.5 m located between longitudes 93^0 46' & 93^0 55' E and latitudes 24^0 25' & 24^0 42' N. Water level is shallow, the depth of which during dry season ranges between 0.5 m to 1.5 m. The total water spread area of about 490 sq km. Main water body of the lake is surrounded by shallow water which stagnates over a marsh/swamp land.

Loktak Lake is the largest wetland in the North-Eastern region of India and has been referred as the lifeline of the people of Manipur due to its importance in the socioeconomic and cultural life. It plays an important role in the ecological and economic security of the region. The Lake has been the source of water for generation of hydroelectric power, irrigation and water supply. A large population living around the lake depends upon the lake for their daily transportation from one place to the other.

A number of streams originate from the hill ranges immediately to the west of the lake and these streams flow directly into Loktak Lake. Loktak lake is also fed by the Manipur river as shonw in Fig. 10.1.

The river has been regulated by two barrages for irrigation and hydropower. The Imphal Barrage downstream of Lilong regulates the flow for irrigation purposes while the second barrage at Ithai, diverts the river flow into the Loktak Lake for lift irrigation and hydropower project.

The Loktak Development Authority (LDA), Manipur has prepared a DPR for development of Loktak Inland Water Transport for providing IWT in three designated routes connecting economically important villages / islands and having lack of basic transport system as listed below under Centrally Sponsored Scheme (CSS).

i) Connecting Toupokpi village (Ningthoukhong and Khordak village via Karang, Thanga islands and Komlakhong village): Total distance – 16.5 km

ii) Connecting Toupokpi village (Ningthoukhong and Mayang Imphal via via Karang island): Total distance – 11.75 km

iii) Connecting Thanga island and Mayang Imphal via via Karang island: Total distance – 11.45 km

The Manipur government also desires to conduct DPR studies on the following ferry services on Loktak lake during second phase. A typical ferry point at Loktak lake to reach Karang island can be seen in Fig. 10.2

(i) From Takmu to Sendra: For promotion of torurism
(ii) Toupoki to Sendra via., Ninghoukhon
(iii) Sendra to Komlakhong via., Thanga
(iv) Komlakhong to Phaibakcho via., Karang island
(v) Phaibakcho to Mayang to Imphal via., Karang island
(vi) Mayang to Imphal to Toupokpi via., Ningthoukhong

10.2 River Barak

The Barak river is the biggest and longest river in the state of Manipur with a total length of approximately 300 kms, it also covers two neighbouring states of Assam and Mizoram (**Fig 4.1**). In Manipur from where the river originates its course run primarily through hill areas and dense forests and can contribute much to the socio-economic development.

There are over 100 villages located on the banks of the river and another 50 villages in the hinterland within 1 to 2 km distance. The total population is approximately 14-15 thousands all comprising of schedule tribes. Besides, the river also covers Assam and Mizoram and directly populated with 4000 and 2000 inhabitants (approx).

There is a proposal to construct multipurpose dam on river Barak at Tipaimukh in Manipur. The down stream of the river reach from Tipaimukh to Karimganj has already been considered for DPR study by IWAI. The Barak river reach in the upstream of Tipaimukh up to NH 53 crossing at Nungba (60 km) has also potential to develop river navigation in Manipur. A view of the river Barak at Nungba can be seen in Fig. 10.3. The river is navigable round the year with 10 tons vessel during lean period and 50 tons vessels during flood period.

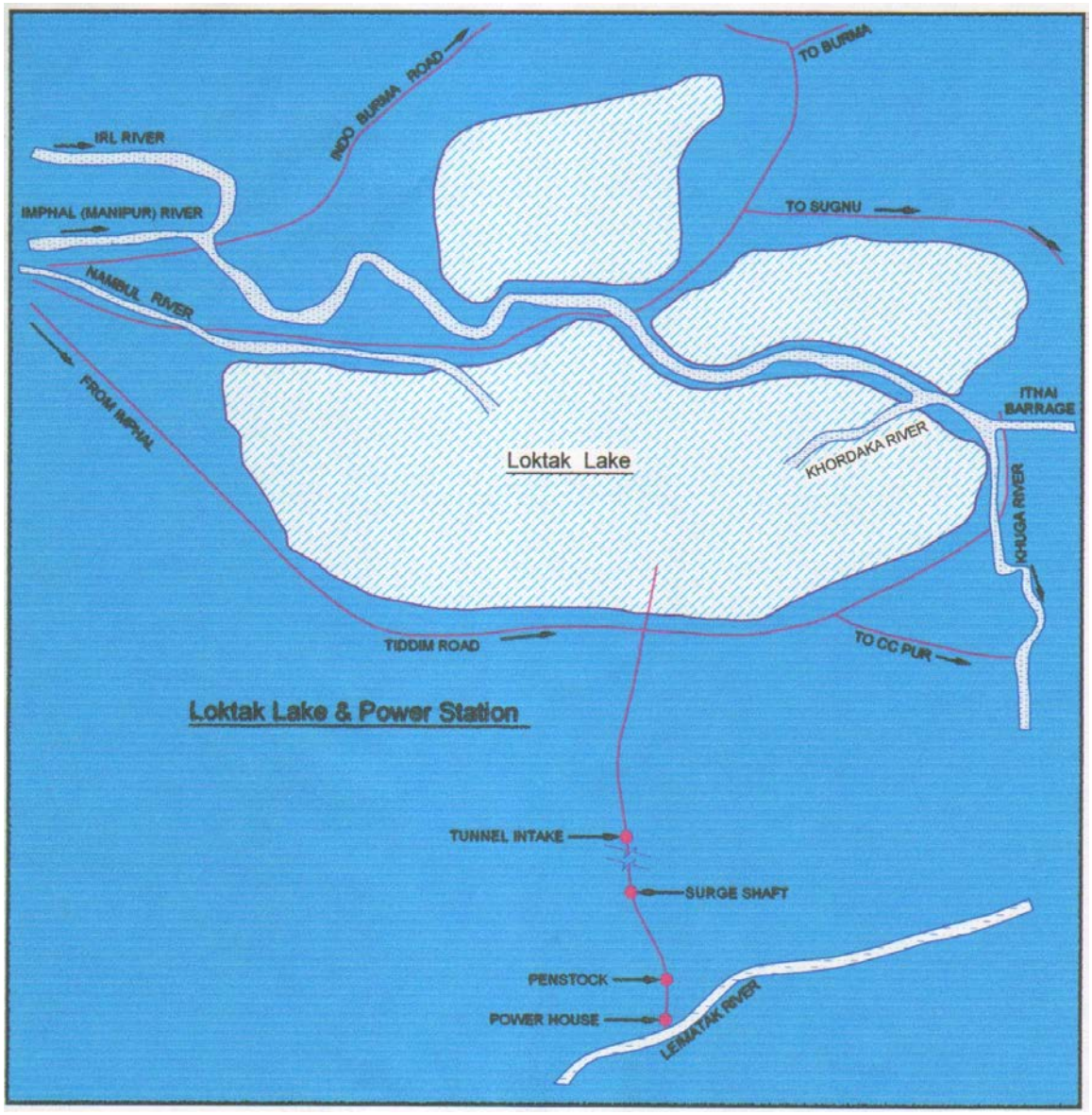

Fig.10.1: Loktak lake in Manipur
(Source: Downed loaded from web site)

Fig. 10.2 : Ferry point at Loktak lake – Karang Island

Fig. 10.3: A view of river Barak near Nungba town

11.0 WATERWAYS IN SIKKIM

11.1 TEESTA RIVER

One of the rivers that almost flow right across the length of Sikkim is the Teesta**.** It's major tributary is the Rangeet which originates from the Rathong Glacier, meets it at the border between Sikkim and West Bengal (11.1). Teesta originates from the Cholamu lake.

Fig. 11.1: Teesta and Rangeet rivers

During monsoons the otherwise innocuous looking rivers of Sikkim become swollen, swift, muddy and dangerous. The rivers are narrow, serpentine and full of rocks and hence are not navigable. The river Teesta with rocky river bed can be seen in Fig. 11.2. Because of swift currents hitting rocks, the rivers are very noisy and can be heard for miles together. The Teesta finally joins the Bhramaputra in Bangladesh.

Fig.11.2: Rocky river bed of River Teesta

The rivers are fed by snow melting on the mountains as well as rain that accumulates in the catchment areas during the monsoons. Human settlements usually must exist above the level of rivers and hence even if flooding takes place life and property remain safe.

Through its course, the Teesta river has carved out ravines and gorges in Sikkim meandering through the hills with the hill station of Kalimpong lying just off the river. Variegated vegetation can be seen along this route. At lower elevations, tropical deciduous trees and shrubs cover the surrounding hills; alpine vegetation is seen at the upper altitudes. The river is flanked by white sand which is used by the construction industry in the region. Large boulders in and around the waters make it ideal for rafting enthusiasts.

11.2 RANGEET RIVER

Rangeet or Rangit is a tributary of the Teesta river (Fig. 11.1). The Rangeet river originates in the Himalayan mountains in West Sikkim district. A perennial river, it is fed

by the melting snow of the Himalayas in early summer and the monsoon rains in July-August. It is popular among rafting enthusiasts owing to its turbulent waters. The river flows past the towns of Jorethang, Pelling and Legship. During its final few kilometres, it forms the boundary between West Bengal (Darjeeling District) and Sikkim. The tortuous river joins the Teesta river at Teesta Bazaar on the border of West Bengal and Sikkim. The river bed is with bolders and rock out crops. The confluence point of river Teesta with Rengit river can be seen in Fig. 11. 3. Like Teesta, the river Rangit also not navigable. The Rangeet river has a NHPC hydel power plant of 60 MW capacity in Sikkim.

Fig. 11.3: Confluence of rivers Teesta and Rangeet

12.0 ADDRESSES FOR CORRESPONDANCE

The telephone numbers / fax and other details of communication collected from various IWT cells of North East India states during the site visits for the purpose of further correspondence are furnished below:

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2	Mr. T.V. Fambawl, M.C.S. Secretary (Transport)	0389 2324512 (O) M: 9436142334		
3	Mr. Lal Chungnunga, Dy. Commissioner (STA), Ramhlun North, Department of Transport, Government of Mizoram, Aizawl - 796001	0389 2306078 (O) M: 9436151659	0389 2306091	zoramtpt@nic.in
4	Mr. Zothankhumi, M.S.S. Dy. Secretary Mission Veng	0389 2300307 M: 9436354521		
5	Mr. K. Lairozama, M.S.S. Under Secretary Zema Bawk	0389 2300307 (O) M: 9436154577		
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2	Mr. Siddharth Singh, I.A.S. Joint Secretary, Transport	M: 9435545275		
3	Ms Jolly Das Brahma, Director, IWT Assam	M: 9435012149	0361 2526421	
4	Ratul Chandra Sarma Secretary, Water Resources	M: 9435063829		
5	Dilip Kumar Bhuyan, Chief Engineer, Water Resources Department	0361 2666030 (O) M: 9435057340		

6	Mr. Biman Bordoloi Superintending Engineer, Water Resources Department	M: 9864188240		
7	Jayanta Goswami, Director (Design), Water Resources Department	M: 9435047863		
8	Mr. Navin Kumar, General Manager, Brahmaputra Board, Basistha, Guwahati – 781 029	0361 2302527 (O) M: 9435146916		Bbrd-ghy@sify.com
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	Mr. N.D. Rai, Chief Engineer, Transport Department, Government of Sikkim	03592 270940 (O) M: 9933090000		endeerai@gmail.com
	Mr. Uttam Pradhan, Additional General Manager, Transport Department	03592 202774 (O) 9434109784		
	Mr. SN Sherpa, Dy. Director, Transport Department	9647859719		
	Government of Meghalaya			
	Mr. H.M. Shangpliang, MCS Commissioner of Transport, Government of Meghalaya, Shillong	0364 2232779 (O) M: 9863021317		Hmshang_44@yahoo.co.in
	Government of Manipur			
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	Government of Arunachal Pradesh			
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	Mr. T.Kaye, APCS,Director (Transport), Government of Arunachal Pradesh, Itanagar	M-09436227700		
	Mr. Toli Basar,Chief Engineer,Easrern Zone (Zone –I), Itanagar	M-06436257734		
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	Mr N.Hangsing, Secretary, Transport Department, Nagaland State Transport, Kohima, Nagaland	0370-227-0008 (O) 09436011300(M)	0370-227-0008 (telefax)	
	Mr P. Angamy, General Manager, Office of the General Manager, Nagaland State Transport, Dimapur, Nagaland, Pin - 797112	03862-248-317 (O) 09436002216 (M)	03862-248-304	
	Mr T. Vero, Deputy Transport Commissioner, Transport Department, Nagaland State Transport, Kohima, Nagaland	09436819752 (M)		
	Mr Akuto, Executive Engineer, Office of the General Manager, Nagaland State Transport, Dimapur, Nagaland, Pin - 797112	03862-229-440 (O) 09436002400 (M)		
	Government of Tripura			
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	Mrs Durba Ganguly, Executive Engineer, Resource Division, Panchamukh, P.O. Bandhaghata, Agartala, Tripura West, Pin 799001	09436130935 (M)		
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