8 INFRASTRUCTURE, PUBLIC UTILITIES & SERVICES

Infrastructure is the key determinant to the community which decide the functions towards their socio-economic development of the city. Facilision of sustainable development the physical and social infrastructure are very much essential. Physical and social Infrastructure is the basic requirement which decides the quality of urban and rural life & overall productivity of the people. This chapter deals with the analysis of existing conditions of physical infrastructure such as Water Supply, Sewerage System, Solid Waste Management and Power as well as social infrastructure viz., Health and Educational facilities. Based on the analysis and clear understanding of existing scenario, future predicted the physical and social infrastructure for the projected year 2045.

In the formulation of infrastructure plan, attention was given to the followings.

Emergency task is to directly respond to the basic needs of physical and social infrastructure both for the present communities and new settlement of the returnees.

Needs survey at the community level is a fundamental study for preparation of urgent rehabilitation and development programs for basic physical and social infrastructure. The plan is to be prepared as practicable and flexible one by staging the needs and level of services of basic infrastructure.

Institutional strengthening and capacity building will be carried out through actual planning and construction of the basic infrastructure, at the community, state government and Ground Operational Support System (GOSS) level.

Solid Waste Management Plant, Lekai Gaon, Dibrugarh

8.1 PHYSICAL INFRASTRUCTURE

Infrastructure is the basic physical structures needed for the operation of a society for an economy to function and physical networks that support society.Socio- economic growth of a town/city and the physical Infrastructure development in the town.Urban physical infrastructure (UPI) is one of the major assets of a city in terms of capital investment, critical services provisioning, and sustainable and resilient urban development. UPI includes physical objects like roads, sewerage, energy networks. Various data regarding details about amount of water supply, Hours of Supply, number of bore wells, details of sewerage system viz. capacity of STPs and details of drainage etc. have been procured from Public Health Division of PWD, Dibrugarh.

Dibrugarh Master Plan Area has the population of 3,61,397(Census, 2011) and the population is projected to increase up to 551757 for the horizon year 2045. Therefore, in order to meet the future demand, calculation of the same for various sectors is necessary and the same is dealt with in this chapter.

8.1.1 WATER SUPPLY

Urban water supply infrastructure has often been designed with a focus on treatment and distribution and with only minimal consideration of source water characteristics. Sustainable urban water supply systems must link more closely with the natural water systems in which they are located. one of the important and essential resource of Water for the development any Region, saunter supply of the suffice the domestic, industrial and irrigation requirements within the planning area. Presently the planning area is influential on both part of ground and surface water sources to address the water requirements of the area. Due to the non-contiguous geomorphic nature of the planning area and for better management water supply within the planning area is divided into two, urban area and rural area.

8.1.1.1 Water Supply Scenario in Urban Area

water supply is one of the important infrastructure services for a city/town and a proper supply of water for its population ensures the city have strong basic infrastructure.

Presently, city does not have any performing water supply system, hence no household have piped drinking water connection. Under Central Government's AMRUT Scheme, water supply project is proposed withinf Dibrugarh Municipal Board area. The project details are as mentioned below in table 190.

8.1.1.2 Water supply scenario in rural areas

The water supply in rural areas within the planning area is managed by the Rural Water Supply System department. There is no provision of safe drinking water supply through pipelines and majority of the rural population is depending on various ground water sources. High percentages of population are depending on open or dug wells for water apart from community tube wells. There is no guarantee on the quality of these waters as the routine monitoring is rarely done. Further, proximity to safe drinking water sources is steadily decreasing towards rural areas, suggesting the need for providing more 'closer accesses'.

8.1.1.3 Ground Water Scenerio

Hydrogeology: Unconsolidated alluvial deposits of Quaternary Age covers major part of the region. Only about 4 % area of the region is underlain by semi consolidated formation of Tertiary Age belongs to Disang and Barail Groups of rock. A single system of aquifer (granular zone) below a thin clay cover on top is present mainly in the southern part. In the northern part, this single aquifer system is separated into a multiple aquifer system by thick clay partings. Thickness of aquifer increases from east to west.Ground water in the shallow aquifer group exists in unconfined to semi confined condition. In general depth of tube wells varies from 35 to 45 m. The tube wells constructed down to a depth of 50 m yields 27 to 45 m3/hour. Pre-monsoon depth to water level ranges from 0.16 to 4.23 m bgl. It is observed that Pre-monsoon depth to water level ranges from 2 to 4 m bgl in the southern part of the region and in a limited area in the northern part of the region.

8.1.1.4 Ground Water Quality:

Chemically, the water to be used for domestic purpose should preferably be soft, low in dissolved solids and free from poisonous constituents. Ground water of the region is colorless, odor-less and free from turbidity. Presence of TDS within 150 to 1000 ppm, SAR within 0.30 to 1.97, RSC value within 0.01 to 1.01 meq /lt and Fe content in most part of the district is below 5 ppm in ground water. But, towards Tengakhat area, concentration of iron is found more than permissible limit for drinking purpose. Moreover, goiter has been reported in some of the villages like Kalakhowa, Lejai and Sessa area which is due to deficiency of iodine in ground water. Thus, in general, the area is safe in all respect for utilizing of ground water. *(Source: Central Ground Water Board, Ministry of Water Resource)*

8.1.1.5 Area Traverse by Major River

Brahmaputra River: Flowing in the extreme North (flowing from NE to SW)

Sessa River: Flowing through the central part of the Borbaruah, flowing from NE to SW

Burhi Dihing River: Flowing in the southern boundary of the block, flowing from NE to SW

Mai Jan River: Flowing in the northern part of the Lahoal (flowing from East to West) Dibru River: Flowing from NE to SW and meets with Brahmaputra River in the West.

Table 160 Proposed Water supply scheme details at Dibrugarh MB Area

Sl. No.	Parameters	Details
1	RAW water	5.164km
2	Clear water	28.567km
3	water sources	Surface Water
4	Quantity of water supplied	48.2MLD
5	Sources of water supply	Brahmaputra river
6	Length of Distribution Network	224.14Km
7	Domestic House service connections	25691 nos.
8	Other Connections	300 nos. 15mm dia. multi-jet type AMR domestic water meter
9	Daily Duration	21Hours
10	No. of Connections metered	25691nos. 15mm dia. multi-jet type non AMR domestic water meter
11	Quantity treated (MLD)	40.6MLD

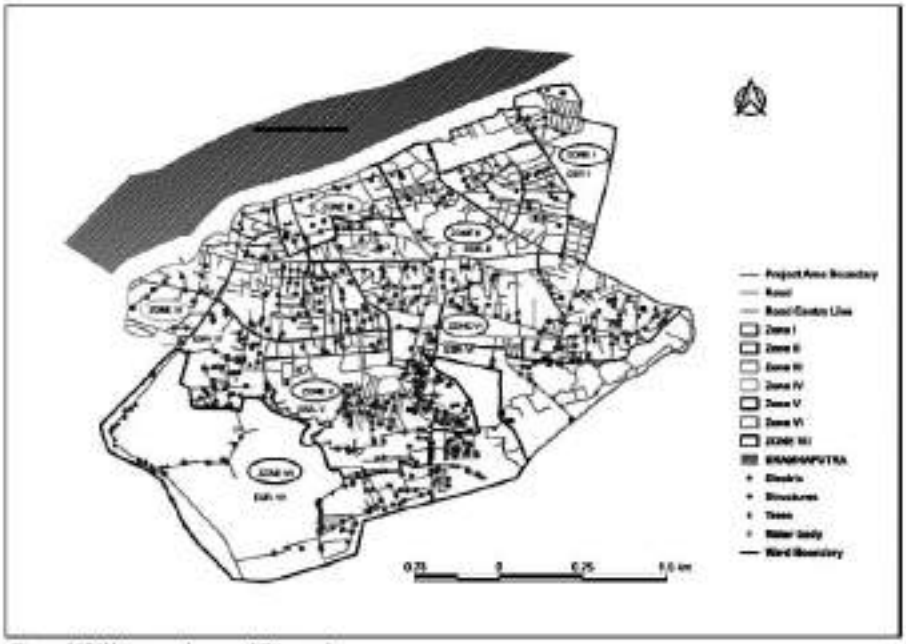


Figure 152 Water supply map of Dibrugarh

The map showing the boundary of the area covered by PWD for water supply is given in the next figure. Total water supplied quantities is 48.2 MLD and the main source of the water supply is Brahmaputra river. In here, domestic house service connections are 25691 nos and other connections are 300 nos.

8.1.1.6 Calculation of Future Demand Projections

In order to calculate the demand for a projected year, it has to be calculated for certain stages as per CPHEEO Manual. The four stages are mentioned below:

1. Intermediate Stage (20 years from the base year) - 2031
2. Ultimate stage demand (35 years from the base year) - 2045

The water supply demand should include the fire demand, institutional demand etc. as per the CPHEEO guideline. In order to calculate the demand, it is essential to calculate the projected population for the defined stages. The domestic water supply demand is taken as 135 lpcd. The Projected population considered for this project is as under

Table 191 Water Demand assessment for Water Supply Source & Rehabilitation System

Sl. No	Particular	Popu lation	Amount of Water supply (lpcd)	Total demand in MLD	Popu lation	Amount of Water supply (lpcd)	Total demand in MLD
	Year		**2011**			**2021**	
1	Demand for existing population	361397	135	48.79	417572	135	56.37
2	Fire Demand 100*((population)/1000^1/2)/1000			1.9			2.04
3	Unaccounted Water (15%)			7.6			8.76
4	**Total Demand**			**58.29**			**67.17**
Sl. No	**Particular**	**Popu lation**	**Amount of Water supply (lpcd)**	**Total demand in MLD**	**Popu lation**	**Amount of Water supply (lpcd)**	**Total demand in MLD**
	Year		**2031**			**2045**	
1	Demand for existing population	470719	135	63.55	551757	135	74.49
2	Fire Demand 100*((population)/1000^1/2)/1000			2.17			2.35
3	Unaccounted Water (15%)			9.86			11.53
4	**Total Demand**			**75.58**			**88.37**

8.1.1.7 Summary of Water Demand

Table 192 Summary of Water Demand for 2045

Sr. No.	Particulars	Particulars Demand for 2045
1	Total Projected Population for MPA	551757
2	Water Demand @ 135 lpcd for planning area in 2045	74.49 MLD
3	Fire Demand Unaccounted Water	(2.35+11.53) = 13.88
4	**Total water Demand**	**88.37 MLD**
5	Total water demand including Water loss @ 15% of water demand	13.25 MLD
6	**WTP Capacity**	**101.62 MLD**
7	Storage – GLSR @ 67% of WTP	68.09 MLD
8	Storage – ESR @ 33% of WTP	33.53 MLD

(Source: Compile by Consultant)

The water Demand of entire planning area for year 2045 will be around 88.37 MLD, including fire demand and 15% of water losses during water supply (Source: CPHEEO manual for water supply). In absence of water treatment plan in planning area, there is an urgent need of Water Treatment Plant. Additional GLSR & OHT storage requirement is to be provided considering the future requirements of year 2045 respectively 68.09 and 33.53. The capacity of OHT and GLSR are worked out based on the thumb rules set for calculating storage capacity.

8.1.1.8 Proposed Strategies

There is requirement of 88.37 MLD water to meet the drinking water demand of Dibrugarh Planning Area by horizon year 2045. As ground water potential of the area appears reasonably enough to support the drinking water needs, the present trend of relying solely on it may continue. But, apart from providing individual tube wells, a system of collector wells (cluster of tube wells) with an arrangement for treating the raw ground water is recommended for safe drinking water. Majority of the drinking water demand can be met using the surface/sub-surface flow of River Barahmaputra as a source of supply through collector wells/intake wells.

Action Plan

- Planning, design and implementation of a sustainable water supply scheme mainly based on surface/ sub-surface/intake wells water supply from the river Brahmaputra and ground water
- Covering the entire planning area with a continuous water supply system assuring 24 hr supply with adequate pressure in the distribution system even at the tail ends
- Controlled use and management of ground water assuring treatment with disinfectants before distribution
- Public awareness against misuse of water
- Adequate reforms so as to balance the O&M cost with the revenue out of the water supply distribution.

For areas outside conurbation, respective Commune Panchayats will have to arrange for the water supply without hampering the environment.

Rainwater Harvesting

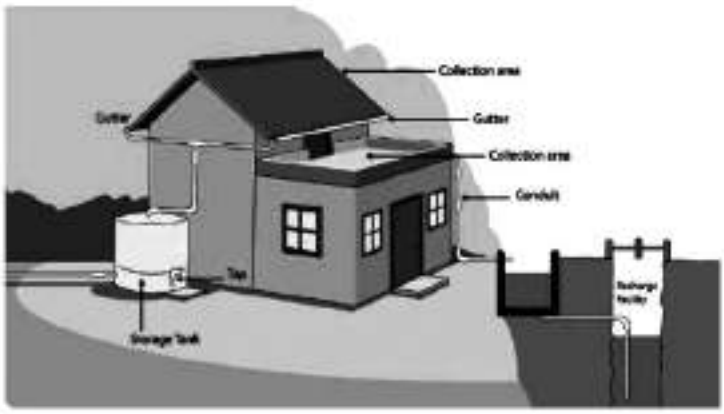
Rain water harvesting must be made mandatory in newly developed houses to increase ground water potentials.

Desilting of Tanks

The water tanks located outside conurbation area are recommended to undergo desilting process. This will increase the capacity of the tanks and ultimately lead to better ground water recharge.

Ground Water Recharging

As agricultural land is being converted to urban use, identifying sites for additionalgroundwater recharge is essential to keep water supplies balanced. The existing village tanks which are normally silted and damaged can be modified to serve as recharge structure. The village tanks can be converted into recharge structure. Several such tanks are available which can be modified for enhancing ground water. Construction of Percolation well is also an option for ground water recharge.



Recycling of Grey Water

Recycling of Grey Water is proposed for Car wash, landscaping, industrial cooling, flushing etc. Recycling of Grey Water should be promoted.

8.1.2 SEWERAGE SYSTEM

As at present, Dibrugarh does not have an integrated planned sewerage management system, and majority houses in the city have septic tanks, of which many are not maintained well; hence, overflowing and dysfunctional. In fact, many septic tanks are now non-functional because of the high water table, and as a result, much of the untreated wastewater directly flows into the storm water drains or into the natural drainage channels. It is a high time that the authority plan and implement proper public wastewater collection and disposal system to ensure that sewage or excreta and sludge discharged from communities is properly collected, transported, treated to the required degree and finally disposed off without causing any health or environmental problems.

As per the survey done, present wastewater generation by Dibrugarh town is approximately 166584 KLD but there is no STP provision done for sewerage generated by town.

Table 193 Sewerage Generation Calculation

Sr. no.	Area	Population	Water consumption (KLD)	Sewage generation (KLD)	No. of STPs proposed	Existing Treatment capacity (KLD)	Gaps in KLD
1	Dibrugarh	1,54,296	208230	166584	00	Nil	166584

(Source: Consultant Compilation)

8.1.2.1 Estimation of Wastewater Generation

The total water requirement for the Master Plan Area is 88.37 MLD (by the year 2045). As per CHPEEO guideline, 80% of total water demand is considered as the sewerage flow; therefore, around 70.70 MLD water is expected to go in sewerage lines. As time passes, the area is expected to grow and along with high water demand, there will be larger wastewater discharge; hence, the project area required systematic sewerage system so the wastewater will not be discharged in the natural drains, which will help in reducing the flood problem.

There should be underground sewerage connection to each households and from where the discharged wastewater should go to sewerage treatment plant before discharging it into the natural drains. While planning for the proposed sewerage system, consideration should be given to the natural drainage pattern. The sewerage system should be planned in such a way that there will be minimum pumping involved in collection and conveyance of sewage. New Sewerage Treatment Plant (STP) sites should be identified depending on considerations such as the quantum of environmentally suitable land, and availability of government land, capital and O&M cost of different options. While the underground sewerage is been planned and implement, the authority needs to make sure that each household in the region has a septic tank installed and is being managed and is fully functioned. Water from commercial and industrial activities wastewater is being treated before discharging in the river.

8.1.2.2 Issues

- **Absence of sewerage system:** there is absolute absence of sewerage system in Dibrugarh planning area resulting in discharge of un-treated waste water in drains and river Salandi
- **Mixing of storm water and sewage:** In absence of sewerage and improper drainage system, in many parts of planning area, there is discharge of sewage into storm water drains and other water bodies
- **Maintenance of Septic Tank:** As per the present practice, the septic tanks are the only mode of disposal of sewage in Dibrugarh planning area, which are not frequently cleaned by the Dibrugarh Municipal Board.
- **Open Defecation:** Open defecation in slums and rural areas can be seen throughout the planning area and no efforts are taken till date.
- **Degradation of natural water bodies:** The disposal of waste water into drain and in other water bodies resulting degradation and contamination of water and land.

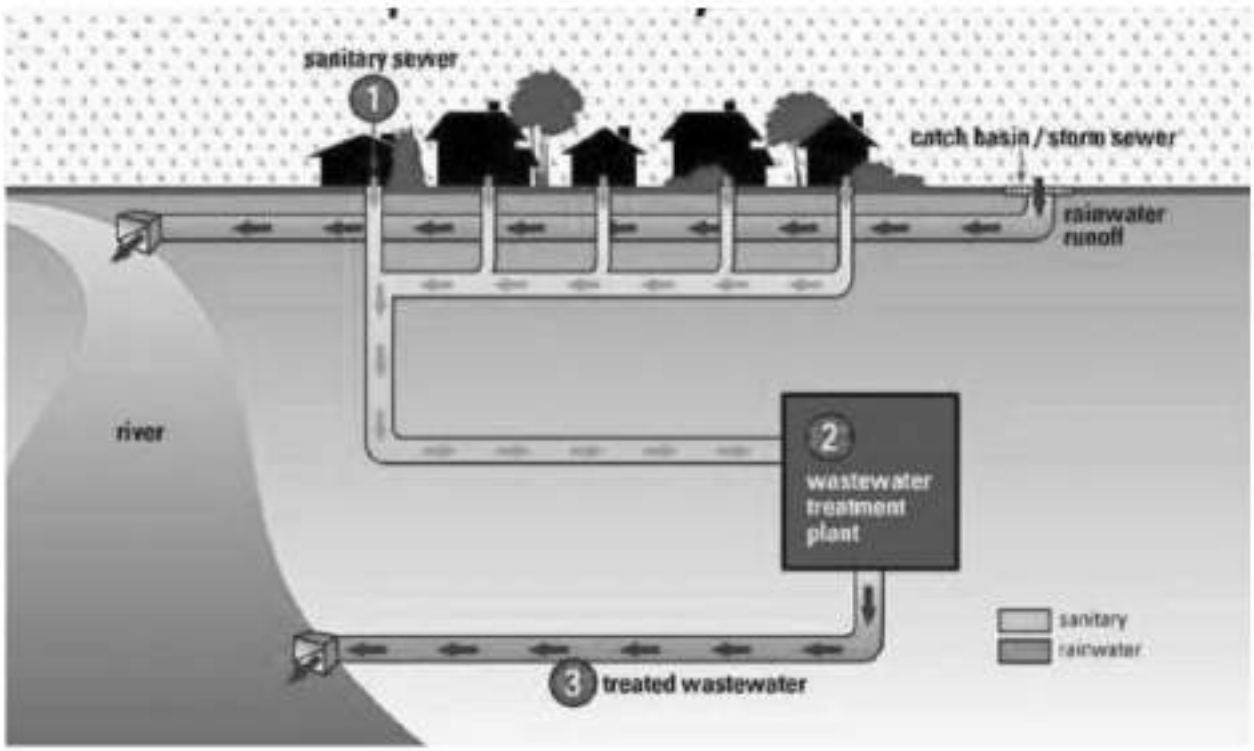
8.1.2.3 Proposed Strategies

In a modern society, proper management of wastewater is a necessity, not an option. A wide range of communicable diseases can be spread through elements of the environment by human and animal waste products, if not disposed properly. The development of effective water and wastewater treatment methods has virtually eliminated major water borne epidemics in developed countries.

Developing countries like ours, where treated water is not available to a majority of the population, still experience epidemics like cholera and typhoid. It is also to be mentioned that as per the report of the Planning Commission for the Tenth Five Year Plan, which emphasizes that all cities, towns and industrial areas should compulsorily have sewage treatment plants and are to be implemented in a time bound manner. Advanced waste water treatment process is currently being so developed that it will produce palatable water from domestic wastewater.

Recommendations

- For treatment of waste water generated from the planning area, a decentralized wastewater treatment system would be more appropriate. The centralized sewage treatment system appears inappropriate as it may end up with very huge sizes of sewers and various issues of conveyance in handling this huge quantity of wastewater.
- The treatment plants and sewers are to be so aligned as to reduce the number of crossings with railway tracks and National Highways of the area. The proximities of natural drains for treated effluent disposal, minimum obstructions for laying sewers, and the possibilities of acquiring land for sewage treatment plants (STPs) turns important in orienting and locating the plants.
- The possibilities of re-use of treated wastewater effluent for irrigation, gardening etc. should be looked into.
- The construction of treatment plants could be carried out in a phased manner on a modular/zonal basis in the planning area consistent with the future development/demand.



8.1.3 STORM WATER DRAINAGE SYSTEM

The terrain of the Planning Area is almost flat with an elevation varying from 55mt to 38mt from Upper North-East region of DMPA area to Western region. Rajabhetha Jan and DTP are forming the two main drainage basins. Dibrugarh Town Protection (DTP) drain and Main Drain are manmade constructed drains. In DMPA, due to the absence of underground storm water drainage system, open drains are existing along the roads. This drain carry water from kitchens as well as rainwater. The water from these channels goes to the bigger channels and ultimately discharges it into the Brahmaputra River.

The Assam Urban Infrastructure Investment Program is a key urban infrastructure initiative of the Government of Assam. The investment program aims to provide improved access to water supply, sanitation and urban infrastructure facilities to the urban population in Dibrugarh. The project uses a multi tranche financing facility (MFF) modality and, requires the preparation of a Resettlement Framework and Resettlement Plan for all subprojects under the Program. The major outputs of this program include improved drainage in Dibrugarh to reduce economic losses due to flooding, and comprehensive SWM. The Plan states infrastructure bottlenecks and lack of long-term funds for infrastructure investment, is one of the main constraints for growth.

The project components include improvements of drains which will reduce flooding in Dibrugarh town. It includes all major drains of the town, including the DTP drain and key lateral drains for improvement. The Dibrugarh drainage subproject covers (i) sludge removal from the bottom of the existing drain; (ii) widening and construction of 9.515 km of reinforced cement concrete (RCC) drain linings; (iii) construction of a 0.386-km diversion channel in two stretches; (iv) demolition of existing narrow culverts and replacement with 8 m-wide new box culverts; (v) construction of a 16-m bridge on the national highway; (vi) demolition of an old narrow sluice gate and construction of a new, wider sluice gate with 10 gates; (vii) provision of fencing along drain sides at road crossings; (viii) provision of slab covers on both sides of the culverts and foot bridges; and (ix) provision of 10 RCC foot bridges.

The benefits would be improved environmental and living conditions and public health in Dibrugarh. In addition, the economic benefits considered due to the proposed project are: (i) reduction of household healthcare cost due to flooding and water logging problems; (ii) reductionin person-days lost due to water logging and flooding; (iii) reduction in temporary resettlement costdue to flooding; (iv) reduction in annual cost of protection measures from flooding; (v) reduction inannual agricultural loss; and (vi) reduction in road maintenance cost

Desilting of the DTP drain will have to be carried out from the downstream end. Widening and construction of the 9.515-km RCC drain is necessary because: (i) due to favourable climatic conditions, vegetation growth in the drain is quick, and reduces the flow velocity; and (ii) since the soil of the Dibrugarh is alluvial, it is highly susceptible to rainwater erosion, so the runoff is always sediment laden. Lining the drains will increase flow velocity and conveyance of the channel. A key component of this subproject entails widening and construction of the 9.5-km RCC drain in the town section of Dibrugarh, which would entail permanent impacts on private structures located along the drains as well as some temporary impacts during subproject construction. All construction/widening activities of the DTP drainage is being carried out on the existing channel and adjoining government land.

Table 194 Storm water Drainage parameters

Sr. No.	Drains	Length of Drain (metre)	Percentage(%)
1	DTP Drain	4572 m	-
2	Rajabheta Jan Drain	2955 m	-
3	Covered RCC Drain	26452 m	43.09
4	Main Drain	9392 m	15.30
5	Kachha Drain	21923 m	35.71
6	RCC Drains under Progress	3617 m	5.89
Total Length		**34,932 m**	**100**

(Source: T&CP and Dibrugarh Municipal Board)

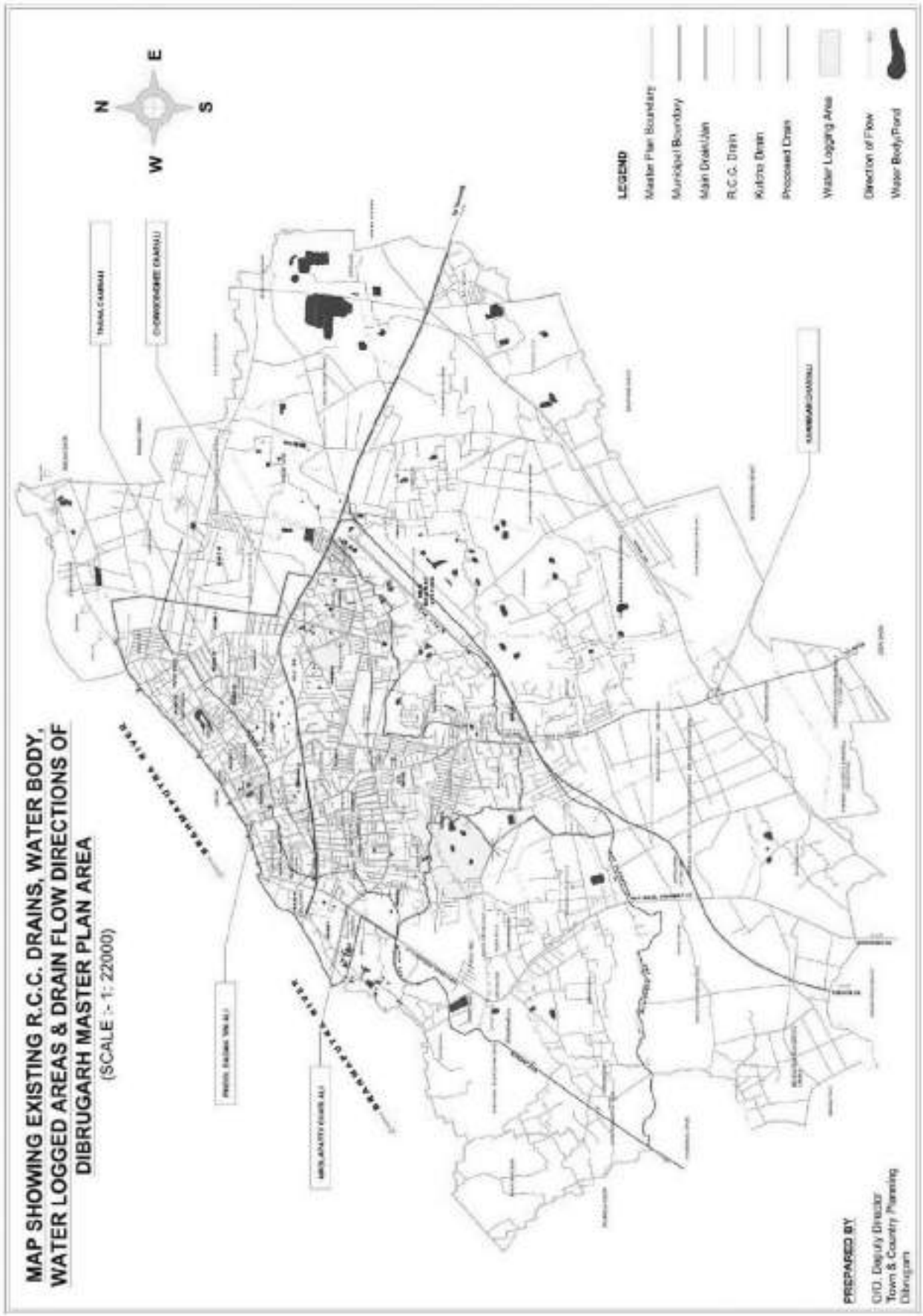


Figure 153 Storm Water drainage within MPA

Issues and Requirement

8.1.3.1 Open Channel Area:

- Closed channel water drainages are observed on many streets within municipal board where some streets are under progress.
- Unhygienic condition due to open channel leads to spread of diseases.
- It also leads to high health risk due to illegal discharge of wastewaters and solid waste.
- Another issue includes foul odour source establishment and becomes a breeding ground for insects and pests.
- Regular cleaning service is not done to remove solids from the open channel area which increases the chances of blockages which can cause spill-over and flooding.
- Open channel areas are differentiated into 3 parts and the locations are mentioned below:
- Drainage block area: Sajid store to Viridi Automobiles shop, along AT Road (length of 110 meters), M/S. DP Groups Battery Store to Kamakhya Pan Shop along Convey Road (length of 370 meters), All India Radio Station and its opposite side along Convey Road (length of 10 meters).
- Open drainage system: Near Asha Medical to State Bank ATM along Mancotta Road (length of 220 meters), Indian Oil petrol pump to Public High School along AT Road (length of 330 meters), All India Radio Station and its opposite side along Convey Road (length of 40 meters), G.M Hospital to Radha Krishna Mandir along AMC Road (length of 310 meters).
- Drainage under construction: Near TV service centre to X junction of University Link Road, Durgadin Road and Convey Road (length of 210 meters).
- The locations of open drainages are marked with major width along roadside

8.1.3.2 Flood Prone Areas:

- Many low-lying areas are found under water logging within the city area.
- Due to absence of storm water drain, the rainwater and the flash water, in monsoon, are unable to flow down stream and due to this the area becomes prone to water logging.
- At many places, the accessibility on pavement hinders due to presence of water logging end hence sometimes become a reason for traffic congestion.
- The major flood prone areas include Mancotta and NH-37 T junction to Civil Defence Office; near Office of The Divisional Forest Officer to cross junction of NH 37 (AT Road) and Red crossroad; cross junction of Jail Road and NH 37(AT Road) to Dibrugarh Hospital (civil hospital).

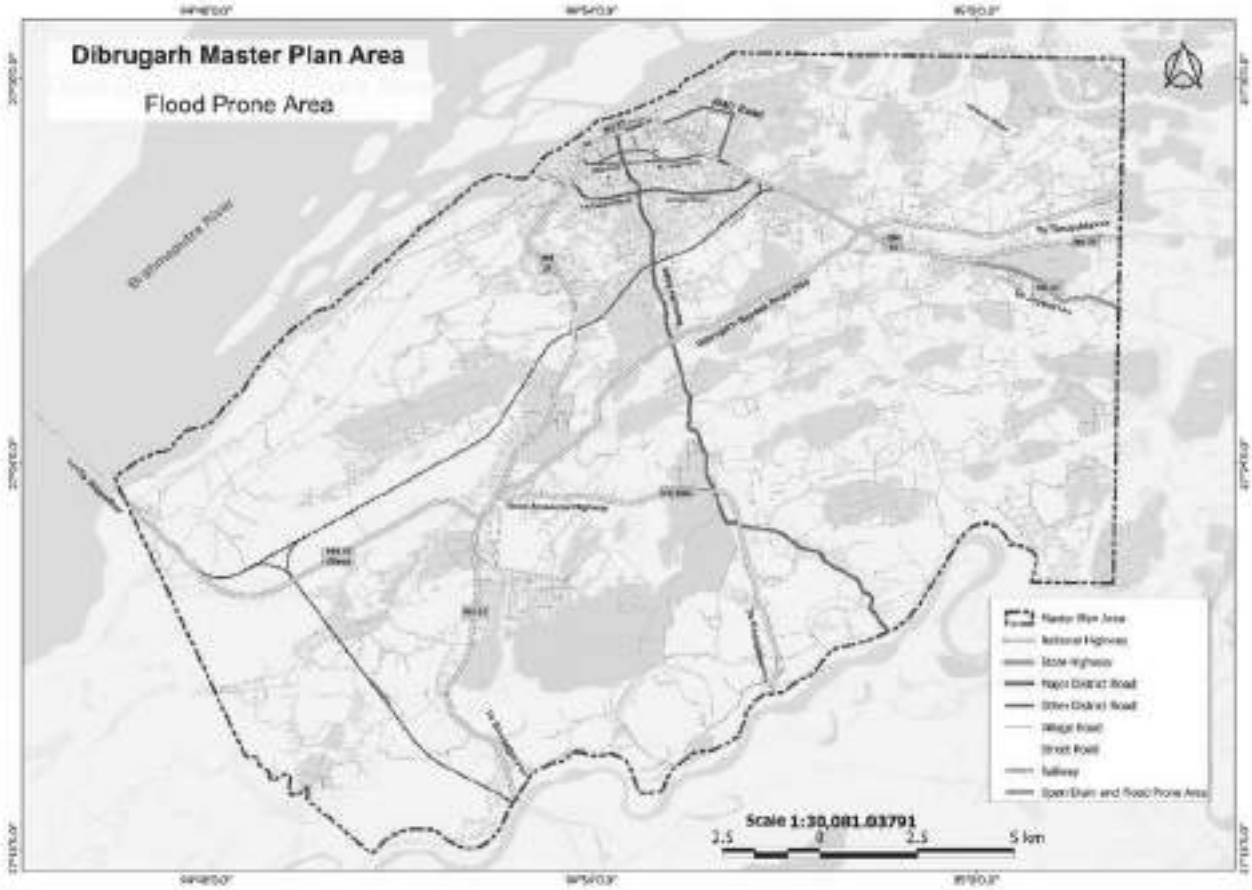


Figure 154 Open channel and flood prone areas

8.1.3.3 Proposed Strategies

A separate storm water drainage network has been proposed in the development area for the collection and safe disposal of storm water during rainfall. The design criteria to be followed for design of Storm Water Drainage network are broadly based on the recommendations as laid down in the CPHEEO Manual of Sewerage and Sewage Treatment, Ministry of Urban Development, Government of India and as per provisions laid down in the relevant I.S. Codes and Consultants' past experience in related field.

- Rectification of slope and width of drains shall be done, wherever required.
- Provision of new storm water drainage network as per phase wise requirements worked out considering key parameters of precipitation intensity, catchment delineation, percolation characteristics and surface runoff.
- Existing drains which can be used as storm water drains, need to be upgraded based on engineering aspects & runoff calculation.

Recommendations

- The lack of proper sanitation and solid waste management, combined with indiscriminate dumping of solid waste in the drains reduces the carrying capacity of these natural drains. The implementation of a systematic solid waste and wastewater collection and treatment system is a necessary prerequisite for proper drainage of the area.
- The natural drains have been encroached upon and are almost in dilapidated state. Also, at many reaches the drain sidewalls are found to be damaged. The section of the drain is also irregular and less adequate at many locations. Proper gradient is not maintained at several stretches on its reach and the hydraulic parameters are also not uniform. Also, no definite drain section is maintained in many reaches. So, proper maintenance and management of the existing natural drains turns important. This necessitates a proper evaluation of the existing natural drainage system.
- Over the years the River Brahmaputra has progressively silted up due to which the flood water flows at ever higher levels than the water levels in this main drain.
- The natural depressions and ponds, which were instrumental in preventing excess storm run-off, are getting filled up at a rapid rate due to urbanization. This may further aggravate the existing problem of water logging. It is necessary that 'natural sinks' be retained as such as, they are instrumental in controlling the water logging of the area.
- An organized drainage system is invariably associated with the implementation of a systematic solid waste and wastewater collection and treatment system.
- Periodic de-silting of the existing storm water drains should be done.
- Perimeter protection of all the major drains should be checked before every rainy season.
- Overall, the preparation and implementation of a master drainage plan appears essential for Dibrugarh planning area
- All roads of the town/city should have side-drains, which will serve as minor or tertiary drains
- Existing drains which can be used as storm water drains, need to be upgraded based on engineering aspects & runoff calculation

8.1.4 SOLID WASTE MANAGEMENT

At present, Solid waste management is one of the major challenges the cities of India are facing. Dibrugarh is the district where first solid waste management project in Assam has been inaugurated recently in August 2021 at Lekal in the Thakurthan area on the outskirts of Dibrugarh. Since a long time, the residents had been facing a lot of problems due to the unavailability of proper garbage disposal unit.

Earlier, garbage and waste materials were dumped in the Maijan area near river Brahmapurtra in Dibrugarh, causing pollution to the entire area. Hence, due to this, the Dibrugarh and Lahowal MLAs have come up with the project proposal in 2017 and it was successfully implemented by 2021.

Assam Urban Infrastructure Investment Program (AUIIP), Government of Assam is a key urban infrastructure initiative of the Government of Assam and aims to improve the urban environment and quality of life in the citiy of Dibrugarh through the delivery of improved water supply, sanitation, solid waste management (SWM), and drainage infrastructure. The major outputs of this Program include comprehensive SWM Plant in Dibrugarh. The project which recognizes infrastructure bottlenecks and lack of long-term funds for infrastructure investment as the binding constraint for achieving its goals. The project is built as a cost of Rs 75.03 crore on a 28.3-hectare plot of land under the Assam Urban Infrastructure Investment Program (AUIIP). It has a capacity to convert 100 metric tonnes per day (TPD) of waste into compost. Additionally, diesel, granules and plastics can also be produced from the plant.

Around 90 metric tonnes of solid waste is being produced by the 22 municipal wards of the town every day. Until now, these wastes were dumped in an unscientific manner at the Maijan ghat along the Brahmaputra river flowing beside Dibrugarh town.

8.1.4.1 Solid Waste Management in Urban Areas

Table 196 Ward wise Solid waste collection,2020

Wards	Average generating (Tons/day)	Average collection (Tons/ day)	No. of Houses covered for House to House Collection	Total Area Used for Sanitary Land Fill (sq.km.)	Manpower deployed	No. of Sites used for Land Fill
1	4.4	4.3	471	Sanitaryland fill is under construction which is at Lekai. At present Waste is dumped at Maizan.	2	1 (Maijan Dumping ground)
2	12.9	12.8	1352		8	
3	4.3	4.2	618		2	
4	4.1	3.9	1625		2	
5	3.5	3.3	1088		2	
6	8.5	8.3	1370		4	
7	2.3	2	715		4	
8	4.2	4	1054		4	
9	2.2	2	556		2	
10	2.5	2.2	488		4	
11	5.2	4.9	763		2	
12	2.7	2.4	779		2	
13	2	1.69	712		2	
14	4.7	4.5	767		2	
15	2.4	2.2	986		4	
16	3.8	3.6	696		3	
17	3.7	3.6	690		4	
18	6.2	6.1	1145		2	
19	5.2	5	1119		2	
20	4.3	4.1	608		2	
21	3.5	3.3	900		4	
22	7.3	7.2	1229		5	

(Source: Dibrugarh Municipal Board,2020)

Presently, the solid waste generation in DMB area as per Govt. record is 99 MT/Day whereas collection is 95.59 MT/Day as per Municipal Board record. Out of total collected waste, 20 MT found degradable, 30 MT as Biodegradable and 10 MT as Hospital Waste. No. of household covered in door-to-door waste collection are 11395 as per Municipal Board record. Vehicle deployed in Solid waste collection system are 31 Trippers, 7 Tractor, 112 Tricycles and 3 Dumper. Manpower deployed to run entire system are 14 Sanitary Supervisors and 64 rag pickers.

Citizens have habit of throwing garbage on streets, into the open drains, in the backyards, and in the open spaces. This section proposes explains the foreseen solid waste generation and the management for the same in the project area.

8.1.4.2 Quantity of Waste Generated

The quantity of MSW generated depends on numerous factors such as population, food habits, standard of living, degree of commercial activities and seasons. The increasing urbanization and changing lifestyles have increased the waste generation rate of Indian cities.

Criteria for assessing waste generation

- Projected populations for the design period
- Existing per-capita waste
- Annual rate of increase of per capita waste generation

8.1.4.3 Solid Waste Demand Projection

For urban area, per Capita Waste Generation for 2015 is taken as 400 gms. As given in the DPR for MSW Disposal through Incineration Process, it is assumed that per Capita Waste generation rate increases at a rate of 1.4 percent annually. Hence per capita waste generation for 2045 is 568 gms.

Table 196 Future assessment of Solid waste Generation

Sr. No.	Particulars	Demand for 2045
1	Projected Population	551757
2	Solid Waste Generation (in Conurbation area @568 gms/cap/day)	313.39 MT

(Source: Compiled by Consultant)

8.1.4.4 Issues in Present System

Lack of Disposal Site

Presently, there is no engineered landfill, and Municipal Solid Waste is dumped in open area, which can lead to ground water and soil pollution, vector naissance etc.

Lack of Primary Collection System

Solid waste is discharged by establishment into open plots, open drains etc. these un-organized disposal methods have resulted in the accumulation of solid waste on roadsides, vacant plots, and storm water drains. This has resulted in a number of hygiene related problems such as breeding of flies/ mosquitoes and stray animals.

Un-hygienically Solid Waste Transportation

Municipal Solid Waste is transported primarily in open vehicles i.e. trucks, tippers and cycle rickshaw. It is also observed that these modes of transportations are overloaded with MSW, resulting in the littering of roads during transportation. The loading and unloading of waste are carried out manually, and Safai Karamcharis involved in these activities do not use any safety measures.

In-sufficient collection and disposal of construction waste

The construction and demolition waste generated by residents is transported in tractor trolleys and disposed at either secondary collection points or open/low-lying areas in the town vicinity.

Handling of MSW with Slaughter Waste

Waste from the slaughters houses is disposed in open dumping sites, although there are provisions for separately disposing slaughter house waste in Dibrugarh town / planning area.

Disposed of Bio-medical waste without any treatment

Presently, there is no treatment facility available for bio-medical waste in Dibrugarh and Medical waste is disposed off along with general MSW

Lack of primary Collection points

Unattended waste lying in open areas is common phenomena in the entire town because of non-availability of required numbers of bins in the planning area

Multiple Handling of Wastes

The waste is handled multiple times leading to potential health hazards for the workers as all types of wastes contains hospital waste, human waste etc are disposed in the same containers

Lack of Awareness

There is absolute lack of awareness among people w.r.t. handling and management of waste.

8.1.4.5 Proposed Strategies

Decentralized Solid Waste Treatment System:

The developmental pattern of all the areas, especially Dibrugarh, demands the implementation of an integrated solid waste treatment system. It is felt that only a decentralized MSW Management System could help solve the seemingly intricate problem of solid waste treatment in this area in an economically viable, socially desirable and environmentally sound manner.

Public Participation:

General environmental awareness and information on health risks due to improper solid waste management are important factors which need to be continuously communicated to all sectors of the population. Building awareness among public and community about the need for a better solid waste management system is as essential as management. Public awareness and attitudes to waste can affect the people's willingness to cooperate and participate in adequate waste management practices. If people keep on throwing waste on the streets indiscriminately, the local body alone cannot keep the city clean in spite of their best efforts .Thus, it is very important to make people understand that the treatment and management of solid waste is a collective responsibility of the local authority and the community. Municipalities or local governments through participatory programs should convey this message to the people.

Collection Enhancement facilities:

- Old dustbins are to be replaced with different types of covered dustbins, which reduces the time of pickup and improves the process of primary collection of wastes.
- Sweepers may be provided with handcarts and detachable containers and be allotted a fixed area or number of houses for door to door collection. They should also be provided with safety gears and proper uniforms.
- It can be made compulsory for the management of societies/complexes to keep covered bins in which waste is to be stored at acceptable locations, to be picked up by the municipal staff.
- The local body may collect waste from community bins by using container handcarts or tricycles whichever may be convenient, for transferring the wastes to the waste storage sites by employing municipality sweepers.
- The collection service can be provided on a full-cost recovery basis using contractor services on a dayto-day basis from individual houses.

- The collection service can be provided on a full-cost recovery basis using contractor services on a dayto-day basis from individual shops also. The service of rag pickers and part-time sweepers can also be used in agreement with the shop owners.
- Sweeping of all public roads, streets, and lanes, by-lanes where there is habitation or commercial activities on either side of the street should be done daily. A list of such streets and roads together with their length and width should be prepared. The local body, keeping in view the norms of work prescribed should work out a program for their daily cleaning. However, roads and streets where there is no habitation around and do not require daily cleaning may be put in a separate group.

Provision of Solid waste Storage:

One of the immediate measures to revamp the existing collection services structure would involve provision of covered community waste bins at proper distances for the people to deposit domestic waste. This is the first step that will ensure that people do not throw their garbage on the roads and hence do not create open dump sites. This will enable the sanitation workers to transfer waste to the transportation vehicle quickly and efficiently with minimum health risk which will also help to maintain the aesthetics of the surroundings.

The Municipal solid waste (Management and Handling) Rules 2000 of the Government of India have prescribed the compliance criteria for waste storage depots as under:

- Storage facilities shall be created and established by taking into account quantities of waste generation in a given area and the population densities. A storage facility shall be so placed that it is accessible to users.
- Storage facilities to be set up by municipal authorities or any other agencies shall be so designed that waste stored are not exposed to open atmosphere and shall be aesthetically acceptable and user friendly.
- Storage facilities or "bins" shall have "easy to operate" design for handling, transfer and transportation of waste. Bins for storage of biodegradable waste shall be painted green, those of recyclable waste shall be painted white and those of other wastes shall be painted black.
- Manual handling of waste shall be prohibited. If unavoidable due to constraints, manual handling shall be carried out under proper precaution with due care for safety of workers. So, the storage and handling of SW are extremely important, and hence the steps to be taken by the Municipal authorities for storage of solid wastes are detailed in table below:

Segregation:

These compositional characteristics of the solid waste underline the need for proper segregation before treatment. Proper segregation of waste into different components and their separate collection can definitely lead to remarkable changes in the entire system.

The segregation of the waste would be a long drawn exercise as it involves attitudinal changes in people and will have to be done with careful planning, in a phased manner. The general public is to be first sensitized towards the whole concept and educated about the need and advantages of doing the segregation. Segregation of waste at the source itself is extremely important as municipal solid waste, which is otherwise environmentally benign on getting mixed with hazardous waste like paints, dyes, batteries, and human excreta turns hazardous. The recyclables like paper and plastic etc. become unsuitable for recycling as these get soiled by the organic matter.

Although, it would be more fruitful to sort and place different kinds of recyclables in separate receptacles, the waste could be segregated into at least two categories of biodegradable and non-biodegradable initially.

Table 19.7 Solid waste Generation Source

Sl. No.	Generation Source	Action Proposed
1	Residential	• Keep food waste / biodegradable waste in a non corrosive bin type – D1 • Not to throw any waste in neighborhoods, on streets, open space, and vacant lands, in drains or water bodies. • Keep dry/ recyclable waste in bin type – D2 • Keep hazardous waste separately
2	Multistoried buildings, commercial complexes, private societies	• 1 to 4 as above. • Provide separate bin type – B large enough to hold wastes generated both biodegradable and recyclable. • Direct member of the association / society to deposits waste in bins provided. Sanitary inspectors should vigil the area and fineshould be imposed for not following the actions
3	Slums	1 to 4 as above. Use bin type -C
4	Shops, offices, Institutions	1 to 4 as above. Store the waste in bin type - D1, D2
5	Hotels and restaurant	1 to 4 as above They should arrange their own bins and dispose waste in nearby municipal bins.
6	Vegetable, fruit markets, meat, fish markets, and street Vendors	• Keep small baskets with them and transfer waste to large bin type-A. • Shop keepers not to dispose of the waste in front of their waste or shops or open space. • Deposit waste as and when generated into bin type-A. • Fines should be imposed for not following the action
7	Marriage halls, Community halls, Kalyan Mondaps.	1 to 4 as above. Provide a large bin type -B
8	Garden Waste	Compost the waste in garden itself, if possible. Store wastes in large bags or bins and transfers it to community bins.

Note: Bin Type A (volume 7 m3), Type B (0.75 m3), Type C (0.5 m3), Type D1 and Type D2 (12 liters)

The recyclables obtained through segregation could be straightway transported to recycling units which in turn would pay certain amount to the corporations, thereby adding to their income. This would help in formalizing the existing informal set up of recycling units, and this formalization in turn could lead to multi-advantages. The biodegradable matter could be disposed off either by aerobic composting, anaerobic digestion or sanitary land filling. Depending upon land availability and financial resources, either of these disposal methods could be adopted. Though simple land filling is the traditionally practiced system of solid waste management in the planning area, aerobic composting by wind-row method will be an appropriate option. All the nonbiodegradable waste which is non-recyclable, non-reusable shall be dumped into sanitary land fill. Biodegradable waste shall be subjected to composting. Area required for composting shall include the area for storage of unprocessed material, processing facilities for composting operation and storage for green compost.

The area required for windrow composting with 15 days composting period with moisture content between 55-60% for aerobic composting, the first turning shall be done at the 4th day and thereafter every third day shall be 1.5 acres to 2 acres per 50 MT per day waste.

Reuse and Recycling:

The concepts of reuse and recycling can well be applied in solid waste management as solid waste is basically a heterogeneous mixture. In typical Indian municipal solid wastes, there is a small percentage of recyclable material and more of compostable and inert materials like ash and road dust. There is a very large informal sector of rag pickers, who can collect recyclable wastes (paper, plastic, metal, glass, rubber, etc) from the streets, bins and disposal sites for their livelihood. Thus, the rag pickers can be effectively used for the collection of reusable materials especially because the use of non recyclable packaging materials like PET bottles for soft drinks, mineral wastes, and soft -foam products and metalized plastic film coated food

packing materials are on the rise. During recycling, many of these release toxic gases and ozone depleting products. So it is advisable to educate people to replace these items with eco-friendly packaging materials. The desirable home sorting mechanisms includes dry recyclable materials (e.g. glass, paper, plastic, cans etc.), kitchen and garden wastes, bulky wastes, hazardous wastes, construction and demolition wastes. Sorting can also be done just prior to waste processing or land filling.

Energy from Solid Waste:

Electricity can be produced by burning MSW as a fuel. MSW power plants, also called waste-to-energy (WTE) plants, are designed to dispose of MSW and to produce electricity as a byproduct of the incinerator operation. Mass Burn is the most common waste-to-energy technology, in which MSW is combusted directly in much the same way as fossil fuels are used in other direct combustion technologies. Burning MSW converts water to steam to drive a turbine connected to an electricity generator. Burning MSW can generate energy while reducing the volume of waste by up to 90 percent, an environmental benefit. However, this burning MSW in WTE plants produces comparatively high carbon dioxide emissions, a contributor to global climate change. The net climate change impact of these emissions is lessened because a major component of trash is wood, paper and food wastes that would decompose if not burned. If left to decompose in a solid waste landfill, the material produces methane, a potent greenhouse gas. The concept of producing energy from MSW derives significance as it is given high priority by the Ministry of Non-Conventional Energy Sources (MNES), Government of India.

Treatment options:

The biodegradable portion of the waste is considerably high. So, aerobic composting of SW after proper segregation will be more appropriate. In selected locations especially in rural areas, Vermi-Composting can also be recommended. The manure obtained by these methods can be sold to the local public as fertilizer. Though costly, sanitary land filling can also be practiced at selected urban locations where the recovery from the waste will be very high, serving minimum ecological damage. It appears that the aerobic composting by Windrow method may be a desirable option for the management of the solid waste. The possibilities of generating energy from SW could be looked into on an experimental basis.

Biomedical wastes and its management:

Biomedical waste has been a growing concern because of the awareness in public regarding HIV, AIDS and Hepatitis B and exposure to discarded needles, syringes and other medical waste from municipal garbage bins and disposal sites. The management of biomedical waste turns important as it has serious bearing on the quality of human life. This becomes more significant especially in the context of the recent trend of establishing multispecialty hospitals in urban centers. Biomedical waste can be regarded as any waste generated during the diagnosis, treatment or immunization of human beings or animals or produced due to ac tivities of biological research, human anatomical waste, animal waste, microbiology and biotechnology waste, waste sharps, discarded medicines and cytotoxic drugs, solid wastes, liquid waste, incineration ash, chemical waste, etc. Medical wastes contain pathological waste (such as human tissues such as limbs, organs, fetuses, blood and other body fluids), infectious waste (soiled surgical dressing, swab material in contact with persons or animals suffering from infectious diseases, waste from isolation wards, cultures or stocks of infectious agents from laboratory, dialysis equipment, apparatus and disposable gowns, aprons, gloves, towels, etc.), sharps (any item that can cut or puncture such as needles, scalpels, blades, saws, nails, broken glass, etc.), pharmaceutical waste (drugs, vaccines, cytotoxic drugs and chemicals returned from wards, outdated drugs, etc.), chemical waste (any discarded solid, liquid or gaseous chemicals from laboratories, cleaning and disinfection) etc.

Implementation of Bio-medical Wastes (Management and Handling) Rules, 1998

The Ministry of Environment and Forests issued the Bio-medical Wastes (Management and Handling) Rules, 1998 which were amended subsequently. These rules provide for segregation, packaging, transportation, storage, treatment and disposal of wastes generated by hospitals, clinics and laboratories. Bio-medical wastes (BMW) have been classified into various categories and the treatment and disposal options for each of the categories are specified. The treatment and disposal should be in compliance with the standards prescribed in Schedule V, which stipulates standards for incinerators (operating and emission standards), for waste autoclaving, for liquid waste, of microwaving and for deep burial. A schedule for implementation of BMW rules has been laid down in Schedule VI. Imposing segregated practices within hospitals to separate biological and chemical hazardous wastes that will result in a clean solid waste stream, which can be recycled easily. An Advisory Committee is to advise the prescribed authority on the implementation of these Bio-medical wastes (Management and Handling) Rules.

8.1.4.6 Processing and Disposal of Solid Waste

The solid waste can be processed by composting, vermi-composting, anaerobic digestion, sanitary land filling, incineration or any other biological processing for stabilization of wastes. Since it contains a high amount of biodegradable portion, composting may be a cost-effective option for processing. The process of microbial composting or vermi-composting may be adopted with least mechanization to keep the cost low, and to market the compost as fertilizers to adjoining villages. So the concerned municipalities are duty bound to earmark required acres of land to meet the requirement of solid waste treatment. The areas of existing dumping yards can also be developed. The rejects from these plants and domestic hazardous wastes may be carefully landfilled. The bio-medical wastes may be disposed off as per the Bio-Medical Waste Management and Handling Rules as described above.

A decentralized treatment system will be more feasible option for solid waste treatment. In combination with primary waste collection, composting improves the precarious waste situation in the communities, and residents become less dependent on the poor municipal waste collection service. Decentralized composting can be operated by an appropriate technology and implemented at reduced investment and operating costs. Manual composting in small, decentralized plants is more easily integrated in the prevailing level of development in India and the socio-economic background, as it requires labour-intensive processes. It will create employment opportunities and a source of income to the underprivileged people in the rural Dibrugarh. Decentralized composting allows reuse of organic waste where it is generated, thereby reducing waste quantities to be transported as well as transport costs. This may drastically reduce the overall cost of municipal solid waste treatment.

8.1.4.7 Proposals for Solid Waste Treatment

The solid waste generation expected in Dibrugarh Planning Area by 2045 is very high, providing compost treatment facilities for this huge quantum of wastes, though essential, may not be practically possible in a single phase. So, it is necessary to propose economically feasible and, technically viable solutions which can be implemented in a phased manner. The densely populated urban areas of DMPA are to be given first priority in providing the composting facilities for solid waste treatment. The area required for solid waste treatment and disposal facilities will be 8 hectares.

8.1.4.8 Disposal of Hazardous Waste

The Notification from the Government of India, Ministry of Environment dated 20th July 1998, which deals with the collection of Bio-Medical Wastes entrusts the liability of its disposal with the waste producer itself. Thus, the management of bio-medical waste is not the responsibility of Municipalities. But, however, they can assist in the management of biomedical wastes on a full cost recovery basis without sharing any legal responsibilities. It is advisable to have bio-medical facility for the entire Dibrugarh Planning Area. The bio-

medical wastes collected from spots can be stored in selective transfer stations and can be transported to this central treatment facility at village Lekai. If so desired, the authorities can formulate an action plan for implementing this plant through some competent agencies and can suitably charge for the treatment and disposal of bio-medical wastes. The solid waste dumping sites closest to industrial sites will be a more appropriate option.

8.1.5 ELECTRIC SUB-STATION AND MAJOR TRANSFORMERS

8.1.5.1 Power Grid of Dibrugarh Master plan Area

The present power demand of the district including that of the three regions of Dibrugarh, West Revenue Circle and East Revenue and area. The demand is normally under these schemes NERPSIP, IPDS, and UDAY Scheme (Installation of Smart Meter). There are 3 numbers of sub – divisions under Dibrugarh Electrical Division. The sub divisions are : 1) Dibrugarh Elect. Sub-Div-I (West Revenue Circle), 2) Dibrugarh Elect. Sub-Div-II (East Revenue Circle) and 3) Dibrugarh Elect. Sub-Div-III (Dibrugarh Municipality Board Area) At present there is no shortage in meeting the requirements of the present demand in any of the three regions. Source from Assam Electricity Grid Corporation Ltd the electricity is Namrup Thermal power station

Table 199 Energy Supply in Dibrugarh town

Sr. No.	Particulars	Details
1	Demand for energy	60 MW Peak Demand
2	Annually or monthly supply of power	Average 22.9 MU per Month
3	Numbers of metered connections	96292 Nos

(Source: APDCL, Dibrugarh)

Table 199 Annual or Monthly Supply of Power of Dibrugarh

Type of Consumer	Demand (mw)	Supply (mw)
Residential	28.71	28.71
Government	4.61	4.61
Social and Institutional	0.01	0.01
Commercial	9.5	9.5
Industrial	16.75	16.75
Agriculture	0.02	0.02

(Source: APDCL, Dibrugarh)

8.1.5.2 Power Supply Demand Projection

The actual demand in 2011 was 99.02MW. the power demand for 2045 is calculated by assuming 2.74 kWh per capita per day considering domestic, commercial, industrial and other requirements as per URDPFI guidelines 2015. The power demand for the 2045 will be 151.1 MW.

Table 200 Power Demand for 2045

Sr. No.	Particulars	Demand		
		2021	2031	2045
1	Projected Population	417572	470719	551757
2	Power Requirement @2.74 kWh per capita per day	114.41MW	128.98MW	151.18MW

(Source: Compiled by Consultant)

Power demand – 2.74 kWh per capita per day considering domestic, commercial, industrial and other requirements as per URDPFI guidelines 2015

As per the population 2021 for Dibrugarh Master Plan Area, the Power Demand is 114.41 MW considering 2.74 kwh per capita per day. The Power Requirement for 2045 will be 151.18 MW. Even if the possibility of use renewable energy is to be explored and promoted. The strategies are proposed below:

8.1.5.3 Proposed Strategies

- There are various other sources, such as Wind energy and solar energy for generating power which is required to be explored.
- Additional solar energy to be sold to public grid/ electricity authority.
- Sector-wise power demand needs should be worked out which will be helpful in proper planning & estimating future power requirement.
- Incorporation of Renewal Power Obligations (RPO) in building byelaws (applicable to major building projects >20,000 sq.ft.)
- Tax concession on material and appliances procured for renewable energy products.

8.2 SOCIAL INFRASTRUCTURE

Social infrastructure plays an important role to provide quality of life to the residents of the city. The effectiveness of social infrastructure in achieving the objective of city development plan would depend upon its capacity to contribute to improvement in the quality of life, enhanced self-dependency and city's sustainability. The level of social infrastructure shall aim the creation of liveable city through reducing the sense of alienation among the residents with less dependence on other settlements for basic infrastructure.

Social infrastructure refers to the facilities and mechanisms that ensure education, health care, community development, and social security, recreational and social welfare. The development cannot be looked at in isolation without considering the basic needs of the people, and a significant level of investment is needed in this sector. Usually this development referred to as the commitment towards realizing the visionof the city.

8.2.1 EDUCATION

Education is an important factor influencing the quality of life of the people and future development of an area. It empowers them with skills and knowledge and helps them to better lead their life and to access best of the employment opportunities available in the market. This in turn will impact the work force participation rate and economy of the area

8.2.1.1 Educational Facilities in Pre-Primary & Secondary Education

The existing scenario of Primary, Middle school and Higher secondary school for the Dibrugarh area is shown in the table given below:

Table 201 No. of Pre-primary Schools to Secondary Schools of Dibrugarh Master Plan Area

Sl. No.	Description	Number
1	Pre-Primary Schools	142
3	Primary School	71
4	Higher Secondary School	48

(Source: Inspector of School, 2020)

Figure 155 Dibrugarh Primary and Higher Secondary school Planning area

8.2.1.2 Educational Facilities in Higher Education

The existing scenario of university, Art/Science/Commerce colleges and professional colleges for the Dibrugarh area is shown in the table given below:

Table 202 No. of Higher Educational Institutes

Sl. No.	Description	Number
1	University	1
2	Engineering Collage	1
3	Art/Science/Commerce Colleges	11
4	Polytechnic	1
5	S.D Sahewalla Memorial School of Nursing	1
6	Medical Collage	1
7	ITI	2

In order to provide adequate educational facilities and infrastructure all through the planning area, it can be proposed as setting up these facilities on a hierarchical basis i.e. at City Level (Planning Area), at Planning Unit Level, at Neighborhood Level and lastly at Residential Area level.

For instance, higher order facilities like college, integrated schools, school for handicapped are to be provided at the master plane level while facilities like Nursery and primary schools are to be provided at the Neighborhood level.

Dibrugarh Hanumanbax Surajmall Kanoi College

DHSK Commerce College, Kanoi College

Dibrugarh University

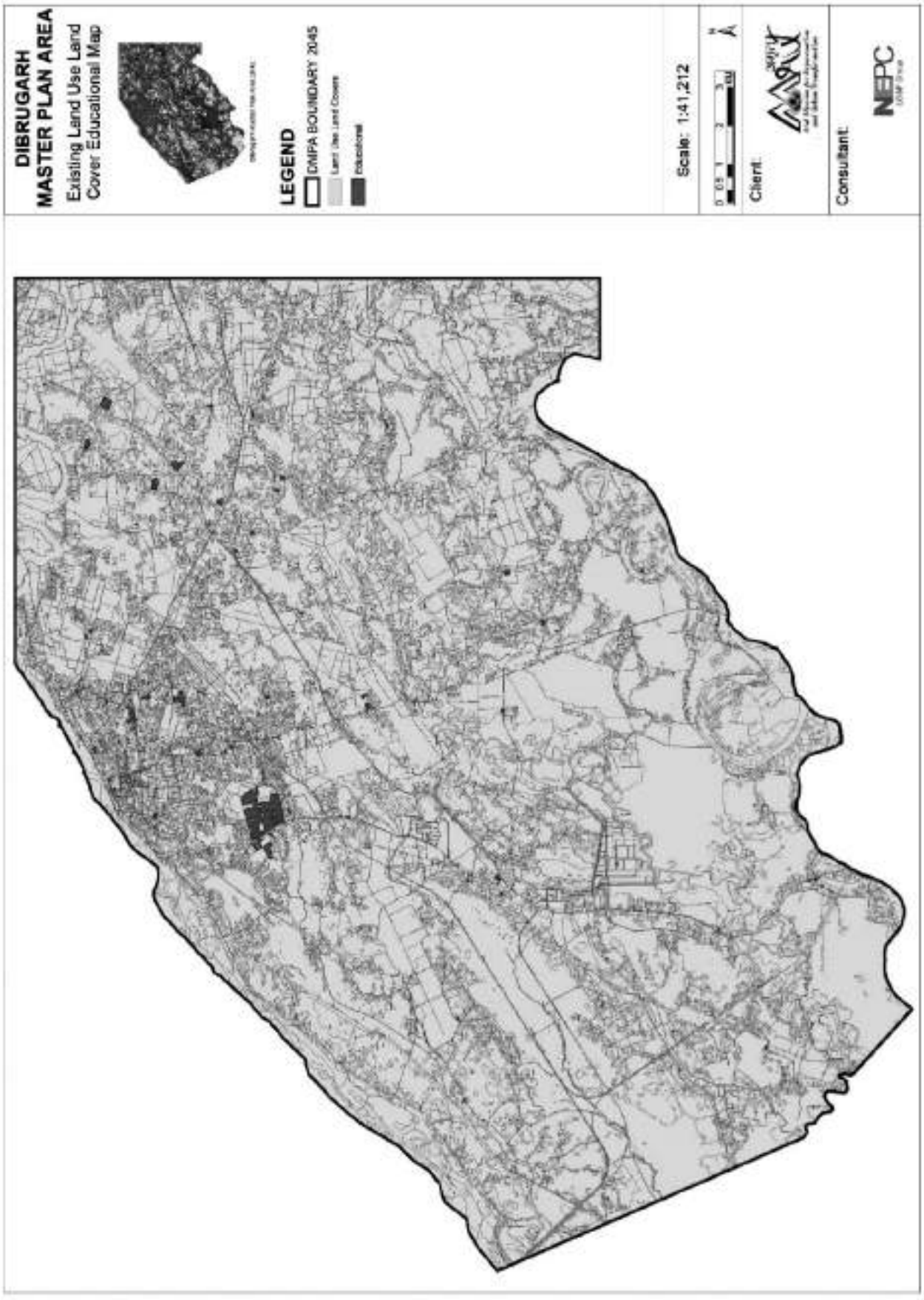


Figure 1.56 Spatial Distribution of Educational Facilities in the Dibrugarh Planning Area

8.2.1.3 Educational Facility Demand Projection

Table 203 Demand-Supply Gap Assessment of Educational Facilities: School Level

Existing Scenario					Short Term		Medium Term		Long Term		Land Requirement as per Future Need									
Sl. No	Particular	Indicator Unit	Current Level (2011)	Current Gap	Desired Level as per URDPFI guideline	2021		2031		2045		Area Require (Ha)	Short Term		Medium Term			Long Term		
						Demand	Gap	Demand	Gap	Demand	Gap		2021		2031			2045		
													Gap	Total Area Require (Ha)	Gap	Total Area Require (Ha)		Gap	Total Area Require (Ha)	
1.	Population		361397			417572		470719		551757										
2.	School																			
	Pre-Primary, Nursery School		142	2	2500	167	25	188	21	220	32	0.08 ha	25	2	21	1.68		32	2.56
	Primary School (Class I - V)		71	1	5000	83	12	94	11	110	16	0.40 Ha	12	4.8	11	4.4		16	6.4
	Senior Secondary School (VI - XII)		48	0	7500	56	8	62	6	73	11	1.80 Ha	8	14.4	6	10.8		11	19.8
	Integrated School without hostel facility (I - XII)		0	0	100000	4	4	5	1	6	1	3.50 Ha	4	14	1	3.5		1	3.5
	Integrated School with hostel facility (I - XII)		0	0	100000	4	4	5	1	6	1	3.90 Ha	4	15.6	1	3.9		1	3.9
	School for physically challenged		-		450000	1	1	1	0	2	1	0.70 Ha	1	0.70	-	-		1	0.70
	School for Mentally channelled		-	0	1000000	-	-	-	-	1	1	0.20 Ha	-	-	-	-		1	0.20

Table 204 Demand-Supply Gap Assessment of Educational Facilities: College level

Existing Scenario					Desired Level as per URDPFI guideline	Short Term		Medium Term		Long Term		Land Requirement as per Future Need						
Sl. No.	Particular	Indicator Unit (number)	Current Level (2011)	Current Gap		2021		2031		2045		Area Require (Ha)	Short Term		Medium Term		Long Term	
						Demand	Gap	Demand	Gap	Demand	Gap		2021		2031		2045	
1.	Population		361397			417572		470719		551757			Gap	Total Area Require (Ha)	Gap	Total Area Require (Ha)	Gap	Total Area Require (Ha)
2.	College																	
		College	11	0	125000	4	0	4	0	5	0	5 Ha	0	0	0	0	0	0
		University Campus	1	0	1000000	-	-	-	-	-	-	10 to 60Ha	-	-	-	-	-	-
		ITI's/Vocational Training	2	0	1000000	-	-	-	-	-	-	4 Ha	-	-	-	-	-	-
		Polytechnic	1	0	1000000	-	-	-	-	-	-	4 Ha	-	-	-	-	-	-
		Engineering College	1	0	1000000	-	-	-	-	-	-	6 Ha	-	-	-	-	-	-
		Medical College	1	1	1000000	-	-	-	-	-	-	15 Ha	-	-	-	-	-	-
		Other Professional Colleges	-	1	1000000	-	-	-	-	-	-	2 Ha	-	-	-	-	1	2.00
		Nursing and Paramedical Institute	1	0	1000000	-	-	-	-	-	-	2000 sqm	-	-	-	-	-	-

8.2.1.4 Summary of Educational Facilities Requirement

The demand of various Educational Facilities for the year 2045 is mentioned below in the table 207. The calculations are done based on URDPFI Guidelines

Table 205 Demand of Educational Facilities & Land Requirement for 2045

Sl. No.	Particular	Demand in 2045	Land required in 2045 (Ha)
1	Pre-Primary, Nursery School	220	6.24
2	Primary School (Class I - V)	110	15.6
3	Senior Secondary School (VI - XII)	73	45
4	Integrated School without hostel facility (I - XII)	6	21
5	Integrated School wit hostel facility (I - XII)h	6	23.4
6	School for physically challenged	2	1.4
7	College	6	0
8	University Campus	1	0
9	ITI's/Vocational Training	1	0
10	Polytechnic	1	0
11	Engineering College	1	0
12	Medical College	1	0
13	Other Professional Colleges	1	2
14	Nursing and Paramedical Institute	1	0

(Source: Compiled by Consultant)

Based on the area requirement for each unit, land requirement for the above mentioned educationalfacilities is worked out. There will be a need of 114.64 Ha. of land for the above mentioned educational facilities.

8.2.1.5 Proposed Strategies

- As the process of Educational department recruitment should be consolidate to make sure only highly skilled teachers are recruited.
- More infrastructural facilities like public library, laboratory, and computers should be provided to schools to enhance the pupil's learning.
- There is a need to set up more schools in villages and out growths of the planning area to improve the people's access to educational facilities.
- Welfare for the differently-abled children should be given due emphasis by setting up special learning schools for them.
- Special emphasis should be laid on technical and skill based vocational education.
- More jobs oriented vocational courses should be introduced by utilizing the existing infrastructure facilities of polytechnic institutions.
- Keeping in view, the influence zone of Dibrugarh, it is suggested that more emphasis should be laid on professional education, thus more number of professional institutes are proposed for future development.
- Looking in to the potential of area, Knowledge District is been proposed in region.

8.2.2 HEALTH

The existing health facilities in Dibrugarh include primary health centre, government and private hospitals, eye hospital, veterinary hospital, national polio surveillance centre and nursing homes. These facilities have been set up by both public and private sector organisations, although, the key medical facilities in the area are provided by private sector.

8.2.2.1 Current Scenario

Table 208 Existing Health Facilities of Dibrugarh Master Plan Area

Sl. No.	Health Facilities in DMPA	Number (as per Census 2011)
1	Primary Health Centre	23
2	First Referral Units	4
3	Community Health Centres	1
4	Sub-Centres	0
5	Clinic/Poly Clinic	1
6	Nursing Home	3
7	No. of Diagnostic Centres	3

(Source: Joint Director Health, Dibrugarh)

AMC Hospital

8.2.2.2 Health Facility Demand Projection

Figure 157 Spatial Distribution of Healthcare facilities in the Dibrugarh Planning Area

Table 207 Demand-Supply Gap Assessment of Medical Services

Existing Scenario					Desired Level as per URDPFI guideline	Short Term		Medium Term		Long Term		Land Requirement as per Future Need					
Sr. No.	Particular	Indicator Unit (number)	Current Level (2011)	Current Gap		2021		2031		2045		Area Require (Ha)	Short Term		Medium Term		Long Term
						417572		470719		561797			2021		2031		2045
1.	Population		361397			Demand	Gap	Demand	Gap	Demand	Gap		Gap	Total Area Require (Ha)	Gap	Total Area Require (Ha)	Gap	Total Area Require (Ha)
2.	Hospital																	
	Dispensary		20	1	18000	23	3	31	3	37	6	0.08 to 0.12 Ha	6	0.40	3	0.36	6	0.48
	Nursing home, child welfare and maternity centre		3	5	45000 to 1 lakh	9	6	10	1	11	1	0.20 to 0.30 Ha	6	1.8	1	0.30	1	0.30
	Polyclinic		1	4	1 lakh	4	3	5	1	6	1	0.20 to 0.30 Ha	3	0.90	1	0.20	1	0.20
	Intermediate Hospital (Category B)		-	4	1 lakh	4	4	5	1	6	1	1.00 Ha	4	4.00	1	1.00	1	1.00
	Intermediate Hospital (Category A)		-	4	1 lakh	4	4	5	1	6	1	3.70 Ha	4	14.8	1	3.70	1	3.70
	Multi-Specialty Hospital		-	4	1 lakh	4	4	5	1	6	1	9.00 Ha	4	36.00	1	9.00	1	9.00
	Specialty Hospital		-	4	1 lakh	4	4	5	1	6	1	3.70 Ha	4	14.8	1	3.70	1	3.70
	General Hospital		-	2	2.5 lakh	2	2	2	-	2	-	6.00 Ha	2	12	-	-	-	-
	Family Welfare Centre		-	7	50,000	8	8	9	1	10	1	600 - 800 sqm	2	1600 sqm	1	800 sqm	1	800 sqm
	Diagnostic centre		-	7	50,000	8	8	9	1	10	1	600 sqm to 800 sqm	1	800 sqm	1	800 sqm	1	800 sqm
	Veterinary Hospital for pets and animals		-	1	5 lakhs	1	1	1	-	1	-	2000 sqm	1	2000 sqm	-	-	-	-
	Dispensary for pet animals and birds		-	4	1 lakh	4	4	4	-	5	1	300 sqm	4	1200 sqm	-	-	-	-

8.2.2.3 Summary of Health Facilities Requirements

Table 208 Demand of Health Facilities & Land Requirement for 2045

Sr. No.	Particular	Demand in 2045
1.	Dispensary	37
2.	Nursing home, Child Welfare and Maternity Centre	11
3.	Polyclinic	6
4.	Intermediate Hospital (Category B)	6
5.	Intermediate Hospital (Category A)	6
6.	Multi-Specialty Hospital	6
7.	Specialty Hospital	6
8.	General Hospital	2
9.	Family Welfare Centre	10
10.	Diagnostic centre	10
11.	Veterinary Hospital for pets and animals	1
12.	Dispensary for pet animals and birds	5

(Source: Compiled by Consultant)

Based on the URDPFI Guidelines 2015, the demand of health facilities in 2045 for Dibrugarh Planning Area is worked out. There will be a need of 2 General hospital, 06 Policlinics, 6 Intermediate Hospitals, 6 Special Hospitals and 1 Veterinary hospitals for pets and animals till 2045. This shall be spatially distributed in the planning area. Based on the area requirement for each unit, land requirement for the above-mentioned health facilities is worked out. There will be a need of 127.32 Ha. of land for the above-mentioned health facilities.

8.2.2.4 Proposed Strategies

Dibrugarh Master Planning Area is having reputed medical institutes which provided best medical facilities and medical education. The rural health system has to be improve the medical services. Government agencies carrying out the planning and implementation of the initiatives in medical services have to be provided with enough funds to upgrade the existing medical infrastructure in the government hospitals and for modernization medical equipment's. It should be made sure that the hospitals are equipped with adequate equipment's and man power to serve the population within the planning area and around it. There should be periodic monitoring and assessment of the health infrastructure within the planning area.

Some important measures that can be taken up by appropriate authority to augment and improve the Health care system and facilities in Dibrugarh Plannig area:

The rural health system has to be improve the medical services. Government agencies carrying out the planning and implementation of the initiatives in medical services have to be provided with enough funds to upgrade the existing medical infrastructure in the government hospitals and for modernization medical equipment's.

- It is also important to cater to needs and welfare of the elderly and differently-abled residents of the area. Thus, old Age Home-cum-Care Centre for Senior Citizens and Mentally Challenged should be appropriately set-up.
- Introduction of new technology like provision of multi specialty facilities and equipments etc. in the hospitals and primary health centers.
- There is requirement for training centers for nurses and paramedical staff like pathology, pharmacy may be started to train local and regional students.
- There is a need for the up-gradation of existing hospital, Clinics, Nursing Homes, etc in the planning area especially those publically owned.
- Setting up of dispensaries in rural parts of the planning area which are currently absent.

8.2.3 OTHER SOCIAL INFRASTRUCTURAL FACILITIES REQUIREMENT

Other social infrastructure facilities like commercial centres; Socio-Cultural facilities, library, milk booths, LPG Go-downs, Police stations, Judicial Court, Post Office, Fire stations, etc.; Recreational facilities like parks, Multi-Purpose Grounds, sports facilities, etc. are also essential for the balanced development of the planning area and improving the quality of life of the its residents.

7.2.3.1 Existing and Future assessment of social infrastructure facilities

Table 209 Existing and Future assessment of social infrastructure facilities

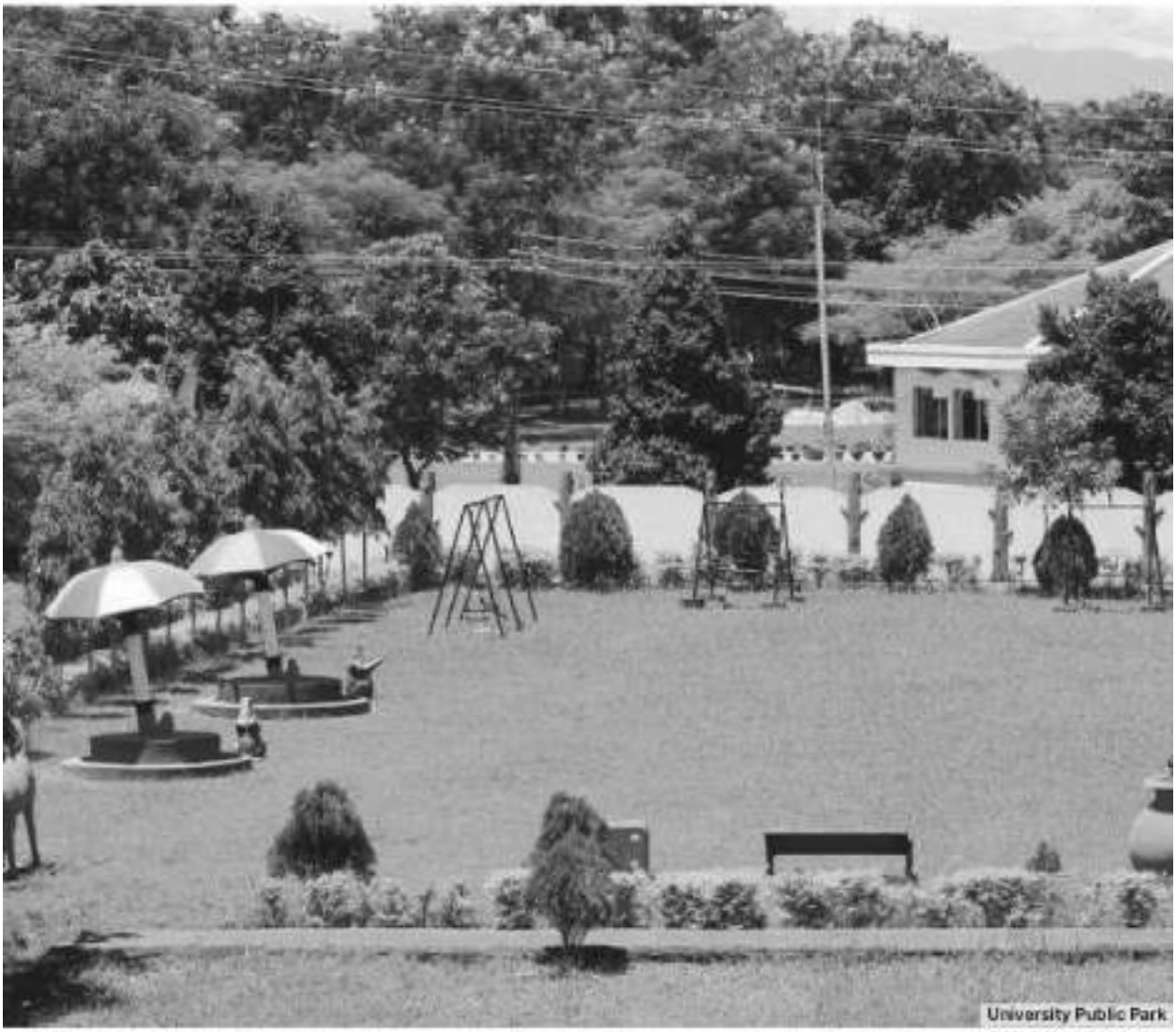
Category	Population served per unit	Area Requirement	Requirement	Existing	Future Requirement (2045)	Future Area Required
Anganwadi - Housing area/cluster	5000	200-300 sqm	110	71	39	7,800 sqm-
Community Room	5000	750 sqm	110	28	82	61,500 sqm
Community hall, mangalkaryayala, barat ghar/library	15000	2000 sqm	37	9	28	56,000 sqm
Music, dance and drama centre	1 lakh	1000 sqm	6	-	6	6,000 sqm
Meditation and spiritual Centre	1 lakh	5000 sqm	6	-	6	11,000 sqm
Recreational Club	1 lakh	Max. 1000 sqm,	6	-	3	6,000 sqm
Old age home	5 lakhs		1	-	1	-
Religious Facilities						
At Neighbourhood /Housing cluster level	5000	400 sqm	110	28	82	32800 sqm-
At sub city level in urban extension	10 lakhs	4.00 Ha	-	-	-	-
Other Facilities						
Orphanage/ Children's Centre one each	10 lakhs	Max. 1000 sqm,	-	-	-	-
Care centre for physically /mentally challenged	10 lakhs	Max. 1000 sqm,	-	-	-	-
Working women – men hostel	10 lakhs	Max. 1000 sqm,	-	-	-	-
Adult education centre	10 lakhs	Max. 1000 sqm,	-	-	-	-
Night Shelter	10 lakhs	Max. 1000 sqm,	-	-	-	-
Socio – Cultural centre/Exhibition cum fair ground	10 lakhs	15 Ha	-	-	-	-
Science Centre	10 lakhs	As per requirement	-	-	-	-
International Convention	City level	As per requirement	-	-	-	-

8.2.4 PARKS & OPEN SPACES

Table 210 Existing and future assessment of open spaces.

Category	Population served per unit	Area Requirement (Ha)	Requirement	Existing	Future Requirement (2045)	Future Required Area
Housing Area Park	5000	0.50 to 1.00	110	71	39	19.5 to 39 ha
Neighbourhood park	10000	1.20 to 2.00	55	14	41	49.20 to 82
City Parks/ playgrounds/ maidan/exhibition grounds/ cultural gathering grounds	1 for every town	–	-	-	- -	-
Botanical Garden	1 for every town	10.00 to 20.00	-	-	-	-
Recreational complex including zoo	1 for every settlement with tourist potential	10.00 to 12.00	-	-	-	-

(Source: Compiled by Consultant)



University Public Park

Figure 158 Parks spatial distribution Map

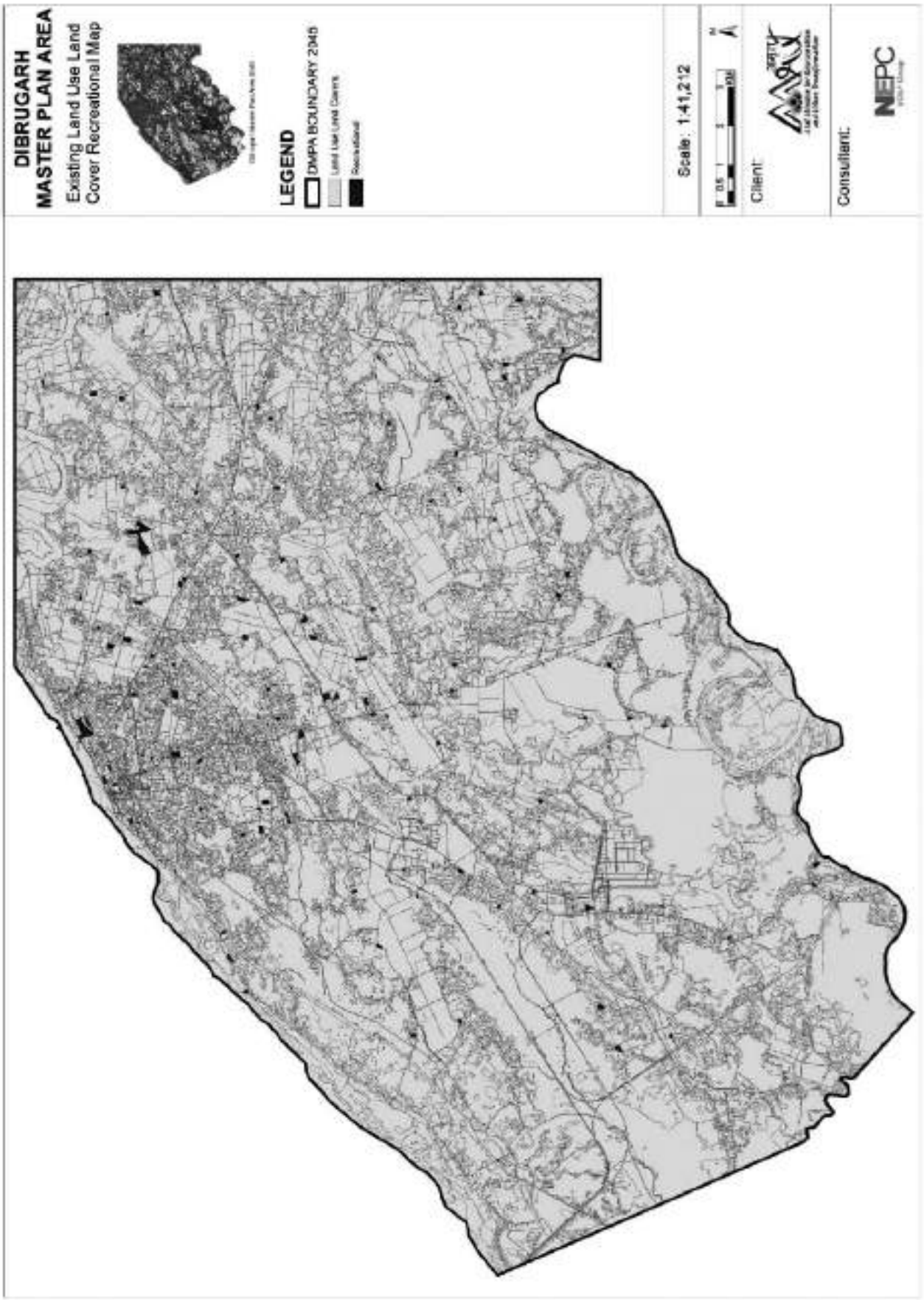


Figure 159 Recreational Facility spatial distribution Map

8.2.5 MULTI-PURPOSE GROUNDS AND SPORTS FACILITIES REQUIRED

Table 211 Existing and future assessment of multipurpose grounds and sports facilities

Category	Population served per unit	Area Requirement (Ha)	Requirement	Existing	Future Requirement (2045)	Future Required Area
Sub city level multipurpose ground	10 lakhs	8	-	-	-	-
District level multipurpose ground	5 lakhs	4	1	-	1	4ha
Community level Multipurpose ground	1 lakh	2	5	-	5	10ha
Residential unit play area	5,000	5000 sqm	137	28	109	545,000sqm
Neighbourhood Play area	15,000	1.50 ha	46	9	35	52.5ha
District Sports Centre	1 lakh	8.00 ha	7	-	7	56ha
Divisional Sports Centre	10 lakhs	20.00 ha	0	-	-	-

(Source: Compiled by Consultant)

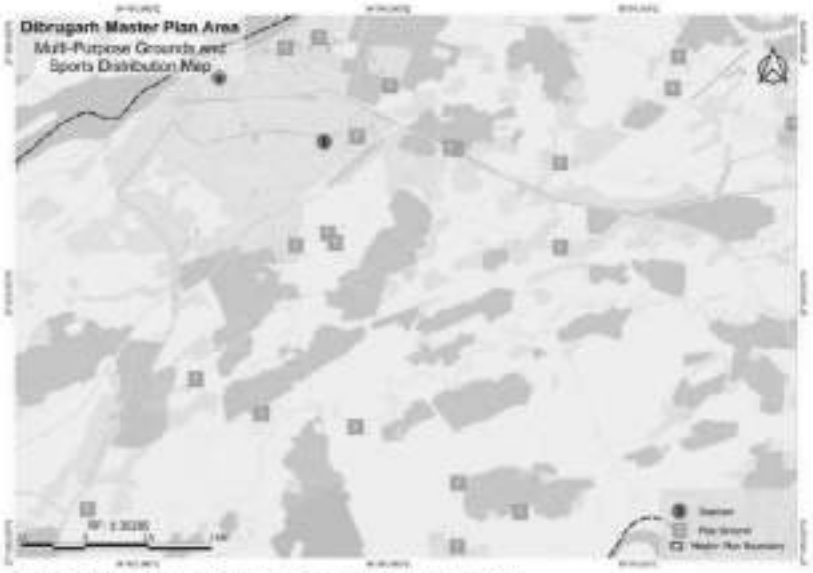


Figure 160 Multi-Purpose Grounds and Sports spatial distribution Map

8.2.6 COMMUNITY FACILITIES

8.2.6.1 Existing Communities and other Facilities

Table 212 Existing Communities Facilities

Sr. No.	Facilities	Numbers
1	Corporation Gardens	1
2	Community Hall	15
3	Swimming Pool	2
4	Corporation Playgrounds	6
5	Gymnasia	10
6	Corporation Stadium	4
7	Cinemas	2
8	Open Air Theatres	0
9	Zoo	0
10	Public libraries	1
11	Art Galleries	0
12	Museum	1
13	Other (specify)	-
14	Fire Services	1
	No. of Fire stations	1
	No. of fire tenders	5
	Personnel	32
15	Cremation/Burial Ground	5
16	Petrol/Gas Station	11
17	Hotels and Eating Places	350

(Source: Dibrugarh Municipal Board)

Table 213 Existing Toilets

Sr. No	Facilities	Numbers
1	Public toilets (in no.)	15
2	No of Toilets Pay & Use	4
3	Users per toilet daily (in No)	570
4	Average User Charge	Rs 5
5	Average yearly expenditure on maintenance (Rs. in Lakh)	1,00,000

(Source: Dibrugarh Municipal Board)

8.2.6.2 Existing and Future assessment of Community facilities

Table 214 Existing and Future assessment of community facilities.

Category	Population served per unit	Area Requirement (Ha)	Requirement	Existing	Future Requirement (2045)	Future Required Area
Milk Booths	5000	0.015	137	28	109	1.64ha
LPG Godowns	50000	0.2	14	-	14	2.8ha
Police Station	90000	1.5	8	-	8	12ha
Police Post	40000	0.16	18	-	18	2.88ha
District Jail	1000000	10	0	-	-	-
Fire Station	200000	1	4	-	4	4ha
Sub Fire Station	within 3-4km radius	0.6	-	-	-	-
Disaster Management Centre	One in each administrative zone	1	-	-	-	-
Post Office	15000	0.6	46	9	37	22.2ha
Graveyard / Burial Ground	10000	1	68	14	54	54ha

(Source: Compiled by Consultant)

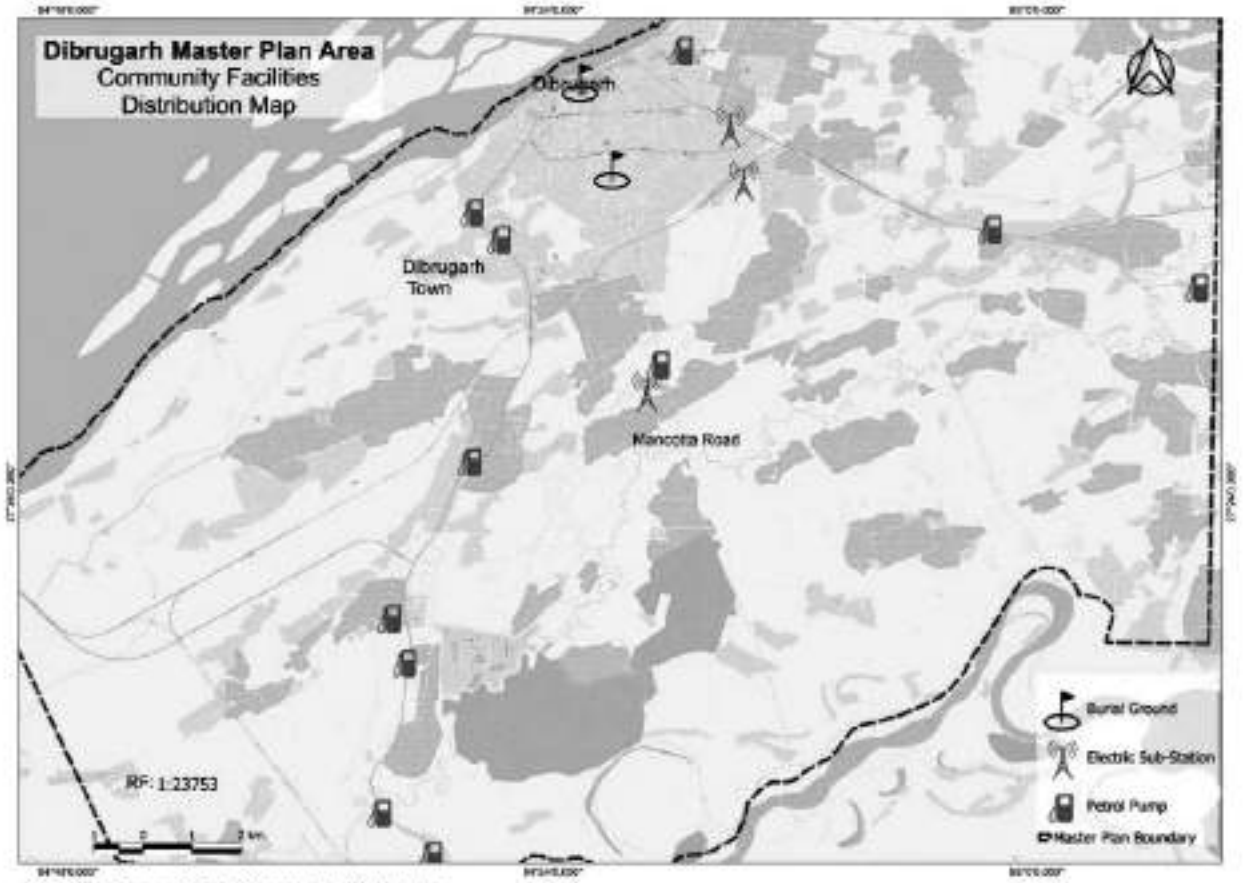


Figure 161 Community Facilities spatial distribution Map

8.2.7 COMMERCIAL FACILITIES

8.2.7.1 Existing Commercial Facilities

Table 215 Existing Commercial Facilities

Year	Hotel	Restaurant	Wholesale	Retail shop
2011	-	-	-	-
2012	-	-	-	-
(up to 2019)	250	70	75	3500

(Source: Dibrugarh Municipality)

8.2.7.2 Existing and Future assessment of Community facilities

Table 216 Existing and future assessment of commercial facilities

Category	Population served per unit	Area Requirement (Ha)	Requirement	Existing	Future Requirement (2045)	Future Required Area
Convenience Shopping	5000	0.15	137	28	109	16.35ha
Local shopping including service centre	15000	0.46	46	9	37	17.36ha
Community centre with service centre	100000	5	7	-	7	35ha
District centre	500000	1	1	-	1	1ha

(Source: Compiled by Consultant)

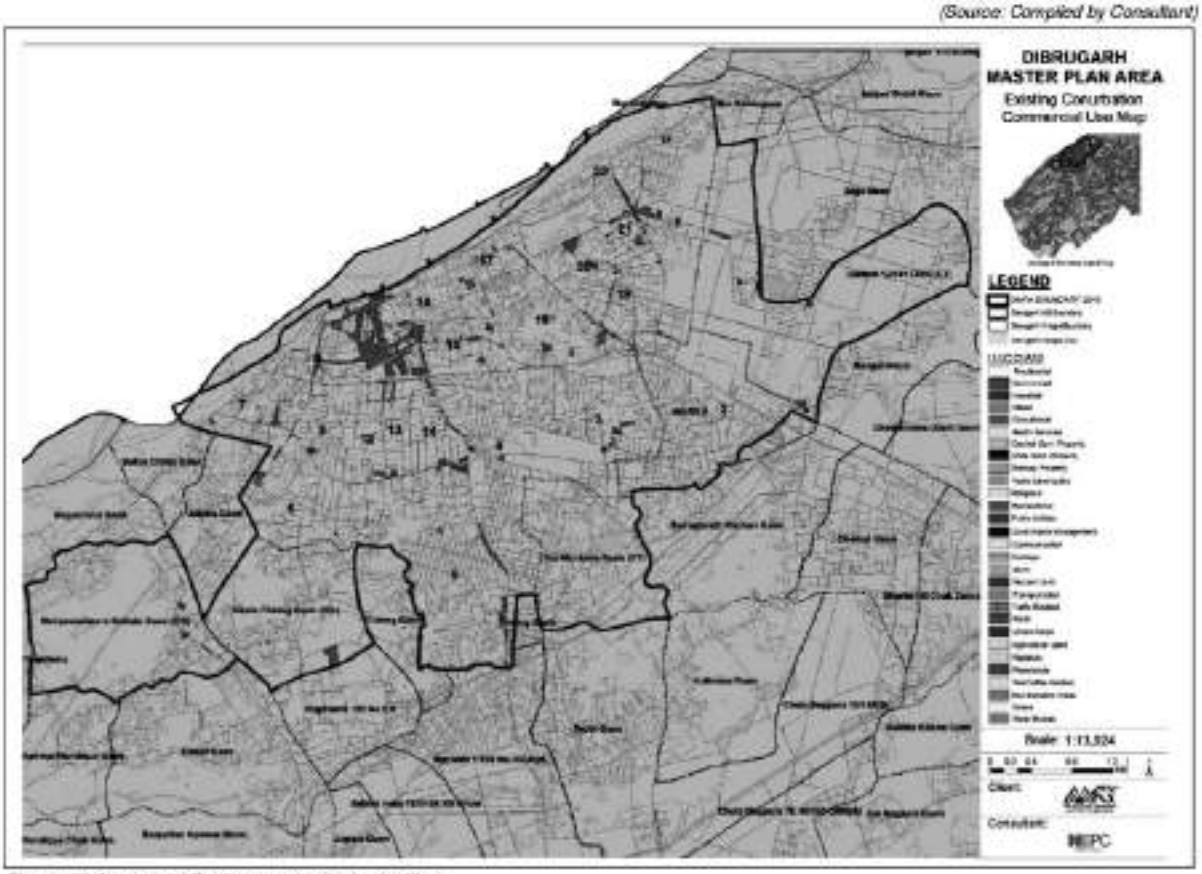


Figure 162 Commercial Facilities spatial distribution Map

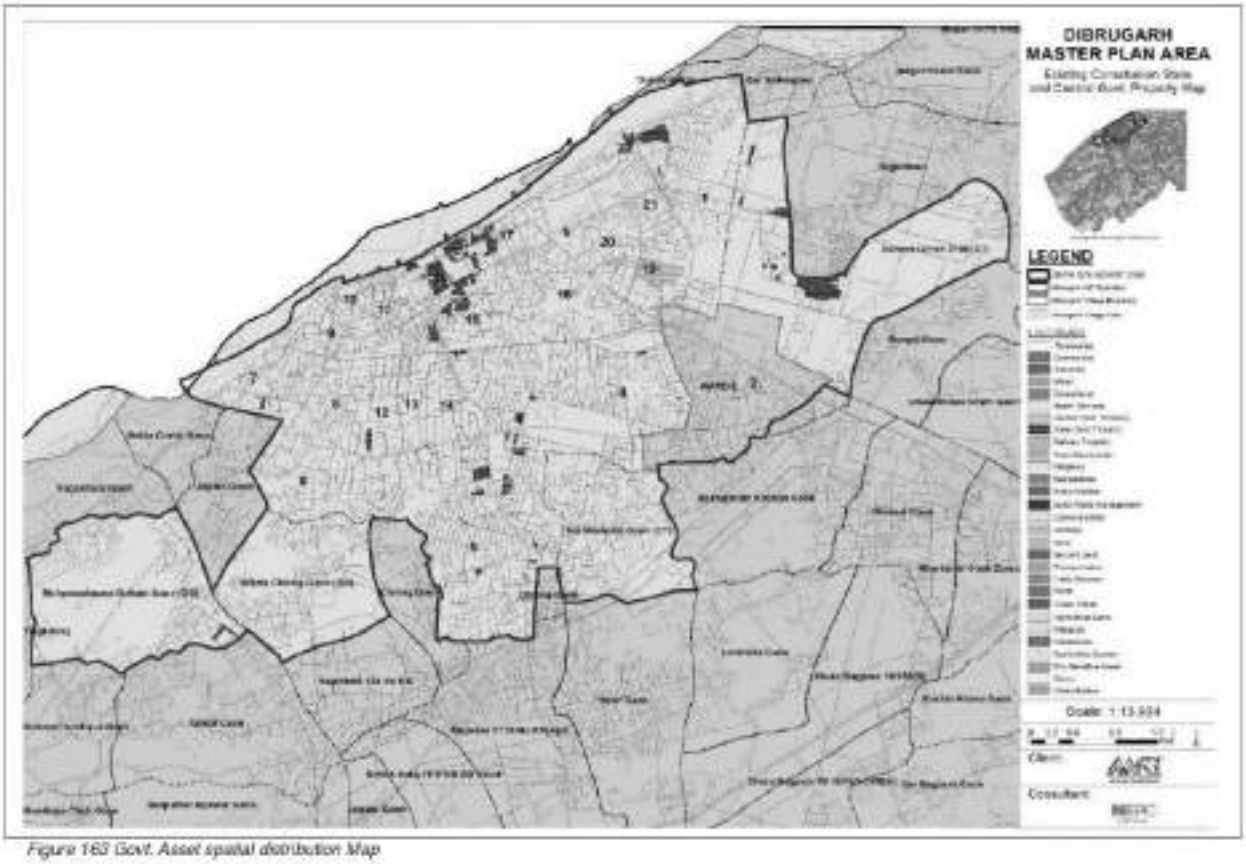
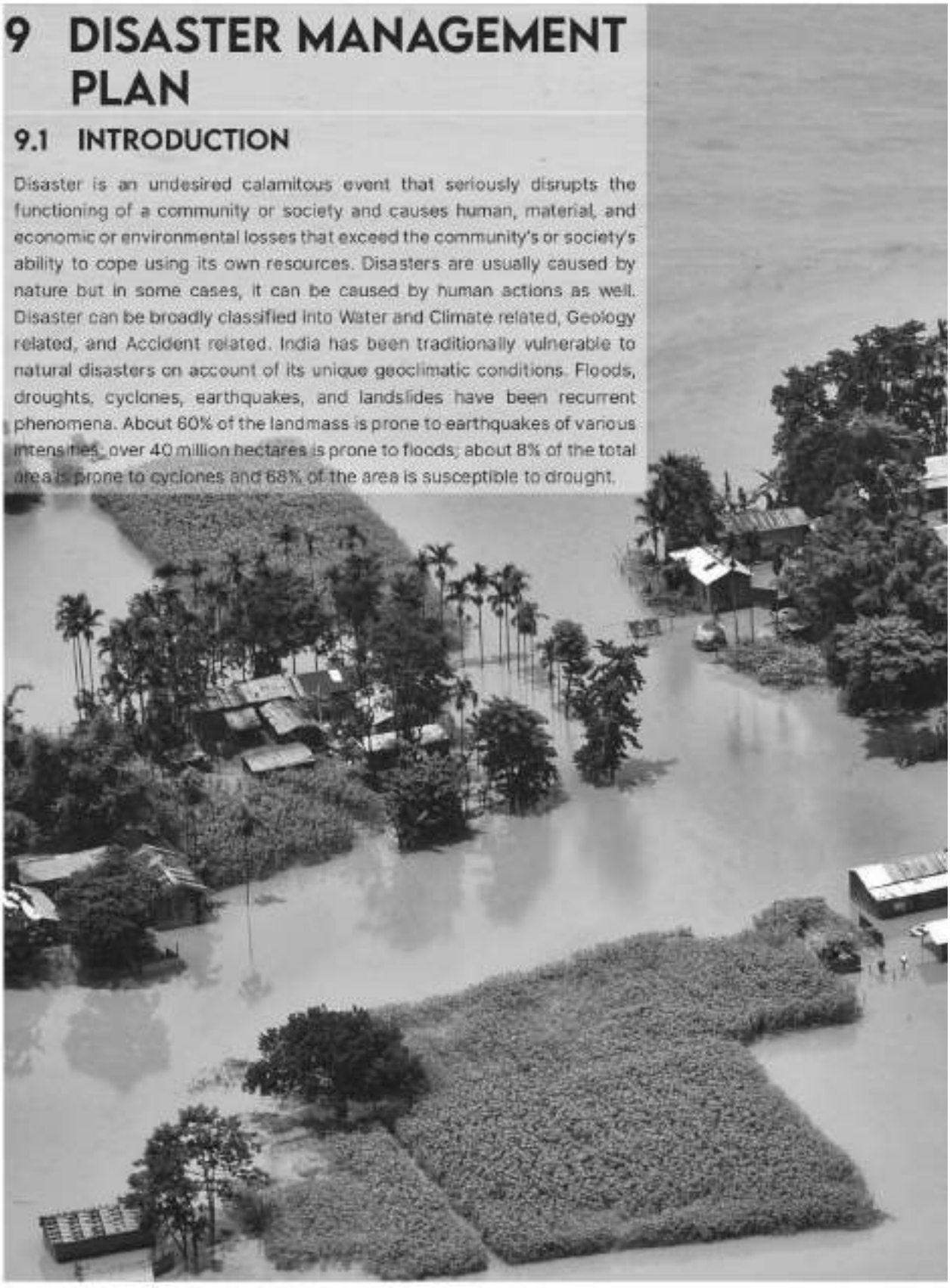


Figure 163 Govt. Asset spatial distribution Map

9 DISASTER MANAGEMENT PLAN

9.1 INTRODUCTION

Disaster is an undesired calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community's or society's ability to cope using its own resources. Disasters are usually caused by nature but in some cases, it can be caused by human actions as well. Disaster can be broadly classified into Water and Climate related, Geology related, and Accident related. India has been traditionally vulnerable to natural disasters on account of its unique geoclimatic conditions. Floods, droughts, cyclones, earthquakes, and landslides have been recurrent phenomena. About 60% of the landmass is prone to earthquakes of various intensities, over 40 million hectares is prone to floods, about 8% of the total area is prone to cyclones and 68% of the area is susceptible to drought.



At the national level, the Ministry of Home Affairs is the nodal Ministry for all matters concerning disaster management. The Central Relief Commissioner (CRC) in the Ministry of Home Affairs is the nodal officer to coordinate relief operations for natural disasters. The CRC receives information relating to forecasting/ warning of a natural calamity from India Meteorological Department (IMD) or from Central Water Commission of Ministry of Water Resources on a continuing basis. The Ministries/Departments/Organizations concerned with the primary and secondary functions relating to the management of disasters include India Meteorological Department, Central Water Commission, Ministry of Home Affairs, Ministry of Defense, Ministry of Finance, Ministry of Rural Development, Ministry of Urban Development, Department of Communications, Ministry of Health, Ministry of Water Resources, Ministry of Petroleum, Department of Agriculture & Cooperation. Ministry of Power, Department of Civil Supplies, Ministry of Railways, Ministry of Information and Broadcasting, Planning Commission, Cabinet Secretariat, Department of Surface Transport, Ministry of Social Justice, Department of Women and Child Development, Ministry of Environment and Forest, Department of Food.

Location: The region falls in the North eastern part of India and in the extreme east of Assam between 26.50-27.900 north latitude and 93.46-96.100 east latitude. The soil is mostly of alluvial origin. Due the heavy rainfall with cool and pleasant climate, vegetation growth is rich. The annual mean of maximum temperature is 27.30 Celsius, while the mean of minimum is 18.40 Celsius. On the other hand, the minimum relative humidity is 64 whereas maximum is 90.

With the passing of years Dibrugarh has become a fully-grown urban centre of upper part of Assam and become the hub of administrative, educational, and commercial activities. The district is located about 103.74 M above the mean sea level. It has the boundaries as follows

North : Dhemaji District and part of Lakhimpur District

South : Sivasagar District and Arunachal Pradesh

East : Tinsukia District,

West : Sivasagar District

The area stretches from the North Bank of the mighty Brahmaputra, which flows a length of 95km through the northern margin of the district, to the Patkai foothills on the South. The Burhi Dihing, a major tributary of the Brahamputra with its network of tributaries and wetlands flows through the district from east to west. Till the great earthquake of 1950, the north easternmost corner was drained by the Dibru River. The Dibru was a main tributary of the Brahamputra the confluence of it being at about 18km east of Dibrugarh City. By raising the bed of the Brahamputra, the earthquake caused severe erosion on its south bank and as a result the Dibru river got merged with its master stream in Rahmaria mouza.

The district suffers following major natural hazards – floods, chemical disasters (fire), draught, famine and earthquake, which are of high frequency of occurrence. In the past years, flood has become a sorrow for the people of Dibrugarh District. Immediately after the great Independence Day earthquake of 1950, consequent land slides in the catchment's areas of Brahmaputra and other tributaries have changed the topography of the rivers. The impact was so morable that river Brahmaputra changed its course with a raised bed. A number of public and private buildings along with major portion of Dibrugarh town were rapidly devoured by Brahmaputra within a short span of couple of years. Dibrugarh Town is 103.74 metres above the sea level whereas an average land of river Brahmaputra remains at 104.35 to 104.65 metres above the mean sea level. The highest flood level recorded was 106.48 metres. Ironically, during the flood season, the people of Dibrugarh are living about three feet of river water level.

9.2 CURRENT SCENARIO

Dibrugarh Town has a very poor drainage system. The Dibrugarh Town Protection (DTP) Drain which runs through the heart of the Town falls at Rajabheta stream at a distance of 5 km. from the town. During the rainy seasons and heavy showers, the drain overspills. A second drain carries water from East-West and central Chowkidinghee and Santipara area to the DTP drain. The third drain i.e., the Rajabheta drain is also not capable of carrying the water load during heavy showers. On the other hand, most of the roadside drains are kutcha and have mild gradient towards the outfall. The low discharging capacity of these drains, poor drainage system and unfair construction practices has been the main determinant of artificial flood and water logging problem in the town. **The worst affected areas are Dibrujan, Grahambazar, Part of Gabharupathar, Khalihamari, Lachit Nagar, (Ward no.4), Jibon Phukan Nagar, East, South & North Milan Nagar, Rup Nagar, Santipara (Ward no. 13 &14).**

Because of the arrival of the southwest Monsoon and with the continuous heavy rain, the water level of the Brahmaputra rises rapidly. During this period, the main drain could not find a gradient to discharge the water from the town area and waterlogged in various pockets cause artificial flood. Pumping out this logged water gives only a temporary solution to the problem. In addition, there were certain areas like ward no.2 which was used as natural reservoir in earlier days donot exist at present. This also contributes to the problem of artificial flooding. As no solid waste disposal system is being set up in the Town till date, the garbage is disposed off by Dibrugarh Municipal Board in Maijan area near the river Brahmaputra. On the other hand, individual service pit and Sanitary Latrine serves the sewerage system.

The basic objective of current Disaster Management Action Plan is to protect all the residents and the wealth of the region from all sort of untoward incidents through the following objectives:

- To prevent loss of human lives and property.
- Institutionalization of disaster management in district administration level.
- Encourage a culture of disaster preparedness.
- Vulnerability reduction and disaster mitigation through better planning process.
- Creation of best government mechanism to handle and unprecedented events.
- Instant response and effective decision making in disasters.
- Better coordination of relief and rehabilitation in the aftermath of a disaster.
- Better coordination of all line departments in disaster management.
- Regular updates of resources in and around the district.

9.2.1 FLOOD

The tributaries of the Brahmaputra have widely divergent characteristics in the district. 45 per cent of Assam's total area is flood prone. The Brahmaputra River with its 34 tributaries causes regular floods in the state. The average annual rainfall in the state is 1662.2 mm. Ninety per cent of the heavy downpour occurs in the months of April-September. In 1999, more than 200 villages were inundated, and 0.27 million people in 749 villages of 10 districts were affected. In the year (2001), 94,382 people in 12 districts and 483 villages were severely affected. Road and rail communication was cut off in many districts. In 2000 alone, 3 million people lost their homes and vast stretches of paddy were swallowed by floodwaters. During 2002 floods 41 people have lost their lives, 19,827 houses damaged, and 0.3 million hectares of cropped land has been affected. During 2003, 30 people have lost their lives, 4660 houses have been damaged, and 0.2 million hectares cropped area has been affected.

On the Brahmaputra the fluctuations in river levels begin towards the end of March or early part of April, when the Himalayan snow begins to melt. From this period onwards the Brahmaputra River levels records a series of "pumps" or rises for short duration till the end of April, when a more defined rise is felt and in early May, the first flood rises are experienced. As a rule, the first big rise is of short duration and does little harm to the land or early cultivation. By early June the southwest Monsoon registers its arrival in the Assam Valley and with the continuous heavy rain, river levels rise rapidly, and the Brahmaputra remains in flood condition, registering a series of peak flood levels till October. The Brahmaputra has been the main determinant of flood in the district of Dibrugarh. Due to increase of the water level of this mighty river Brahmaputra and also of the river Buridihing inundation of the catchment areas of the river causes flood. This is the main reason of flood in the villages of the Chabua/Dibrugarh East/West Revenue Circles, Tengakhat, Moran Revenue Circle of the District It causes a back flow of the water of its tributaries causing flood. This type of back flow causes flood in places like Madhupur forest village area, Kolakhowa area, Garudhoria area under Dibrugarh West Revenue Circle. In the district of Dibrugarh, the entire length of the river Brahmaputra is not protected by Water Resources dike which was constructed in three phases in the fifties protecting the district right from the Oakland Tea Estate upstream to Dehingmukh gaon in the downstream. A stretch of about ten kilometers on either side of the dike is open to the onslaught of the river and is responsible for the main inlet for the floodwater.

Table 21 Flood occurrence from 2011 -2020

Sl. No.	Year of Occurrence	Area Affected	Population affected
1	2011	NIL	NIL
2	2012	104	98682
3	2013	NIL	NIL
4	2014	102	68697
5	2015	257 (22 MNC ward)	145035
6	2016	148	78372
7	2017	111	70072
8	2018	15	9491
9	2019	125	85761
10	2020	251(22 MNC ward)	86776

(Source: Department of Disaster Management, Dibrugarh)

Table 218 Flood disastrous details

Sl. No.	Disastrous Event	Year of Occurrence	Area Affected	Name of localities	Population affected
1	Flood	2012,2014,2015,2016,2017,2018,2019 &2020	Dibrugarh 22 Municipal wards & 257 Villages	Tengakat, Nahirktia,part of rihabari ward towards the western side of Mancota road. Parts of ward no.10,11 & 16), Dibrujan, Grahambazar, Part of Gabharupathar, Khalihamari, Lachit Nagar, (Ward no.4), Jibon Phukan Nagar, East, South & North Milan Nagar, Rup Nagar, Santipara (Ward no. 13 &14)	1.45 Lakh (2015)

(Source: Department of Disaster Management, Dibrugarh)

Elements at Risk: The key factor that contributes to vulnerability of human populations/ infrastructures to disasters are:

- Peoples residing along the bank of Dibrugarh Town Protection Dyke from Mohanaghat to Maijan and their property
- Peoples residing in the flood affected villages of Dibrugarh East, Dibrugarh West and Chabua Revenue Circle
- The slum pockets in the Town which is about 17.67% of the total population of the Municipal area. During rainy season most of the slum areas becomes waterlogged due to which the existing kutcha roads as well as graveled roads has become badly damaged.
- Babies of age group 0-6 years (11,862 as per 2001census)
- 70, 692 number of female (2011 Census)

9.2.2 EARTHQUAKE

Around 58 % of the territory of India is vulnerable to earthquake, and the country has experienced 3 main earthquakes in the past few decades. The state of Gujarat has experienced a major earthquake in January 2001, Jammu & Kashmir in October 2005 and Sikkim in 2011. The major consequences of any earthquake are widespread human and material losses, excessive damage to infrastructure and services. According to the Geographical Survey of India, Seismic Zoning Map of the country, Silchar region lies in Zone-V which is said to be the most active semis zone in the Country. The North-East part of the country were the Dibrugarh region lies has observed major earthquakes in year 1984 and 2009.

Table 219 Earthquake in Dibrugarh

Sl. No.	Disastrous Event	Year of Occurrence	Area Affected	Name of localities
1	Earthquake	1950	Destroyed almost 70 villages, Later the hills and rocks around the geography and Landslide block the dibru river.	Dibrugarh was partly destroyes

(Source: Largest earthquakes in the world since 1900, Sep 20,2011)

9.2.3 RIVER EROSION

River erosion is a season specific calamity observed in certain period of time mostly in fixed seasonal interval. In rainy season specifically from months April to July, when Barak river flows in its peak capacity level, the erosion on banks becomes disaster for the bank settled informal settlements. In year 2008 And 2010 river erosion in a massive scale was observed.

Table 220 River erosion

Sl. No.	Disastrous Event	Year of Occurrence	Area Affected
1	River Erosion	2010, 2008	Rohmoria and Dibrugarh town

(Source: Water resources assam govt.)

9.2.4 STORM

At least 45 people have died and around 4,000 were injured in the worst cyclonic storm to hit India's north-eastern state of Assam in 2005. The storm was so severe, number of people were blown away and some are still missing. The storm, which was accompanied by heavy rains, raged for 30 minutes through remote villages in Assam's Dhubri district and in parts Dibrugarh district.

Table 221 Storm

Sl. No.	Disastrous Event	Year of Occurrence	Area Affected
1	Cyclone storm	2010,2016,2019, and 2020	Area around Dibru river

Table 222 Natural disaster in Dibrugarh district

Sl.No	Year	Fire	Flood	Storm	Lightning	Electrocution	Boat mishap	Bridge colapsed
1	2010	0	0	2	0	0	6	0
2	2011	0	0	0	0	0	0	0
3	2012	6	0	0	0	0	0	0
4	2013	0	0	0	0	0	0	0
5	2014	0	0	0	0	0	0	0
6	2015	7	0	0	0	0	0	0
7	2016	4	0	1	2	0	2	1
8	2017	2	0	0	2	0	0	0
9	2018	0	5	0	1	0	0	0
10	2019	0	0	4	0	4	0	0
11	2020	7	5	1	0	4	0	0
Grand Total		**26**	**10**	**8**	**5**	**4**	**8**	**1**

9.3 SEASONAL HAZARD ANALYSIS

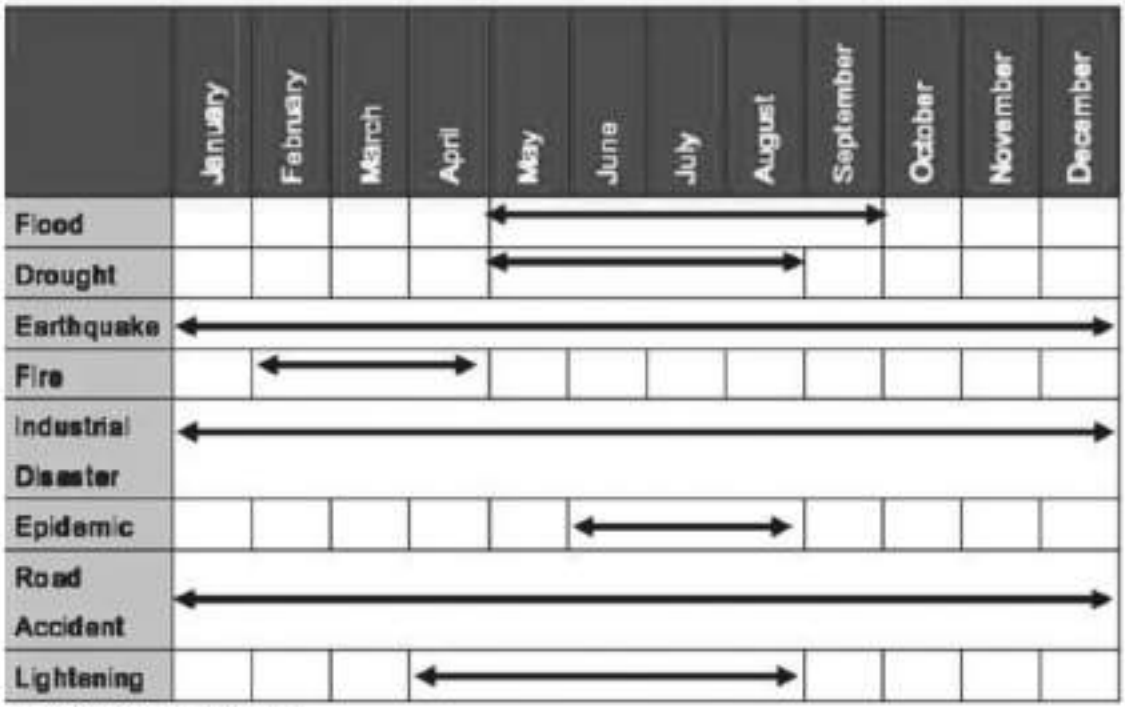


Figure 164 Seasonal Hazard Analysis

9.4 DISASTER VULNERABLE AREA MITIGATION PLAN

Any disaster management plan or emergency management plan consists of four phases, namely: Mitigation, Preparedness, Response and Recovery. The mitigation component in an emergency management plan is aimed at reducing the risk, impact, effects of a disaster. Hence careful planning in the mitigation phase is important to reduce or eliminate the Longterm risk to human life, property from natural and manmade calamities. It's important to have mitigation plans led by local community, working together to identify, plan for in the event of a disaster and reduce vulnerabilities and promote long term personal and community resilience and sustainability. Mitigation plans can concentrate on both pre-disaster and post disaster efforts to reduce the impact of the disaster.

Pre-disaster Mitigation should focus on projects and interventions to address natural and man-made disaster to reduce risk to the population and property. This is mainly achieved by strengthening the resilience of National/State Infrastructures. Post-disaster Mitigation efforts are primarily designed to reduce future damage in an affected area and decrease the loss of life and property due to the incidents following the disaster. The essential steps of hazard mitigation are: -

Figure 165 Disaster management plan

- Hazard Identification.
- Vulnerability Analysis.
- Defining a Hazard Mitigation Strategy.
- Implementation of Hazard Mitigation Activities and projects.

The Dibrugarh region is more prone to Floods, than any other natural disasters hence the disaster vulnerable area mitigation plan focuses on flood and cyclone related eventualities and how can it be mitigated and have a better preparedness. It is important to note that disaster management is an integrated task involving various government departments of region and the plan should focus on prevention, preparedness, mitigation, response, and relief measures.

9.4.1 PREVENTION PLAN

9.4.1.1 Measures already taken

The Dibrugarh Town is protected by Water Resources dyke which was constructed in three phases in the fifties, protecting the district right from the Oakland Tea Estate upstream to Dehingmukh gaon in the downstream.

These construction activities though initially help in protecting Dibrugarh town, continuous erosion at Maijan, Mathala, Oakland, Barsaikia Gaon with a major portion of Rangagarah Tinsukia Road connected with Maijan T.E. and adjoining areas located east of Dibrugarh town, creates threats to these measures. It was estimated that an area of 2,581.22 acres of tea-bearing and other rich land has been eroded. Several measures that have been taken by the Water

Resources department for the safety of dykes as well as to reduce the overflow of rainwater through canals be follows:

- Stone Bouldering and RCC purcopine screening along the dyke in Mohanaghat during 2010-11 (work completed)
- Clearing of water plants from dike and the protection of drains is made during the rainy season
- The existing sluice gates are operated regularly to discharge the stagnant water
- Strengthening and Widening of Dibrugarh Town Protection Dike and to its upstream under Flood and Riverbank Erosion Dibrugarh Sub-Project of FREMAA funded by Asian Development Bank (Work completd)
- Strengething of DTP stone spurs under Flood Management Programme (Central Government Scheme – Work completed)
- Screening by Geo-bags and Purcopine in Rohmoria area under Flood Management Programme has been completed

9.4.1.2 Measures need to be taken

As part of prevention of the said natural disasters, the following measures can be adopted by concerned government departments to avoid and minimize the impacts of natural disasters.

- The Public Works Department should monitor the major water bodies like rivers,
- Streams, lakes for constant flow of water, rising levels, and identify potential areas along the water bodies which need additional embankment or revetments, and these works should be implemented on priority before the onset of the season.
- Power and Communication should carry out through inspection of power lines, communication lines for

defects and rectify them. Trees and branches which may damage power and communication lies should the trimmed or removed.

- Health department should ensure that the primary and community health centers are equipped with medicines and medical staff. Preventive vaccines for epidemics should be stocked in adequate quantity. Chlorination of drinking water should be ensured to avoid the outbreak of epidemics in the event of cyclones and floods.
- The Department of Disaster Management is the nodal agency in the Dibrugarh Region and has already handled several flood and cyclone situation in the region. From this experience, it should be able to identify the low lying and vulnerable areas and the population of such places must be warned to be alert and to be ready to move to the cyclone shelters or to safer areas or to the relief camps in case of warning of disaster.
- The Department of Civil Supplies & Consumer Affairs should decide for creation of buffer stock of food grains by making required withdrawal from the Food Corporation of India. Also, adequate quantities of Kerosene and diesel should be procured and made available through the Fair Price Shops.
- Department of Agriculture should take steps to publicise precautionary measures to be taken to save the standing crops in the vulnerable areas. Farmers should be encouraged to have platforms in their fields to stock the crops. Desilting of public and private irrigation channels should be ensured for quick drainage of paddy fields.
- Fisheries & Fishermen Welfare Department shall alert all the coastal villages and hamlets about the impending natural calamity and advice the fishermen not to venture into sea till normalcy is restored.
- Department of School Education shall keep all schools ready for accommodating the evacuees and keep the Central Kitchens to function around the clock with in charge of the centres. NCC and NSS students shall also be grouped to send them for relief works.
- Transport Department should keep ready the list of sufficient numbers of earthmoving vehicles, transportation vehicles such as trucks, tractors, tippers, mini buses etc. Further, all the listed vehicles allocated in connection with calamity has to be kept in roadworthy condition for using them in emergency.
- Fire Services Department shall keep available sufficient number of rescue materials, like life jackets, buoys, ladders and ropes.
- Department of Animal Husbandry & Animal Welfare should store fodder, cattle feed, poultry food etc. and also carry out the inoculation of animals against epidemics. The Key Village Units should harbour stray cattle with shelters.
- Local Bodies shall make arrangements for availability of Generators and pump sets at short notice. For areas with waterlogging Local bodies should clear the L & U type drains which normally clog due to plastic materials and silt.
- The Police Department shall set up a Search & Rescue Team which shall contain at least 20 Police Personnel for each jurisdiction of the Superintendent of Police.
- Similarly, the Fire Services Department shall set up Search & Rescue Team consisting of at least 6 members of each Fire Service Station.

Identification of hazardous locations in different Circles is to be done and marked on the map. Basically, these locations are found prone to fire, earthquake, and artificial flooding. Fires found to be spread out mostly as a result of narrow roads while artificial flooding because of poor drainage pattern. North East

Space Application Centre has been entrusted to Hazard, Risk & Vulnerability mapping of Dibrugarh Town by Assam State Disaster Management Authority. Master Plan of Drainage pattern is to be completed by Town & Country Planning.

There are 2 types of majors Structural and non-structural i.e., Steps are to be taken to mitigate the problems out of Erosion, threat to DTP dyke, banks of Brahmaputra & Buridehing, Fire & Earthquake and Training of Village Land Management and Conservation Committee Members (VLMCC) on preparation of Village Master Plan and Constitution of Ward Disaster Management Committee in 22 wards of Dibrugarh Municipal Board and follow up action

The activities of different line departments to save the life of people and properties in accordance with disaster management cycle. Police departments, Police control room, Wireless facilities, Fire and emergency services and civil defense and home guard.

Table 223 Measures to be Taken for Prevention Plan

Sl. No.	Structural measures	Non-structural measures
1	Installation of Water Collection Deep Tube Well Pumps at five selected sites to be used for firefighting purposes	Training of Village Land Management and Conservation Committee Members (VLMCC) on preparation of Village Master Plan
2	Water Pumps to install in identified locations to pump out logged water	Constitution of Ward Disaster Management Committee in 22 wards of Dibrugarh Municipal Board and follow up action
3	Construction of Wodden Boat to be used for rescue purposes	Public awareness programmes on Safe Construction Practices & Earthquake Preparedness in different wards of Dibrugarh Town, Moran & Naharkatia
4	Redesign existing storm water and drainage systems in flood prone areas	Training of Doctors on Emergency Health & Mass Casulty Management
5	Erosion protection works in vulnerable reaches along the bank of river Brahmaputra and Buridehing including breech closing works	Training of Engineers on Rapid Visual Screening
6	Undertake structural safety audit of lifeline buildings and schools	Workshop on Earthquake Risk Mitigation and Management
7	Undertake structural safety audit of Shopping Malls, Nursing Homes, multisteoried buildings	Training of Task Force Members (Quick Response Team) on Search, Rescue and First Aid
8	Map locations of all key buildings in the District and rate them on the basis of rapid visual screening exercise/ Non-Destructive (ND) Test	Earthquake Shakeout programme in schools
9	Undertake retrofitting of key lifeline and critical/ social infrastructure	Training of Principal/ Head Masters of HS/High/ME/LP schools on School Safety & Disaster Management
10	Adopt zoning parameters as identified in the Model Building Byelaws issued by MHA (Sept. 2004)	Mock exercises in several locations
11	Fire Safety Audit of Shopping Malls, multi-steoried buildings as per underlying norms National Building Code	Training programmes on Disaster Management conducted for the officers & staff of different vital Govt. establishments
12	Enforcement of National Building Code/Indian Standard Code of Practice (BIS) and Assam Notified Urban Areas (Other than Guwahati) Building Rules, 2014	Disseminate alert and warning mechanisms of flood early warning system (FLEWS) project to communities (preferably through VLMCC)
13	Works to widen and strengthen the Dibrugarh Town Protection dyke	Increase public awareness of flood hazard and mitigation possibilities
14	Conduct detail flood hazard mapping of the District	Promte flood insurance
15	Map all infrastructure at risk to varying intensity of flood hazard	Disseminate flood hazard mapping information to stakeholder
16	Identify areas prone to sediment built up and measures to take up	Undertake Undertake Mock Drill on flood rescue

9.4.2 MITIGATION AND PREPAREDNESS PLAN

Pre- disaster planning consists of activities such as disaster mitigation and disaster preparedness. Disaster mitigation focuses on the hazard that causes the disaster and tries to eliminate or drastically reduce its direct effects. The best example of mitigation is the construction of embankments and construction of proper drainage system in flood prone areas to avoid floods. The other example includes retrofitting of weak buildings to make them earthquake resistant.

And preparedness focuses on plans to respond to a disaster threat or occurrence. It takes into account an estimation of emergency needs and identifies the resources to meet the needs. The first objective of the preparedness is to reduce the disaster impact through appropriate actions and improve the capacity of those who are likely to be affected most. The second is to ensure that ongoing development continues to improve the capacities and capabilities of the system to strengthen preparedness efforts at community level. Finally, it guides reconstruction so as to ensure reduction in vulnerability. The best example of preparedness activities are the development of community awareness and sensitization system through community education and administrative preparedness by way of stockpiling of supplies, developing emergency plans for rescue and relief.

For a successful mitigation plan it is necessary to identify short-, medium- and long-term mitigation measures for various hazards for structural and non-structural risks and damages. Mitigation measures should focus to reduce both the effect of the disaster and the vulnerable conditions to it, in order to reduce the scale of a future disaster and its impacts. Mitigation measures should also focus at reducing physical, economic and social vulnerability of the region at the event of the disaster. Cyclone mitigation and preparedness largely hinges on the preparedness of the community. The following steps can be taken to reduce the risk in the unfortunate event of the said natural disasters.

- Restore Communication networks
- The task force in association with Search & Rescue Teams of Police and Fire should thoroughly search the affected area for survivors and injured.
- In case of heavy flooding and inundation, vehicular access may be restricted and hence suitable rafts/ boats should be used to rescue and evacuate the people affected by the floods.
- The waterlogged in low lying residential areas should be pumped out and the pumped out water could be let through the nearest natural drain or canal. Also, fire engines can be deployed to pump out water from affected areas during emergencies.
- Any breach in rivers, streams or natural drains should be protected with adequate sandbags or creation of temporary embankments to avoid further damage to property and human life.
- In case of heavy storms, power supply to areas which are in the primary path of the storm can be disconnected to avoid hazards due to breakage of power lines. Provisions should be made to provide generators for temporary power supply to storm affected areas.
- Relief camps should be opened in appropriate locations where a large number of people are affected.
- Health facilities like General hospitals and Medical Colleges should be ready to accept crowd in case the primary health centers gets overcrowded.

9.4.3 RESPONSE PLAN

Response measures are those taken immediately prior to and following disaster impact. It is important to have clear organization structures with established line of authority within the government mechanism to handle the response plan in case of natural calamities. The plan should detail out the various phases from early warning to rehabilitation and the roles that agencies play in reaching the vulnerable and affected to identified disaster support infrastructure located in the Dibrugarh Region. Response plans include formation of functional teams and providing plans for transportation, evacuation, search and rescue, and rehabilitation. They are supported by supervisory zone-based teams assuring food, shelter, water, medicine to the vulnerable to uphold physical and psychological health. Survey and assessment should be the part of response activity.

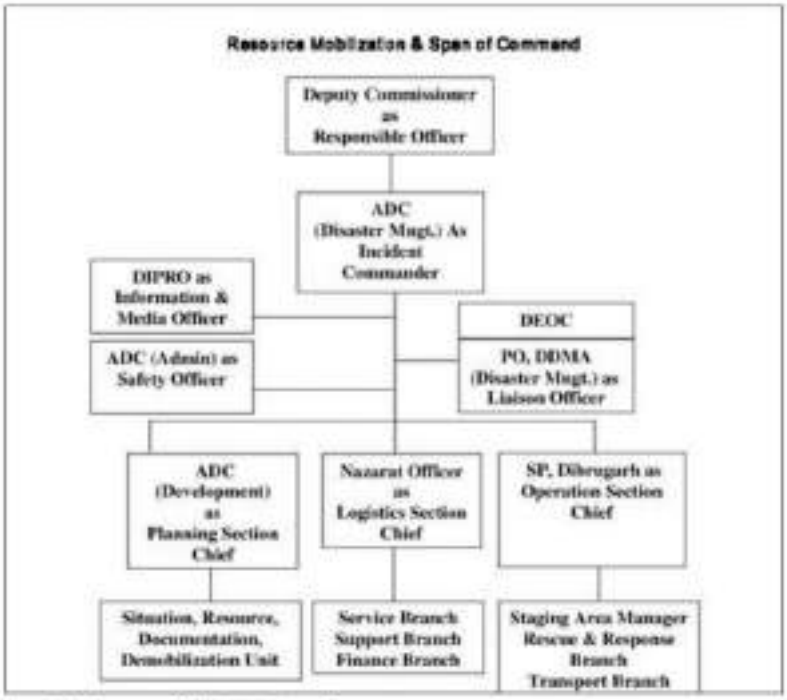


Figure 168 Resource Mobilization during Response

Table 224 Disaster Response Plan for District Level

Sl. No.	Response at district level	
1	On receipt of Flood Warning, DDMA will pass the information for taking necessary measures to: • The concerned SDO (Civil) • Revenue Circle Officer • Suptd. of Police • Executive Engineer WR Dept. • Executive Engineer, PWD(Roads) • Station Officer-Fire Service Station and I/C of State Disaster Response Force (SDRF)/National Disaster Response Force (NDRF) if stationed in the district. • Deputy Director, F&C Supplies • Jt. Director Health Services • District Veterinary Officer to take necessary measures so that if necessary, assistance can be provided in short notice to the affected areas • DIPRO, if requires giving public announcement for evacuating people from vulnerable areas	Deputy Commissioner (DC) will direct Addl. DC or CEO, DDMA
2	SP will instruct Senior Station officer, Fire and Emergency Services/SDRF to assist the Circle Officer in rescue, evacuation and relocation processes	Superintendent of Police (SP)
3	Senior Station officer, Fire and Emergency Services will mobilize teams of SDRF and boats available in their custody and coordinate with DDMA/Circle Officer for response.	Snr. Station officer, Fire and Emergency Services
4	Executive Engineer, WR Dept. shall mobilize man material to strengthen weak embankment, keep constant vigil on Water Levels & and take necessary temporary measures to avert any breaches in embankments.	Executive Engineer, WR Dept.
5	Take adequate measures to ensure that the road communication is not disrupted; repair any breaches on roads for evacuation and supply of relief to the affected people.	Executive Engineer, PWD (Roads)
6	Jt. Director Health Services on receipt of information will initiate to mobilize medical response team, ambulances and alert all government hospitals in the area likely to be affected. JD shall also direct SDMHO and I/C PHC of the concerned area to form a team of doctors equipped with necessary medical equipment and move to the affected places or Relief Camp/centre as required by the Circle Officer	Jt. Director Health Services
7	Take periodic report of the situation and instruct Circle Officers, Jt. Director Health Services, Executive Engineers of PWD (Roads), PHE, WR, Irrigation, Police, Fire & Emergency Services to take necessary measures as required for dealing with the situation	Deputy Commissioner
8	Deputy Commissioner will also inform State HQ about the prevailing situation and actions taken	Deputy Commissioner

Table 225 Disaster Response Plan for Revenue Circle Level

Sl. No.	Response at revenue circle level	
1	On receipt of warning, mobilize the Lot Mondal, Gaon Burah, SDRF and other agencies and resources available under Circle Officer's jurisdiction	Circle Officers (COs) of the concerned Revenue Circle
2	Go to the specific location immediately and inform the villagers on the probability of any flood event and ask them to take necessary precautionary measures	Lot Manadal and Gaon Burah
3	In case of probability of high intensity flood, evacuation of people from vulnerable areas to pre-identified safe locations and preposition of quick Response Team/SDRF/NDRF/Police Force/Sand Bags/ Boats/Tarpaulin/ Tents|	Circle Officers (COs) of the concerned Revenue Circle
4	Keep DC/SDO (Civil) informed on an hourly basis about the situation on the ground level and may request additional resources of man, material and machines if required from DC or SDO (Civil)	Circle Officers (COs) of the concerned Rev. Circle
5	**Inform:** • Block Development Officer (BDO), so that BDO can inform PRI representatives for appropriate action • GP Secretary and GP President for appropriate action	Circle Officers (COs) of the concerned Revenue Circle
6	Open Relief Camps if required and give requisition for GR to DC	Revenue Circle Officer
7	Arrange for distribution of Relief	Revenue Circle Officer

Coordinated IEC activities should be initiated well in advance.

- Mock drill of preparedness should be carried out twice in a year. The mock rehearsal should start from the Control Room. This will help in finding out the preparedness level for the district level functionaries.
- Make separate plan of operation and list of required materials, tools machineries for each kind of disaster.
- Train the rescue forces with the equipments and specialize them for the different types of disaster by the experts.
- Train the Panchayat leaders / village volunteers/ Villagers for helping the affected people for the disaster of their concern.
- Half yearly review the stock of men, materials, and machineries of all lined departments.
- Approach to NDMA and ASDMA for any kind of assistance to the line departments for up-keepment of their machineries and strengthening the resources.
- Warning system through Police Control Room (24x7) DDIPR/AIR/DIO.
- The Incident Command Officer shall organize regular coordination meeting with all DM Committee Members, Head of office, Public leaders, NGO and senior citizen in consultation with the Chairman.
- The Incident Command Officer will liaise with all Head of office, NGO, Public Leaders and other organizations to keep their machineries and manpower in readiness to face occurrence of any type of natural disaster.
- The Incident Command Officer shall keep record of all parameter which might
- indicate occurrence of any type of natural disaster and intimate the concerned higher authority in weekly / daily basis.
- The RRTs (Medical & Police) will be alerted by the Incident Command Officer.

Flow chart showing the directional of information flow at DEOC

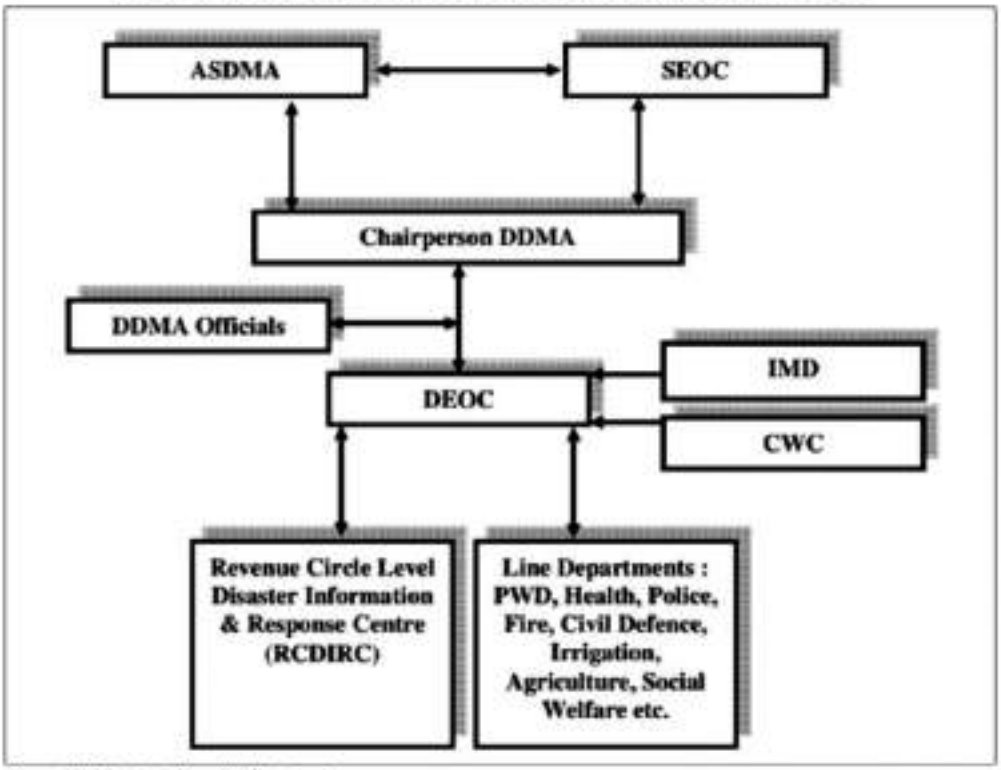


Figure 167 Disaster information flow chart

9.4.4 RELIEF PLAN

9.4.4.1 During the Disaster.

- Disseminate the warning of disaster from DDR&IC to all concerned destination in single attempt by using mass sms, announcement through radio, through mass voice mail and ask the people who are likely to be affected, to take shelter in safer places.
- Immediate deploy the forces to clear the route of search & rescue and also to clear the traffic from the route of rescue.
- Command to the forces, NGO, SHG & volunteers to rush immediately to the affected area for search and rescue with all pre-enlisted tools and equipments for disaster.
- During the time of occurrence of disaster, the Nodal Officer shall liaise with all Head of office, Public Leaders and others organizations and initiate prompt measures to prevent loss of human lives and property damage.
- The Nodal Officer shall initiate immediate necessary measure for evacuations, organize Search and Rescue teams with consultation with the concerned Member which have been entrusted to this work.
- If necessary, the Nodal Officer will initiate setting up of Relief Camp for the affected people in a safer place and ensure proper supply of safe drinking water, electricity, medical facilities and rations etc. with the help of concerned departments to the relief camp.

9.4.4.2 Post Disaster:

- A Post- disaster evaluation should be done after the withdrawal of relief and rehabilitation activities in order to assess
- The nature of state intervention and support,
- Suitability of the organizational structure,
- Institutional Arrangements,
- Adequacy of Operating Procedures,
- Monitoring mechanism,
- Information tools,
- Equipments,
- Communication System, etc.

The impact studies on the aforesaid operations for long term preventive and mitigation efforts are to be undertaken. Evaluation exercises may be undertaken to understand the perceptions about disaster response in terms of

- Adequacy of training
- Alert and warning system,
- Control Room functions,
- Communication plans,
- Security,
- Containment,
- Recovery procedures,
- Monitoring

9.4.4.3 Relief and Rehabilitation Plan for Flood

Table 226 Relief and Rehabilitation Plan for Flood

Sl. No.	Floods	Deputy Commissioner/ DDMA
1	**Pre-Flood**	• Maximum number of relief centres likely to be set up Facilities to be available at each centre • Maximum likely number of relief parties The way individuals and voluntary organizations are to be associated with the relief teams. • The way Panchayats will be associated with relief operations. Divide the district into compact zones each comprising a group of villages falling under both 'very vulnerable' and 'vulnerable' areas as classified in DDMP and each such zone shall be serially numbered Select sites for evacuation centres and relief centres in safe areas. The site for sheltering livestock may be decided in consultation with the district A. H. & Veterinary officer. In selecting sites, preference shall be given to high lands, schools, marketplaces, and places not likely to be inundated. • Make a rough estimate of requirements Prepare • A sub-division wise list of officers and staff available for deployment of relief duty as and when called for. • A list of jeeps, buses, trucks and other vehicles for requisition in case of necessity, in consultation with the D.T.O;
2	**During Flood**	• DDMA will conduct weekly meeting to review flood management during the flood season. On receipt of flood warning D.C will: take action as per Standard Operating Procedure (SOP) prepared by the State On occurrence of Flood the DC will: visit the places of occurrence, ascertain the nature and extent of flood and make prompt operational decisions, DC will arrange proper distribution of relief articles received as donation in kind among the deserving affected people through the official and non-official agencies • DC will arrange for taking care of the infirm, destitute, orphans, children, and expectant/nursing mothers in the relief centres through the assistance of the distribution social welfare officer.
3	**Post Flood**	• DC will collect agricultural statistics from the revenue staff and the district agricultural officer about areas under crops affected by flood, damage to crops and the number of cultivators involved. • After the flood recedes, a report on losses and damages of each area needs to be submitted the Government in the Revenue & Disaster Management Department in the form as given in Appendix X of Assam Disaster. • Generally, full pictures as to the 35 duration of relief measures will emerge as soon as the waters have subsided. In declaring closures of relief operation, he will take the approval of the divisional commissioner and inform all concerned.

9.4.5 RECOVERY

In the unfortunate event of a natural calamity like a cyclone or flood its important focus on the methods and activities to restore lifeline support physical infrastructure like adequate water supply, power and communication networks, accessibility to the site. These must be the described in the disaster management plan- relief & recovery part. In the river side of the Dibrugarh area the communities are depended on the specific infrastructure for their livelihood, and these should be identified and methods to restore them in short/medium/long term have to be identified and respective funding reequipments have to be made available and followed by speedy decision-making process.

In the District, the Nodal agency plays direct and active role in relief. The Deputy Commissioner office either directly or through assistance will inform to the nearest police stations, WT stations, administrative officers and nodal agencies at Circle, Sub-Divisional and Dist. HQ by quickest means. For timely assistance to the people affected by natural disasters it is necessary to have correct assessment of extend of damage to crops, public & private properties and loss of human lives and livestock. The emergency relief measures and relief measures in the aftermath of a disaster is generally carried out in compliance with Calamity Relief Fund Norms by Deputy Commissioner.

The task force is responsible for collecting the extend of the damages with respect to number of houses damaged, loss of human lives, number of person injured, information about individual families, their income, property and assets. The zonal officer has to prepare a report on the same to be sent to the Deputy Commissioner. The mentioned assessment is to be carried out on priority basis so that the Nodal Department in the district Region which is the Department of Disaster Management can extend relief assistance in time in order to mitigate the effect of the natural disaster.

9.4.6 DEPARTMENT ROLES AND RESPONSIBILITIES

9.4.6.1 Police department:

In order to achieve smooth and orderly evacuation of human lives and properties the district Police Department has to play vital role. The Police Department will keep close liaison with Deputy Commissioner/ Addl. Deputy Commissioner (Disaster MAnagement) and the District Emergency Operation Centre (DEOC). The Superintendent of Police will chalk out action plan forming different zones and sectors with Police Zonal & Sector Officers for smooth conduct of rescue and relief operation. The Zonal and Sector Police Officer will keep close liaison with the District Headquarter as well as concerned departments like Fire Service, Civil Defence, Health, Army & Paramilitary, Air Force, Transport, and ensure the following tasks.

- Visit the affected areas and keep informed through wireless system/ telephone etc. about the up-to-date status of the affected areas and prompt actions to be taken for rescue and relief operations.
- Take adequate care for maintaining law & order. They also assist the Civil Adminisration in times of Disasters
- Round the clock vigil of the area including the high and vulnerable buildings and ensure rescue operations at every affected areas/houses
- Requisition of services of Civil Defence, Homeguards/VDPs and other military/ paramilitary forces in rescue operations 21
- Provide assistance to the community for shifting of affected and injured persons to the health camp for medical treatment.
- Extend support to Fire & Emergency Services in controlling fire incidents and security to individuals and public properties
- Establish emergency communication system
- Extend support to Civil Administration in management of dead

9.4.6.2 Fire & Emergency Service

Fire (natural as well as manmade) is one of the major disasters that causes loss of human lives and property. Sometimes not because of earthquake, but because of fire people lose their lives

- Ensure that proper fire fighting precautions has been taken while issuing permission for construction of buidings.
- Make sure that smoke detectors/ fire fighting equipment are installed in all important places like Govt. offices/ schools/ colleges/ cinema halls/ industrial units and other installations where the people gather in large number. Also train up employees about the techniques of using fire fighters
- Make sure that sufficient number of fire tenders with all equipments in working condition are available round the clock.
- Train up/ Motivate people how to use fire fighters and its advantages.
- Carry out Fire Mock Drill in schools/ public places/ apartments etc. to raise public awareness.

9.4.6.3 State Disaster Response Force Services

Sometimes not because of fire, but because of flood/earthquake etc. people lose their lives. SDRF People will be in alert mode with all lifesaving equipmets/ boat and extend their services as and when required. The will work under the command and control of Sr. Station Officer, Dibrugarh Fire & Emergency Services Station.

9.4.6.4 Civil Defence & Home Guard:

For effective operation, works of various services, personnel must have proper training and discipline with a view to achieve this intensive training with special reference to the earthquake disaster should be arranged to train up the volunteers and 23 other related personel as well as the public. The efficiency in performance of the various services depends highly upon the amount of training imparted to them. In Civil Defence towns, training with special reference to earthquake are already introduced in educational institutions. It is suggested to conduct some exercises by Civil Defence department, in the rural areas to enlighten the public and students for their action and part played in a disaster. The existing Civil Defence Organization of Duliajan and Namrup will play their role as per scheme of Civil Defence in case of Earthquake disaster. Civil Defence Department will keep a register of trained volunteers so that their services can be utilized in disaster relief operation in respective service. The Deputy Controller of Civil Defence, Dibrugarh will properly maintain the equipments necessary for conducting rescue operation to extricate the casualties trap from under debries. He will also ascertain the resources of manpower and materials available with the local Agencies like Home Guard, and other Local voluntary organization such as Indian Red Cross Societies, N.C.C., and Scouts & Guides Etc. Civil Defence and Home Guard, Dibrugarh will have to prepare a separate contingency plan for this purpose. They need to spare sufficient numbers of Home Guards for emergency operations as and when called for.

9.4.6.5 HealthDepartment:

The Health Department will make necessary arrangements for blood banks and other lifesaving emergency services. All Civil Hospitals and The Assam Medical College should be on alert. One senior Doctor for emergency duty should be detailed on a round-the-clock basis in the Casualty Ward in these Hospitals. Ambulances with life savings drugs need to be kept in readiness. An inventory of all private ambulances should be prepared along with the names of the drivers and their contact phone numbers.

- Provide health and medical care in normal and disaster situations
- Develop adecuate health infrastructure in the district and implement programmes towars improvement of health across all sections of the society 24

- Conduct vulnerability assessment of all health facilities across the district and undertake preparedness and mitigation measures
- Render immediate medical service and transport casualties to hospitals
- Activate Hospital Disaster Management Plan including mass casualty plan
- Prioritize patient management; Activate triage system as per the established protocol
- Set-up relief camps from District to PHC Level, Medical Colleges.
- Establish a base for field hospitals along with basic/support services
- Maintain Ambulance network
- Establish network among medical practitioners/ health institutions to facilitate quick mobility of Doctors and massa casualty management
- Ensure that emergency communication is functional at all times, including medical services (pharmacy, blood bank, paramedics, ambulance services)
- Conduct training to Hospital Administrators, Doctors, Nurses, Paramedics, and other staff
- Work towards developing a cadre of volunteers trained in basic first-aid
- Provide support in recovery operations
- Carry out impact assessment on health infrastructure
- Provide support to line departments in Recovery and Rehabilitation efforts of the communities
- Provide expert counselling/psychosocial support to disaster survivors
- The principal of the AMC&H Dibrugarh will keep few beds ready for treatment of the referred cases. He will help with manpower and medicines, vehicles and voluntary Blood Donors.
- Document actions taken by the department and incorporate lessons learnt in the sector plan.

9.4.6.6 Public Works Department:

Structural safety of all existing RCC, Steel and masonry buildings needs to be assessed with regards to its safety against potential hazards like earthquake, floods, fires and accidents. The PWD (Bldg.) division has to prepare and provide checklist for regulatory and development authorities

- The PWD (Bldg.) division has to identify vulnerable buildings for seismic safety in compliance with Govt. of India guidelines. They has to create, compile and maintain a database of all weak structures (Govt./ Non-Govt. and lifeline buildings) and provide technical support for the corrective measures to follow like retrofitting/demolishing of such structures.
- The PWD (Bldg.) division will provide technical assistance to the DDMA for enforcing BIS codes/ Assam Notified Urban Areas (Other than Guwahati) Building Rules, 2014 to the extent applicable in the district. The DDMA may take necessary actions against deviation/ violation of such resistive measures.
- PWD (NH) & PWD (State Roads) will make an inventory of the machineries like Bulldozers, Excavators, Cranes etc. necessary for restoration of roads.
- Construction and repair of roads, bridges, culverts in the district
- The departmental Engineer should keep vigilance on the NH and all other important road during and immediately after the earthquake and take immediate measures to clear the blockade found anywhere

using the required machineries like bulldozers etc.

- Preposition emergency supplies and equipment/tools in high-risk concentration areas
- Establish mitigation funds within the department26
- Undertake damage assessment of lifeline infrastructure; Prepare estimates and undertake repair/ strengthening works; Supervise the civil work activities and ensure safe construction practices are streamlined during Recovery/Reconstruction phase
- Conduct training for staff in latest advancements of engineering, demolition techniques, health monitoring of infrastructure assets, seismic strengthening and retrofitting, critical infrastructure protection, DM.

9.4.6.7 Public Health Engineering Department:

Water born diseases are one of the major reasons of increasing the number of death after any disaster. Providing purified water to the affected people is a challenge. The PHE department plays a vital role in this regard. Checklists for this department are as follows,

- The PHE department, Dibrugarh will have to keep sufficient stock of water purification materials like bleaching powder, alum and lime etc. for carrying to the area where necessary and depute their field staff whenever disaster situation claims.
- The PHE Engineer staff will keep in constant touch with the Zonal Officers during and after the disaster.
- Ensure safe hygiene through Total Sanitation Campaign (TSC). Motivate the people to exercise proper disinfections and hygiene practices for drinking water and taking food.
- Undertake risk assessment and management of groung water resources in emergency situations.

9.4.6.8 Water Resources Department:

The Water Resource Department will assess and make a list of vulnerable dykes and keep close eye on these areas. Accordingly, they will have to prepare contingency plan to meet any emergency. The Executive Engineer is to check regularly the condition of the sluice gates and do necessary rectifications, if any, so that stagnant water can be 27 discharged effectively. He is responsible for deploying officials/ experts along the dyke/ bundh etc. during the flood period at the vulnerable points and send their contact numbers to DDMA and zonal officers. The WR Department has to keep sufficient number of empty gunny bags, sand and other facilities in the vulnerable reaches. In addition to this they have to deploy strict vigilance over all the major embankments round the clock.

9.4.6.9 Irrigation Department

The Executive Engineer is to keep sufficient nos. of portable pump sets ready on 24x7 hourly basis. He will arrange sufficient manpower and assign duties likewise.

9.4.6.10 Transport Department:

Proper maintenance/cleanliness of roads during disaster is an important task so that rescue/relief operations, transportation of essential goods & manpower are not affected. A checklist for Transport Department is as under:

- The DTO Dibrugarh will keep list of owners with contact details of all type of vehicles Excavators, Bull-dozers, Cranes. Recovery Vans Tractors, buses, trucks etc. which can be arranged immediately during and after any disaster. A copy of the same is to be made available to the District Disaster Management Authority.
- Arrange vehicles for transport of people and relief supplies, navigation aid
- The Transport Department will have to prepare an Action Plan for supply of the all type of vehicles when required. The DTO would have to keep liaison with the DEOC.
- Take up awareness program for road safety (Accident prevention)

9.4.6.11 Food and Civil Supplies Department

They are responsible for proper and quick distribution of Civil Supplies at the time need. They will ensure procurement of essential commodities (controlled & noncontrolled) and maintain buffer stock of sufficient quantities to be released during necessity. They are also to issue instructions to the Roller Flour Mills to keep rolling stock of wheat bran/ rice barn and send regularly a list displaying availability of these 28 items. The F&CS department has to keep constant vigil so that traders do not take advantage of the situation creating artificial scarcity of commodities and inflate prices.

9.4.6.12 Veterinary Department:

Disaster causes death and injury to animals also. The veterinary Department with the assistance of NGOs/ volunteers working in this line will organize in such a way that can expeditiously take steps for rescue of seriously injured animals and disposal of dead animals also. District Veterinary Officer will assess requirement of equipment's and other veterinary staff, medicines vaccines disinfectants etc. and prepare an Action Plan to combat the possibilities of injuries and epidemics etc. They will conduct assessment of damage and economic loss due to disasters within the sector.

9.6.4.13 Agriculture Department:

During flood/draught, loss to seasonal crops is considerable. The Agriculture Department is entrusted with provide necessary technical support to the district administration.

- Establish coordination in implementing and providing technological know-how on drought management to the farming community through agricultural extension services
- Continue educationg farmes on soil and water conservation technologies through implementation of watershed projects and know-how of drought resistant crops
- The Agriculture Department will make an assessment of acreage under crops and number of cultivators to be affected in each of the areas.
- They need to assess the requirement of seeds, seedlings, manures etc. for grants, tools and plants for emergency relief works
- They have to advice on the suitable cropping pattern. Arrange for spraying of pesticides wherever necessary.
- Make sufficient stock of seeds, manures, implements etc. and make arrangements for raising seedlings. 29
- Arrange distribution of agricultural inputs in consultation with the district administration.
- Render technical support to the needy cultivators for salvage and protection of surviving crops
- Repair the damaged tools and plants

9.4.6.14 Social Welfare Department:

During any disaster the weakest & neglected section of the community viz. women, children, senior citizens, physically handicapped suffer the most. It is the responsibility of our society to protect them.

- The Social Welfare Department has to make arrangement for mobile maternity and child welfare centres wherever necessary
- Access the requirement of baby food etc. and arrange them. They have to extend help for taking care of orphan & mother, and the sick

- Maintain in directory of all social welfare organizations located in the district and made it available to the DDMA
- Alert personnel for floods on receipt of warning and kept constant touch with the district administration All heads of the Departments/Offices will keep constant touch with the District Officials/Disaster Emergency Operation Centre at DC's office. Every department will have to prepare separate Action Plans showing the Standard Operating Procedures (SOPs) to be adopted on emergency and Resource Inventory (human & material) and made it available with the DDMA, Dibrugarh.

9.5 CITY DISASTER MITIGATION PLAN

The points mentioned above should be part of a larger city or region level disaster management plan. The Disaster Management Act, 2005 has brought a change from Response & Relief oriented approach to proactive and comprehensive approach. This has encouraged many Indian cities to develop and formulate a City Disaster Management Plan, the same should be worked for Dibrugarh MPA as well to enable it to be better prepared in the case of natural disasters in the future. As part of the Master Plan 2045 the authority feels there is a need for a CDMP for the planning area covering the following general principles: -

- Risk & Hazard Assessment
- Planning
- Organization
- Resource Utilization
- Need for Specialist
- Training

Generally, the CDMP prepared for the planning area should include sectoral plans covering the following aspects of disaster & emergency management: -

- Overall Preparedness
- Rehabilitation
- Emergency Response
- Prevention
- Mitigation
- Recovery
- Reconstruction
- Capacity Building Plans

Based on the above discussed general principles a detailed City Disaster Management Plan (CDMP) for Dibrugarh Planning Area have to be prepared for strengthening the institutional mechanism.

10 ENVIRONMENT

Environment plays an important role in the sustainability of a region. The balance between different environmental aspects and development defines the progress and livability of an area. The most crucial factors which affects the livability of an area are primarily, land and water. With an increase in the demand of the water, the demand for urban land is also increasing. People flock to urban areas to seek employment, entertainment, shopping and generally a higher standard of living. At the same time, environmental infrastructure for works and services are inadequate to serve the resulting increase in population and population densities.

The inevitable congestion causes environmental hazards and degradation until strategies for reversing environmental deterioration can be implemented. Hence, the magnitude of urban population growth in developing countries is a direct indicator of the degree of spatialconcentration of people, industries, commerce, vehicles, energy consumption, water use, waste generation and other environmental stresses. Several environmental aspects are considered and studied to access the environmental conditions of the planning area. This analysis is presented in this chapter along with proposed strategies to safeguard the environment of the planning area.

Jokai Reserve Forest, Dibrugarh

10.1 GEOGRAPHY OF REGION

Geography of Dibrugarh is appositely characterized by various highlands, rivers, flat paddy field, Tea gardens and marshy lands. Geo-morphologically, Dibrugarh District form the shape of a Gun. Dibrugarh District is bounded by Dhemaji District and Brahmaputra River on the North, by part of Majuli, Lakhimpur and Sivasagar District on West, by Sivasagar District on its South, by Tinsukia District on its East. Geographically, Dibrugarh District is one of the largest districts of Assam. Its highlands include Hatimura Parbat with an altitude of 186.5 metres, Barkandali with an elevation of 853 metres and Kamakhya Parbat with a height of 244 metres.

Geography of Dibrugarh is also determined by the pleasant weather of the region. In fact, it enhances the picturesque topography of this district of Assam. The climate is in general monsoon type. However, there are some differences from the other districts of Assam. The climate is of an extreme type compared to other districts of Assam. The pattern of rainfall is such that the south is usually dry and the north is relatively rainier. Rainfall from south to north increases. The average rainfall in the Dibrugarh is 2618 mm with average relative humidity of 95%. The average annual rainfall of the Dibrugarh in the north is 2760 mm with a total number of 193 rainy days. Rainfall records show a decreasing trend towards east and west of Dibrugarh city. The average rainfall is 26 cm. The months of March, April and May constitute the pre-monsoon season. The norwesters locally called Bordoichilla appears during the period. Rainfall ranges between 59 cm and 160 cm. With the onset of monsoon in early June, heavy rainfall occurs. Widespread low clouds and high humidity together maintain almost uniform temperature over the area. The average annual rainfall during the period is 300 cm.

Physiographically, there is a large tract of Tropical Rainforest in its eastern and southern regions, which is a part of the Dehing Patkai wildlife sanctuary. The MPA is a plain area with occasional highlands, flood plain, beels, swamps and foothills of the Barail Range. The region is flat with a gradual lope from the East Arunachal hills to the west. The soil of the region is mostly fertile, alluvial soil.

Thus, it is noticeable that geography of Dibrugarh District is spread over vast plain lands dotted with fewer hilly terrains. The wonderful climate enhances the topographical features of the region.

10.2 RIVERS

Urbanization has got its own advantages and disadvantages. The main advantage is that it provides scope for provision of common infrastructure facilities. The main disadvantage is that it creates more strain on the natural resources (including land and waterbodies). The environmental consequences of urban growth are considerable. Cities are prolific users of natural resources and generators of wastes. The urban ways of living contribute to relatively more pressure on resources. Migration of people to riverbank creats scattered clusters of settlement which puts enormous pressure on the available water resources. Some of the issues will be water scarcity and water pollution, air pollution, climate and Heat Island Effect, poor management of solid wastes, urban congestion etc. in the system.

Dibrugarh is a geographycally potential as three rivers passes through entire Master Plan Area. Brahmaputra on North, Sessa from Middle and Burhi Dihing from South.

10.2.1 THE BRAHMAPUTRA RIVER

The river originates from the Kailash ranges of Himalayas at an elevation of 5300 M. After flowing through Tibet it enters India through Arunachal Pradesh and flows through Assam and Bangladesh before it joins Bay of Bengal. The average width of Brahmaputra is 5.46 Km. The average annual discharge is about 20,000 cumec and average dry season discharge is 4,420 cumec. The river slope is very steep till it enters India. A drop of about 4800 M is achieved in a length at about 1700 Km in China (Tibet). This average slope of about 2.82 m/Km gets reduced to about 0.1m/Km in Assam valley. Due to this sudden flattening of river slope, the river becomes braided in nature in the Assam valley. During its course in Assam valley from Kobo to Dhubri the river is joined by about 20 (twenty) important tributaries on its North bank and 13 (thirteen) on its South bank. Joining of these tributaries bringing high sediment load activates braiding. All the tributaries of the valley area are rain fed and foam up with rain. The precipitation here is mainly due to South West monsoon. Heavy precipitation occurs here from May to September. It travels a distance of 750 KM throughout the entire state of Assam.

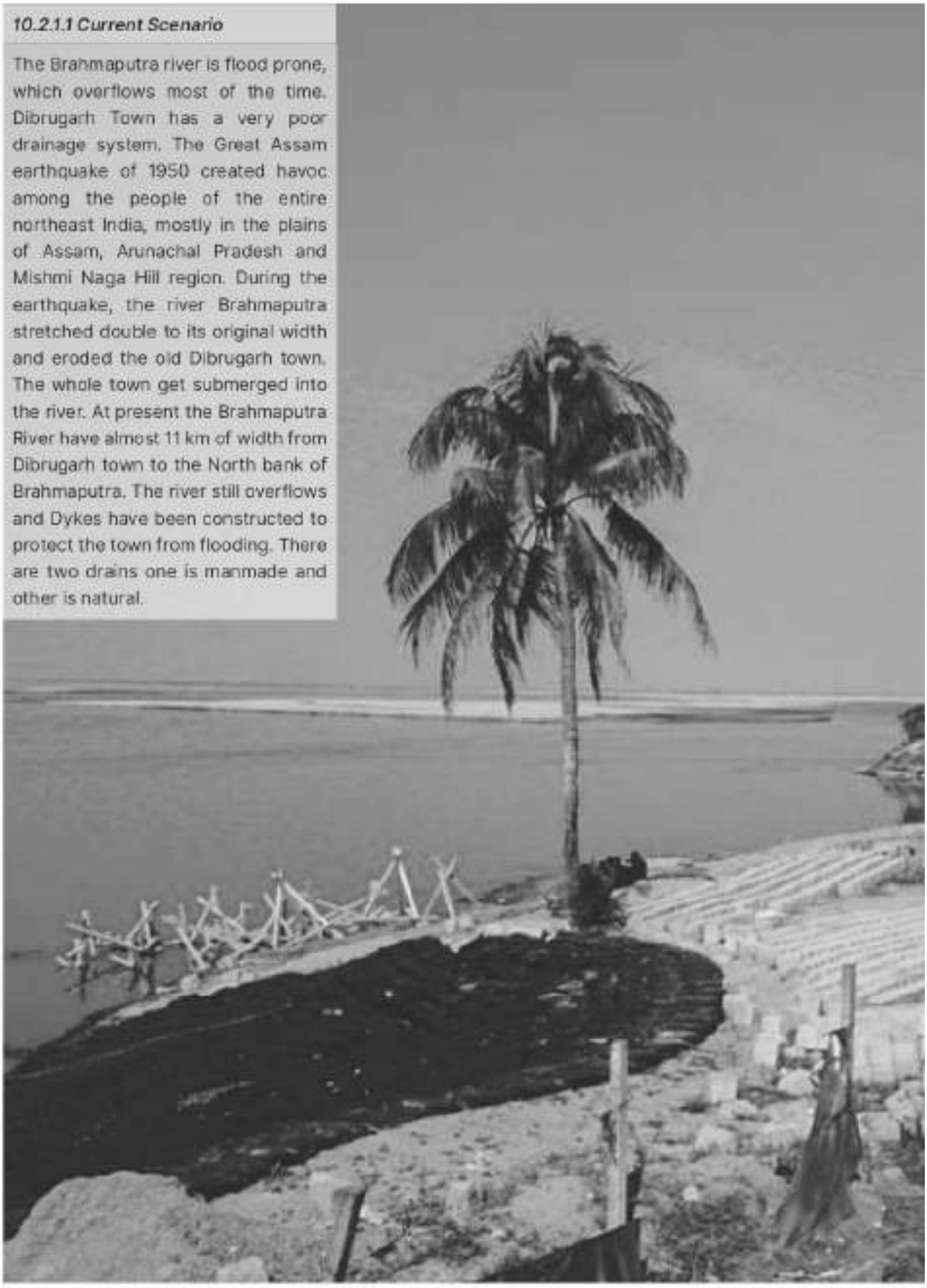
The Brahmaputra River basin hosts very rich and unique biodiversity. The whole of north-eastern region is a globally recognized bio-diversity hot spot. In the Indian territory the total forest cover of the Brahmaputra basin is 1,14,894 sq. km. which is 54% of the total basin area. In the distribution of forest cover among 6 states in Brahmaputra basin, Arunachal Pradesh tops the list with 82.8% forest cover, but it is sad that the highest number of hydro-electric dams are planned in this state inviting disastrous impacts for the biodiversity, forests, people, and environment. The tally of rest of the five states is as follows – Nagaland (68.9%), Meghalaya (63.5%), Sikkim (38.1%), West Bengal (21.4 %) and Assam (20.6 %). Brahmaputra is a huge river. In some places of Assam it is close to 10 kilometres wide and looks more like a sea than a river.

The Brahamputra is very wide and braided in the district of Dibrugarh. Sunrise and Sunset at the river are worth watching at many places across Assam. Dibrugarh being present very close to Brahmaputra provides great views of the river which are worthy to watch.

Brahmaputra river basin is known to be very prone to flood and erosion and these two hazards have led to many problems in the basin. In India, out of the eight north-eastern states, Assam faces the most severe brunt of flood and erosion. Both flood erosion has been severely affecting the economy as well political, social, and cultural milieu of Assam.

10.2.1.1 Current Scenario

The Brahmaputra river is flood prone, which overflows most of the time. Dibrugarh Town has a very poor drainage system. The Great Assam earthquake of 1950 created havoc among the people of the entire northeast India, mostly in the plains of Assam, Arunachal Pradesh and Mishmi Naga Hill region. During the earthquake, the river Brahmaputra stretched double to its original width and eroded the old Dibrugarh town. The whole town get submerged into the river. At present the Brahmaputra River have almost 11 km of width from Dibrugarh town to the North bank of Brahmaputra. The river still overflows and Dykes have been constructed to protect the town from flooding. There are two drains one is manmade and other is natural.




Brahmaputra Dike, Embankment View

10.2.1.2 Polluted River Stretch

The length of the polluted stretch of Brahmaputra river is 373 kms out of 750 kms of the total stretch (Fig 168) and the stretch identified as polluted is from Bogibeel to Sualkuchi. The entire stretch of Brahmaputra river covers eleven (11) monitoring locations under NWMP. However, the BOD level was found to be exceeding 3mg/L in only six (06) monitoring stations on few occasions.

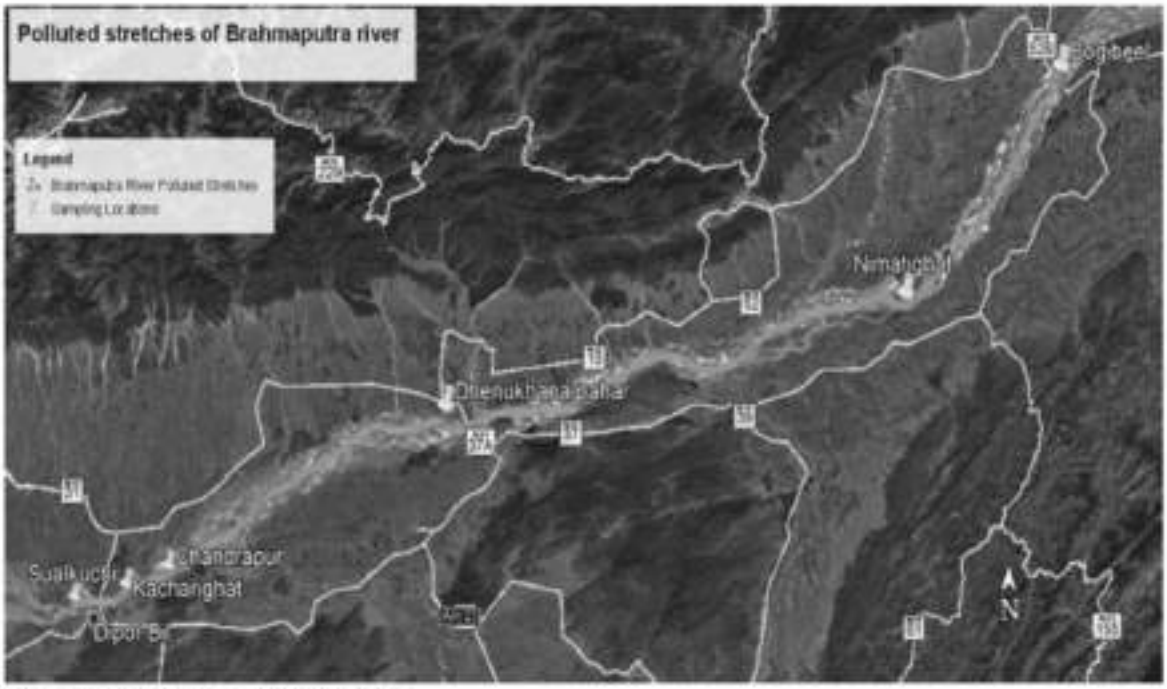


Figure 168 Polluted Stretches in Brahmaputra River

10.2.1.3 Identification of Major Locality around riverbank

Dibrugarh is one of the major towns located on the bank of the Brahmaputra River. The approximate population of the Dibrugarh town is 1.54 lakh as per Census 2011. The major localities identified in and around the catchment areas of polluted stretch of Brahmaputra River at down streams of Dibrugarh Town are

a) Bogibeel: Dibrugarh is the major town located in the bank of river Brahmaputra at around 18 kms upstream of the sampling station. Medium sized villages viz: Bogibeel gaon, Lengapathar gaon, Hapekheti gaon and Walkhabi gaon no.1 of Disbrugarh district and Kareng gaon, Garmara Chapori, Dambuk kalabari, Merchapori and Amguri bali of Dhemaji district under Sissiborgaon tehsil are situated in the catchment of the Bogibeel polluted stretch.

b) Nimatighat: The nearest major town from the sampling point is Jorhat. However, the Nimatighat stretch is located around 15 kms upstream from the Jorhat town. The name of the villages identified in the catchment of the Bogibeel polluted stretch are Kumar gaon, Makori khuti gaon and Kobortta gaon.

c) Dhenukhana Pahar: Tezpur is the major town belonging to Sonitpur district is located in the Bank of the river. d) Chandrapur: No major towns are located near the sampling point. However, few medium sized villages viz: Chandrapur, Tatimara and Barchapori are situated in the catchment of the polluted stretch.

e) Kacharighat: The localities identified to be situated in the catchment area are Fancy Bazar, Pan Bazar and Kachari which are localities of Guwahati city and Rajaduar and Madhyam Khanda under North Guwahati circle. There are only few permanent human settlements in the Fancy Bazar, Panbazar and Kachari area as these places are busy commercial market and considered as central locations of various shopping hub.

f) Sualkuchi: Sualkuchi is the only major town located nearby the sampling station.

10.2.1.4 Quantity of Sewage generated

There are no existing STPs located in the towns and cities. The aggregate sewage generated from the localities and towns are 385.14 KLD at Bogibeel polluted stretch.

Source: Action plan for Brahmaputra River, PCB, Assam)

10.2.1.5 Sewerage Treatment Proposal

As per the survey done, one (01) number of STP has been proposed at Dibrugarh town in consultation with the District Administration.

Table 227 Sewerage Generation Calculation

Sr. no.	Area	Population	Water Consumption (KLD)	Sewage Generation (KLD)	No. of STPs proposed	Existing Treatment capacity (KLD)	Gaps in KLD
1.	Bogibeel gaon, Lengapathar gaon, Hapekheti gaon and Walkhabi gaon no.1 of Disbrugarh at Bogibeel stretch	1271	171.6	137.3	01	Nil	137.3
2.	Kareng gaon, Garmara Chapori, Dembuk kalabari, Merchapori and Amguri bali of Dhemaji district at Bogibeel stretch	2295	309.8	247.84	0	Nil	247.84

(Source: Action plan for Brahmaputra river, PCB, Assam)

10.2.1.6 Water quality of polluted stretches of Brahmaputra River

The detail analytical data of the polluted stretches of Brahmaputra River for the month of February 2020 (Bogibeel) are presented further in table 228.

Table 228 River Water Quality Parameter

Sl No.	Parameter	**Bogibeel** (Feb 2020)
1	D.O. (mg/L)	7.2
2	pH	7.4
3	Cond (µS/cm)	140
4	OD (mg/L)	1.8
5	COD (mg/L)	6.5
6	NO3- N (mg/L)	0.4
7	TSS (mg/L)	60
8	Turbidity (NTU)	4
9	p-Alkalinity (mg/L)	Nil
10	m-Alkalinity (mg/L)	44
11	Hardness (mg/L)	48
12	Calcium as CaCO3 (mg/L)	30
13	Magnesium as CaCO3 (mg/L)	16
14	Chloride as Cl (mg/L)	6

(Source: PCB, Dibrugarh,2020, Assam)

The above data indicates that the BOD load is above 3 mg/L only at eleven (11) occasions out of two hundred sixty four (264) samplings carried out from Jan 2016 till March 2020 in the above stations. It was observed that the BOD value was found to be within permissible limit during the last two years at all locations of Brahmaputra River. Based on water quality monitoring reports of the last 2 years, it is observed that the river Brahmaputra does not have polluted stretches at present. Since the river has high volume and discharge, it has the phenomenon of self-purification which is constantly taking place and hence no actions for rejuvenation of the mentioned river stretches of Brahmaputra River may be required.

10.2.1.7 Drains contributing to pollution

Poor drainage in Dibrugarh is an age-old problem. The entire drainage system is based on the Dibrugarh Town Protection (DTP) drain constructed in 1955-56. Encroachment and siltation of this primary drain plus dumping of garbage has made the drain incapable of effectively draining he town. With an ineffective primary drain, the connecting secondary and tertiary drainage systems become in-operative with resultant public health. DTP drain started at Jalan Nagar, it originally had an outfall at Naharani/ VBogibeel area with a length of 22.4 km. But, due to siltation at the mouth of the drain it was later linked with the Laura Jamira drain which ultimately discharges to the Sessa river that eventually flows into the Brahmaputra. Total length of the drain, including the Laura Jamira drain, is 32 km.

The Dibrugarh Town Protection (DTP) Drain which runs through the heart of the Town falls at Rajabheta stream at a distance of 5 km. from the town. During the rainy seasons and heavy showers, the drain overspills. A second drain carries water from East-West and central Chowkidinghee and Santipara area to the DTP drain. On the Brahmaputra the fluctuations in river levels begin towards the end of March or early part of April, when the Himalayan snow begins to melt. From this period onwards the Brahmaputra River levels records a series of "pumps" or rises for short duration till the end of April, when a more defined rise is felt and in early May, the first flood rises are experienced. As a general rule the first big rise is of short duration and does little harm

to the land or early cultivation. By early June the southwest Monsoon registers its arrival in the Assam Valley and with the continuous heavy rain, river levels rise rapidly, and the Brahmaputra remains in flood condition, registering a series of peak flood levels till October. The Brahmaputra has been the main determinant of flood in the district of Dibrugarh. Due to increase of the water level of this mighty river Brahmaputra and also of the river Buridihing inundation of the catchment areas of the river causes flood.

The Dibrugarh Town is protected by Water Resources dyke which was constructed in three phases in the fifties, protecting the district right from the Oakland Tea Estate upstream to Dehingmukh gaon in the downstream.

10.2.1.8 Ground Water Quality

The water quality of Assam is found to be well within the permissible limit for drinking, irrigation and industrial purposes. Slightly higher content of iron in some sporadic patches of the area are observed, hence water needs to be treated before being used for drinking purpose. Also fluoride content is found to be exceeding permissible limit in few pockets of the state. As per the data generated from PCBA, the ground water quality around the catchment area of polluted stretch of the Brahmaputra River is found to be within the permissible limit and safe for domestic and irrigation purposes.

Table 229 Ground Water quality of catchment area of Brahmaputra River

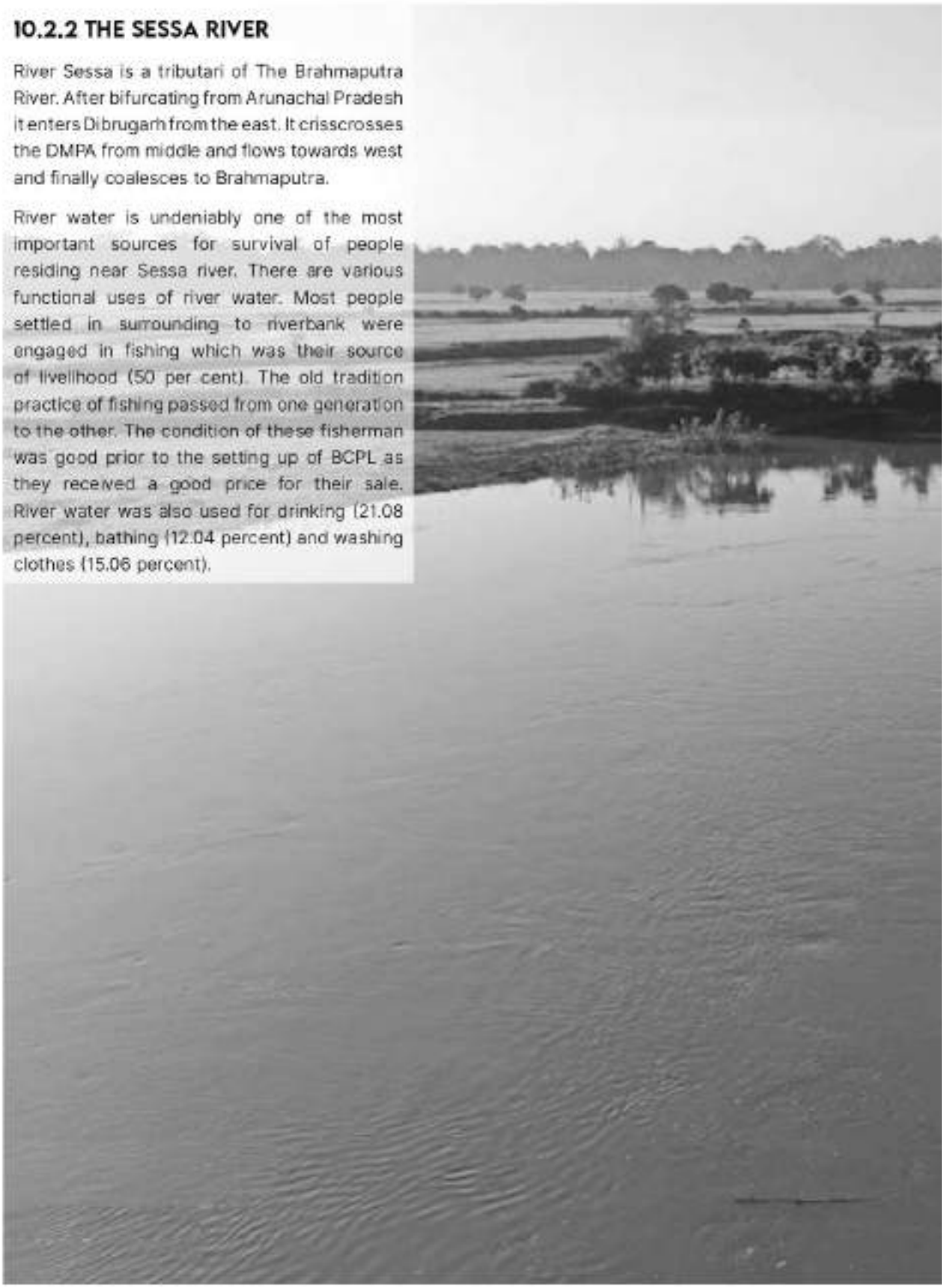
Sl No.	Parameter	Bogibeel (Feb 2020)
1	D.O. (mg/L)	7.2
2	pH	7.4
3	Cond (µS/cm)	98
4	BOD (mg/L)	1.5
5	COD (mg/L)	4.8
6	NO3- N (mg/L)	2.6
7	TSS (mg/L)	8
8	Turbidity (NTU)	2
9	p-Alkalinity (mg/L)	Nil
10	m-Alkalinity (mg/L)	88
11	Hardness (mg/L)	30
12	Calcium as CaCO3 (mg/L)	20
13	Magnesium as CaCO3 (mg/L)	10
14	Chloride as Cl (mg/L)	8
15	Sulphate as SO4-2 (mg/L)	4.6
16	Phosphate as PO4	0.06
17	Total Dissolved Solids (mg/L)	64
18	TFS (mg/L)	18
19	Fluoride (mg/l)	0.33
20	Boron (mg/l)	0.010

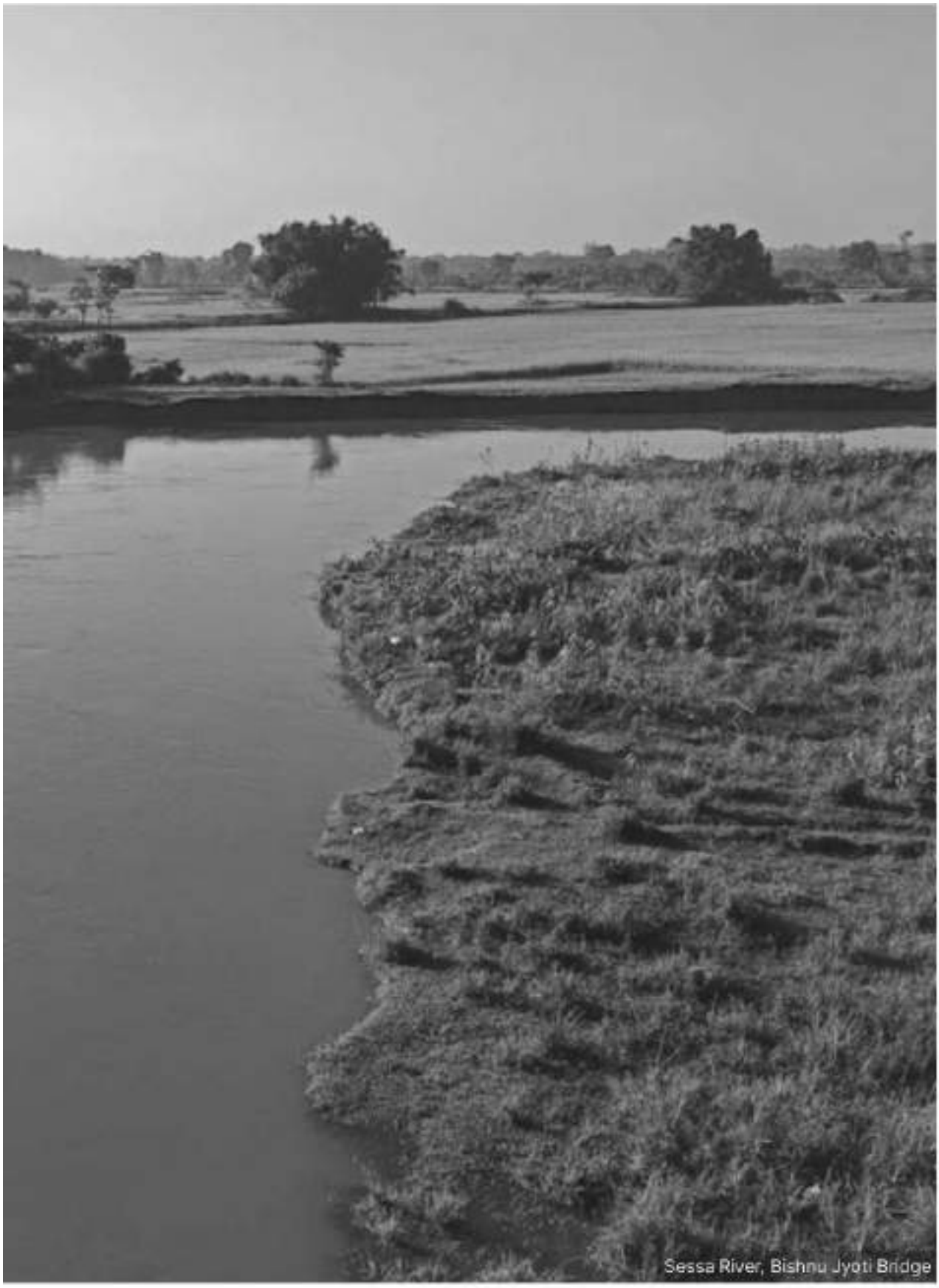
(Source: PCB, Dibrugarh,2020, Assam)

10.2.2 THE SESSA RIVER

River Sessa is a tributari of The Brahmaputra River. After bifurcating from Arunachal Pradesh it enters Dibrugarh from the east. It crisscrosses the DMPA from middle and flows towards west and finally coalesces to Brahmaputra.

River water is undeniably one of the most important sources for survival of people residing near Sessa river. There are various functional uses of river water. Most people settled in surrounding to riverbank were engaged in fishing which was their source of livelihood (50 per cent). The old tradition practice of fishing passed from one generation to the other. The condition of these fisherman was good prior to the setting up of BCPL as they received a good price for their sale. River water was also used for drinking (21.08 percent), bathing (12.04 percent) and washing clothes (15.06 percent).




Sessa River, Bishnu Jyoti Bridge

10.2.2.1 Current Scenario

After the functioning of BCPL, there had been changes in the quality of the river water with its progressive deterioration as industrial waste has been dumped in the river. Earlier the river water was very clear but now some greasy sticky foams can be seen floating. The water in the river had turned a strange brown-black hue and there is suffocation in the odour. The plants emerging from water have turned out brownish- black in colour and the smell of kerosene made it impossible for them to use for consumption purposes. People had stopped using river water for washing clothes as it turned white clothes dirty and shady. Sessa river's fishes were once considered to be a good quality and there was a great demand for the Sessa fish. The various fish species found were Giant river cat fish (Arii), Indian butter cat fish(pabhoh), Magur, Freshwater shark (Barali), chital fish, Rohu (Rau), Day's mystus (Singarah) etc. Fish that used to fetch them thousands of rupees was now sold at hundreds.

Skin diseases like scabies and lesions are affecting the people living in its vicinity. The symptoms of these diseases are intense irritation at night, increasing nervous tension, fatigue, lack of concentration, impairment of efficiency and eventually loss of working time. They also suffer from prolonged loss of sleep due to intolerable noise and foul smell from the plant. They have also been suffering from stomach ailments, headaches and respiratory problems[6].

10.2.2.2 Polluted River Stretch

No stretch of Sessa river is found polluted within Dibrugarh Master Plan Area, however the length of the polluted stretch of Burhi Dihing river at Lezai area is 3.1 km (approx.). The Lezai- Kolakhowa area consists of two Panchayats (Primary tier of Rural Local Self Government) i.e. Lezai panchayat and Kolakhowa panchayat. These are the immediate adjacent areas of the BCPL plant. The inhabitants of these two areas are mostly scheduled caste and scheduled tribe people and their primary source of income is fishing. Thus, the pollution and contamination of the river water of the Sessa directly impacts the people of the Lezai-Kolakhowa area.

10.2.2.3 Identification of Major Locality around riverbank

Dibrugarh is one of the major towns located on the bank of the Sessa River. The approximate population of the Dibrugarh town is 1.54 lakh as per Census 2011. The localities identified in and around the catchment areas of polluted stretch of Sessa River are villages of Lezai–Kolakhowa area- Bordoibam, Dewanbari Gaon No.1, Dewanbari Koibarta Gaon No.1, Dewanbari Koibarta Gaon No2, Lezai Gaon, Lezai Miripathar, Lezai Matak Gaon No 8., Pani Gaon No.1, Kolakhowa Gajai Gaon, Sessakuch No.1. Sessa Kuch No.2, Sessakuch No. 3.

The strategic location of the BCPL plant has been a reason of difficulty for the river side people. Even before its inception, during the land acquisition process for the project, 500 families have lost their residential plots and farm lands. Adding to this, after its commissioning the BCPL residues and wastes are being dumped in the Sessa river, because of its proximity and lack of other alternative dumping areas which has converted the Sessa river to almost into an abandoned river. Infect the Sessa River has turned into a 'Bane from a Boon'. Thus, it can be safely concluded that the strategic location of the BCPL plant have contributed in creating livelihood security related problem. Because it is located amidst areas which are vastly populated and is adjacent to a river, which hitherto have been providing livelihood assets to the people living in the villages situated in the river bank, the BCPL has become a cause of distress for the people for the people have been located in some isolated or secluded area far from residential places and natural entities river, it could have less affected the people and the environment[7].

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[6] *Hazarika, O. B., & Dutta, D. (2017). Mega-projects and the Erosion of Human Security. Economic & Political Weekly, 52(33), 95*

10.2.2.4 The issue of staking livelihood security of the affected families

As mentioned in the forgoing sub section, the wastes of BCPL plant are dumped in the Sessa River leading to the pollution of the river water and affecting the lives of the fishing community. Because, almost majority of the people of the surrounding locality are dependent on the river water for their livelihood, thus their livelihood security is not only in stake but also in danger. The negative impact of BCPL plant has grossly affected the people of surrounding village area, specially the fishing community is under clouds of an unseen and insecure future. Though, the BCPL was expected to generate production, creating income avenues and the people living in the adjacent areas of the plant were very much hopeful of getting secure jobs before its establishment but in reality the plant has become a threat even for their settled parental occupation from which they hitherto were getting their source of income. Infect, as an immediate effect, the BCPL is directly impinging on the livelihood security of the fishing community. After the commissioning of BCPL plant, wastage that are generated by the BCPL plant are dumped in the Sessa river which polluted the river as well as the fishes which are found in the river eventually deteriorating the quality and even the quality of the fishes. In an interview conducted by the researcher the people living in the nearby village reported that they are grossly affected by the negative consequences after commissioning of the plant. They opined that not only their source of income, but their health is also affected by the emissions caused by the plant pushing them to meet unseen fate and future.

10.2.2.5 Impact on Health of the Marginalized Communities

The pollution of the river has a multidimensional affect on the lives of the people of bank residing area. The water pollution has not only affected their livelihood but also created severe health problems and diseases. The pollution caused by the BCPL has lead to severe health hazards and diseases. Contagious health diseases are in rise in the villages which are the product of the pollution which the river is experiencing since the set-up and the functioning of the BCPL. It was also stressed that several people from the villages had psychological problems due to the fear of the loss of livelihood because the pollution in the rivers rendered fishing impossible. Thus, as far as health security is concerned for the least privileged who are the residents of the places near to the BCPL plant, the plant which is supposed to provide 'socio-economic' benefits, is largely lacking it and instead new and expensive medicines and way of life is being made essential for these people already in trouble and trauma[1].

[1] *Development and Marginalisation: A study of the BCPL Plant, by POOJA SHARMA, Research Scholar, Department Of Political Science Dibrugarh University, Assam, India, Journal of Xi'an University of Architecture & Technology, ISSN No: 1006-7930, Volume XII, Issue IV, 2020, Page No: 2367*

[1] *Development and Marginalisation: A study of the BCPL Plant, by POOJA SHARMA, Research Scholar, Department Of Political Science Dibrugarh University, Assam, India, Journal of Xi'an University of Architecture & Technology, ISSN No: 1006-7930, Volume XII, Issue IV, 2020, Page No: 2367*

10.2.2.6 Impact on the Livestock

Livestock has a great importance for the marginalized rural poor who have no stable economic assets, deposits and investments. The rural people depend on livestock to meet with any type of unseen emergency like medical expenditure, educational requirements of children etc. Moreover, livestock work as a source of food. As the poverty ridden people of the rural areas can't afford to buy nutritional foods from the market, they completely depend on the livestock like cow, goat, pig and poultry for milk, butter, meat, egg. Moreover, livestock has also an immense importance for agriculture and cultivation as like most of the places in Assam also ploughing with cattles is done in large scale till today. It is important to mention here that pollution caused by the BCPL has not only impacted livelihood security of the people but also has a huge impact on the livestock. The domestic animals like cow, dog, goat, duck etc are getting affected due to the breathing of polluted air and consumption of water from the polluted Sessa River. Livestock are either falling sick or dying rapidly. Chickens and ducks are dying due to the foul environment created by the gases and other effluents being released by the BCPL as prior to it such problems had never arisen. These farmers were clearly depressed about the loss of income from the produce of these animals as well as the fact that they could no longer rely on such produce for their own diet.

The Brahmaputra Cracker and Polymer Limited's (BCPL) refutation on the alleged water pollution in Sessa River appears to be a mere eye wash as fish fau in particular had been badly affected by the pollutants discharged from the plant during past one and a half year. The inputs received from prime fish market of Daily Bazar in Tinsukia revealed that, traders of late stopped selling fishes from Sessa River which otherwise fetched very high prices for its famous Pabta (Ompokbimaculatus) and Chital (Notopteruschitala). These fishes, according to traders and consumers, have developed distasteful kerosene like odor with changes in the skin colorations and brightness. As most of the fish traders had refused to sell Sessa fish in the main market, the vendors from Dibrugarh sell these fishes in the outskirts of Tinsukia town even as quantity had dwindled from few quintals to mere 40-50 kg in an average that often surface in retail markets currently. After complains being poured from different quarters, a chemical research laboratory of repute carried out a 'prelimiry' water sampling alysis of Sessa River that contained effluent of BCPL plant and detected contamints of high proportions, told a scientist, on condition of anonymity.

(Source: Article on The Sentinel, dated: 20th Aug, 2021, https://www.sentinelassam.com/news/toxic-water-affects-fishes-in-sessa-river/, accessed on 10th Sep,2021)

10.2.2.7 Initiatives taken by BCPL authority

The inhabitants constantly protested the BCPL and accused that it discharges the industrial waste directly into the Sessa river. So to combat pollution, BCPL initiated some measures. In conformity with the Pollution Control Board of Assam, a modern water treatment plant was set up to treat all effluents. Moreover, to enhance safety and reduce atmospheric emissions, safety valve outlets were connected to an integrated flare system, a gas detection system to ensure quick detection of gas leak [7].

10.2.2.8 Water quality of polluted stretches of Sessa River

The detail analytical data of the stretche of Sessa River at Sessa Tiniali near Sessa Bridge on NH-37, is presented further in table 230.

Table 230 River Water Quality Parameter

Sl No.	Parameter	Sessa Bridge, NH-37 (May 2017)
1	D.O. (mg/l)	5.1
2	BOD (mg/l)	2.1
3	Fecal Coliform (MPN/100ml)	Nil
4	Total Coliform (MPN/100ml)	780

(Source: Water Quality Index, PCBA, 2017)

The above data indicates that the BOD value was found to be within permissible limit during the year 2017 at specific mentioned location of Sessa River. Since the river has good volume and discharge, it has the phenomenon of self-purification which is constantly taking place and hence no actions for rejuvenation of the mentioned river stretches of Brahmaputra River may be required.

10.2.3 THE BURHI DIHING RIVER

Dihing or Burhi Dihing (Dihong means wide river) is a large tributary, about 380 kilometres (240 mi) long, of the Brahmaputra River in Upper Assam in North-Eastern India. The river originates at 2,375 metres (7,792 ft) above sea level in the Eastern Himalayas (the Patkai Hills) in Arunachal Pradesh and passes through the Tinsukia district before entering Dibrugarh district from the east. The river meanders almost through middle of the district and confluences with the Brahmaputra at Dihingmukh. It has a drainage catchment of 2,465 km² spreading across in the districts of Dibrugarh and Tinsukia. The length and width of the plain are around 75 km and 40 km respectively within Dibrugarh district. Its watershed covers about 6,000 square kilometres (2,300 sq mi) The Dihing has created number of oxbow lakes in the area.

Its watershade receives about 300 cm average annual rainfall. The meandering Burhi Dihing River being migratory in nature has created a number of abandoned channels, swamps on its either banks. This plain is prone to floods causing havoc due to overflowing of water from the Burhi Dihing or its tributaries and inundation caused due to spillage of water in the confluence of this river and Brahmaputra. This flat and low-lying plain is littered with areas of paddy cultivation, forests, and wetlands, while the higher areas are occupied by tea plantations and human settlement.

The Burhi Dihing meanders through the plains facing Patkai Hills for a length of 50 kilometres and then enters into Joypur-Digboi low hill range. It then comes out near Joypur to flow through the plains for a length of 120 kilometres and ultimately joins the Brahmaputra at about 32 km south-west of Dibrugarh town. At the later stage in its course, Burhi Dihing acts as a divider between Dibrugarh and Sivasagar districts. There is a presence of a number of ox-bow lakes in the area of flow of the river. The Disam is an important tributary of the Dihing in the southern bank of the river. The Dihing River provides a unique landscape of bamboo orchards, wet paddy fields, tea gardens, and natural scenic beauty. The tributary serves as a source of livelihood for people living along its banks.


Burhi Dihing River, Horeyghat Bridge

10.2.3.1 Polluted River Stretch

No stretch of Burhi Dihing river is found polluted within Dibrugarh master plan area, however the length of the polluted stretch of Burhi Dihing river at Margherita is 2.7 km (approx.) with an area of 7.7 sq.km. The stretch identified as polluted is from Niz Makum Gaon to Lagun Gaon No. 1 & No. 2 for Burhi Dihing river at Margherita.

10.2.3.2 Identification of Major Locality around riverbank

Dibrugarh is one of the major towns located on the bank of the Burhi Dihing River. The approximate population of the Dibrugarh town is 1.54 lakh as per Census 2011. The major localities identified in and around the catchment areas of polluted stretch of Burhi Dihing River are Duliajan OIL town, Hatigarh Block, 1 No. Dulia, 2 No. Dulia, Rangajan No. 1, Bordubi No.1 and Sarupathar Bengali. As per Census 2011, the approximate population is 40,356.

10.2.3.3 Quantity of Sewage generated

There are no existing STPs located around the bank of Burhi Dihing within MPA.

10.2.3.4 Sewerage Treatment Proposal

As per the survey done, one (01) number of STP has been proposed at Duliajan. However, the sewage generation from the other villages are minimal and hence the untreated sewage can be taken care of by adopting stringent remedial actions.

Table 231 Sewerage Generation Calculation

Sr. no.	Area	Population	Water Consumption (KLD)	Sewage Generation (KLD)	No. of STPs proposed	Existing Treatment capacity (KLD)	Gaps in KLD
1.	Intake point of OIL, Duliajan & d/s of Burhi Dihing at Tinsukia and Dibrugarh	40,356	5448	4358.4	01	Nil	4358.4

(Source: Action plan for Burhi Dihing river, PCB, Assam)

10.2.3.5 Water quality of polluted stretches of Burhi Dihing River

The change in the water quality of Burhi Dihing in terms of BOD value in mg/l of Burhi Dihing at intake point of OIL, Duliajan, Tinsukiafor the period 2016-2019 is presented below:

Table 232 River Water Quality Parameter

Sl No.	Parameter	Value
1	B.D.O. (mg/L)- 2016	0.6
2	B.D.O. (mg/L)- 2017	3.3
3	B.D.O. (mg/L)- 2018	24
4	B.D.O. (mg/L)- 2019	1.0

(Source: PCB, Dibrugarh,2020, Assam)

The above data indicated that BOD value has increased in only five (04) occasions out of forty (40) occasions at polluted stretch of Burhi Dihing at Duliajan, Dibrugarh. The increase of BOD load which indicates organic load may be due to draining of storm runoff along with the organic waste originating from domestic household waste into the river through the drains. The marginal increase of BOD level during dry period may probably be due to decomposition and high concentration of organic matter as their rate of dilution is very low due to lean flow of the river. Moreover, Assam is cursed with the catastrophic flood every year and hence this incidental exceedance of BOD value may be due to additional organic matter introduced in the river as a result of continuous rainfall during this disastrous calamity. This marginal and occasional exceedance of BOD level does not reflect the extremity of pollution. Hence this can be considered as incidental and can be omitted from the polluted river stretch.

10.2.3.6 Drains contributing to pollution

No Drains identified carrying industrial waste as well domestic waste directly to Burhi Dihing river within the Boundary of MPA.

10.2.3.7 Ground Water Quality

The quality of ground water in the Dibrugarh district is suitable for both the drinking and irrigation purposes.

10.2.4 WASTE MANAGEMENT PLAN

Table 233 Waste Management Plan

Sr. no.	Type	Status	Proposed actions	Authority
1	**Industrial Waste**	• No industrial waste dumped on land or discharged into water bodies/river. • Industrial wastes are managed by industries itself. • Authorisation have been granted to different industries in line with Water act 1974, Hazardous Waste (Management, Handling and Transboundary Movement) Rule, 2008 as amended. • Regular monitoring by PCBA to ensure that the terms and conditions are strictly adhered in accordance with the prescribed standard	Direction issued to the industries to identify the non-point sources and arrest contamination of storm water.	**Pollution Control Board Assam**
2	**Municipal waste**	a) Municipal Body has engaged NGOs ward wise for collection of Municipal Solid Waste from the generation point for treatment and disposal. b) The wastes are being segregated into dry and wet waste categories and are collected separately and transported to treatment and disposal site.	Municipal Body is in process of inducting the following activity • Implementation of segregation of waste at source • Door-to-door garbage Collection of waste • Formation of Sanitation task Force • Formation of Neighbourhood Community • Awareness campaigns Processing and disposal of waste	**Municipal Body**
3	**Plastic Waste**	• At present plastic wastes are being dumped along with Municipal solid waste. • Lack of unscientific disposal facilities/ infrastructure technology like decentralized composting or bio-methanation plant, waste to energy plant, solid waste management plant.	Letter is being issued intermittently by PCBA to Municipal Board to segregate and collect plastic waste and initiate necessary steps to channelize the waste to authorized agencies for recycling and reprocessing	Municipal Body/Pollution Control Board Assam
4	**Hazardous Waste**	• No hazardous wastes are directly disposed in the river	Awareness campaign regarding health and other issues related to Hazardous waste	Pollution Control Board Assam
5	**Biomedical Waste**	• Segregation at the source under Biomedical waste Management Rules, 1998 as amended • The HCFs have installed ETP for treatment of liquid waste generated	Direction issued to all HCF unit to implement the BMW Rules, 2016 as ammended in all HCF Units. (As per guidelines of CPCB)	HCF units/ Pollution Control Board Assam
6	**E -waste**	• Annual return in (Form-3) is submitted by E-Waste generating units to PCBA from time to time for onwards transmission to CPCB. • There is no authorised recycler, refurbisher, dismantler etc. available to ensure environmentally sound management of E-waste.	Few entrepreneur approached PCBA for registration and authorisation as Recycler	Pollution Control Board Assam

(Source: Pollution Control Board, Dibrugarh, Assam)

10.2.5 PROPOSED STRATEGIES FOR RIVER

10.2.5.1 Key elements to encounter

- Slum Settlement around the river
- Polluted drains contributing to the river
- Solid waste dumping around river

The conservation of the River is an important goal for the Dibrugarh town. To achieve this goal, in a sustainable manner, several actions are necessary. These actions focus on addressing pollution from the major sources – raw domestic sewage and MSW – and improving the hydraulic conditions. Actions are also proposed to provide human use benefits for the citizens of Dibrugarh. By providing these benefits, and connecting people to an improved waterway, the stewardship of the river can be shared by all and achieve lasting conservation success

10.2.5.2 Proposed Actions that Comprise the Restoration Solution

To remain consistent with the framework, the proposed actions which comprise the restoration of the River and its drains include:

- Greenery Development – Plantation plan
- Sewage collection and treatment.
- Setting of Effluent Treatment Plant
- Solid waste collection and management.
- Hydraulic improvement (including uptake of water from the Brahmaputra River)
- Improving hygiene and sanitation conditions.
- Community access and benefits.
- Setting of monitoring system.

Each of these actions is described in more detail further:

- **Greenery Development** – Plantation plan: State Government has initiated afforestation in the degraded forestland, also raising roadside plantation besides creating check dams/embankments in the river catchment areas to combat erosion and soil conservation. The following remedial actions has to be initiated in consideration of greenery development

1. Raise plantation along the riverbank to control the flow runoff water directly to the river
2. Bamboo species to be raised as it is a good soil binder thereby stabilize the banks of the river from erosion

- • **Sewerage collection and treatment:** Presently there is no centralised sewerage collection and treatment facility in Dibrugarh largely because most households have either a septic tank or soak pit. A new sewage collection system is proposed to collect all sewage and transport it to a centralised place for treatment. The system, if properly implemented, will significantly reduce pollution loads to the river. Another option which may be considered is to have multiple decentralized STPs located at strategic locations throughout the catchment area. This option will be evaluated in the Feasibility Report.
- **Setting of Effluent Treatment Plant:** It should be observed that none of the small-scale units of the identified polluted stretch discharge their effluent directly into the river stretch as they have to captive

ETP for treatment of their effluent. Moreover, the Board has to issue direction to build their own set up in their premises which do not have STP/ETP.

- **Solid waste collection and management:** As the Dibrugarh town does not have any existing solid waste collection and management plan, it is proposed to have an Integrated Solid Waste Management Plan for the catchment area, which will also cover the entire town. As the town will implement a MSW collection and management system, waste will be collected from primary and secondary locations, and transported off-site to a disposal or reclamation facility. This system will require many years to become effective as the population learns to use and value the system over current litter and dumping practices.
- **Hydraulic improvements:** Regular flooding of the Dibrugarh town due to Brahmaputra River in the past has resulted in closer connectivity of the Sessa River with the Brahmaputra River by the water resources department. This has resulted in less flow in the Sessa River.
- **Improving hygiene and sanitation conditions:** A number of community toilet complexes are required in slum area along the river. Solid waste collection bins and proper washing and bathing facilities are required at slums along the river.
- **Community access and benefits:** One of the keys to river conservation success is to provide human connections to the waterway. When these connections are established, everyone becomes a steward of the river and the restoration will be more likely to succeed. Examples of community benefits include the establishment of greenways along the waterfront and points of interest to educate the community on conservation features and ecological resources.
- **Setting of monitoring systems:** An on-line system can be designed and proposed to be implemented to monitor the water flow as well as water quality of the Brahmaputra River system. The on-line information will be used by decision makers to avoid flooding in the town.

10.2.5.3 Treatment and Disposal of Septage

Some of the households in the towns are equipped with ordinary septic tanks. Under the Swacch Bharat Abhiyan, Public Health Engineering has constructed 5893 numbers of IHHLin the Dibrugarh district to attain open defecation free status. Moreover, public toilets have also been constructedat the commercial areas.

Following remedial actions will be taken in consideration of treatment and disposal of sewage

- Sewage Treatment plant should be installed for treatment
- The discharge should be trapped by strainers before draining off to the river.
- Every individual households should be connected to sewer lines.
- Every households should be recommended to have individual drainage that should be connected to soak pits or stagnated pool.
- Roadside hotels/restaurants should not be allowed to dispose untreated sewage and solid waste into the nearby drains or rivers. These establishments should be properly regulated by the concerned authority.
- Public awareness to control open defecation and understand the sanitary hygiene.
- Local administration should provide proper pucca toilets for the individuals or atleast community toilets through the IHHL scheme under Swachh Bharat Mission.

10.3 JOKAI RESERVE FOREST

Located around 12 km away Dibrugarh Town on the Mancotta-Khamtighat road, the Jokai Botanical Garden cum Germplasm Center is a protected biodiversity forest area.

Jokai Reserve Forest and Botanical Garden

Dibrugarh being heavily rain fed boasts of wet evergreen forests, tropical moist deciduous forest, canebrakes and grasslands. They support a wide variety of flora and fauna, many of which are highly endangered. The Jokai Reserve Forest, located around 12 kilometres away from the Chowkidinghee Chariali point, happens to be the natural habitat for a number of flora and fauna, with variations strictly marking from a wide variety of monkeys to different species of deer, wild cats, hornbills, cranes, storks, woodpeckers and kingfishers. The forest has an area of 11000 sq. mts, and it has within it the Jokai Botanical Garden cum Germplasm Center. As a result of a massive thunderstorm and lightning, a large number of trees and vegetation of the Botanical Garden got uprooted, absolutely devastated and totally exterminated forever. It has yet not been possible to replenish the tremendous loss of greenery and vegetation; such has been the magnitude of the loss, suffered by the Jokai Reserve Forest, owing to natural disasters and calamities.

Butterfly Breeding on Flower

the Dibrugarh Forest Division – which had initiated an eco-tourism project adjacent to the Jokai Botanical Garden and Germplasm Centre in the Jokai Reserve Forest which is only 15 kms from Dibrugarh town and within Master Plan Area 2045. The Dibrugarh Forest Division, the Northeast Council (NEC) had financed a project which has been christened as the Jokai Botanical Garden Development and Ecotourism Project.

The Jokai Reserve Forest had been a rich treasure trove of various species of flora and fauna which included some important species which are nearly extinct now. Besides, the reserve forest is also home to various types of butterflies. Some of the commonly found animals are the Assamese macaque, leopards, elephants, deer, and wild buffaloes, slow lorris, civet cats, etc. Jokai which houses a lot of fruit bearing trees attracts a large number of migratory birds every year and around 100 species of these migratory along with residential birds had been recorded in the reserve forest. Moreover, there are around 17 species of reptiles present here.

There is a huge water body - which is known as Erashuti - attached to the reserve forest is also home to various types of indigenous fishes, turtles, etc. and the forest department has plans now to introduce boating in these water bodies.

The department will construct eco-huts in and around the Erashuti to house tourists who want to spend time in the ambience of nature. The eco-huts will be built in a traditional way using materials like bamboo, timber, thatch etc, some cementing work will be done keeping in view the comfort level of the tourists, however, the general look will be completely traditional.

10.4 WIND DIRECTION

In Dibrugarh region, the wind direction is not the same throughout the year. It changes from season to season. Over Dibrugarh, the wind will be from either North or Northwest during monsoon season, i.e., June to September. It will be from northeast during Northeast monsoon season, i.e., October to December. When westerly winds are weak (particularly during south west season) northern mountain breeze over rides and blows from the North in the afternoon timings on most of the days. During northeast monsoon season the mountain forest breeze strengthens the lready prevailing easterly winds. Thus, easterly winds blow most of the days in a year particularly in the afternoon.

The diagram for Dibrugarh shows the days per month, during which the wind reaches a certain speed and the monsoon creates steady strong winds from December to April, and calm winds from June to October.

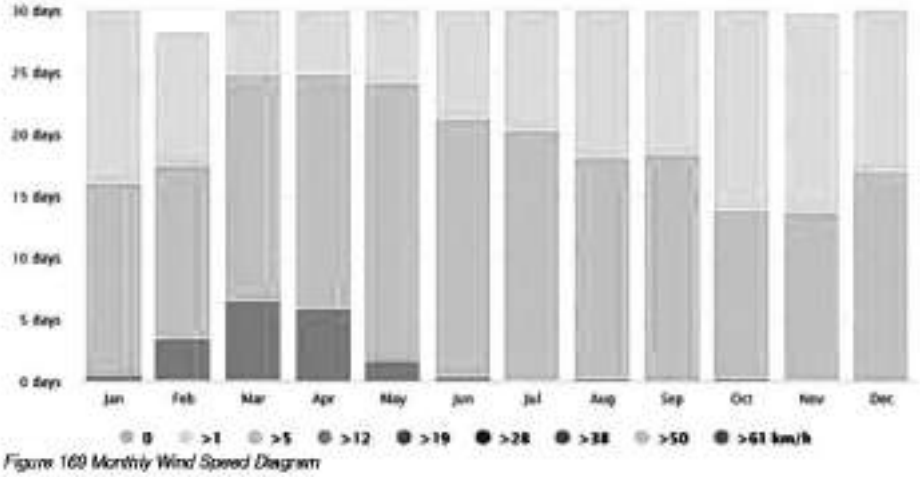


Figure 169 Monthly Wind Speed Diagram

The Wind Rose diagram of Dibrugarh shows how many hours per year the wind blows from the indicated direction.

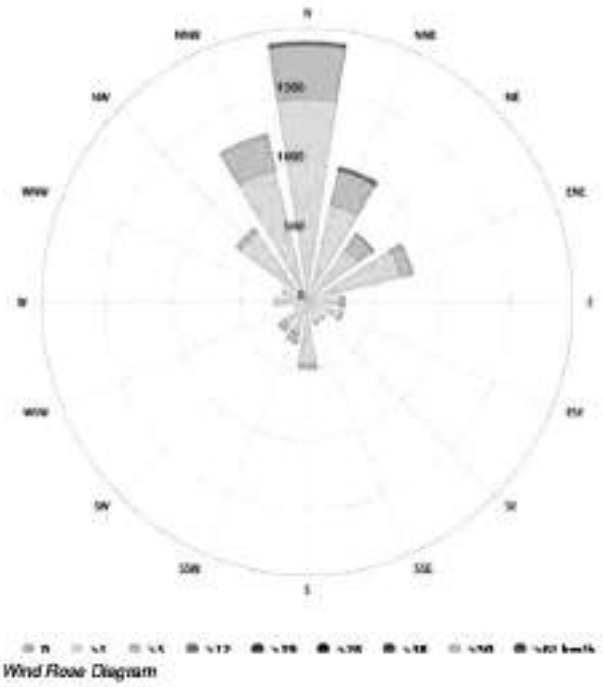


Figure 170 Wind Rose Diagram

10.5 GROUND WATER

The region is a part of Brahmaputra River basin. The area is drained by Brahmaputra River and its tributaries. Important tributaries of Brahmaputra River are Burhi Dihing, Disang, Dibru, Sessa and Lekhijan. All these tributaries are pereminal and are highly meandering. The lower order streams present a dendritic pattern, but higher older streams show a subparallel pattern. Majority portion of the people of the region are either agriculturists or engaged in related activities. Paddy is the dominant crop of this area and is grown in low land area while high land supports a good number of tea gardens. Other crops of the district are gram, tur, cotton, jute, Mesta, mustard etc.

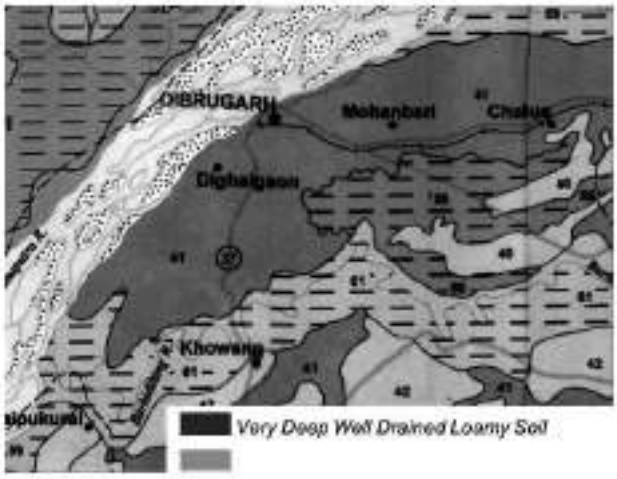


Figure 171 Soil Map of Dibrugarh Region

Ground water occurs in these formations both water table as well as confined conditions and is being developed by dug wells, dug-cum-bore wells and tube wells. The main aquifers that contribute ground water in Dibrugarh are a) Alluvial Aquifer b) Cuddalore sandstone

The district is occupied with two different landforms namely

(1) Flood plain of Brahmaputra River

Flood plains: The alluvial flood plains occupying the maximum part of the district is almost flat, except gentle undulations at places. Land elevation of the land ranges between 86.88 m and 152 m AMSL. General slope is towards west and southwest.

(2) The terrace deposits and denudational hills in the southern part.

The terrace deposits and denudational hills: This present in the south-eastern part of the district, range in elevation from 115 to 350m AMSL and rise upto 500m AMSL in Tikak Parbat area. The regional trend of the hills is NE-SW.

Table 254 Existing Ground Water condition

Block	Premonsoon depth to water (in m bgl)	Postmonsoon depth to water (in m bgl)	Flood plain/Area traverses by major rivers
Borboruah	0.90 to 1.79	1.27 to 2.20	Brahmaputra River: Flowing in the extreme North (flowing from NE to SW) Sessa River: Flowing through the central part of the block, flowing from NE to SW. Burhi Dihing River: Flowing in the southern boundary of the block, flowing from NE to SW
Lahoal	0.30 to 0.86	1.06 to 2.64	Brahmaputra River: Flowing in the extreme Northern part of the block Mai Jan River: Flowing in the northern part of the block (flowing from East to West) Dibru River: Flowing from NE to SW and meets with Brahmaputra River in the West

The water table contour ranges in elevation from 97 m AMSL in western part to 113 m AMSL in the eastern part. The gradient varies between 0.30 to 0.55 m/km. Seasonal fluctuation in most part of the district is within 1 to 2 m .But, along the BurhiDihing river and Brahmaputra river, the fluctuation is less than 1m. In semi-

consolidated Tertiary formation, water level fluctuation is 2 to 4 m. The piezometric surface rests between 1.25 and 4 m BGL. A number of shallow bamboo tubewells constructed in this district down to a depth of 36 m by tabbing 12 to 15 m of saturated medium to coarse grained sand zone. Yield of these wells varies from 27 to 31.5 m3/ hour. Deep tube wells constructed down to 253 m bgl yield around 82 - 164 m3 / hour for a nominal drawdown of 2 – 3 m. Transmissivity in the area ranges from 6,500 to 10,350 m2 /day. Storage coefficient ranges from 2.57 X 10-3 while specific capacity ranges from 798 to 915.

- Net Ground Water Availability = 1794.65 mcm
- Gross Ground Water Draft = 266.76 mcm
- Stage of Ground Water Development = 15%
- Future provision for Domestic & Industrial Use = 37.45 mcm
- Future Provision for Irrigation Use = 1519.49 mcm

(Source: Ground Water Information Booklet Dibrugarh District, Assam,2013)

10.6 POLLUTION

10.6.1 WATER POLLUTION

Surface water quality has been monitored at different locations viz. Bogibeel, Near Sessa NH Tiniali and Maijanghat for Brahmaputra and Burhi Dihing river. The observation data for last two years i.e. 2018 and 2019 are within the prescribed limit for surface water standards.

The PCB Assam had conducted the below survey of surface water quality monitoring on monthly and ground water quality on monitoring on half yearly basis under National Water Monitoring Program (NWMP) at different location in Dibrugarh district. BOD Standards observed within standard limits in major duration of year (Not above 3).

Table 2.6 Water Pollution in River

Source	Year	BOD Level		Fecal Coliform		Total Coliform	
		(Min-Max)	(Mean)	(Min-Max)	(Mean)	(Min-Max)	(Mean)
Brahmaputra river at Maijanghat	2017	0.9 - 3.0	1.8	Nil - 21000	3203	Nil - 2800	781
	2018	0.7 - 2.5	1.6	Nil - 2900	1163	Nil - 1500	711
	2019	1.1 - 2.2	1.7	300 - 1100	443	360 - 4300	1400
Sessa river near Sessa Tiniali,NH bridge,Dibrugarh	2017	1.8 - 2.4	1.9	Nil - 910	635	Nil - 1500	1068
	2018	1.3 - 3.2	2.1	Nil - 2100	1025	Nil - 2100	1147
	2019	1.2 -2.2	1.7	Nil - 1500	747	Nil - 3500	2020
Brahmaputra River at Bogibeel Bridge Bogibeel, Dibrugarh	2017	1.2 - 3.6	2.3	Nil - 730	545	Nil - 730	582
	2018	1.0 - 2.0	1.5	Nil - 2000	671	Nil - 2800	1373
	2019	1.0 - 2.3	1.7	Nil - 920	394	Nil - 2700	1312
Bor Beel at Jakai, Assam	2017	2.2 - 18.1	5.4	Nil - 2100	649	360 - 29000	3680
	2018	2.1 - 10.0	5.1	Nil - 3500	1254	360 - 24000	3846
	2019	1.3 - 4.5	2.7	Nil - 1100	624	300 - 3500	1752
Ground water from Niz-Kodomoni PWSS Complex, Dibrugarh	2017	0.8 - 2.6	1.6	Nil - 730	515	Nil - 2000	1470
	2019	2.0 - 2.7	2.4	Nil - 360	360	Nil - 360	360
	2019	1.2 - 1.3	1.2	Nil	Nil	Nil	Nil

(Source: Regional Office, PCB, Dibrugarh, Assam, 2020)

10.6.2 LAND POLLUTION

Land is one of the most important and limited resource and it is directly or indirectly linked to most of the sectors like industrial, agricultural, residential etc. Improper drainage of water and water logging apart from polluting water resources has degraded land as well. Its degradation will directly affect the agricultural activities and ground water quality. Once ground water quality is affected, it will affect the water supply of the planning area since Planning Area is predominantly depended on ground water. In certain areas of the planning area like Patra Gaon has led to loss of fertile topsoil. This has degraded the land to a large extend in terms of agricultural use. The Patra Gaon area in the west of DMPA, is low lying area where most of time during monsoon season it gets flooded by flashflood water from Brahamaputra river.

Water Flooded Area near Patra Gaon

10.6.3 NOISE POLLUTION

Noise level recorder within Planning Area during 2017 and 2019 at different locations are mentioned below in table 235.

Table 236 Existing Noise Standards

Year of Monitoring	Milan Nagar (Residential) dB		Maruwaripatty, Dibrugarh (Commercial) dB		Assam Medical College & Hospital (Silence) dB	
	Before Deepavali	After Deepavali	Before Deepavali	After Deepavali	Before Deepavali	After Deepavali
2017	57.3	63.2	61.2	86.0	50.7	61.5
2019	58.0	77.0	62.0	87.0	50.0	62.0

(Source: Regional Office, PCB, Dibrugarh, Assam, 2020)

10.6.4 AIR POLLUTION

Pollution Control Board is monitoring ambient air quality at the following three air Quality monitoring stations in Region under National Air Monitoring Program (NAMP) at one location in residential area at Dibrugarh Town (Dibrugarh Regional office Building, Chowkidingee,) has been measuring SO2, NO2, PM10. The pollutant assessed are Suspended Particulate Matter, Particulate Matter of size less than 10 µm, Sulphur-di-oxide (SO2) and Nitrogen di oxide (NO2). The table below depicts the result of these four parameters. The yearly average values of these parameters from 2017 to 2019 are mentioned in table below.

Table 237 Air Quality Standards Recorded

Type of pollutants	Residential Area		
	2017	2018	2019
SO_2 (ug/m³)	7	6	5
NO_2 (ug/m³)	16	12	11
PM_{10} (ug/m³)	58	54	36

(Source: Regional Office, PCB, Dibrugarh, Assam, 2020)

As it is seen from the above table, the annual average concentrations of the pollutants in all the three Air Quality monitoring locations are within the prescribed standard limits.

10.7 ENVIRONMENTAL STRATEGIES

10.7.1 PROTECTION OF WATER CHANNELS

Protection/conservation of water channels is as much important as preserving a lake as these are the main channels, which brings water to the waterbody. Every stream, tributary, or river has an associated watershed, and small watersheds aggregate together to become larger watersheds. Stream systems have been classified according to their relative position within a stream network in order to understand, discuss, and explore similarities and differences between them. Many stream order classification systems have been developed, but no single system has been universally accepted. One of the earliest methods developed, and arguably the most commonly used method today, was developed by Strahler in 1952. In this system, the smallest head-water tributaries are called first-order streams. Where two first-order streams meet, a second-order stream is created; where two second-order streams meet, a third-order stream is created; and so on.

The major/important water channels with their orders are identified and the identified primary, secondary and tertiary water channels are given a buffer. The buffer zone for water bodies are categorized according to proposed planning strategy. The detail of the buffers are given in the proposed strategy.

In this buffer zone, regulated development is allowed. Protecting the drains will ultimately provide a smooth drainage in the area reducing the risk of flooding and water logging, ensuring uninterrupted flow of water to the waterbody. Other than this, detailed Environmental Management Plan has to be prepared which extensively studies the environmental parameters of the region. Under which numerous proposals can be developed. One of them can be identification of various catchments where the ground water recharge can take place. A concept of green infrastructure can also be adopted. At the site scale, different green infrastructure proposals consisting of site-specific management practices (such as interconnected natural areas) that are designed to maintain natural hydrologic functions by absorbing and infiltrating precipitation where it falls can be introduced.

10.7.2 PROTECTION OF FOREST AND MANGROVES

Mangrove forests are among the most threatened habitats in the world. They may be disappearing more quickly than inland tropical rainforests, and so far, with little public notice. Conservation of mangroves is important due to its various benefits like, It Protects the land from erosion

- Acts as an important natural shield against natural disasters like cyclones, ecological
- Disasters etc.
- Good source of timber, fuel and fodder
- Saves the marine diversity
- Purifies the water by absorbing impurities and harmful heavy metals
- Potential source of tourism and recreation

Figure 172 Jokai Reserve Forest

10.7.3 SUMMARY OF ENVIRONMENTAL STRATEGIES

- The south bank of Brahmaputra River which falls under Master Plan area should be protected as special area upto 50 mt for Public realm and recreational spaces.
- The north bank of Burhi Dihing River falls under DMPA should be protected from urban settlement and need to be utilized as Organic farming and recreational spaces.
- The water bodies (ponds/Lakes) outside the conurbation area should follow the 30m buffer from the edge of the water body boundary.
- The Sessa river stretch which fall under the DMPA should have the 15 m buffer on both the sides.
- There is a lack of green spaces/recreational area in the planning area. Thus, after the detail study the city level and neighbourhood level parks/playgrounds are proposed.
- Tea Gardens are the traditional farming activity observed in the Planning Area, hence this area will be preserved by declaring agricultural zone under Master Plan -2045 and Regulated Development will be allowed in certain parts of this area.

10.7.4 RECREATIONAL ACTIVITIES AROUND RIVER

- River Front Development
- Jogging trails around the Water Body
- Water sports activities

River Front Development

- Design, development adjacent to natural features in a sensitive manner to highlight and complement the natural environment in areas designated for development;
- Integrate development on river fronts with the natural environment to preserve and enhance views, and protect areas of natural drainage;
- Minimize grading to maintain the natural topography, while contouring any landform alterations to blend into the natural terrain;
- Screen development adjacent to natural features as appropriate so that development does not appear visually intrusive, or interfere with the experience within the open space system. The provision of enhanced landscaping adjacent to natural features could be used to soften the appearance of or buffer

development from the natural features;

- Use building and landscape materials that blend with and do not create visual or other conflicts with the natural environment;
- Design and site buildings to permit visual and physical access to the natural features from the public right-of-way.

Jogging trails around waterbody

Jogging trails are popular for bird viewing, walking, bike riding and other outdoor activities. Land managers often design and maintain trails in expansive public use areas. There is increasing interest from homeowners, business owners, wildlife enterprise entrepreneurs, schoolteachers, boy scouts, hospital personnel, parks department staff and others to develop and maintain nature trails on smaller landholdings.

Nature trails can be designed to minimize human disturbance and impacts on wildlife, plants, soils, and waterways. A well-designed trail can aid in land management, such as through simplifying timber evaluations or creating fire breaks. Properly built trails also provide opportunities to teach youngsters about wildlife, forestry, and natural resources.

To reduce impacts of trails and trail users on wildlife and plants, best trail practices are:

- Align trails along or near existing human-created edges or natural edges rather than bisecting undisturbed areas.
- Keep a trail and its zone of influence away from specific areas of known sensitive species.
- Avoid or limit access to critical habitat patches.
- Provide diverse trail experiences so that trail users are less inclined to create trails of their own.
- Use spur trails or dead-end trails to provide access to sensitive areas because these trails have less volume.
- Generally, concentrate activity along trails rather than disperse it.
- Keep trail construction impact as narrow as possible.
- Concentrate weed control at road and trail crossings, trailheads, and riparian areas

Nature Friendly Jogging Track

Water Sport Activities

Water Sport Complex could be identified on suitable river frontage area where water Sport activities like boating, Jet ski, riding could be promoted for public recreational activities.

11 SPATIAL STRATEGY AND LANDUSE PLANNING

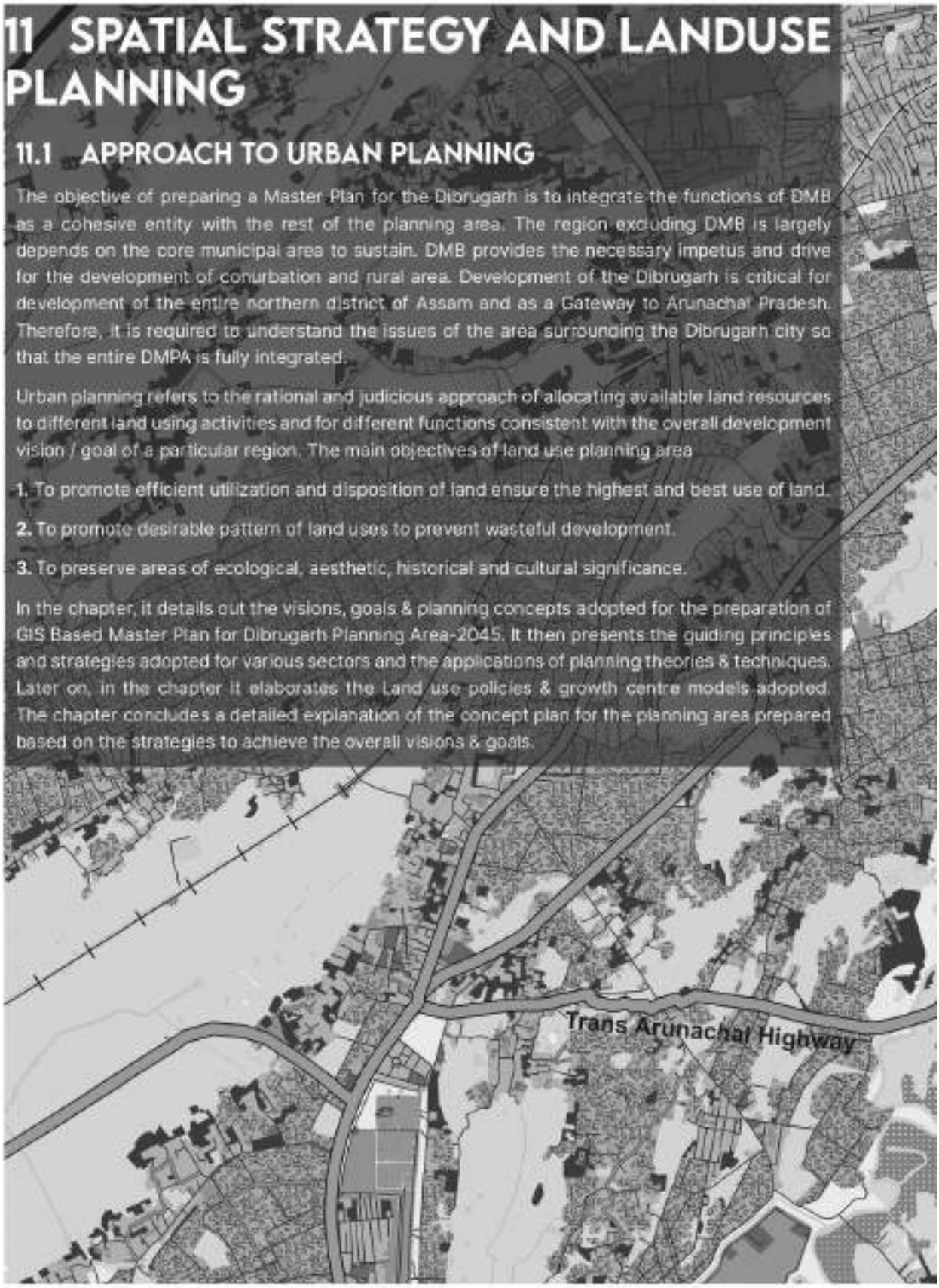
11.1 APPROACH TO URBAN PLANNING

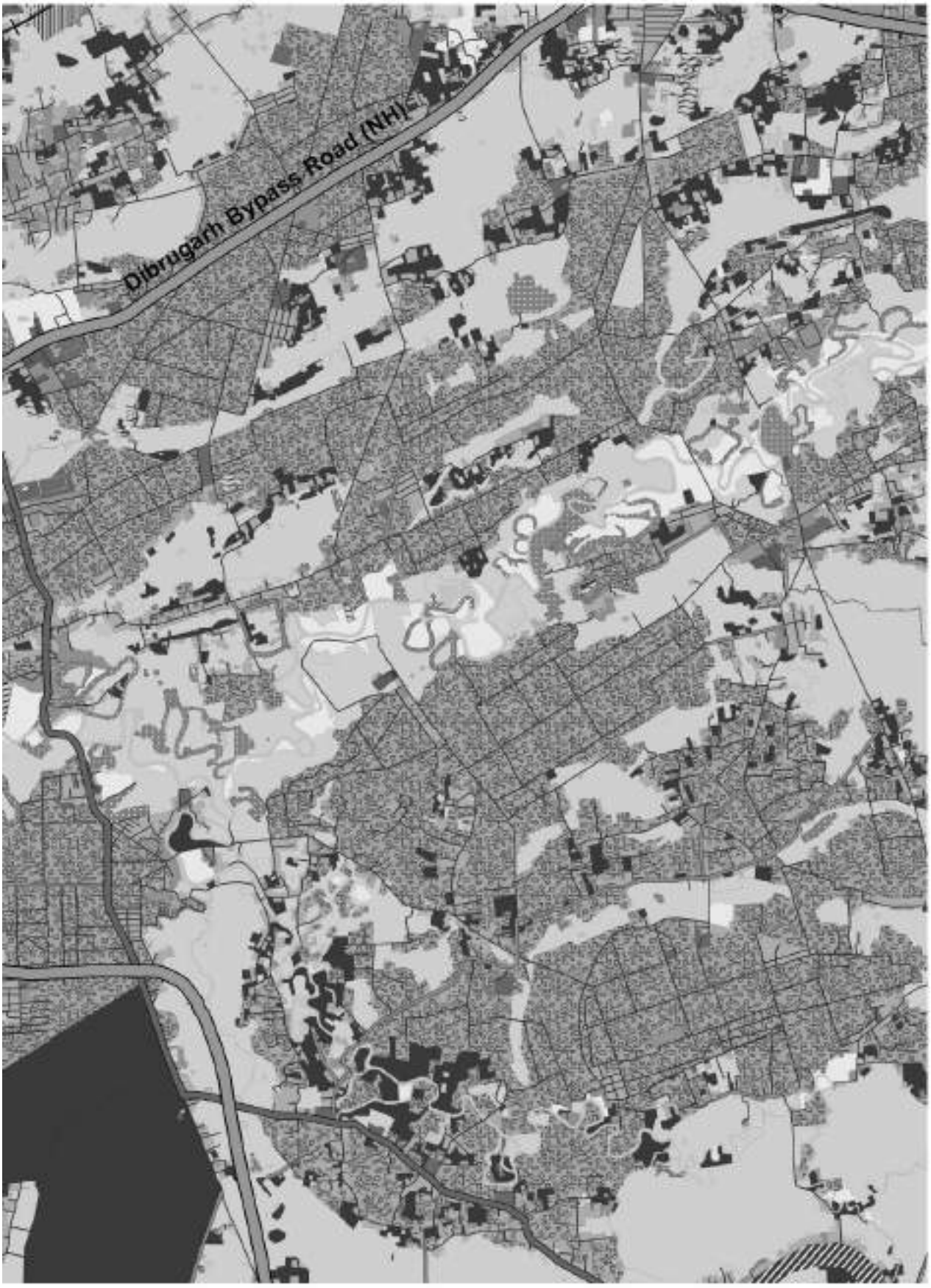
The objective of preparing a Master Plan for the Dibrugarh is to integrate the functions of DMB as a cohesive entity with the rest of the planning area. The region excluding DMB is largely depends on the core municipal area to sustain. DMB provides the necessary impetus and drive for the development of conurbation and rural area. Development of the Dibrugarh is critical for development of the entire northern district of Assam and as a Gateway to Arunachal Pradesh. Therefore, it is required to understand the issues of the area surrounding the Dibrugarh city so that the entire DMPA is fully integrated.

Urban planning refers to the rational and judicious approach of allocating available land resources to different land using activities and for different functions consistent with the overall development vision / goal of a particular region. The main objectives of land use planning area

1. To promote efficient utilization and disposition of land ensure the highest and best use of land.
2. To promote desirable pattern of land uses to prevent wasteful development.
3. To preserve areas of ecological, aesthetic, historical and cultural significance.

In the chapter, it details out the visions, goals & planning concepts adopted for the preparation of GIS Based Master Plan for Dibrugarh Planning Area-2045. It then presents the guiding principles and strategies adopted for various sectors and the applications of planning theories & techniques. Later on, in the chapter it elaborates the Land use policies & growth centre models adopted. The chapter concludes a detailed explanation of the concept plan for the planning area prepared based on the strategies to achieve the overall visions & goals.




Dibrugarh Bypass Road (NH)

11.2 EMERGING CONCERNS AND ISSUES

However, though its strategic location, Dibrugarh as a whole is lagging behind the rest of the country. Flood and water logging are the main reasons that the region has not been able to come up to a certain standard of all-round development, particularly in the countryside. Apart from that, there are many other issues affecting the growth of the region, such as, weak infrastructure, and exhausted and congested CBD area, narrow accessible carriage ways encroached by unorganised parking stretches in the city core area. Following are the main emerging concerns and issues in the project area:

- Flood and Water Logging- Flood and water logging have been a major concern for the region since 1950. During the last almost six decades, this problem has devastated the urban and rural economy of the region in a big way. Water level of the Brahmaputra River, inadequate drainage system, informal settlements, and lack of solid waste management are the main reasons for flooding and water logging in the region.
- Flowing river like Brahmaputra would have low pollution level; however, the river in the project area is polluted because of the raw sewage directly discharged into the river without any treatments. In addition, a vast portion of the municipal waste flows directly into the river through its tributary rivers. Due to lack of efficient solid waste disposal mechanisms, people have a tendency to throw plastics and other garbage into the open drainage, which leads to clogged drains.
- Existing quality of roads in the region is extremely poor; on top of that, the encroachment on the roads has narrowed the streets, which is causing the traffic chaos. Not even the national highways passing through the region is four lane. The collector roads and streets of markets and narrow and lake of sufficient parking area. All these are creating traffic congestions in and around the city area.
- Neither artificial nor natural drains have the capacity to carry the storm water effectively. Additionally, untreated wastewater from residential, commercial, and industrial activities is discharged into the underground and open drains.
- Haphazard Development- throughout the region, number of illegal construction, encroachments on the pedestrian pathways and wetland, and violation of Byelaws have led to imbalanced built-open relationship.

11.3 VISION, GOAL AND OBJECTIVES

The Dibrugarh GIS Based Master Plan - 2045 is initiated with the aim of achieving a better economic growth, better infrastructure facilities, and higher quality of life for the planning area while keeping the heritage, culture and form of the city intact and preserving the environment of the area. To achieve these, it is essential to set out goals and adopt the planning concepts and guiding principles so as to ensure maximum benefits and least adverse effects. The discontinues & non-homogenous geographical profile of the planning area which is a historical accident has thrown several challenges towards ensuring continuity and proper planned development. Despite this limitation, through forethoughts & reasonable approach to the situation desired results could be achieved. This section elaborates the vision statement, goals that are formulated to achieve the goals and the planning concepts, which will guide to achieve the same.

11.3.1 VISION

The Vision for the planning area perceived around the following core ideas:

- Preserving our historical past, maintaining the livability of the present, and transforming our future through the implementation of the highest quality planning, to enhance the level of infrastructure service to all people of Dibrugarh Region.

- Plan and implement the future by guiding the physical and economic development of Dibrugarh town while enhancing the quality of life for all through a comprehensive range of planning to promote the cultural, built and natural heritage in a sustainable manner.
- Expand urban infrastructure to encourage appropriately compact, connected, and synchronized development by unlocking the potential of urbanization for better economic, social, and environmental outcomes at the heart of the government's economic strategy.

11.3.2 GOALS

In the next 25 years, Dibrugarh will grow by half million people and will consolidate its reputation as one of the Most Liveable; Socially Beneficial; Regionally Contextual; Environmentally Sustainable; Financially Viable; Institutionally Executable; Politically Acceptable and Culturally Prosperous areas in Assam for residents, business and visitors."

11.3.3 OBJECTIVES TO ACHIEVE THE VISION

1. To generate higher service facilities for attracting various developmental activities, investors and industrial houses.
2. To generate facilities and activities to support small investors, informal sectors and slum inhabitants and rural migrants.
3. To improve the Transport Network system for faster communication and high standard linkages between the Growth Centers and their rural hinterlands.
4. To transform the whole region to a pollution free zone with conservation of biodiversity and environment.
5. To manage the natural and human resources for followed development.
6. To frame land policies and development proposals for eradicating bottlenecks for future development.
7. To provide decent housing for all sections of people living in the region.
8. To formulate a Disaster Management Policies to tackle natural hazards.
9. To provide high levels of physical and social infrastructure ensuring safe drinking water, improved sanitation, well distributed education, health, recreation and cultural facilities.
10. To convert the region to a learning and cultural centre for the state as well as nation.
11. To transform the region to a hub of tourism through preserving and promoting the rich cultural heritage and aesthetics of tea gardens, with high standard facilities and convenience.
12. To design an effective development control mechanism with a high value of public serviceability.
13. To reenergize the institutional and administrative system to manage future urban.

11.4 PLANNING THEORIES

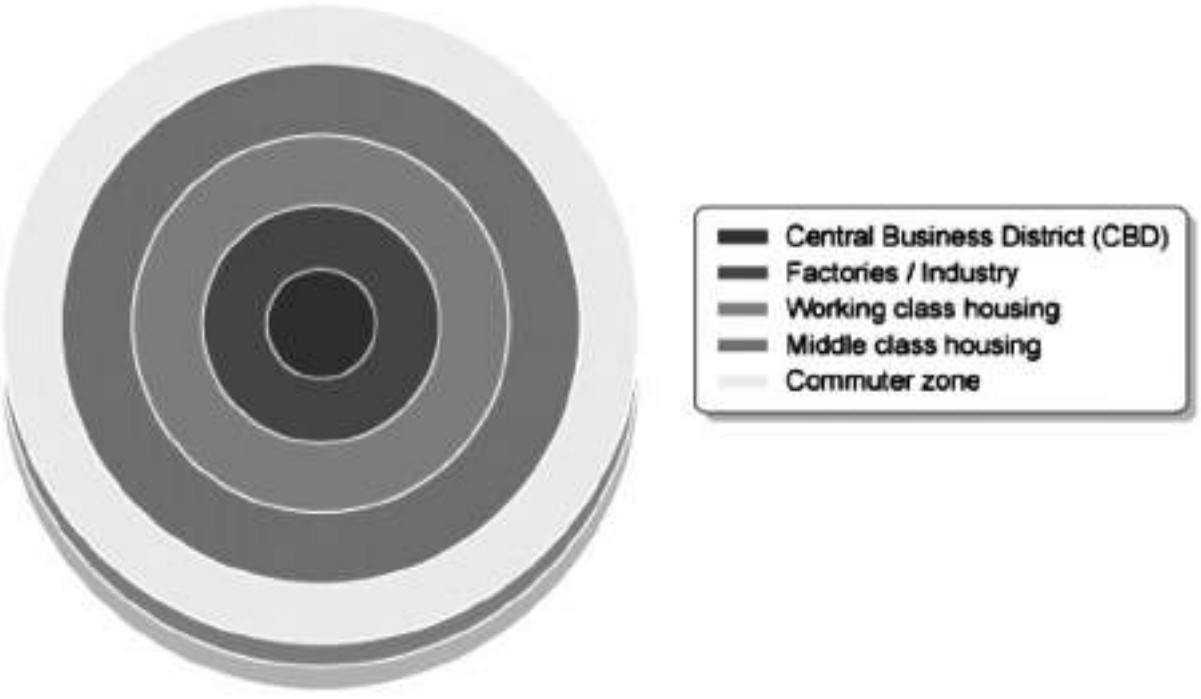
The planning is based on order of settlement, level of urbanization, planning area morphology it's evident that the growth over the last few decades are spearheaded due to certain factors like spatial organization of the several urban functions of commerce, production, education, and much more. One of the most important forces determining where certain activities or growth is focused within a city deals with the price of land. Thus, it is important to understand different urban models developed over the course of time. The different planning theories are explained in the following section to understand which theoretical model suits best for the planning area.

11.4.1 CONCENTRIC ZONE MODEL

The Concentric Zone model is a model of the internal structure of cities in which social groups are spatially arranged in a series of rings. The concentric zone model was resulted from a study of Chicago in the 1920's by Ernest Burgess. This model is also known as Bull's eye Model. The idea behind this model is that the city grows outward from a central area in a series of rings. The size of the rings may vary, but the order always remains the same. Under this model, five concentric functional zones are recognized. At the center was the CBD (1). The zone of transition (2) was characterized by residential deterioration and encroachment by business and light manufacturing. The zone of independent workers' homes (3) was primarily occupied by the blue collar (wage-earners, manual laborers) labor force. The zone of better residences (4) consisted mainly of the middle-class. Finally, the commuters' zone (5) was the suburban ring, consisting mostly of white-collar workers who could afford to live further from the CBD. This model was dynamic. As the city grow, the inner zones encroached on the outer ones.

Disadvantages:

- This model was developed for American cities and had limited applicability elsewhere.
- The model does not take into account any physical barriers and gentrification - which may occur in the cities.
- It does not address local urban politics and forces of globalization.



11.4.2 SECTOR MODEL

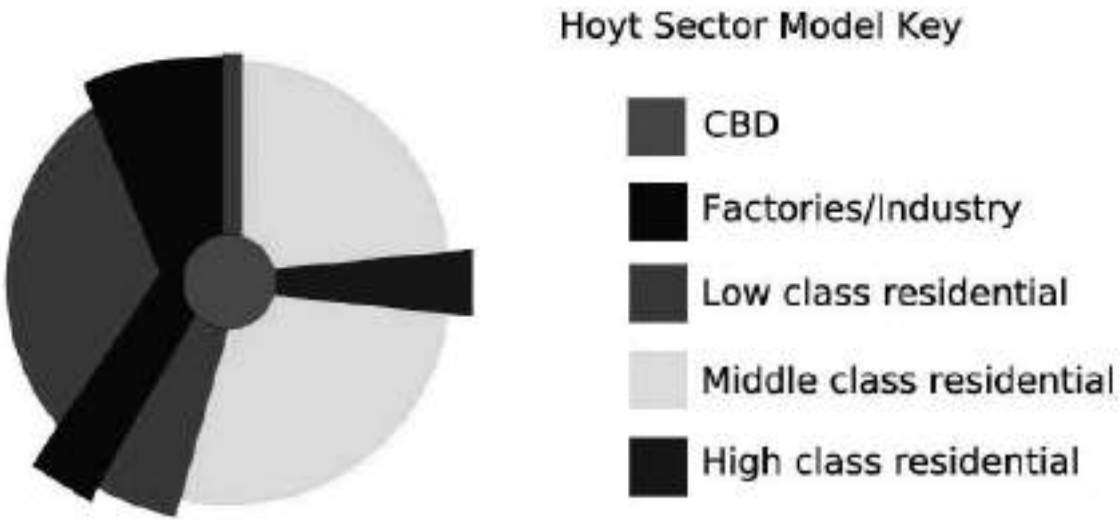
In the late 1930s, Homer Hoyt's sector model was published, partly as an answer to the drawbacks of Burgess' concentric zone model. This model was based both on urban land-use pattern and on demography. Hoyt accepted the existence of business district at the core, but suggested that various groups expand outward from the city centre along railroads, highways and other transportation arteries. As technology dealing with transportation and communication was improving, growth alone created more of a pie-shaped urban structure. Hoyt discovered that land rent (for residential, commercial, or industrial) could remain consistent all the way from the CBD to the city's outer edge.

Based on the above observation, Hoyt theorized the following:

- Cities tend to grow in wedge-shaped patterns—or sectors—emanating from the core business district and centered on major transportation routes.
- Higher levels of access meant higher land values; therefore, many commercial activities would be carried on in the central business districts, but manufacturing units would be developed in a wedge surrounding transportation routes.
- Residential areas would grow in a wedge-shaped pattern with a sector of low-income housing bordering manufacturing/industrial sectors (traffic, noise and pollution would make these areas least desirable), while middle and high income households would be located as far away as possible from manufacturing industrial units.

Disadvantages:

- The theory is based on nineteenth century transport and does not make allowances for private cars that enable commuting from cheaper land outside city boundaries. This occurred in Calgary in the 1930's when many near-slums were established outside the city but close to the termini of the street car lines. These are now incorporated into the city boundary but are pockets of low cost housing in medium cost areas.
- No reference is given to out of town development.



11.4.3 MULTIPLE NUCLEI MODEL

In the 1940s, Chauncy Harris and Edward Ullman, arguing that neither of the earlier models adequately reflected city structure, proposed the multiple nuclei model. This model was based on the notion the CBD was losing its dominant position and primacy as the nucleus of the urban area. Several of the urban regions would have their own subsidiary but competing "nuclei." As manufacturing cities became modern cities and modern cities became increasingly complex, these models became less and less accurate.

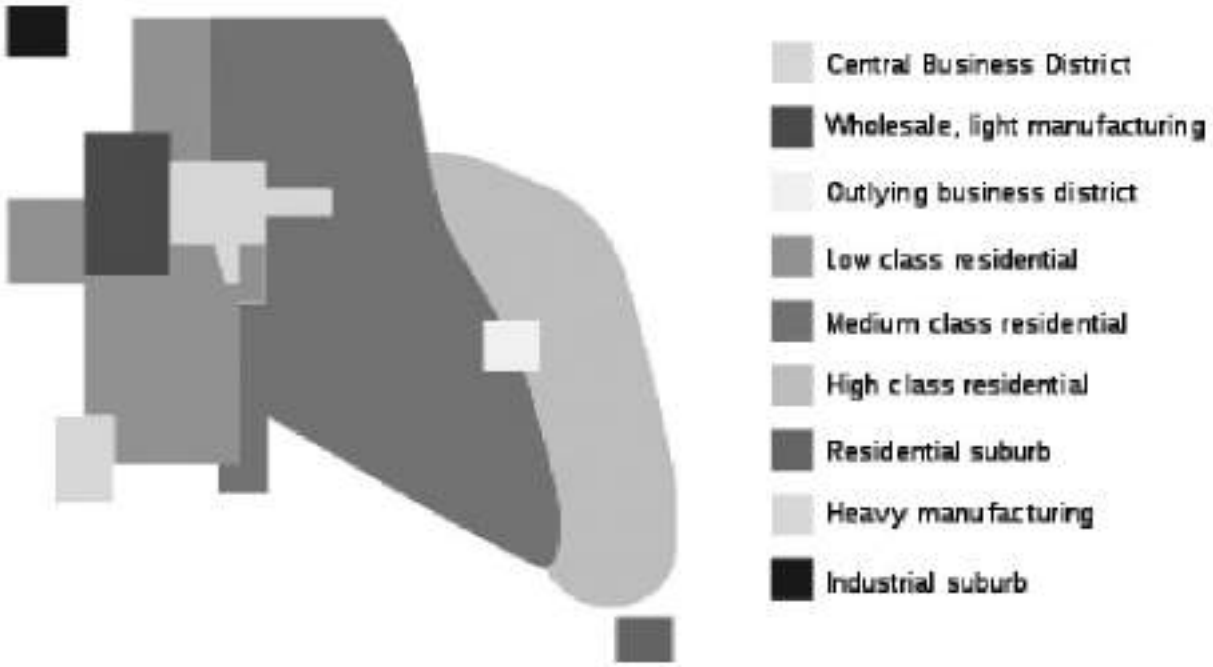
Today, there are urban realms, components of giant conurbations (connected urban areas) that function separately in certain ways but are linked together in a greater metropolitan sphere. In the early postwar period (1950s), rapid population diffusion to the outer suburbs created distant nuclei, but also reduced the volume and level, of interaction between the central city and these emerging suburban cities. By the 1970s, outer cities were becoming increasingly independent of the CBD to which these former suburbs had once been closely tied. Regional shopping centers (e.g., malls) in the suburban zone were becoming the new CBDs of the outer nuclei.

Advantages:

The advantages of this model lie in its multi nuclei approach - many sources give slight variants on the model shown in the diagram, since the model is rather flexible and adapts to local situations (the exact positions of the nuclei are not important but only the basic trends) so it can be modified to match the city under consideration.

Disadvantages :

- Negligence of height of buildings.
- Non-existence of abrupt divisions between zones.
- Each zone displays a significant degree of internal heterogeneity and not homogeneity.
- Unawareness of inertia forces.
- No consideration of influence of physical relief and government policy.
- The concepts may not be totally applicable to oriental cities with different cultural, economic and political backgrounds.



11.4.4 URBAN REALM MODEL

Vance's urban realms model is an extension of the multiple-nuclei model and is based on the San Francisco Bay area but has been applied to other US cities. The key feature is the emergence of large self-sufficient urban areas, each focused on a center independent of the traditional downtown and central city. The area, shape and other characteristics of each realm depends upon the following several factors:

1. The terrain – mountains and rivers and other barriers will help to determine the extent and shape of a region.
2. The size of the metropolis – a larger metropolis may have more and larger realms.
3. The amount of economic activity within each realm – a determinant of the area it can serve and hence its size.
4. The transport infrastructure available within each realm – an easily accessible economic core increases the area of influence and thus size of each realm.

Transport infrastructure between realms – e.g. circumferential links (such as freeways) and airports such that people no longer have to travel to the CBD and its central realm in order to travel to other realms and to another metropolis. If a realm can become more important in this manner, then it may increase in importance. E.g. West Los Angeles is within easy reach of the LAX airport (along the freeway) but to travel by train residents have to travel to the CBD (by bus or car).

Advantages:

- If the city is successful, It can accommodate a large and growing population easily due to its automobile dependence.
- Each realm has its own economic strength, so overall the metropolis can be an economic powerhouse and can become some self-sufficient.

Disadvantages:

If a model fails, then the city displays a large amount of urban sprawl. Urban sprawl is the uncontrolled expansion of urban areas. Urban areas will expand into previously rural areas.

11.4.5 CENTRAL PLACE THEORY

Central Place Theory (CPT) is an attempt to explain the spatial arrangement, size, and number of settlements. The theory was originally published in 1933 by a German geographer Walter Christaller who studied the settlement patterns in southern Germany. In the flat landscape of southern Germany Christaller noticed that towns of a certain size were roughly equidistant. By examining and defining the functions of the settlement structure and the size of the hinterland he found it possible to model the pattern of settlement locations using geometric shapes.

Advantages:

- The theory helps us understand the organization from a theoretical perspective and the spatial distribution.
- Important in Policy Making.

Disadvantages:

- The theory doesn't incorporate the temporal aspect in the development of central places.
- The theory is good for agricultural regions but not industrial or postindustrial regions.

11.4.6 A MODEL BEST SUITED FOR DIBRUGARH

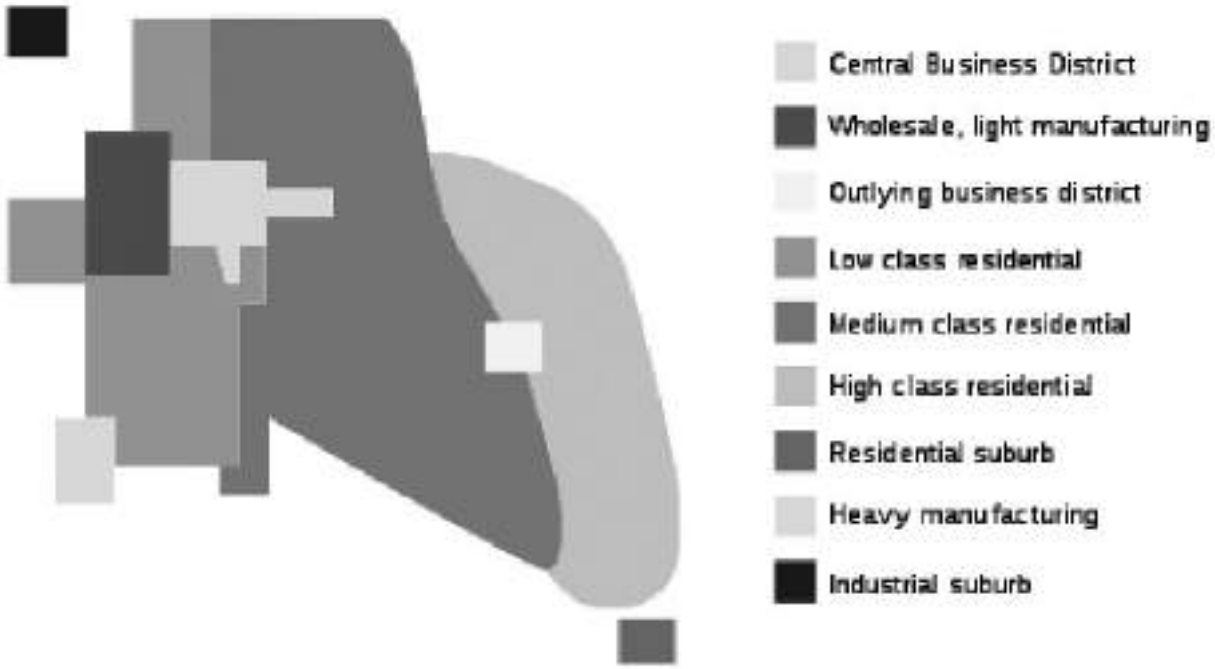
After studying above mentioned theory, following analysis has been conducted.

It is evident that concentric zone model is not suitable for Dibrugarh as it was developed mostly for American cities and does not take into consideration any physical barrier or gentrification. Similarly, Sectoral model is also not applicable to DMPA as there is no allowances for private cars while considering the transportation sector. Additionally, it doesn't include any reference for the development which occurs immediately after town, which is the scenario in almost all Indian cities. In the case of urban realm model, if a model fails, then the city will start developing large amount of urban sprawl. This can't be applicable to Dibrugarh due to the absence of contiguous mass of land. Additionally, in todays' context, a city should focus less urban sprawl as a city can't afford to lose its agricultural area. Central place theory is also not applicable to DMPS as it is good for agricultural regions.

Multiple Nuclei Model is best suited for Dibrugarh as it has a unique character of non-contiguous land mass. Additionally, the city has already developed a character where the application of this theory will become inevitable. The Major issues of the city can be solved with Multiple Nuclei Model.

Some of the issues include, the high-level congestion in the core town, increasing urban sprawl and decreasing agricultural land, haphazard development inside the planning area. Additionally, this model is flexible and can fit according to the local condition of a city/town. The other major reasons to adopt the Multi Nuclei Model in Dibrugarh region are listed below.

- Dibrugarh region possess flat terrain.
- Dibrugarh region is a noncontiguous settlement pattern paves the opportunity to develop the decentralization model.
- The administrative boundaries (noncontiguous settlement pattern) itself create the ways to decentralize the core activities from Central Business District.
- Dibrugarh region is sharing the major road network with Assam as well Arunachal regions.
- Multi Nuclei model allows the even distribution of resources allocations.



11.5 GUIDING PRINCIPLES

The principles below further articulate the vision and are to guide planning of the proposed DMPA to achieve the foreseen vision.

11.5.1 TRANSIT ORIENTED DEVELOPMENT (TOD)

Transit oriented development is a mixed-use development integrating planning and implementations of transport and land use. Mixed-use developments include residential, commercial space and office space, or a combination of the same. Generally, mixed-use development is within easy access to transit corridors. Development within easy accessibility to the transit corridors encourages residents and workers to use public transit more often over private vehicles.

11.5.2 URBAN RURAL CONTINUUM

Rural Urban Continuum is essentially the gradual change observed in terms of intensity of development from core city areas towards the peripheral area. The nature of settlement structure helps to understand the rural-urban dichotomy or continuity. In the initial stage, the chance can be seen in form of changes in agricultural land use, in terms of high commercialization of agriculture activities. In the later stage, the chance can be seen in occupational structure of the rural areas, in terms of when the rural population starts responding to possible employment opportunities in the surrounding urban areas. As time passes, the range of private enterprises would widen to include almost every type of enterprises sectors. Public transport would the means of commutation, houses would be improved and better furnished; however, the basic amenities such as water supply, sewage disposal and drainage may not show any improvement. In the third and the last stage, changes in urban land use would be observed.

11.5.3 MULTIPLE NUCLEI CONCEPT

Population of metropolitan area will grow along with a growth of the metropolitan area, and so the demand for the infrastructure too will grow. By creating, multiple nuclei centers will help reduce the burden of providing sufficient infrastructure from the metropolitan area. These nuclei centers can be identified based on the physical demarcation and accumulation of cluster of activities. They would not the absolute population accumulation in a particular area but the service population with different size.

11.5.4 URBAN GROWTH BOUNDARY

Urban growth boundary circumscribes the possible urbanizable and developable area. Local governments would use the boundary as a guide to zoning and land use decisions. The local or regional government does not support development for a specified period beyond an officially adopted and mapped line. Growth is supported inside the boundary with utilities and development-friendly policies. Growth is discouraged outside the growth boundary. The purpose of providing urban growth boundary is to synchronize existing urban growth with the provision of infrastructure needed to accommodate future growth, and to promote compact and contiguous development patterns that can be effectively served by public services; as well as to preserve open space, agricultural land, and environmentally sensitive areas that are not currently suitable for urban development.

11.5.5 PERI URBAN DEVELOPMENT

UNDP (1996) defines peri-urban as an activity that produces processes and markets food and other products, applying intensive production methods and reusing natural resources and urban wastes to yield a diversity of crops and livestock. Peri urban in addition can also involve animal husbandry, aquaculture, agro-forestry and horticulture.

11.5.6 PROVISION OF SOCIO-PHYSICAL AMENITIES

URDPFI guidelines will be base line for foreseeing the socio-physical amenities requirement for the horizon year 2045.

11.6 CONCEPTUAL PLAN DEVELOPMENT

To achieve the vision and goals set for the planning area it is critical to have a concept, which illustrates the long-term direction guided by planning principles.

Several considerations were taken into account while formulating the concept for the planning area, which are listed below.

Socio-demographic Projections

- Current Growth Trends
- Level of Urbanisation
- Stakeholder Meeting Suggestions
- Suggestions from various government organisation, NGOs etc.
- Existing Physical & Social Infrastructure
- Existing Land Use Analysis & Land Availability for Future Development
- Economy of planning area
- Govt. Policies & Future Projects

Based on the various analysis and exploration the nodal points are identified for the projected year 2045. The figure 387 reveals that the identification of growth centers, growth points and location for the Multi Modal Transit Centres in Dibrugarh region. They are detailed in the table 238.

Table 238 Details of Development Centres and Nodal Points

Multi Nuclei Model Dibrugarh Planning Area- 2045		
Sr.No.	**Development Centre**	**Nodal Point**
1.	Growth Centre	Lahowal Gaon
		Chengmari Gaon
		Changmari Garia Gaon
2.	Growth Point	Kapor Tepow Gaon
		Lekai Gaon
		Dhekeri Gaon
3.	Transit Hub	Niz- Khanikar

The planning area currently accommodates 3.6 lakhs of population with a gross density of 9 persons per hectare and this population is projected to grow to almost 5.5 Lakhs by 2045. The planning area have certain inherited nodes like the Institutional area, Industrial area, Municipal areas & its outgrowth and the rural hinterland. For ease of planning, the Dibrugarh Planning Area is divided into three zones as mentioned below.

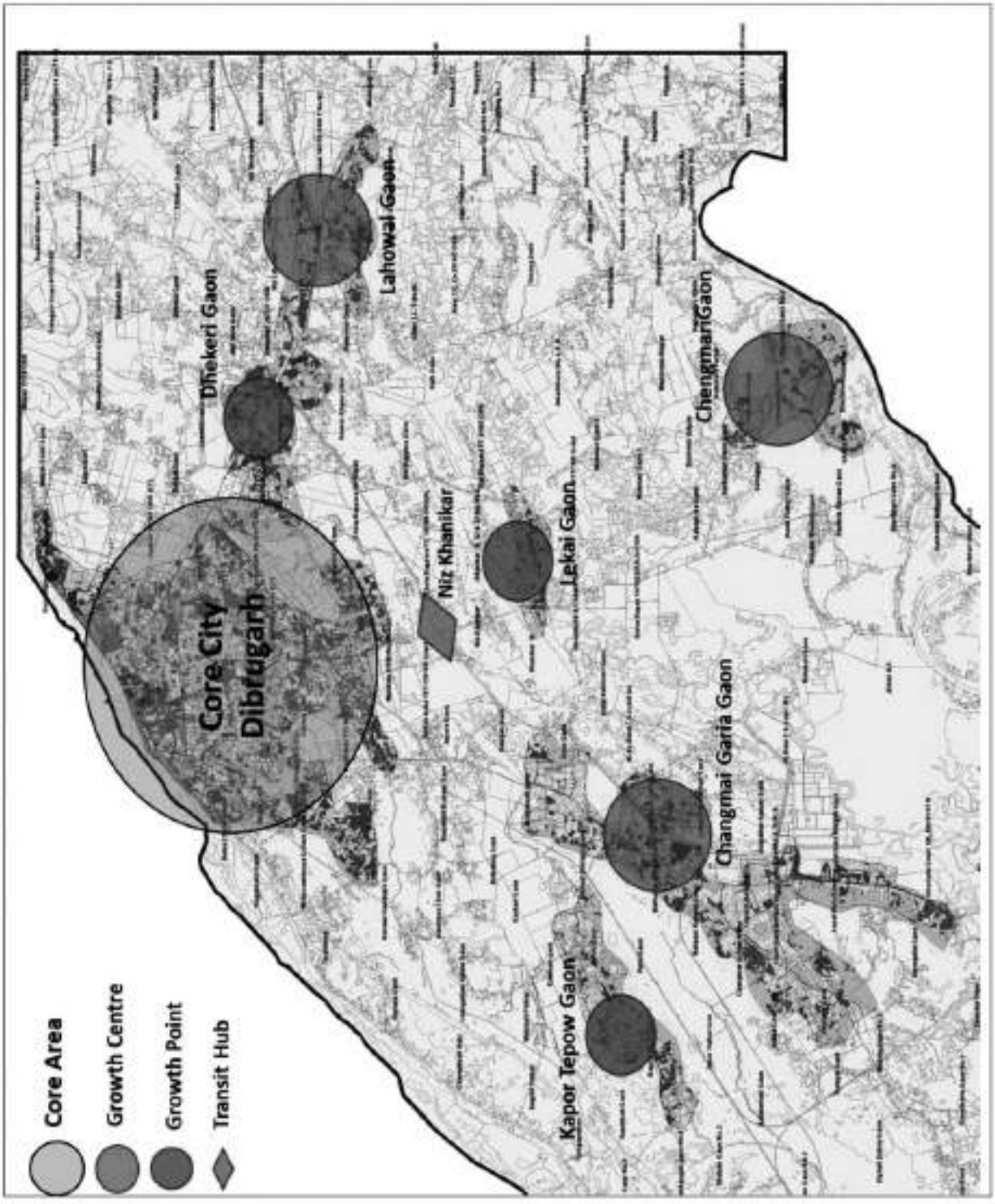


Figure 173 Concept Plan for Dibrugarh Master Plan Area - 2045

11.6.1 CONURBATION AREA

Conurbation area is a continuous urban area comprising of towns and their outgrowths merged with each other due to physical expansion and population growth. In the case of Dibrugarh, conurbation area includes Dibrugarh Municipality, 2 Census Towns (Niz-Mancotta and Barabari AMC area) and 2 Outgrowth area (Mohpuwalimora Gohain Gaon and Tekela Chiring Gaon). The continuous development has occurred up to Konwar Handique Village due to existence of NH 37 on western side of Dibrugarh. The continuous development also has occurred due to Mancotta Road in Tepor and Mankota village on southern part of Dibrugarh. This area is also well connected through NH Bypass. The villages included in the conurbation area are listed below.

Table 239 Proposed Conurbation Area 2045

Proposed Conurbation Area - 2045				
Sr No.	**DMB Area**	**OGs**	**CTs**	**Villages**
1	Dibrugarh Town	Mohpuwalimora Gohain Gaon	Niz-Mancotta	Mankota
2	Kolihamari	Tekela Chiring	Barabari	Tepor Gaon
3	Niz Kadamoni	-	-	Bairagimath Kachari Gaon
4	Japara Gaon	-	-	-
5	Chiring Gaon	-	-	-
	5	**2**	**2**	**3**
Total no. of villages covered within Conurbation Area				**12**

(Source: Consultant Compilation)

11.6.2 EXISTING LAND USE OF CONURBATION AREA

The various industries, the educational and health sectors, trade and commerce and transportation sector are responsible for the city's function. Dibrugarh has been observed to be a multi-functional town having characters of trade and commerce cum industries cum tea farming.

The existing land use pattern of the conurbation area shows the dominance of residential area. It can be observed that a considerable area is under Public-Semi Public use as this land use consists of the administrative and government buildings, educational institutions, medical institutions, social amenities and public utilities being part of this land use. The maximum developed area is on the Northern side of planning area towards the Dibrugarh town. There is a dense network of roads within the market area. But outside that there are only some radial roads connecting various communes and the nearby state of Assam. There is large parcel of land occupied under the railway station. Commercial areas are mainly located in city centre Town and along the major transportation corridors. The area for Recreational Use is practically negligible, since there are few green spaces, parks and gardens. There is a portion of area under agricultural use as tea estate also. The existing land use area on new conurbation area is **83.10** sq.km.

11.6.3 RURAL AREA AND GROWTH CENTRES

The formation mainly happens when the CBD gets saturated with developmental activities and there is hardly any room for further development. Thus, it demonstrates the complex nature of urban areas. In the light of this, three growth centers and three growth points are identified in Dibrugarh Planning Area since there is a dire need to decentralize the commercial/public semi-public activities towards outskirts of the urban area. Three Growth centers are proposed in Lahowal, Chanmai Garia Gaon and Chengamari Gaon while the growth points are proposed in Dhekeri Gaon, Lekai Gaon, and Kapor Tepow Gaon.

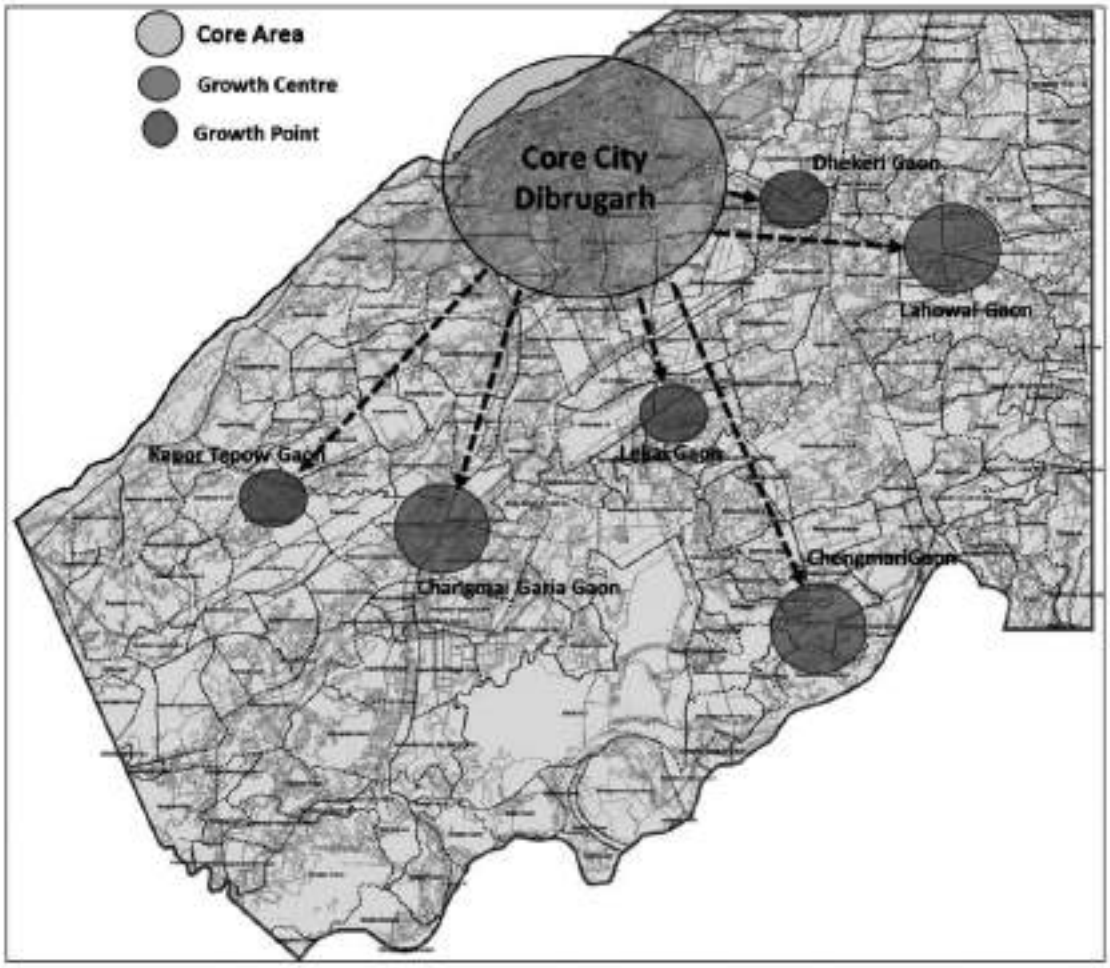


Figure 174 Concept Plan for Dibrugarh Planning Area 2045

The formation mainly happens when the CBD gets saturated with developmental activities and there is hardly any room for further development. Thus, it demonstrates the complex nature of urban areas. In the light of this, three growth centers and three growth points are identified in Dibrugarh Planning Area since there is a dire need to decentralize the commercial/public semi-public activities towards outskirts of the urban area. Three Growth centers are observed in Lahowal, Chengmari Gaon and Changmai Garia Gaon while the growth points are proposed in Dhekeri Gaon, Lekai Gaon and Kapor Tepow gaon.

11.6.3.1 Chengmari Growth Centre

Chengmari located in the Southern side of planning area is known as the rice bowl of the area and has very fertile chunks of agricultural land. Thus, protection of this prime agricultural land is necessary for preserving the dwindling numbers of agricultural land and to increase the employment opportunities in primary sector. Moreover, preserving the big chunk of agricultural land will enhance the overall environment of the DMPA. Thus, Chengmari and near by villages are proposed as an agricultural growth centre. Other reasons stating the potential of Bahour commune to be developed as a growth centre are mentioned below:

- Chengmari is 3 km from Joikai reserve forest and recreational area are existing at reserve forest like botanical garden and well-developed tea estates. These villages are situated along the Dihing river, hence there is huge scope for river front development for tourism and recreational are for upcoming settlements.
- Since Chengmari and villages have very fertile agricultural land, to support the agricultural activity like Tea gardens and paddy fields, special permission will given in the agricultural zone of Chengmari region, where the Godowns, Agricultural tool and equipment repairing, Cold Storage and allied activities etc. are allowed. Hence, commercial zone is proposed along the stretch of NH 45 A falling under Bahour Commune.
- Chengmari is situated 14 Km from Dibrugarh town via road, this road has ribbon development and potential to develop.
- Since the DMPA is Non-contiguous area, it is essential to focus on Chengmari centre as self-sustainable development to the extent which will reduce the generation of trips from Chengmari to Dibrugarh every day.
- Moreover, the proposed educational institutions in Lekai gaon and proposed Special tourism zone near Jokai R.F village will accelerate the scope of Chengmari to function self-sufficiently.
- The proposal of adventure sports facilities on Burhi Dihing river and amusement park at Muwamora Gaon will Pull the population from the nearby region which will further strengthen the development.
- Tea garden belt in villages of Bortomoto Bagan, Majutomoto Bagan and Kachamari Deori will act as green zone for Chengmari Growth Centre.
- Chengmari will have the impact of proposed outer ring road and Trans Arunachal Highway.

11.6.3.2Chagmai Garia Gaon Growth Centre

- Chagmai Garia is situated around 12 km from Dibrugarh town via NH 37 and closer to Lapatkata Bengali gaon town where BCPL Industries are functonal.
- Development of Chagmai Garia as Multi Nuclei / Self sustainable center may reduce the traffic flow to Dibrugah town.
- The presence of already existing industries will attract a greater number of industries. Tool based industries are proposed to be strengthened by capacity building programs.
- Apart from this, Chagmai Garia is also proposed as a Multimodal Transit Hub which will attract and boost the development in the surrounding area. People travelling from Sivasagr and North Lakhimpur to Dibrugarh can interchange the mode of transport from Chagmai Garia.

- Existing Railway line is also passing from the West-Northern side of the Chagmai Garia. The Growth centre can take an advantage of this connectivity as well. The existing Dhamal Gaon Railway station over this route will be an important mode of regional transport between Chagmai Garia and Dibrugarh. Due to this connectivity, the Growth centre will be further flourished in terms of development.

11.6.3.3Lahowal Growth Centre

Lahowal (Vidhan Sabha constituency) is one of the 126 assembly constituencies of Assam Legislative Assembly. Lahowal forms part of the Dibrugarh Lok Sabha constituency. Lahowal is connected with railway and have its own railway station. Lahowal Collage is well known in the region established in 1994, it is accredited from NAAC and it is affiliated to Dibrugarh University. Collage offers 15 courses across 5 streams namely Vocational, IT, Arts, Education, Commerce and Banking. Hostel facility is not available for its students. Mohanbari Dibrugarh Airport is just 3 km away from Lahowal Railway station.Thus, it is proposed to be developed as a hub of Hotel and Service industry to promote the agricultural activities like tea farming and tourism to enjoy aesthetics of tea and golf courses. Sufficient commercial areas are proposed to facilitate agricultural allied activities. Other reasons stating the potential of Nettapakkam commune to be developed as a growth center are mentioned below:

- Majority of the area in this commune falls under agriculture category and the residents are dependent on primary sector for economy generation.
- In consideration of this aspect, Nettapakkam has been proposed as agricultural Growth Centre where agriculture and its allied activities will be promoted.
- The connectivity with NH-37, SH-23, Railway and Airport will accelerate the scope of development for this area.
- Eco village tourism is proposed here as the existing character of the area has the potential to be developed as an Eco village tourism. Moreover, this will act as a livelihood option for the residents of the area.

11.6.4 GROWTH CENTRES

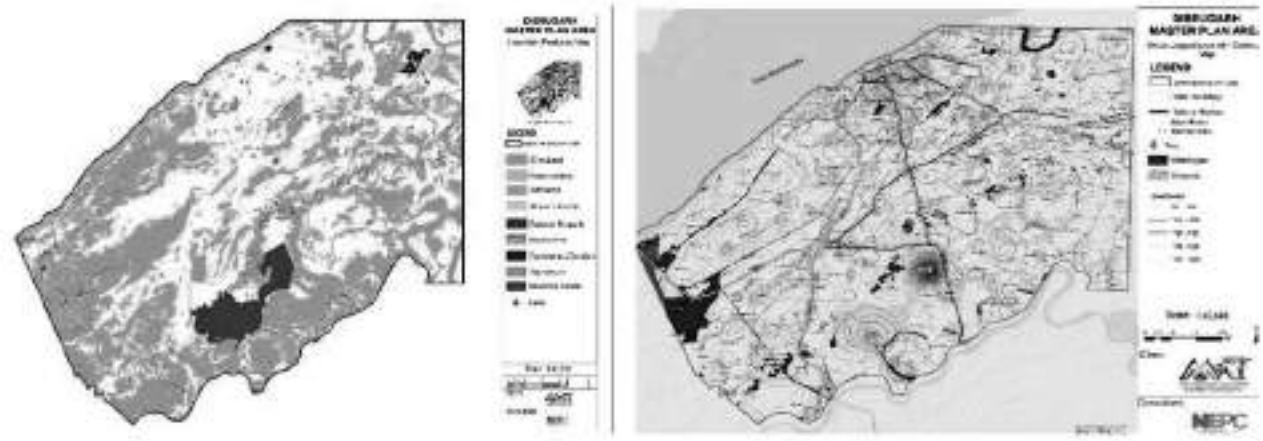
The selected points will produce self-sustaining growth. In Dibrugarh Planning Area, three growth points have been identified viz. Lekai, Kapor Tepow, and Dhekeri Goan.

11.6.4.1 Lekai Growth point

Lekai Growth Point which is located on the southern side of the planning area, has the close proximity to Dibrugarh Bypass. It's close proximity to the proposed special tourism zone enables this area with great potential to grow as a growth point attracting investments and being a node for services for the surrounding areas.

11.7 RATIONAL FOR THE CONTIGUOUS URBAN DEVELOPABLE AREA

In addition to the regional connectivity of the DMPA with the rest of the seven sister states and the country, existing settlement pattern and urban growth in and around the Dibrugarh city, location of eco-sensitive areas and existing land use have to be taken into consideration while developing concept plan for the proposed DMPA.



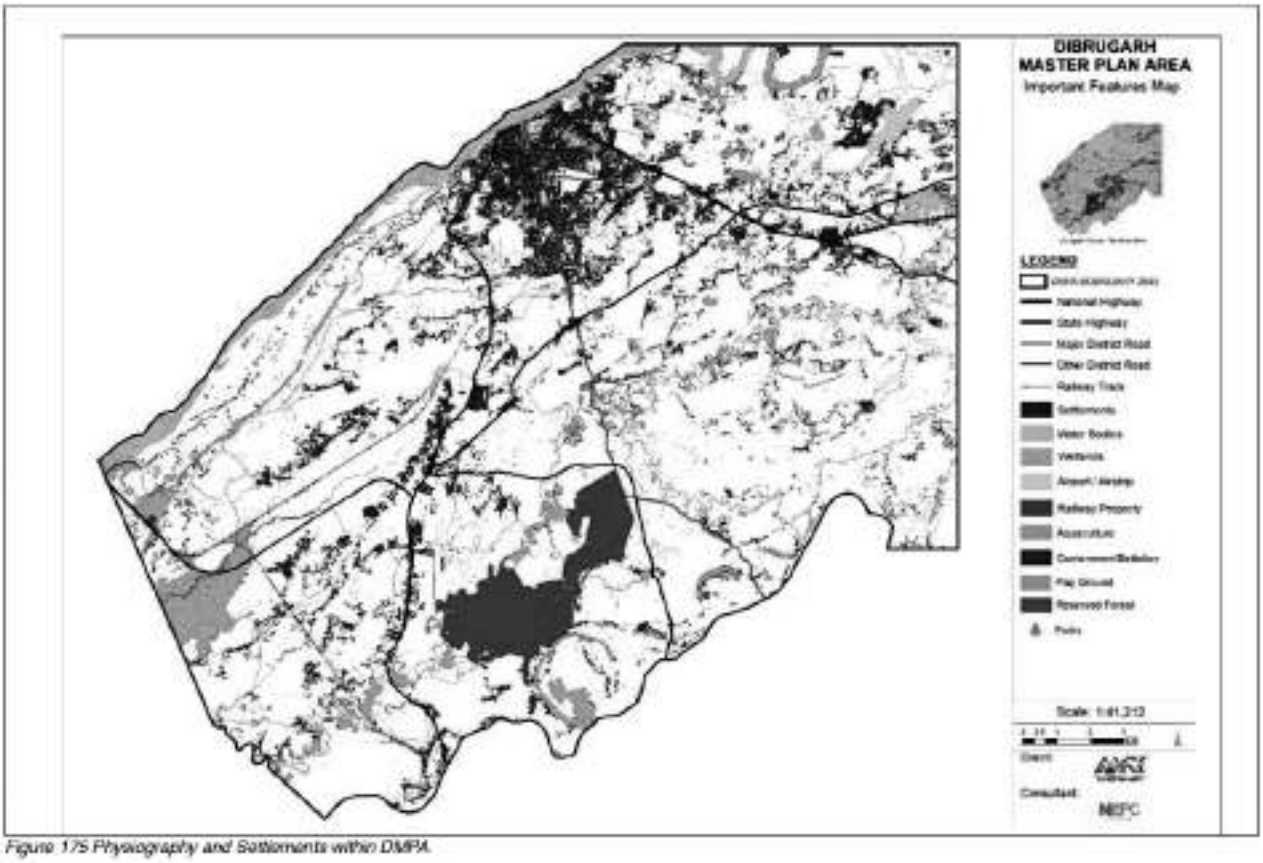


Figure 175 Physiography and Settlements within DMPA.

11.7.1 TRANSPORTATION AXIS AND GROWTH PATTERN

Strategic location of the Dibrugarh city makes it the regional center of the Upper Assam region. Number of nation highways that are spread across the Assam State; connect Dibrugarh with the other states of northeast, as well as to the remaining India. In fact, over the last two decades, visibly urban growth has been observed along the transport axis. In addition, location of the airport and the railway stations have influenced the growth pattern of the region. Hence, road network, rail network and location of airport is taken in the consideration while developing the alternatives for the Contiguous Urban Developable Area.

Road connectivity has enhanced the urban development of DMB and its surrounding areas. There has been visible growth observed in the East-West direction along the NH-37, towards south along Mancotta Road, in the south-west towards Sivasagar along NH-37 and towards Lahowal to some extent. Numbers of new urban centers have gradually emerged along these transportation corridors. In fact, number of urban areas has increased to 4in 2011 (including Mohpowalimora outgrowth). The maximum growth in the urban centers has been observed in the areas situated on the south of the existing boundary of DMB area, especially in Niz Mankatta and Chiring gaon, along the Mancotta road.

In addition, the functional interdependency of the first order and second order urban settlements on the Dibrugarh city is also taken in the consideration, while developing the alternatives for the proposed Contiguous Urban Developable Area.

11.7.2 ECO-SENSITIVE AREA AND EXISTING LAND USE:

Other than the urban centres, pattern of the rural settlements in the region is also taken in the consideration, along with the existing economic nodes and eco-sensitive areas. Eco sensitive area, such as forest, wetlands, and waterbodies have also taken in the consideration while developing the alternatives for the Contiguous Urban Developable Area. In the context of Dibrugarh whole river tributary system of Brahmaputra and reserve forest need to be taken care of. Those areas are restricted, and eco-friendly zones and land uses are proposed accordingly.

11.8 ALTERNATIVES FOR CONTIGUOUS URBAN DEVELOPABLE AREA

Overlaying the existing development pattern with the transportation axis, layer of eco-sensitive areas, and with the existing land use pattern in the region, following options were worked out. Here, presented all the alternatives were discussed with the Govt. officials. Recommendations and objections suggested by the authority have later incorporated in the final concept plan, presented at the end of this chapter. In addition, four gross density alternatives were also developed to exercise the proposed urban developable area. As per URDPFI guidelines, ideal density for urban developable area in plain region should be 100-150 pph (person per hectare). Considering this guidelines, the urban developable area should be comprised around between 60 sq.km to 80 sq.km. Below explained the possibilities for Contiguous Urban Developable Area, which comprises area between 60 to 70 sq.km. All presented alternatives were discussed with the authority, and the alternative-1 was finalized after weighting pros and cons of each of them.

Table 240 Considered Gross Density for Developable Area

2045 Population	**5,51,757**
Alternative-1: 90 pph Density	
Req. Area (sq.km)	61.31
Alternative-2: 100 pph Density	
Req. Area (sq.km)	55.17
Alternative-3: 125 pph Density	
Req. Area (sq.km)	44.14
Alternative-4: 150 pph Density	
Req. Area (sq.km)	36.78
DMPA Area (sq.km)	391
Gross Density (pph)	14.14
UDPFI Guideline Recommended Density	100-150

11.9 GUIDELINES AND CRITERIA CONSIDERATION

All the above considerations would ensure in the future DMPA a planned spatial structure of the urban settlements and their functional interdependency with each other. Proper zonation and prioritizing the fragile ecology area with least development activities in terms of extensive usage of land including recreational and low-density zone would ensure a balance between developable and open spaces. The transportation axis in the area is also a major consideration, which will help facilitate the region in improving inter and intra connectivity. The final concept plan for the urbanization area of the DMPA hereby have been conceptualized with the approach that other towns around DMB would be developed as Growth Centre and Growth Point within the DMPA. After the discussion with the authority, 391 sq.km of the proposed DMPA with 322.13 sq.km of the contiguous urban developable area has been selected. Out of total DMPA area, 322.13 sq.km area is the Contiguous Urban Developable Area, which is around 82.40% of the total DMPA area. Out of total Urban Developable Area, 39.11% area is non-developable area that comprise tea estates, waterbodies, nallas, forest, and defense land; while rest of the 60.89% area is available for urban development.

Table 241 Existing Landuse Distribution

Sr. No.	Landuse Type	Area (Sq Km)	Percentage of Developed Area (%)	Percentage of Planning Area (%)
1	Residential	45.96	66.73	11.75
2	Commercial	1.19	1.73	0.30
3	Industrial	4.95	7.19	1.27
4	Mixed	0.30	0.44	0.08
5	Public and Semi Public	5.58	8.10	1.43
6	Public Utilities	0.195	0.28	0.05
7	Recreational	1.71	2.48	0.44
8	Transportation	8.98	13.04	2.30
Total (Developed Land)		**68.87**	**100**	**17.61**
9	Vacant	31.42		8.04
10	Agricultural	143.35		36.66
11	Tea Estates	86.72		22.18
12	Forest	23.08		5.90
13	Tree Clad	2.52		0.64
14	Waterbody	21.24		5.43
15	Wetlands	13.75		3.52
16	Eco Sensitive Areas	0.06		0.02
Total (Undeveloped Land)		**322.13**		**82.40**
	Grand Total	391.00		100

Out of total DMPA area, 322.13 sq.km area is the Contiguous Urban Developable Area, which is around 82.40% of the total DMPA area. Out of total Urban Developable Area, 39.11% area is non-developable area that comprise tea estates, waterbodies, nallas, forest, and defense land; while rest of the 60.89% area is available for urban development.

11.9.1 CRITERIA TAKEN IN CONSIDERATION FOR PROPOSED LAND USE DISTRIBUTION

URDPFI guidelines for the land use distribution (within urban developable area) are taken in consideration for the land use distributions in the DMPA. Apart from the URDPFI guidelines, residential area requirement for housing provision based on the 1.2 FSI (Floor Space Index) and commercial and industrial area requirement based on the employment projection are also taken into the considerations.

11.9.2 GUIDELINES FOR LAND USE DISTRIBUTION

Following table presented the recommendation for land use distribution within the urban developable area by URDPFI Guidelines. The able also show the proposed land use distribution within the proposed urban developable area.

Table 242 Guidelines for Land Use Distribution

Land use Categories	Recommendation as per URDPFI Guidelines (in percentage)
Residential	43-48
Commercial / Mixed Use	4-6
Manufacturing/ Industries	7-9
Public and Semi-Public	6-8
Open Space Zone/ Recreation	12-14
Transportation & Communications	10-12
Agriculture, Water Bodies and Special Areas	Balanced
Total	**100**

11.9.2.1Residential Area Requirement Based on Housing Demand

As per the housing projection (refer chapter-6), the DMPA would be required total 74,070 housing by 2045. Based on the consideration of 200 sq.mt/housing unit and 1.5 FSI (Floor Space Index), with 25% circulations, and 50% ground coverage, around 18.57 sq.km of residential land is required to accommodate the 74.07 thousand houses within the urban developable area of the proposed DMPA. Overall, minimum 64.47 sq.km of land will be required for residential settlement in the Planning Area 2045.

Table 243 Residential Area Requirement Based on Housing Demand

Criteria	Year 2045
Total No. of Houses Required	74,070
Area Per Housing Unit (sq. meter)	200
Total Residential Unit Area (on sq. meter)	14814000
Assumed Additional 25% Circulation Area Required per unit	
Total Gross Area (Total Residential Plot/Area) (sq.mt)	18517500
Allowed FSI / Average FSI as per GDCR	1.5
Net Area Residential Requirement at Plot Level	12345000
Required Residential Area (sq.km)	12.34
Required Residential Area (ha)	1234
Assumed Allowed (as per GDCR) 50% is Ground Coverage for road and other circulation at city level	
Gross Residential Land Requirement (DMPA Level) (sq.mt)	18517500
Required Total Gross Residential Area in DMPA (sq.km)	18.51
Required Additional Residential Area (ha)	1851

11.9.3 CRITERIA TAKEN IN CONSIDERATION FOR LAND USE PROPOSALS

Based on the land suitability and potential analysis, existing land use pattern, and existing situation following criteria were considered while developing land use proposals for the DMPA, especially within the contiguous urban developable area:

- As the region is blessed with three rivers and eco-sensitive area, the area surrounding them should be kept conserve and no or low intensity development should be allowed. No-development buffer varying from 9 meter to 30 meter should be kept surrounding river and reserved forest.
- As far as possible low intensity of residential development should be considered in the area that is in the close proximity of the eco- sensitive areas.
- Based on the existing land use pattern, high intensity of mixed use development along the major roads should be considered.
- Transport zone or transport related activities should be kept nearby transport facilities such as Interstate Highway.
- Road network should be designed to have a proper road circulation throughout the Master Plan area, with road hierarchy to provide free movement and to reduce congestion from the existing roads.

11.10 PROPOSED LAND USE PLAN

The total project area includes DMB, Existing DDA Area and additional area added to make Dibrugarh Master Plan Area. Area other than settlements and developmental activities, such as open land (waste land, open / vacant land), wet lands (used for recreational development), Tree covers, Tea estates can be foreseen based on development potential, feasibility, suitability, and consultation with stakeholders.

11.10.1 PROPOSED LAND USE DISTRIBUTION

Based on the above mentioned all the criteria, below mentioned land use distribution has proposed. The proposed land use map allocate 49.49% for residential, 5.26% land for commercial and mixed use development, 8.71% land for industrial development, 9.10% for public and Semi Public, and 8.89% land for open space and recreational purposes out of total developable area. The Master Plan also conserves 38.61% area for the urban agriculture and tea cultivation within DMPA.

Table 244 Existing and Proposed Land Use Distribution of DMPA 2045

	Existing - 2020				Proposed - 2045		
Sr. No.	**Landuse Category**	**Area** (Sq Km)	**% age of Developed Area**	**% age of Planning Area**	**Area** (Sq Km)	**% age of Developable Area**	**% age of Planning Area**
1	Residential	45.96	66.73	11.75	88.95	49.49	22.75
2	Commercial	1.19	1.73	0.30	9.45	5.26	2.42
3	Industrial	4.95	7.19	1.27	17.36	9.66	4.44
4	Mixed	0.30	0.44	0.08	15.65	8.71	4.00
5	Public and Semi Public	5.58	8.10	1.43	16.35	9.10	4.18
6	Public Utilities	0.195	0.28	0.05	3.2	1.78	0.82
7	Recreational	1.71	2.48	0.44	15.98	8.89	4.09
8	Transportation	8.98	13.04	2.30	12.79	7.12	3.27
Total (Developed Land)		**68.87**	**100**	**17.61**	**179.73**	**100**	**45.97**
9	Vacant	31.42		8.04	0		0.00
10	Agricultural	143.35		36.66	66.15		16.92
11	Tea Estates	86.72		22.18	84.8		21.69
12	Forest	23.08		5.90	23.08		5.90
13	Tree Clad	2.52		0.64	2.52		0.64
14	Waterbody	21.24		5.43	21.24		5.43
15	Wetlands	13.75		3.52	13.75		3.52
16	Eco Sensitive Areas	0.06		0.02	0.06		0.02
Total (Undeveloped Land)		**322.13**		**82.40**	**211.6**		**54.12**
Grand Total		391.00		100	391.00		100

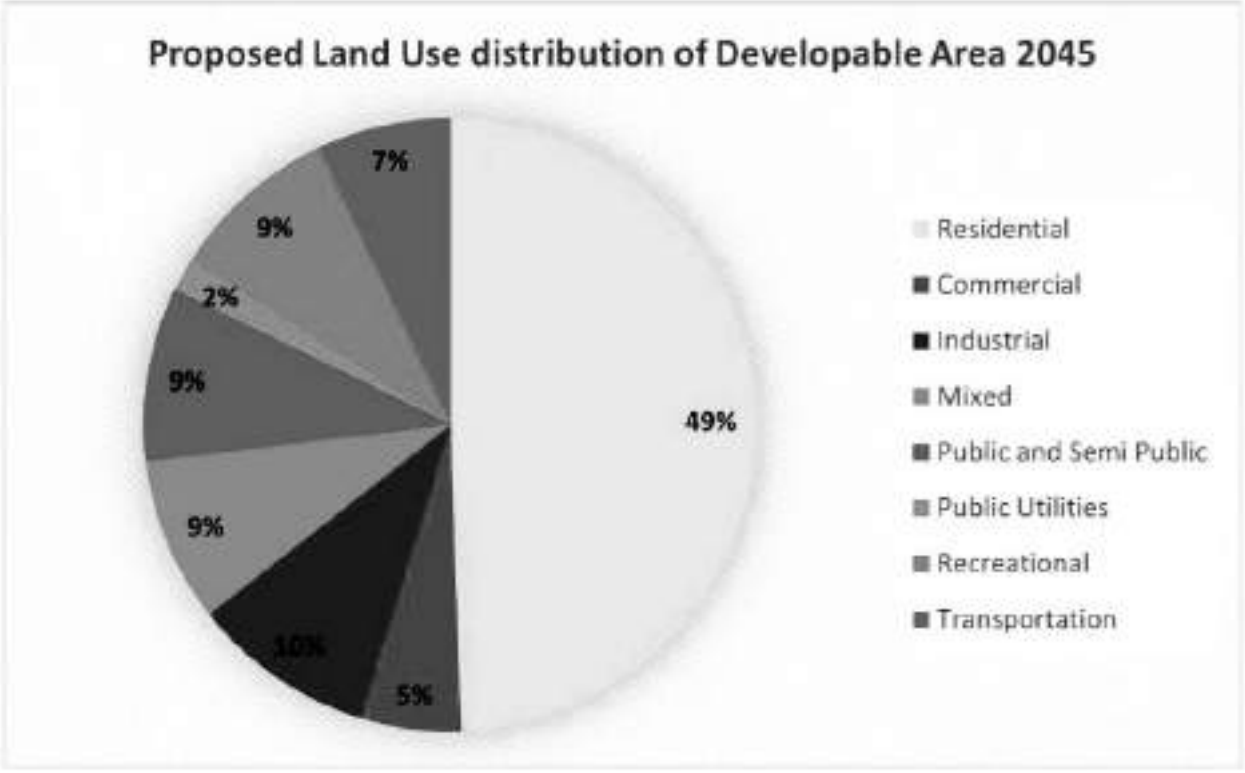


Figure 176 Dibrugarh Developed Planning Area Proposed Land Use Distribution

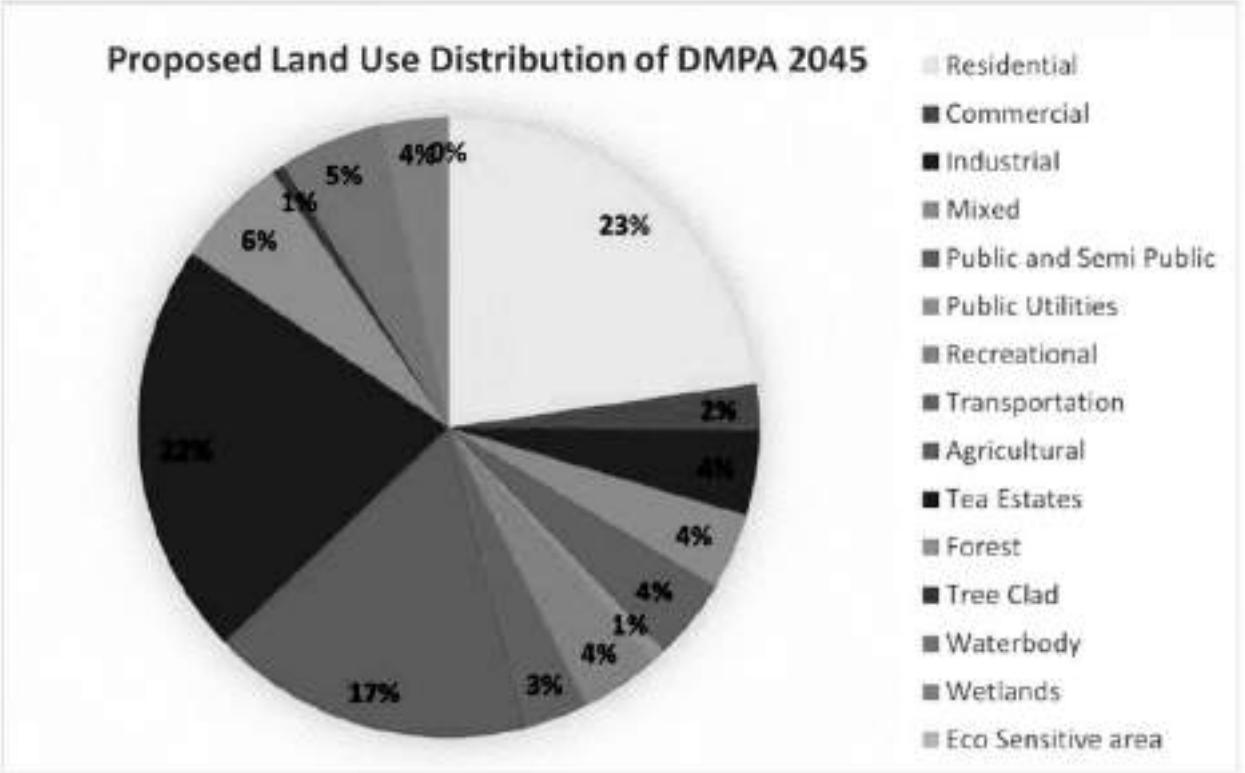


Figure 177 Total Dibrugarh Planning Area Proposed Land Use Distribution

11.10.1.1 Residential Use

For the projected residential population of 5,51,757 persons, the total area required by 2045 for urban development is forecasted to be 17973 hectares, out of which 8895 hectares (49.49% of the developable area) are earmarked for residential development against 4596 hectares available at present. The dedicated area for affordable housing for economical weaker sections is separately identified in the proposed land use plan 2045.

11.10.1.2 Commercial Use

Commercial use has been increased to 945 hectares for the projected year 2045 from the existing 173 hectares which contributes about 5.26 % and 2.42% of the developed area and the total planning area respectively. As the population increases the demand for commercial area increases, hence commercial areas has been planned at the major junction nodes.

11.10.1.3 Mixed Use

Mixed use has been increased to 1565 hectares for the projected year 2045 from the existing 30 hectares which contributes about 8.71 % and 4.00% of the developed area and the total planning area respectively. As the population increases the demand for mixed use area increases, hence mixed use areas has been planned along all the higher level roads.

11.10.1.4 Industrial Use

Industrial use has been increased to 1730 hectares for the projected year 2045 from the existing 495 hectares which contributes about 9.66 % and 4.44 % of the developed area and the total planning area respectively.

11.10.1.5 Public and Semi-Public Use

Public and Semi-Public Use has been increased to 1635 hectares for the projected year 2045 from the existing 558 hectares contributing about 9.10 % and 4.18 % of the developed area and the total planning area respectively.

11.10.1.6 Recreational Use

Recreational use has been increased to 1589 hectares for the projected year 2045 from the existing 171 hectares.

11.10.1.7 Transportation Use

Area under Transportation use has been increased to 1279 hectares for the projected year 2045 from the existing 898 hectares.

11.11 FACILITY CENTRE

Based on the hierarchy of order of settlements, facilities are planned. The following are the levels based on hierarchy:

- City level

To facilitate higher order planning, city level facilities are provided.

- Neighborhood/ Planning Unit

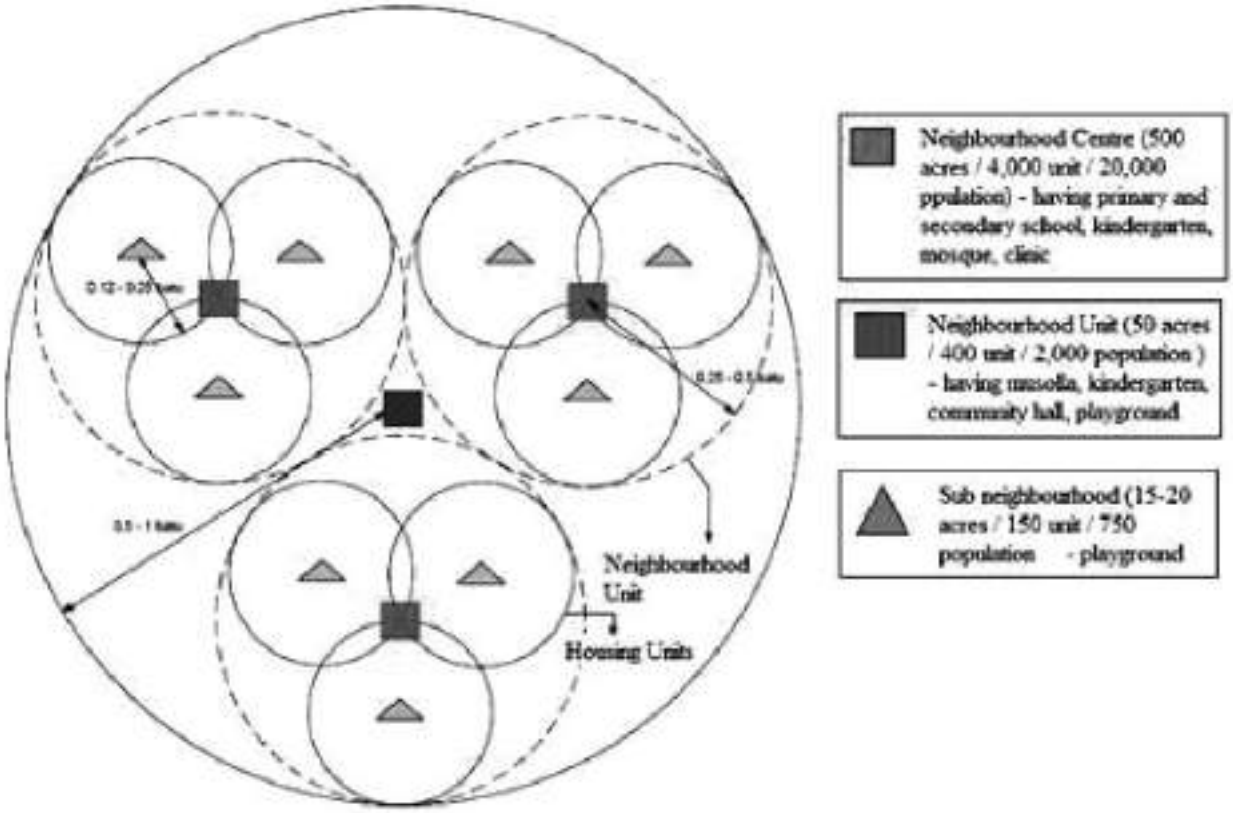
Neighborhood into 2 levels

Level I-- 10000-11999

Level II- 12000-15000

- Housing Area Level/neighborhood level

Grouped to form Housing Area with an average population of 5000 population.



Higher order facilities as general hospital, intermediate hospital, college, integrated schools, and school for handicapped, socio-cultural and recreational club, fire and police stations are provided at the master plan level. Nursery and primary schools, dispensaries are provided at the Neighborhood.

Table 245 Details of Neighbourhood Centres (10 Hectares for 10000 to 12,000 population)

Sr. No.	Facilities	No.	Area per Unit (ha)	Total Area (ha)
1	High Secondary School	1	1.6	1.6
2	Dispensary	1	0.1	0.1
3	Community Hall cum Library	1	0.2	0.2
4	Community Room	2	0.1	0.2
5	Primary School with Playfield	2	0.4	0.8
6	Middle School with play field	1	0.5	0.5
7	Electric Sub Station	1	0.05	0.05
8	Local shopping including Service Centre	1	0.45	0.45
9	Neighbourhood Park	1	0.75	0.75
10	Neighbourhood Play Area	1	0.75	0.75
11	Three wheeler cum Taxi Stand	1	0.05	0.05
12	Religious Building	1	0.05	0.05
Sub Total -A			**100**	**5.5**
13	Transportation and Communication			2.5
Grand Total				**8.0**

Table 246 Details of Neighbourhood Centres Provisions (10 Hectares for 12001 to 15,000 population)

Sr. No.	Facilities	No.	Area per Unit (ha)	Total Area (ha)
1	High Secondary School	1	1.6	1.6
2	Dispensary	1	0.1	0.1
3	Community Hall cum Library	1	0.2	0.2
4	Community Room	2	0.1	0.2
5	Primary School with Playfield	2	0.4	0.8
6	Middle School with play field	1	0.5	0.5
7	Electric Sub Station	1	0.05	0.05
8	Local shopping including Service Centre	1	0.45	0.45
9	Neighbourhood Park	1	0.75	0.75
10	Neighbourhood Play Area	1	0.75	0.75
11	Three wheeler cum Taxi Stand	1	0.05	0.05
12	Religious Building	1	0.05	0.05
Sub Total -A			**100**	**5.50**
13	Housing Area			2.00
Sub Total -B				**7.50**
14	Transportation and Communication			2.50
Grand Total				**10.00**

11.12 ZONING REGULATIONS

In order to promote public health, safety and the general social welfare of the community, it is necessary to apply reasonable limitation on the use of land and buildings. This is to ensure that the most appropriate economical and healthy development of the city takes place in accordance with the land use plan. For this purpose, the City is divided into a number of use zones, such as residential, commercial, industrial, public and semi-public, etc. Each zone has its own regulations as the same set of regulations cannot be applied to the entire town.

Zoning protects residential area from the harmful invasions of commercial and industrial uses and at the same time promotes the orderly development of industrial and commercial areas. By regulation the spacing of buildings, adequate light, air, protection from fire etc. can be provided. It prevents overcrowding in buildings and land thus ensures adequate facilities and services.

Zoning is not retrospective. It does not prohibit the uses of land and buildings that are lawfully established prior to the coming into effect of the zoning regulations. If these uses are contrary to the newly proposed uses, they are termed as non-conforming uses and are gradually eliminated over years without inflicting unreasonable hardship upon the property owners.

The zoning regulations and their enforcement are a major tool in keeping the land uses pattern of the Comprehensive Master Plan. It has been stated that the consultants have adopted the UDPFI guidelines with minor modification. However while detailing out the use permissibility, etc in various categories all care has been taken to integrate:

(A) "Guwahati Building Construction Byelaws" (Planning and Building Standards), Regulation 2020;

(B) UDPFI Guidelines.

This formulated guideline may adopt other provision of the regulation towards intensity of development and built form guidelines, etc.

1. In the Dibrugarh Master Planning Area (DMPA), various use zones namely Residential, Commercial, Mixed Use, Industrial, Public and Semi- Public, Utilities and Services, Recreational, Transportation, Agricultural, Protective and Undevelopable Areas having their location as indicated in the Comprehensive Master Plan shall be regulated and guided. Except or otherwise provided, no structure or land here inafter shall be erected, recreated or altered unless its use is in conformity with the following regulations.
2. All existing places of worship, temples, churches, mosques, burial and cremation ground etc. shall be exempted from being treated as nonconforming uses, provided that continuance of such uses are not detrimental to the locality as decided by the Authority from time to time.
3. All non-conforming uses of land and buildings shall be discontinued by the owner and the modified uses shall be made to conform to the land use of the development plan in force within six months of the Regulations coming in force.

11.12.1 RESIDENTIAL ZONE (R)

Residential Zone is pure residential area in which major commercial and industrial activities are not allowed, however some for day-to-day needs of shopping uses should be allowed. In addition, a comprehensive range of community facilities, including schools, medical facilities, neighborhood retail and open space are allowed. Total 88.95 sq.km (49.49%) of area is earmarked for Residential Zone in the proposed land use plan. Further, the zone is classified into three categories viz. Residential Zone-1, Residential Zone-2, and Residential Zone-3. Refer the GDCR (General Development Control Regulations) for allowed activities and permissible floor space for each activity, in all zones.

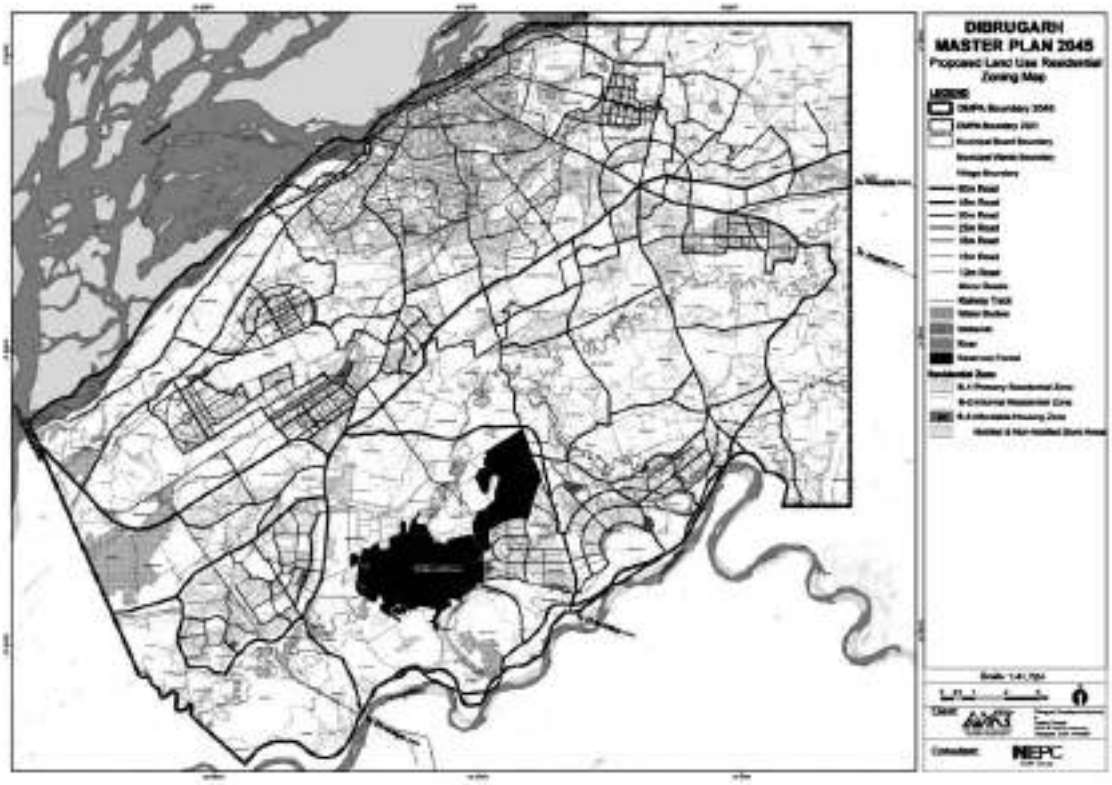


Figure 178 Proposed Residential Zone Map, DMP 2045

As conurbation area will be facing the higher pressure of development, ample residential area is proposed in order to accommodate the future expansion which will take place in the future.

11.12.1.1 Primary Residential Zone-1 (R1)

Total 67.41 (17.24%) sq.km of land is allocated for R1 zoning. Higher intensity residential development is allowed in this zone. No other than residential uses are allowed in this zone; however, housing will be developed with a comprehensive range of community facilities, including schools, medical facilities, neighborhood retail and open space.

11.12.1.2 Unplanned Residential Zone-2 (R2)

The residential area that is proposed outside the proposed Contiguous Urban Developable Area are earmarked as a Residential Zone-2. Medium to low intensity residential development is allowed in this zone. Total 20.6 (5.27%) sq.km of area is earmarked as R2 zone.

11.12.1.3 Residential Affordable Housing Zone-3 (R3)

This zone is an overlay Zone that permits predominantly residential development for providing Affordable Housing along with ancillary commercial uses Affordable Housing as a use is permitted in all zones except all types of industrial Zones, Restricted Zone, Residential 3 and agriculture Zone. It shall also be permitted as a use in all other categories. Affordable Housing is predominantly Residential development for providing Affordable Housing of dwelling units up to 80 sq.mts along with ancillary commercial use up to 10% of the total utilized FSI. Projects under Residential Affordable Housing (R3) shall utilize a minimum FSI of 1.8 and maximum 2.7 to avail the benefits of "RAH". Total 0.94 (0.24%) sq.km of area is earmarked as R3 zone.

11.12.2 COMMERCIAL ZONE (C)

Total 9.41 (5.26%) sq.km of area has earmarked in the proposed land use plan as Commercial Zone for commercial land uses. This zone allows a range of commercial uses including retail shops, offices, small-scale warehouses, and the hospitality industry that includes hotels and entertainment venues.

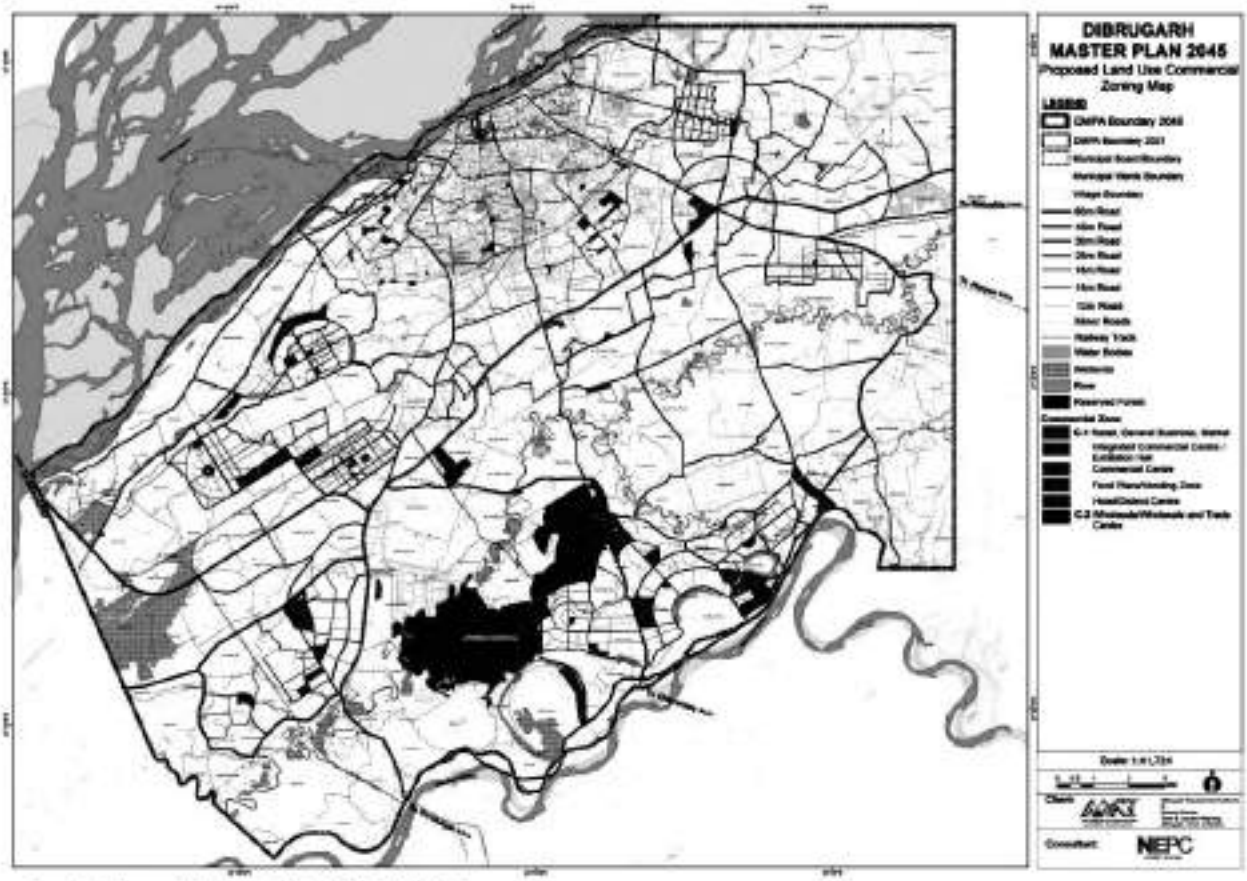


Figure 179 Proposed Commercial Zone Map, DMP 2045

Further, the zone is classified in two categories viz. Commercial-1 and Commercial-2.

C1: Retail Shopping Zone, General Business and Commercial District/ Centres, Regulated markets, Service Sector, Regulated/ Informal/ Weekly markets

C2: Wholesale, Go-downs, Warehousing

Existing industrial activities will be allowed to continue as non-confirming use but no new industrial related activities would be allowed in the earmarked commercial zone. Refer the GDCR (General Development Control Regulations) for allowed activities and permissible floor space for each activity, in all zones.

Retail Space:

- Neighborhood and Community Level Retail Space- will be located near residential area that will include kiosks, shops, and community markets; where day-to-day needs of consumers, particularly food shopping and convenience goods will be accommodated.
- District and City Level- Larger commercial center and intermediate commercial ccentres, which includes the prime retail space represented by malls and high quality shopping space

Office Space:

Offices space will be required primarily for the indirect employment generated because of direct employment in the base industries and economic sectors. The following sectors will require office space:

- Transport and Storage
- Construction and Infrastructure
- Public Administration
- Utility Companies and Institutional bodies
- Banking and financial services
- IT based company and tele communication

It is assumed that the wholesale, retail sectors, banking and financial sectors will operate out of their own premises.

11.12.3 MIXED USE ZONE (MU)

Total 15.65(8.71%) sq.km area is earmarked as Mixed Use Land Use in the PLU. Further, this land use is classified into two zones viz Mixed Use-1 and Mixed Use-2.

11.12.3.1 Mixed Use-1 (MU-1)

Total 6.07 sq.km of area is proposed under this land use zone. Part of it is located along the part of NH 37 that is passing from South Gemmon Bridge on Burhi Dihing to the North of DMP area. 100 meter of influence area on both sides (Except Tea Estates) of the highway is proposed as a Mixed Use -1 zone.

Another earmarked 100 meter influence area on both side of NH-37 (from Hatkota Tiniali at Dainijan village to Amolapatty Chariali) and NH-37 (Chalkhuwa to Lahowal) is also proposed as a Mixed Use-1 zone. In the proposed Mixed Use-1 zone 80% of the FSI will be available for commercial/institutional/ PSP purposes, while the rest of the 20% FSI will be for residential purpose. Existing industrial allowed as non-confirming use but no new industrial activities will be permitted Refer the GDCR (General Development Control Regulations) for allowed activities and permissible floor space for each activity.

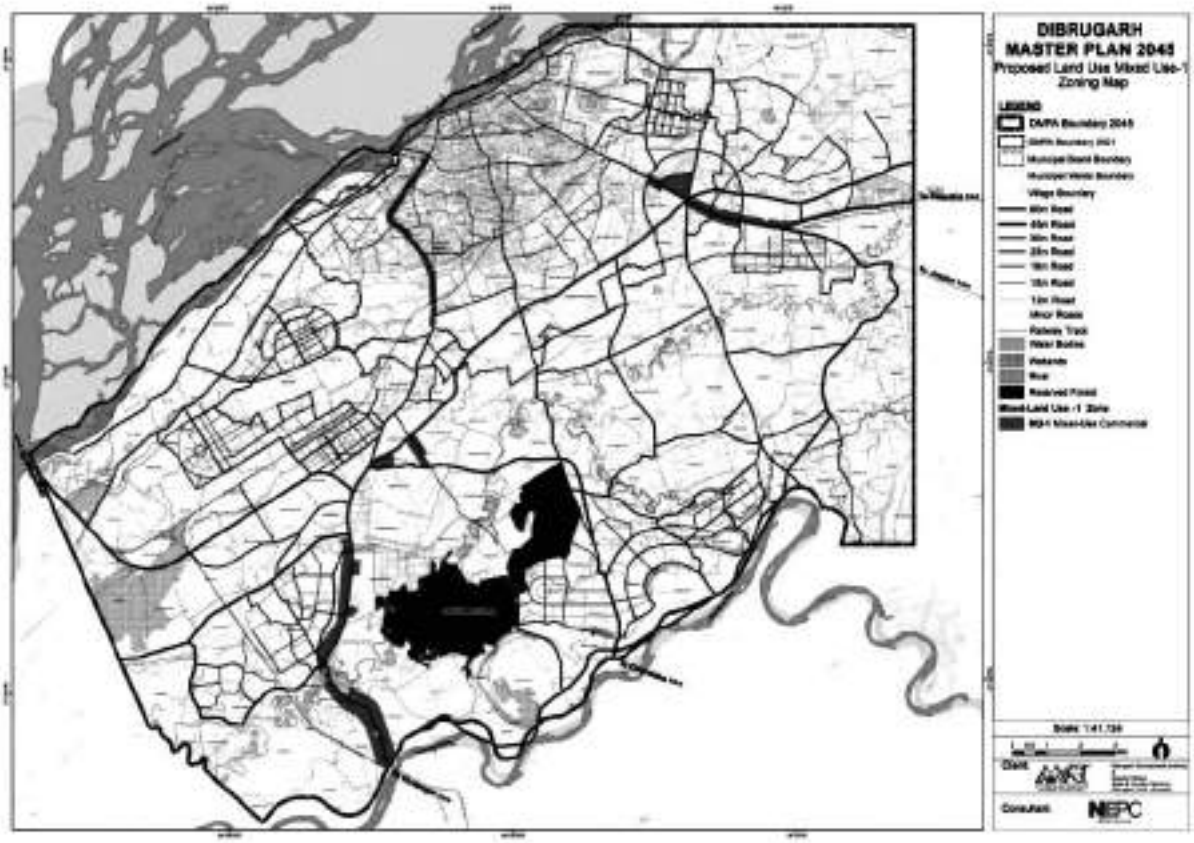


Figure 180 Proposed Mixed Use-1 Zone Map, DMP 2045

11.12.3.2 Mixed Use-2 (MU 2)

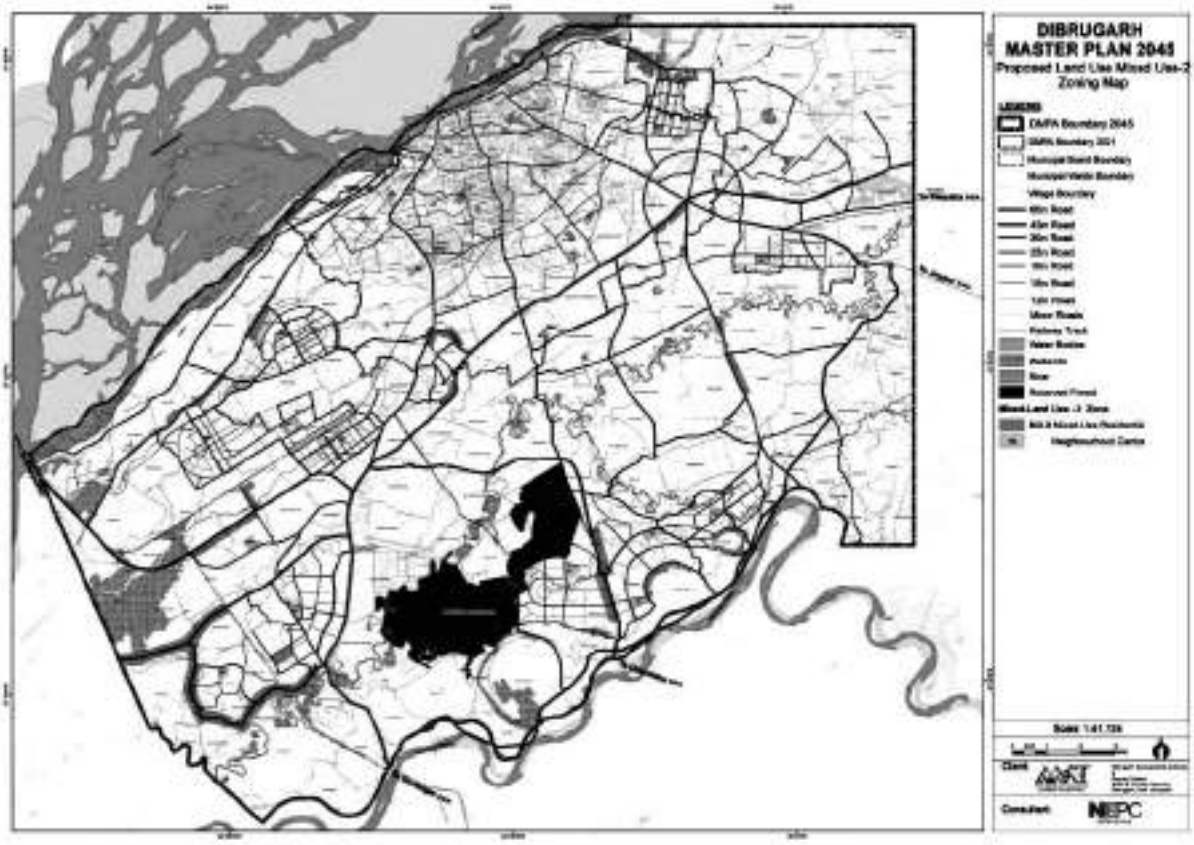


Figure 181 Proposed Mixed Land Use-2 Zone Map, DMP 2045

Total 2.64 sq.km of area is proposed in DMPA as a Mixed Use-2 where 40% area will be available for commercial/institutional/ PSP purposes, while the rest of the 60% will be for residential purpose. If for any reason, the 40% area allotted for commercial development will not fully or partly developed for commercial activities then the area can be used for residential purpose; however, if the residential area is not fully developed then allotted residential area cannot be used for commercial purpose. Locations of the Mixed Use Zone-2 is as per the Proposed Land Use Map. Refer the GDCR (General Development Control Regulations) for allowed activities and permissible floor space for each activity. However, Existing industrial allowed but no new industrial activities will be permitted.

11.12.4 PUBLIC AND SEMI-PUBLIC ZONE (PS)

Dibrugarh is home for many educational and health institutes like AMC Medical Collage, Dibrugarh University, DHS Kanoi College, S.D Sahewalla Memorial School of Nursing and Gyan Vigyan Acedemy. It is considered a favorite destination among students in the Upper part of Assam. This has led to many educational and health institutes being established within the planning area leading to an increase in percentage of land falling under the public and semi-public category against the prescribed limit of URDPFI guidelines for P&SP land use.

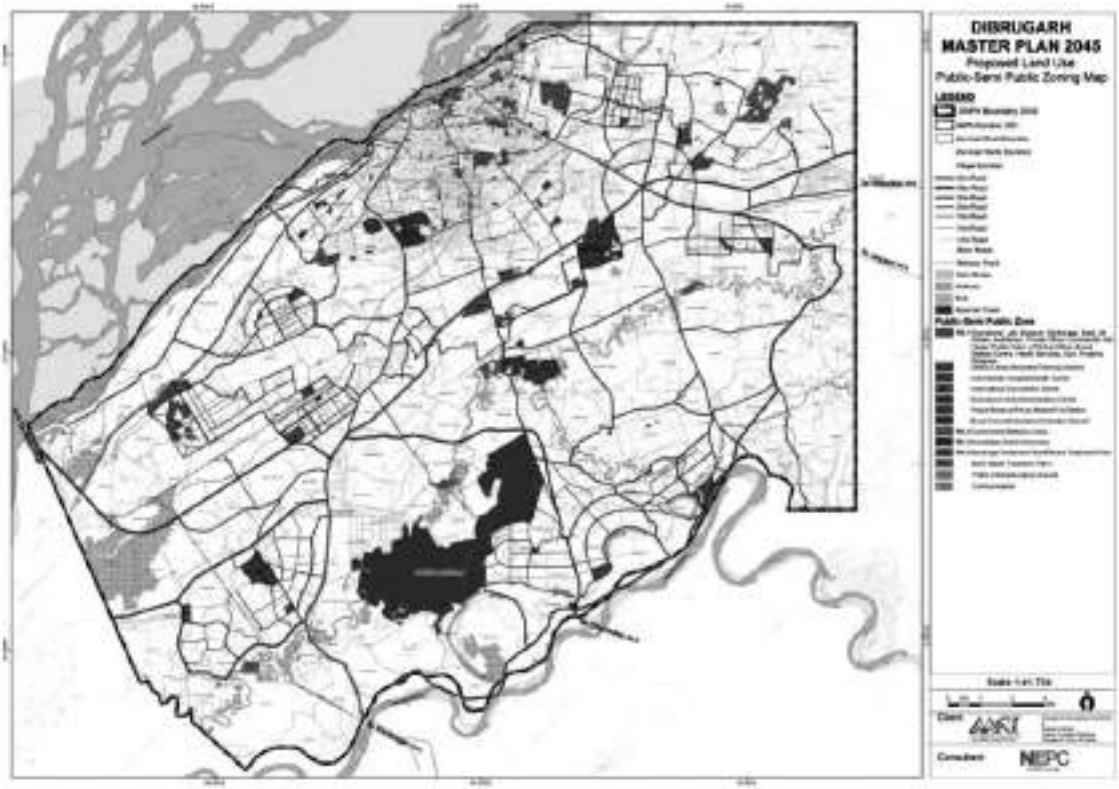


Figure 182 Proposed Public & Semi-Public Zone Map, DMP 2045

Further, the zone is classified in three categories viz. PS-1, PS-2,PS-3 and PS-4.

PS-1: Govt./Semi Govt. / Public Offices Govt. Land use, Police Headquarter/ Station. Police line, Educational and Research, Medical and Health, Socio Cultural and Religious (incl. Cremation, Cemetary and Burial Grounds)

PS-2: Cantonment / Battalion

PS-3: Knowledge District / University

PS-4: Utilities and Services (STP, ETP, SWTP, Sub Stations, Communication, etc.)

Total 16.35 sq.km of area is earmarked as a Public and Semi-Public zone in the proposed land use map. Health, Educational, Cultural, Government Buildings, sports and open space facilities will be allowed in this zone. Refer the GDCR (General Development Control Regulations) for permissible activities and permissible floor space for each activity.

11.12.5 INDUSTRIAL ZONE (I)

To create a conductive environment for development, Industrial Zone is created. Total 17.36 sq.km of the Industrial land use zone has demarcated in the proposed land use plan.

The Industrial zone is further classified in two categories viz. I-1, and I-2.

I-1: Service, Manufecturing and Light Industry

I-2: Extensive and Heavy Industry

The distribution of the main industrial zones is shown in the map. Only industrial activities are allowed in the demarcated industrial land use in the PLU map. In addition, small workshops and businesses can be allowed on the edge of the main industrial. However, existing land uses within the proposed industrial zone will allow as non-confirming use until redevelopment of such land parcels. Refer the GDCR (General Development Control Regulations) for permissible activities and permissible floor space for each activity.

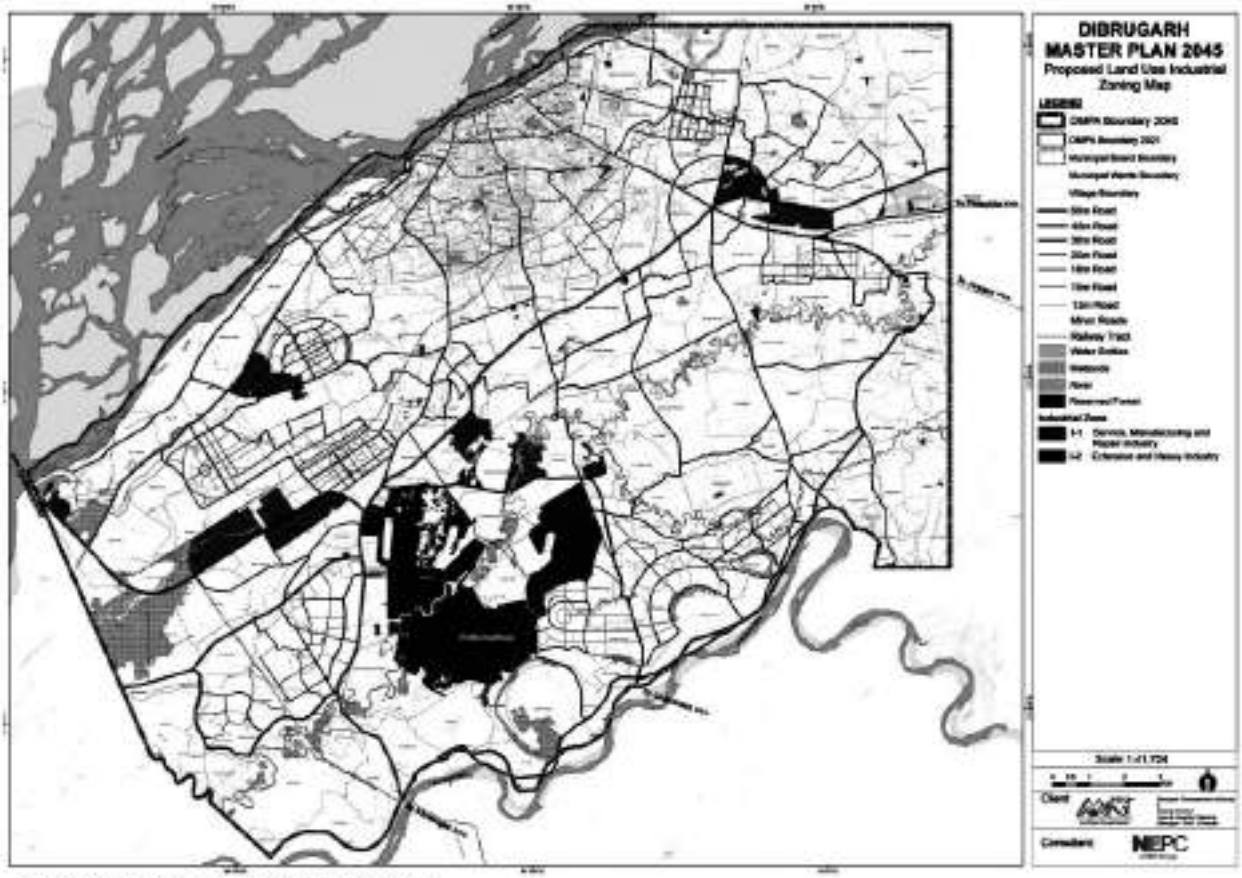


Figure 183 Proposed Industrial Zone Map, DMP 2045

11.12.6 OPEN SPACE AND RECREATIONAL LAND USE (P)

In order to ensure that the city is an attractive and desirable place to live, a high proportion of the developable area is proposed for open spaces and recreational activities.

The Recreational zone is further classified in three categories viz. P-1, P-2 and P-3.

P-1: Play Ground, Stadium, Sport Complex, District Sport Centre and District Multipurpose Ground

P-2: Zoo, District Park, Neighbourhood Park, Community Garden, Organised Open Space, Hotel, Resort and Spriritual Park.

P-3: Science City, Theme Park

The major green areas are proposed surrounding the waterbodies like Kachmari Bill, Bar Bill, Kath Bill, Gargari Bill and Wetlands. Around Sessa river and Ghogra Jan, buffer of 50 m and 20 m is given respectively. In Khanikar area, a District Sports Centre, Science City, Sport Complex, Stadium, District Park and District Multipurpose Ground have been proposed. In the neighbourhood level, recreational areas are proposed. Space for Zoo is identified near Jokai Reserve Forest. Amuesment Park cum Theme Park is proposed at Mohmari Gaon.

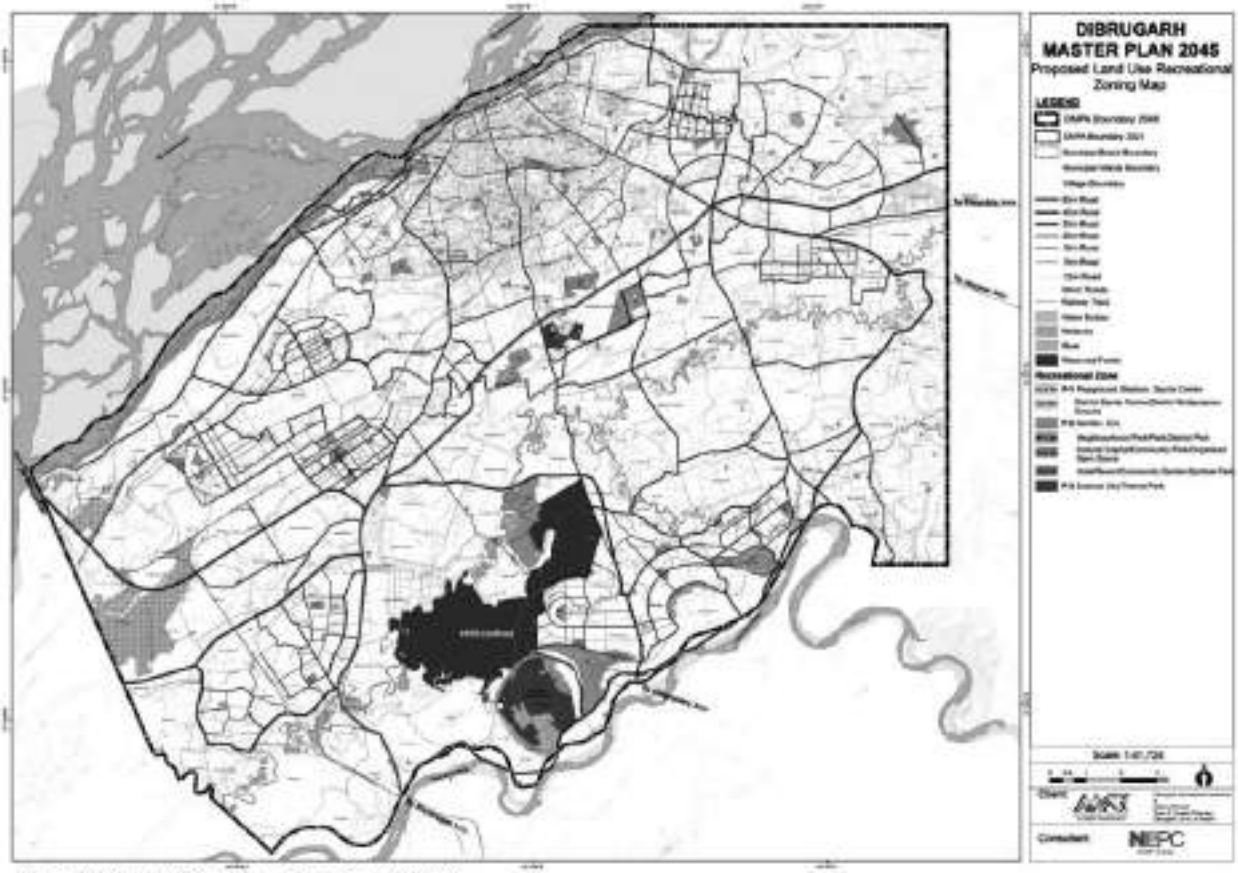


Figure 184 Proposed Recreational Zone Map, DMP 2045

Total 15.98 sq.km of area earmarked as Open Space and Recreational Land Use, where recreational activities, parks, riverfront development, playground, theme parks, and exhibition grounds can be allowed. Refer the GDCR (General Development Control Regulations) for permissible activities and permissible floor space for each activity.

11.12.7 URBAN AGRICULTURE ZONE (A)

With the rapid growth and expansion of cities, agricultural lands starts declining. Thus, this issue is meticulously dealt with, by providing dedicated agricultural lands in the planning area. The agricultural lands are protected till possible extent. Except conurbation area, in rest of the area agricultural land are proposed to be preserved. Moreover, every large chunks of Tea garden lands have been kept intact in different village.

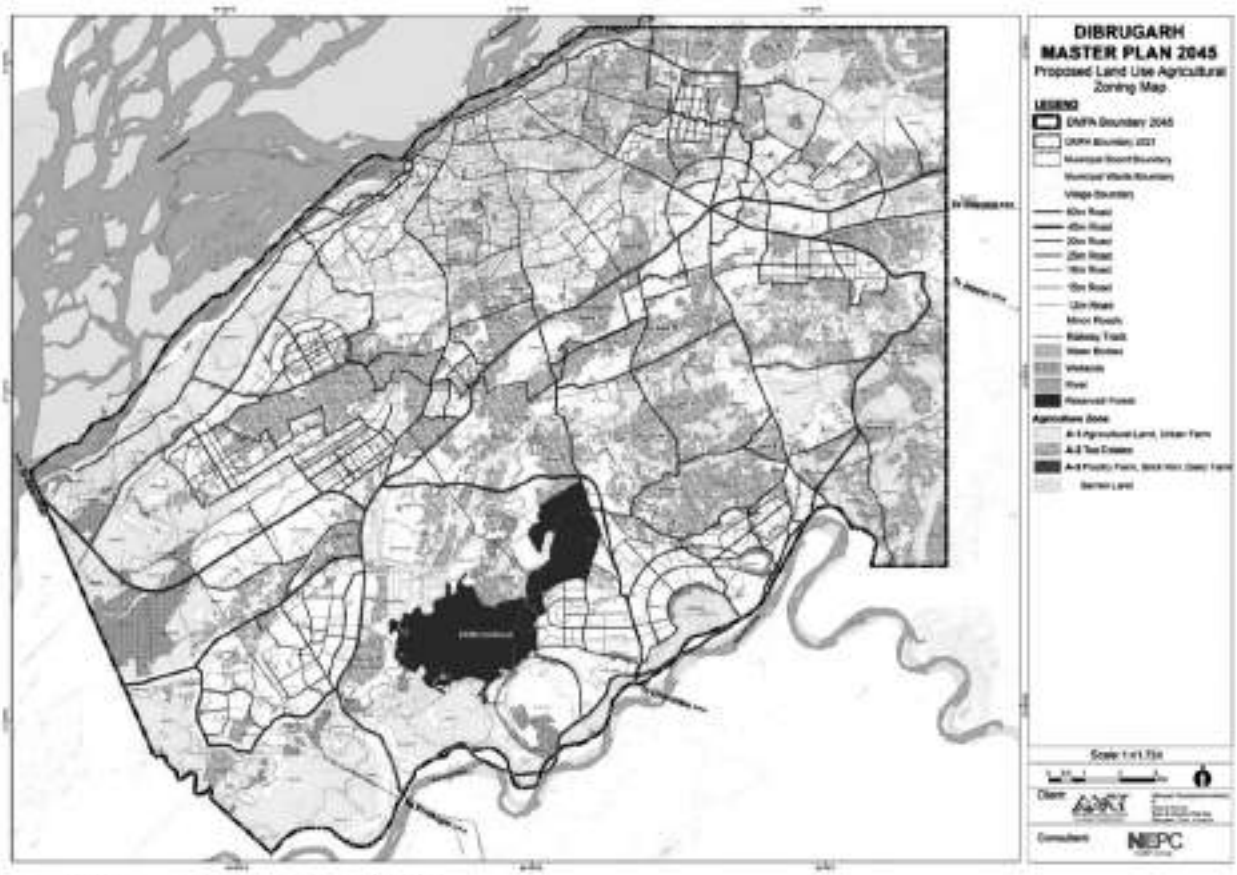


Figure 185 Proposed Agriculture Zone Map, DMP 2045

Total 150.95 sq.km of area earmarked as Urban Agriculture[10] Zone, around the identified 'Contiguous Urban developable Area' in the proposed Land Use Plan. Urban agriculture land use is divided into three parts,

A-1: Agriculture Land, Urban fram

A-2: Tea Estates

A-3: Poultry Farm, Brick Kiln, Dairy Farm and Barren Land

Activities such as animal husbandry, aquaculture, agro-forestry, and horticulture will be allowed in this land use area. Refer the GDCR (General Development Control Regulations) for permissible activities and permissible floor space for each activity

[10] United Nations Development Program (1996) defines urban agriculture as an activity that produces, processes and marketa food and other products, on land and water in urban and peri-urban areas, applying intensive production methods and reusing natural resources and urban wastes to yield a diversity of crops and livestock. Urban agriculture in addition can also involve animals.

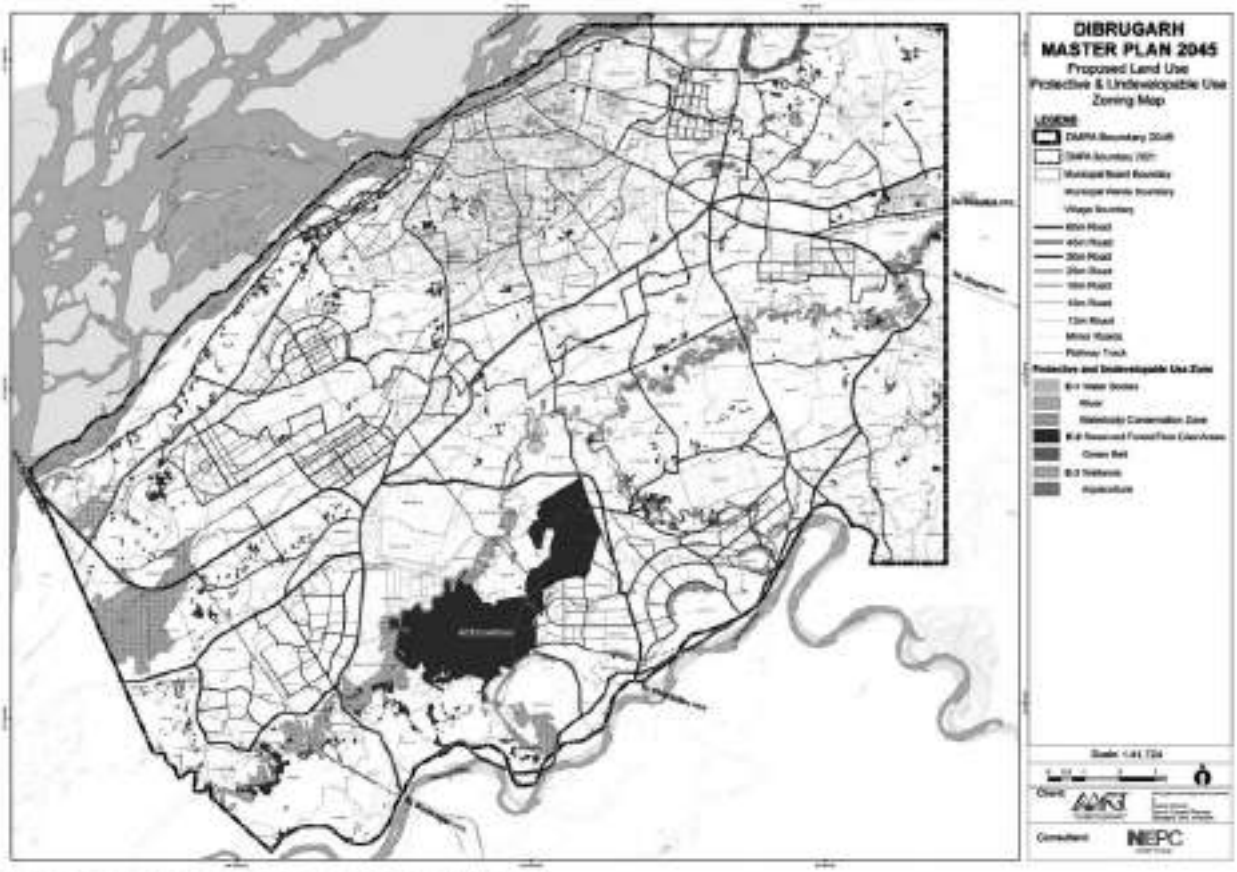
11.12.8 PROTECTIVE AND UNDEVELOPABLE USE ZONE (E)

Protective and Undevelopable Use Zone integrates all existing Waterbodies (i.e. rivers, streams, lakes, fisheries, natural drains and wetlands, as indicated in the topographical sheets published by the Survey of India, the State Irrigation Department or Revenue Department or other competent Authorities), Reserved Forest and Tree Clad Areas. The boundary of the waterbodies relate to the full tank level as indicated in relevant maps, covering both perennial and non-perennial parts when such distinction exists. As per the MoEF Guidelines, no development buffer is given surrounding the waterbodies. Depending of the size of the waterbodies, the buffer width varies between 9 to 30 meter. The 30-meter buffer is given to the larger waterbodies, such as rivers, lake, wetlands, while minimum of 9-meter buffer is kept around small waterbodies, such as nallas, streams, small water ponds, etc. There are around 34.87 sq.km of land is covered with Protective and Undevelopable Use Zone in the Planning Area.

Protective and Undevelopable Use Zone is divided into three parts,

E-1: Water Bodies and River, **E-2:** Reserved Forest, Tree Clad and Green Belt, **E-3:** Wetlands and Aquaculture

In addition, no development buffer around the forests and river is also earmarked as a Conservation. No development should be allowed within the close proximity to it. No development is permitted in this zone, except with the special permission from the DDA.



11.12.9 TRANSPORTATION ZONE (T)

Total 12.79 sq.km of area is specifically earmarked as a Transportation Zone for which permissible facilities as classified as ISBT, Railways, Airports, Parking, Logistics Hubs (Bus Terminals and Truck Terminals), Tele-Communication. Refer the GDCR (General Development Control Regulations) for permissible activities and permissible floor space for each activity.

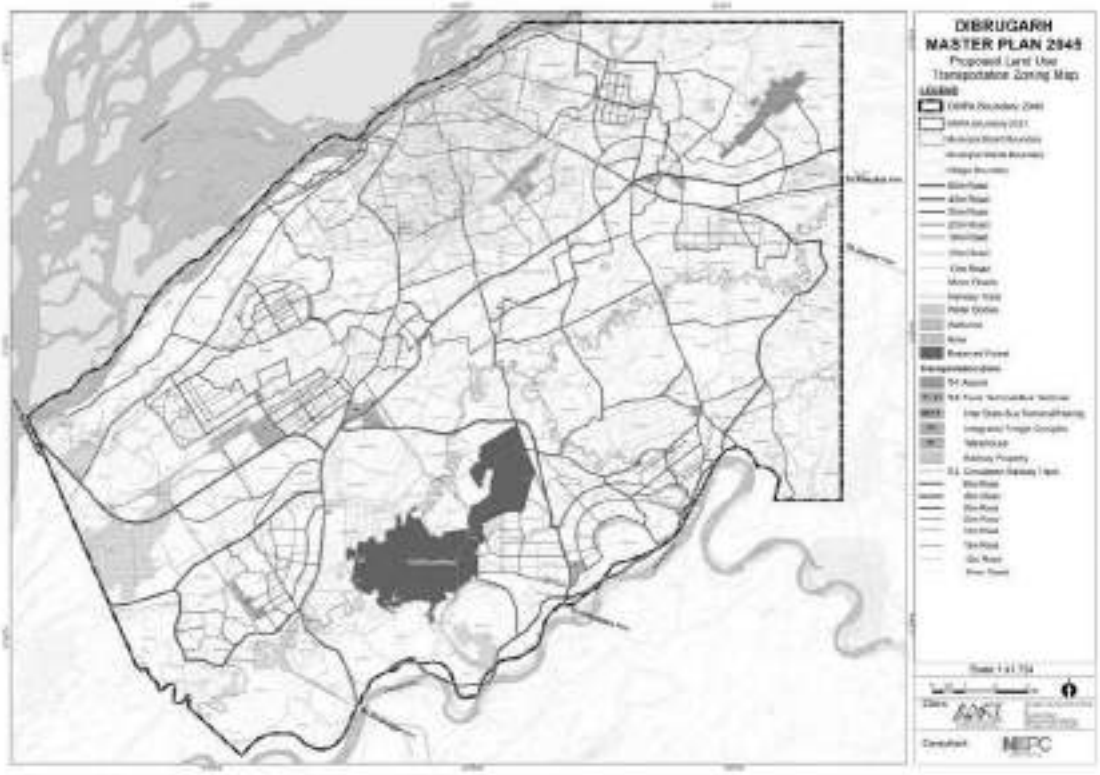


Figure 186 Proposed Transportation Zone Map, DMP 2045

11.12.10 ROAD

The proposed road system together with new linkage is designed to have a proper road circulation throughout the Master Plan area. Road hierarchy is proposed to provide free movement within the Master Plan area. Two Ring Roads have been identified within DMPA to avoid entering the regional traffic into the city center, and will help in relieving the existing congestion in the surounding of the DMB area. NH 37 that is entering from Gammon Bridge on Burhi Dihing River from South-East and passing through the Boboruah Point, will jointly work as bypass road towards Khanikar chariali upto Bokul Flyover which further extend towards Airport. Outer Ring Road road will be carrying the regional traffic that does not intend to enter the city center and will generally travel towards easten city centers like Lahowal, Chabua, Tengakhat and Tinsukia.

11.12.10.1 Proposed Hierarchy of Roads

The proposed Master plan for Dibrugarh exhibits a definitive hierarchy in its structure. The proposed road network would increase connectivity within the region, simultaneously helping alleviate traffic problems. The proposed road network is in radial and arterial pattern with hierarchy in structure. The concept is to integrate the existing road of DMB with proposed road in DMPA. The proposed hierarchies of roads are 60mt, 45mt, 30mt, 24mt, and 18mt wide.

60mt Wide Roads:

This is the 1st order road in the proposed road network. Part of National Highway - 37 and Dibrugarh Bypass falling within the DMPA is proposed for 60mt wide. National highway is the main trunk of the proposed road network, as it is connect the entire region with the rest of the India and other states of the seven sisters.

45mt Wide Roads:

This is the 2nd order road in the proposed road network. The Outer ring road of contiguous urban area would be of 45mt wide. The 45 mt wide road will through the traffic coming from NH-15 and NH-37 towards NH-52B, Dibrugarh Bypass and SH-23 without entering to the core city centre area.

These roads are designed as an arterial road. Access to land uses on one or both sides of the arterial roads can be provided through a service road in order to separate the low-speed local traffic from the higher speed traffic. On certain arterial roads, there will also be provision for public transport. This would normally be on the same side of the road as the mixed commercial/residential areas.

Pocket Major Road 30mt Wide:

The proposed 30mt wide roads are second order in the hierarchy of the proposed road network. These roads are working as collector roads and at the nodes; they are well connected with the 45mt wide roads.

The collector road network intercepts traffic from inside the urban areas and feed it into the arterial roads. The proposed cross section of these roads comprises a divided dual 2-lane carriageway with a pedestrian footpaths and a narrow median.

Pocket Minor Road 24mt Wide:

The proposed 24mt wide roads are fourth order in the hierarchy. These routes are originated from with the 45mt or 30mt wide roads and are designed as collector roads. Roads with restricted truck access indicate priority routes for all light traffic (with a limited access for the service trucks during non-peak hours of the day). These routes are intended to provide safe access of the passenger traffic to the surrounding residential areas.

Pocket Minor Road 18mt Wide:

The proposed 18mt wide roads are fifth order in the hierarchy in the urban developable area. These routes are originated from with the 30mt or 24mt wide roads and are designed as collector roads, within DMP area.

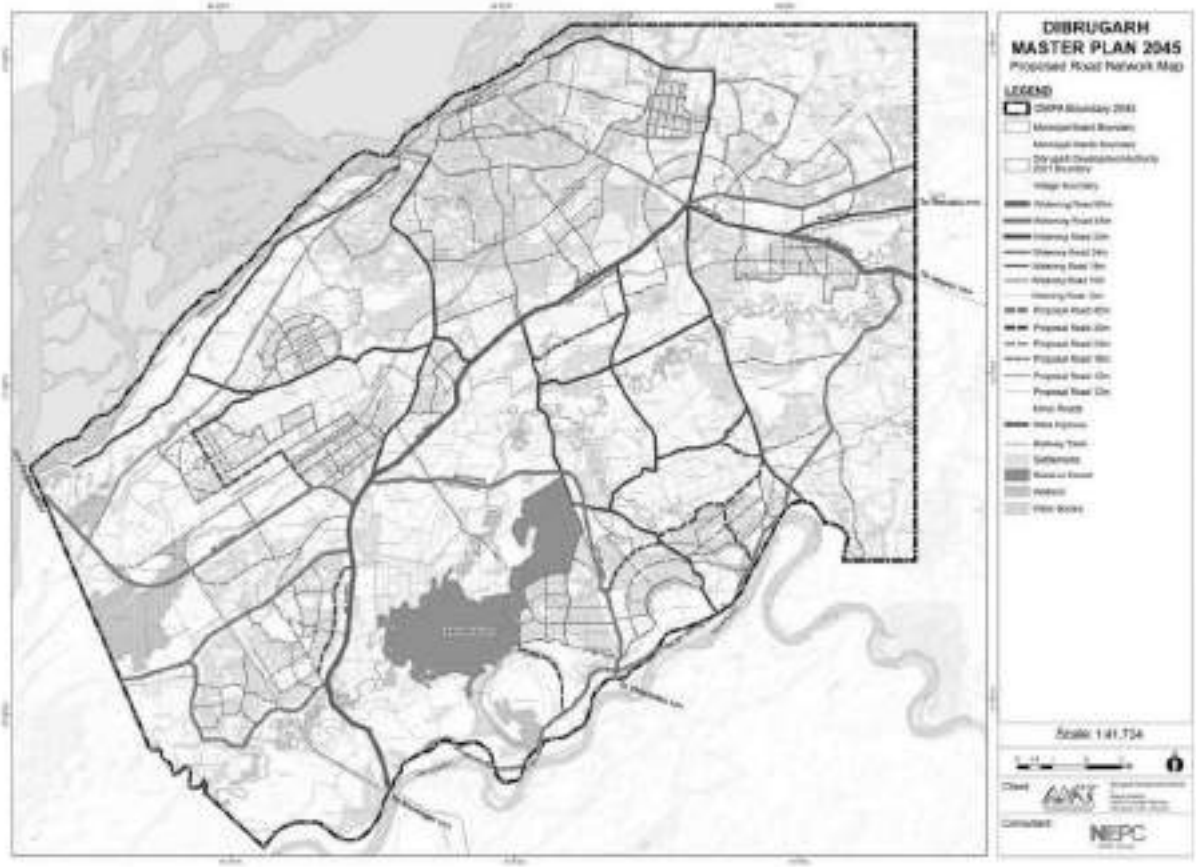


Figure 187 Proposed Transport Network Map, DMP 2045

Each Planning Zone can be put to such use(s) as detailed out in the Master Plan. The proposed Land use Plan indicates the location of broad uses and major facility areas. The requirements of these facilities are subject to necessary modifications when the detailed Zonal Development Plans are conceived. Therefore, the purpose of Zonal/Sub-zonal byelaws and regulations is not to stop the urban development activities in the Planning Area but to serve as broad policy framework for the promotion of planned devel opment. The Master Plan proposes building activity within the prescribed Local Area limits should be controlled and guided by following set of regulations as spelt out in the below table.

The aim of enforcing the regulations is to achieve a desirable development pattern and structure with good quality of life. In order to ensure complete harmony between land uses, town has been divided into various Use Zones including Residential, Commercial, industrial, Recreational, Public & Semi-Public, Transport & Communication, Agriculture, Plantation, Water bodies etc. However, in enforcing master Plan proposals the regulations have been made efficient to avoid inconvenience to public. Mixed land use concept has also been adopted and prescribed which shall need approval of Government. The adoption of mixed land use concept is to enhance functionality of the uses.

11.13 SPACE STANDARDS & DEVELOPMENT AND DESIGN CONTROLS

Space standards are fundamental to obtain the basic objective of Zoning Regulations to achieve desirable pattern of development in each Use Zone. Strict enforcement is needed to achieve articulated urban development as envisaged in the Master Plan.

Table 247 Spatial Norms and Standards

Sl. No.	Description	Standard Prescribed	Plot Area/ Unit (HA)
A	**Educational Facilities**		
1	Pre-Primary School	1 for 2,500 – 4,000 Population	0.08
2	Primary School (including a playfield)	500 students / 4,000 Population	0.4
3	Middle School (including a playfield)	1000 students or 1 for 7,500 Population	0.6
4	Middle School with Hostel	1000 students or 1 for 7,500 Population	0.75
5	Higher Secondary School (IX-XII)	1000 students or 1 for 10,000 Population	1.6
6	Higher Secondary School (IX-XII) with Hostel	1000 students or 1 for 1,00,000 Population	2
7	Integrated School (Class I-XII) with Hostel	1000 students or 1 for 1,00,000 Population	3.0
8	Integrated School (Class I-XII) without Hostel	1500 students or 1 for 1,00,000 Population	3.5
9	School for Handicapped (including a playfield)	400 students / 45,000 Population	0.5
10	College (including a hostel and playfield)	Students 1000-15000 or 1.25 Lac Population	4
11	University campus without residential quarters	-	10
12	New University Campus with residential quarters	-	30
13	Industrial Training Institute (ITI)	500 students / 10 Lac Population	2
14	Polytechnic	400 students / 10 Lac Population	2
15	New Engineering College	1500-1700 Students	30
16	Medical College with Specialized General Hospital	1500-1700 Students	15
B	**Health Care Facilities**		
17	Health Unit / Dispensary	1 for 15,000 Population	0.1
18	Nursing Home / Maternity Centre	30 Beds / 1 per 45,000 Population	0.25

19	Polyclinic with some observation beds	1 for 1 Lac Population	0.25
20	General Hospital (300-500 beds) with residential accommodation	1 for 1 to 2.5 Lac Population	6
21	Intermediate Hospital with residential accommodation	100-200 Beds / 1 Lac Population	3.7
22	Intermediate Hospital	80-100 Beds / 1 Lac Population	1
C	**Socio-Cultural Facilities**		
23	Community Room	1 per 5,000 Population	0.1
24	Community Hall and Library or Multi- purpose Hall	1 per 15,000 Population	0.2
25	Recreational Club	1 per 15,000 Population	0.3
26	Recreational Club	1 per 50,000 Population	0.5
27	Recreational Club	1 for 1 Lac Population	1
28	Music, Dance & Drama Centre	1 for 1 Lac Population	0.2
29	Club Houses	1 for 1 Lac Population	1
30	Museum & Art Gallery with Parking	-	1
31	Community Centre with Hall and Library etc	1 for 15,000 Population	0.3
32	Meditation and Spiritual Centre	1 for 50,000 Population	0.5
33	Botanical / Zoological Park	1 for 1 Lac Population	5
34	Exhibition Area (s)	1 for 1 to 10 Lac Population	10
35	Cinema / Theatre	1 for 1 Lac Population	0.5
36	Stadia / Sports Centre/ Complex	1 for 1 Lac Population	8
37	Mini-Play Field	1 for 2,500 Population	0.75
38	Play Field	1 for 15,000 Population	1.5
39	Religious Place / Structure	1 for 2,000 Population (for all community)	0.2
40	Religious Place / Structure	1 for 10,000 Population (for all community)	0.5
41	Graveyards	1 for 20,000 Population	2
42	Cremation Ground	1 for 50,000 Population	0.5
D	**Distribution Services**		
43	Post and Telegraph Office	1 for 1.5 Lac Population	0.4
44	Post Office	1 for 40,000 Population	-
45	Telephone Exchange	-	0.2
46	Petrol Pump	1 per 2.25 ha of Gross Residential Density	0.2
47	Petrol Pump	1 per 40 ha of gross Industrial Density	0.2
48	Milk Booth	1 for 5,000 Population	-
49	LPG Godown	1 for 50,000 Population	0.2
50	LPG Plant with Bottling Facility	-	1
51	Electrical Sub Station of 11 KV	1 for 15,000 Population	-
52	Electrical Sub Station 66 KV	1 for 1 Lac Population	-
E	**Police and Fire Services**		
53	Police Station	1 for 90,000 Population	1.5
54	Police Post	1 for 40,000 Population	0.2
55	Fire Station	1 for 90,000 Population	1.5
F	**Slaughter House**		
56	Slaughter House	1 for 1 Lac Population	0.4
57	**Abattoir**	**1 for 1 Lac Population**	**1**

12 IMPLEMENTATION AND MONITORING

12.1 PROVISIONS GIVEN IN THE ASSAM TOWN & COUNTRY PLANNING ACT 1959

In order of secure planned development of Dibrugarh Planning Area, it will be important that proposals defined in the GIS Based Master Plan of Dibrugarh are implemented on the ground in letter and spirit. The concept defined in the Comprehensive Master Plan for securing rational development shall not be achieved unless it is adequately supported through a well-defined mechanism for ensuring its proper implementation.

Use and Development of land

As per Section 13 of the Act, no person can use or permit or carry out any development in the Planning area without conformity with the Development Plan after coming into operation of the Development Plan. No development can be taken up by an individual and Department of the Government without the permission of the Competent Authority for which an application shall be made accompanied by documents and fee, as may be prescribed under Section 13(2). Act provides for regulating all constructions / development undertaken by any person including stopping of illegal construction, imposing penalties, demolition of buildings etc.

Acquisition and disposal of land

Section 32 of the Act provides for acquisition of land as per the provisions under Land Acquisition Act, 1894 for public purpose. The Planning Authority may, at any time, and for the purposes of a Development Plan acquire any land with the sanction of the Government. Land is acquired by the Government and then transferred to the Authority for development on payment of compensation.

Levy of Betterment Fee

As per Section 41 of the Act, Every property which has increased in value due to its inclusion within an area under a plan or a scheme or due to the execution of such schemes shall be charged with a betterment fee and such change or development is capable of yielding a better income to the owner, the Planning Authority may levy a not exceeding 1/3 rd of the estimated increase in the value of the land or building for permitting such change in use or development.

12.2 SALIENT FEATURES DEVELOPMENT CONTROL REGULATIONS

For better implementation of the GIS Based Master Plan, it is to be controlled through Development Control Regulations. To derive the Development Control Regulations for Dibrugarh Planning Area, Gross Residential Density is worked out.

As per URDPFI Guidelines 2015, the gross density for developed area of Medium Town (Population having 1 lakh to 5 lakh) in Plain Areas should be 100-150 PPH. As per Census 2011, the population of Dibrugarh Planning Area is 3,61,397 with total area of 391 sq.km. The gross density of the planning area is 9 PPH. The Gross Residential Density is 78 PPH which is nearly matching with the URDPFI guidelines 2015. As per incremental increase method, projected population for year 2045 is 4.96 lakhs for the planning area. For projection year 2045, there can be of more growth and anticipated compared to the growth rate of the previous decades. The reasons for that are cited in chapter 2.5 Population Projection 2045. For year 2045, projected population is coming to be 5.51 lakhs. By considering projected population of 5.51 lakhs, the proposed gross residential density is worked out to be 62 PPH which can be considered as per the URDPFI Guidelines 2015.

12.3 POLICY FRAMEWORK RELATED ACTIONS

It will be important to focus on following to achieve the effective implementation besides promoting planned development of the local area. This should include:

- Putting in place appropriate order of manpower in Town Planning and Engineering division within the Authority
- Creating a dedicated Enforcement Wing for implementing the Master Plan
- Creating Land Bank – creation of inventory of Government Land through which status of Government land can be monitored (buying & selling of Government Land)
- Looking at new options for generating resources for funding the development work for making urban development self – financing.
- Involving Private, Corporate and Cooperative Sectors as major partners in the Planning, Development & Implementation of Master Plan through an investor friendly framework.
- Creating awareness among people about the role and importance of Comprehensive Master plan including its major provisions and schemes to make local citizens as partners in the development process and in providing appropriate quality of life.
- Creating a High-Powered Board for coordinating the activities of various departments operating within the planning area and define Policy Framework for implementation of GIS Based Master Plan 2045.
- Maintaining a GIS based system for updating database and monitoring of Master Plan implementation (Master Plan 2045 is already prepared on GIS platform which has to be updated time to time)
- Phasing of development and developing trunk infrastructure including major roads, water supply, sewerage, drainage or electricity etc. as per priority.
- Formulation of the annual plan and identification of projects for implementation within the framework of approved Master plan - adopting Project Based Approach.
- Transforming the role of Government /Authority from 'Provider to Enabler' and devising innovative methods of resource mobilization.
- Making use of different central and state government schemes to finance major proposals in the DMP 2045.

12.4 LAND POOLING AND PLOT RECONSTITUTION FOR PLAN IMPLEMENTATION

Based on the pattern followed in states of Maharashtra and Gujarat, DMP 2045 advocated the use of land pooling and reconstitution mechanism to manage, service, reconstitute the private land and promote planned development. The mechanism involves development without acquisition of land involving land owners as equitable interests in the development process. The entire development cost is generated out of part sharing of increase in land values due to planned development of the area. Land is earmarked for roads, open spaces, parks, play grounds and amenities including healthcare and education. Planning Authority also gets land from the scheme, which is disposed off by the designated agencies to raise resources to meet the development cost and pay the cost of land, which is used for public purpose, etc. Land owners get full compensation of land, which is used by public agencies and shares the cost of development. The scheme is prepared in consultation with land owners, which minimize the chances of conflict between land owners and the Planning Authority. Development agency on its parts gets land for roads, open spaces, amenities, etc. free of cost

without resorting to land acquisition. The developed land which is made available to land owners can be disposed off by him in the open market at a negotiated price fetching him higher returns.

Land Pooling and Redistribution Scheme (Town Planning Scheme)

It is a land development technique undertaken by the land owners who pool their land to receive a good layout, following a procedure involving:

- Notifying an area for Town Planning Scheme.
- Pooling of land of different land owners to the Authority.
- Preparing a detailed scheme as per the provision of Master Plan indicating the original and final plots, roads, open spaces, amenities, involving the land owners.
- Redistribution of final plots after charging betterment contribution and paying compensation for the land used for public purposes, transferred to the local authority.
- The role of development authority remains most critical in order to finalise the scheme by involving land owners, preparing layout plans, getting it approved from land owners and the state government and ensuring execution of scheme. In the entire process land is developed as per the plan involving no acquisition of land. This is the major feature which distinguishes Town Planning Scheme from other modes of land assembly like bulk acquisition or bulk acquisition of selected land for public amenities. After the Town Planning Scheme is finalized, entire land earmarked for public purposes involving roads, open spaces, amenities, etc. vests with the local authority without paying any compensation and is generally called "Land Acquisition without tears". It makes land owners also happy because they lose only part of their land used for public purposes and get the remaining land after planning with freedom of disposal in urban markets. Compensation is also paid to the land owners for the land which is used for public purpose. However, the scheme has been found to popular in large cities with adequate demand of land. Scheme has one drawback that it takes considerable time for finalization. However, the model adopted by state of Gujarat for speedier framing of T. P. Scheme could be used for formulation of T. P. Scheme on time bound basis. This method can be considered for adoption by Dibrugarh Planning Authority after detailed study of various aspects of the scheme and legal framework required to make these schemes a reality. It would also require placement of trained manpower to be put in place to frame and finalise the T.P. Scheme.

Spatial planning of any urban area tends to increase the land value of that area. A further increase takes place when the actual development works start. It's a common experience that ULBs excepting a few municipal corporations lag badly in executing the development works which mainly consist of basic civic services. This is mainly on account of the paucity of funds. Since the spatial planning and the development works tend to increase the land prices, it was thought necessary to mop up a part of the incremental increase in prices for the purpose of carrying of the developmental work. Traditionally this has been sought to be achieved by levying charges at two stages termed betterment charges and development charges. As soon as the spatial planning is finalised, the authorities responsible for spatial planning levies a charge termed as betterment charges.

Unfortunately, this charge, however, does not lead to any net income for the planning authority. This is because the entire rationale seems to be individual owners of plot are going to surrender land owned by them for the development works and therefore, are entitled to some compensation. The cost of carrying on the planning work will be offset. Therefore virtually there will be no net income to the planning authority.

Anticipated expenditure for laying of roads and various other civic services. Part of the increment of land value on account of this is sought to be mocked up by levying the development charges. However, actual

amount generated falls much below the expenditure for levying the services. Secondly, this charge is levied and collected when a person owning a plot comes for actual development on that plot. Here also this hardly serves the purpose of effectively providing the fund backup needed for actually executing development jobs.

The government has therefore in various states has made provision for a part of the land under development to devolve on the spatial planning authority. The idea is that funds generated by the sale of the devolved land would be helping the institutions to carry on the development works, if need be, by borrowing funds from the public finance institutions by putting the sum as margin money.

In case the state government agrees to resorting to land pooling methodology for executing town planning, the suitable provisions can be made for reservation of land for the planning authority for generating funds needed for actual development. In this context, as is being done in Maharshtra and Gujarat.

12.5 PHASING AND COSTING

The successful implementation of a Master Plan is depending on the availability of resources with the implementation authority and the concerned department. The availability of funds sets the guidelines for the development for various proposed projects of the planning area. The different proposals for Dibrugarh Master Plan (DMP) have been drawn up for achievement over the period up to 2045 have given a broad estimate of investment to be undertaken.

This is an indicative investment plan, it would be imperative to find out sources of enhanced capital finances to be able to carry out the required investment. Further, it has been a common phenomenon that many of the capital expenditure has not been sustained properly leading the delivery of services to suffer. Therefore, sustenance of capital expenditure in terms of operation and maintenance of assets created becomes all the more important and this force for identification of different revenue generating options.

Phasing is done for the development to take place incrementally over the period of time, according to the financial resources available. Initial projects are to be selected in such a manner that they act as catalysts for economic growth of the city. Generally, it includes projects such as knowledge cities, business and high tech parks and commercial centres etc. These will cause huge inflow of people to the city for education and employment.

For Dibrugarh Planning area, the implementation of the proposals is divided into three phases; short term, Medium term and long term. The proposlas to be implemented in these phases are described below:

12.5.1 SECTOR-WISE INVESTMENT PROPOSAL

The sector wise investment requirement for the implementation of various projects of Dibrugarh Master Plan is detailed in table below.

Table 248 Sector Wise Investment for Dibrugarh Planning area

Sr.No.	Location	Project Name	Total Project Coast (in lac.)	Cost in Phase I (in lac.)	Cost in Phase II (in lac.)	Cost in Phase III (in lac.)
		Urban Development				
1	Core area of Dibrugarh Town	Urban Renewal of Core Old Areas of Dibrugarh Town	500	250	250	-
2	Core area of Dibrugarh Town	Development of Heritage Buildings of Dibrugarh Town	100	50	50	
3	Distributed in Town	Rehabilitation of Slums dwellers along Brahmaputra river and on Water Bodies located in Planning Area	2500	1500	1000	
4	Dibrugarh Planning Area	Green Belt around Industrial area and Wetlands	150	100	50	
5	Tingkhong Gaon	Neighbourhood Centre at Ward 15 (9.3 Ha)	820	820		
6	Subha Chuck Gaon	Neighbourhood centre at Subha Chuck Gaon (9.26 Ha)	918		918	
7	No. 122 Burahajar Konwar Gaon	Neighbourhood Centre at No. 122 Burahajar Konwar Gaon (7.8 Ha)	680			680
8	No. 1 Mancotta	Neighbourhood centre at No. 1 Mancotta (5.08 Ha)	500			
9	Niz Mankatta Gaon (CT)	Neighbourhood Centre at Niz Mankatta Gaon (5.31 Ha)	480		4800	
10	Mohpowalimora Gohain Gaon (OG)	Neighbourhood centre at Mohpowalimora Gohain Gaon (7 Ha)	700		700	
11	Mahmaripather Gaon	Neighbourhood Centre at Mahmaripather Gaon (8 Ha)	810			810
12	Lepetkata Gaon	Neighbourhood centre at Lepetkata Gaon (11.04 Ha)	1010		1010	
13	Lekai Gaon	Neighbourhood centre at Lekai Gaon (6 Ha)	700	700		
14	Konwar Kheroni Gaon	Neighbourhood centre at Konwar Kheroni Gaon (13.4 Ha)	1200	1200		
15	Japara Gaon	Neighbourhood centre at Japara Gaon (7 Ha)	600			600
16	Hatimura Gaon	Neighbourhood centre at Hatimura Gaon (12 Ha)	1100		1100	
17	Hahchora Gaon	Neighbourhood centre at Hahchora Gaon (12 Ha)	1000	1000		
18	Ghitira Pather	Neighbourhood centre at Ghitira Pather (6 Ha)	700		700	
19	Dibruwal Changmai Gaon	Neighbourhood centre at Dibruwal Changmai Gaon (12.56 Ha)	1100			1100
20	Bhurbhuri Gaon No. 3	Neighbourhood centre at Bhurbhuri Gaon No. 3 (12.11 Ha)	1050		1050	
21	Chengamari Tekela Gaon	Neighbourhood centre at Chengamari Tekela Gaon (8 Ha)	910	910		
22	Ward 4	Affordable Housing (2 Ha)	2000	2000		
23	Tinsukia Gaon	Affordable Housing (3 Ha)	3000		3000	
24	No. 2 Bhurbhuri Gaon	Affordable Housing (9.5 Ha)	9500			9500
25	No. 150 Dibruwal Dihingia Gaon	Affordable Housing (21 Ha)	21000	10000	11000	

26	No. 1 Mancotta	Affordable Housing (2 Ha)				
27	No 186 Binoi Gutia	Affordable Housing (11 Ha)	11000			11000
28	Mankota 1/159 No. RR (A)pt	Affordable Housing (2 Ha)	2000	2000		
29	Mahmaripather Gaon	Affordable Housing (13 Ha)	13000	13000		
30	Jokai Region	Affordable Housing (11 Ha)	11000			11000
31	Hatimura Gaon	Affordable Housing (3 Ha)	3000		3000	
32	Dewanbari Bengali Gaon	Affordable Housing (5 Ha)	5000		5000	
33	Chamoguri Kasari Gaon	Affordable Housing (15 Ha)	15000			15000
		Public Semi Public Places				
34	Niz Khanikar	Administrative Block (50 ha)	50000	25000	25000	
35	Jalan Tea Estate, Convoy Road	International Convention Centre (ICC) (25 ha)	20000	20000		
36	Bogpara Gaon	District Library	300		300	
		Water Supply System				
37	Dibrugarh Planning Area (DMPA)	Preparation of DPR for Water Supply System for Dibrugarh Planning Area	120	120		
38	Existing Dibrugarh Town	Water Supply System sanctioned under AMRUT	100	50	50	
39	Existing Dibrugarh Development Authority Area	Improvement of Water Supply System of Dibrugarh	3000	1500	1500	
40	Dibrugarh Planning Area	Hand Pump water Distribution System	1000	500	500	
		Power				
41	Existing Dibrugarh Master Plan Area	Renovation and modernization of 33/11 KV and 11 KV / 440 V sub- stations	400	200	200	
42	Existing Dibrugarh Master Plan Area	Installation of new transformers and capacity augmentation of existing transformers	650	300	350	
43	Existing Dibrugarh Master Plan Area	Metering of All connections	200	100	50	50
44	Existing Dibrugarh Master Plan Area	Installation of a HVDS (High Voltage Distribution System)	500	250	150	100
45	Dibrugarh Planning Area 2045	Preparation of DPR for Power Supply System for Dibrugarh Planning Area	200	200		
		Sewerage System				
46	Dibrugarh Planning Area	Preparation of DPR for Sewerage System for Dibrugarh Planning Area	70	70		
47	Dibrugarh Planning Area	Laying of Sewer Network for Planning Area	5000	2500	1500	1000
48	Konwar Handique Gaon	Construction of STP (35 MLD) on 4 Hectare of Land	700	400	300	
49	Dewanbari Bengali Gaon	Construction of STP (35 MLD) on 5 Hectare of Land	680		350	330
50	Bhurbhuri Gaon No. 3	Construction of STP (35 MLD) on 5 Hectare of Land				
51	Jokai T.E Co. 29/143 ORR	Construction of STP (25 MLD) on 5 Hectare of Land	450		450	

		Solid Waste Management				
52	Dibrugarh Planning Area	Improvement and Modernization of Solid Waste Collection, Transportation and Disposal System of Dibrugarh	250	250		
		Drainage System				
53	Dibrugarh Planning Area	Preparation of DPR for Drainage System for Dibrugarh Planning Area	70	70		
54	Dibrugarh Town	Cleaning and maintenance of existing main drains	1000	500	500	
55	Dibrugarh Planning Area	Laying of Roadside drains in new proposed areas within Dibrugarh Planning Area	3000	1000	1000	1000
56	Dibrugarh Town	Construction and Improvement of Existing Storm Water Drains	5000	2500	2500	
57	Dibrugarh Planning Area	Slope protection, Improvement, Construction, Repair & Restoration	100	100		
		Water Bodies				
58	Dibrugarh Planning Area	Repair and Renovation of Water Bodies in Planning Area	1000	500	500	
59	Dibrugarh Planning Area	Development of Green Conservation Belt around all water bodies	500	250	250	
60	Dibrugarh Planning Area	Development of Brahmaputra River Front Under Progress (Bank Stabilization Work)	2500	1500	1000	
61	Dibrugarh Planning Area	Development of Burhi Dihing river with joggers track as recreational zone	1000	500	500	
62	Dibrugarh Planning Area	Development of water sport complex as recreationel zone	2000	500	1000	500
63	Bhurbhuri Gaon No. 2	Rejuvenation of Kathbil with organized open space	1000		500	500
		Traffic and Transportation				
64	Dibrugarh Town	Repair and Renovation of Existing Road Network of Dibrugarh Town	2500	1500	1000	
65	Ward 9	Improvement and Conservation of old Dibrugarh Town Railway Stations	1000	500	500	
66	Tepar Gaon Pathar	Development of Dhamalgaon Railway Staion	500	250	250	
67	Changmai Goria Gaon	Development of ISBT (26 Ha)	500	500		
68	No. 172 Tepar Gaon Pather	Development of Intermediate Freight Complex (60 Ha)	3000			
69	Bairagimath Kachari Gaon	Development of Bus Terminal (14 Ha)	200	200		
70	Patra Gaon	Development of Bus Terminal (9 Ha)	90		90	
71	Tinsukia Gaon	Development of Bus Terminal (8.5 Ha)	90			90
72	Dhargatoli Gaon	Development of Bus Terminal (7 Ha)	80		80	
73	Bhurbhuri Gaon No. 3	Development of Bus Terminal (25 Ha)	500			500
74	Ward 19	Development of Jalan nagar Bus Terminal	50	50		
75	Lepetkata Kachari Gaon	Development of Truck Terminal (35 Ha)	300	300		
76	Bokel Bari Tea Estate	Development of Truck Terminal (10 Ha)	150		150	
77	Bhurbhuri Gaon No. 3	Development of Truck Terminal (6.25 Ha)	100			100
78	Dibrugarh Planning Area	Preparation of DPR on City Mobility Plan	30	30		

79	Dibrugarh Planning Area	Construction of City Ring Road	20000	10000	5000	5000
80	Dibrugarh Planning Area	Construction of Outer Ring Road	38000	10000	10000	18000
81	Dibrugarh Planning Area	Improvement of Traffic Signal facility in Dibrugarh Planning Area	600	300	200	100
82	Dibrugarh Planning Area	Augmentation of City Bus Fleet	1000	400	400	200
83	Dibrugarh Planning Area	Construction of Non-motorised Transport facilities (Footpaths & Cycle Tracks & Cycle Parking)	1600	600	500	500
84	Bairagimath Kachari Gaon	Construction of Cycle parking near Bus stand	300		200	100
85	Bairagimath Kachari Gaon	Construction of Multi level Parking at Banipur Railway Station	1500	1500		
86	Ward 9	Development of Multilevel Car Parking near Town Railway Station	400	400		
87	Ward 6	Development of off- street Car Parking	200	200		
88	Ward 5	Development of off- street Car Parking	150		1500	
89	Ward 4, Near Jalan Tea Estate	Construction of off-Street Parking	200	200		
90	Banipur Railway Station	Construction of Road Over Bridge on road near Banipur Railway Station	1005	1005		
91	Mancotta Road	Construction of Road Over Bridge on Railway Track	1500	1500		
92	Bypass Road, Khanikar Cross road	Dvelopment of Khanikar Fly over on Dibrugarh Bypass Road	900	900		
93	Bogpara	Dvelopment of Bogpara Fly over on Dibrugarh Bypass Road	900		900	
94	Nh-37, Borboruah Point	Dvelopment of Fly over at Borboruah Point towards Bypass road	1000	800	200	
95	NH-15, Sukafa Point	Dvelopment of Fly over at Sukafa Tiniali from Bogibill	900		900	
		Commercial				
96	Bokul Gaon	Development of Commercial/ District Centre (31 Ha)	1500	500	500	500
97	Patra Gaon	Development of Commercial/ District Centre (20 Ha)	800		800	
98	Changmari Tekela Gaon	Development of Commercial/ District Centre (15 Ha)	700	300	450	
99	Hiloibam Gaon	Development of Integrated Commercial Centre (40 Ha)	4000		1000	2000
100	No. 2 Bhurbhuri Gaon	Development of Integrated Commercial Centre (11 Ha)	1000		500	500
101	Ward 4	Development of Vending Zone (2 Ha)	70	70		
102	No 186 Bindi Gutia	Development of Vending Zone (10 Ha)	350		350	
103	Mohmari Gaon	Development of Vending Zone (8 Ha)	200			200
104	Bhurbhuri Gaon No. 3	Development of Vending Zone (14 Ha)	400			400
105	Changmai Gorla Gaon	Development of Wholesale and Trade Centre (15 Ha)	3000	1000	2000	
106	Bhurbhuri Gaon No. 3	Development of Wholesale and Trade Centre (10 Ha)	1000			1000

		Social Infrastrucutre				
107	Garudharia Gaon No. 1	Development of Multi-Specialist Intermediate District Hospital (13 Ha)	900		900	
108	Lahowal Chah Bagicha	Development of Multi-Specialist Intermediate District Hospital (14 Ha)	900		450	450
109	No 186 Binoi Gutia	Development of Multi-Specialist Intermediate District Hospital (7 Ha)	450	450		
110	Bhurbhuri Gaon No. 3	Development of Health Centre (13 Ha)	800		400	400
111	No. 150 Dibruwal Dihingia Gaon	Development of Health Centre (13 Ha)	800		400	400
112	Sapekhati Gaon	Development of Health Centre (11 Ha)	700	350	350	
113	Bogpara Gaon	Development of Knowledge District (142 Ha)	14000	4000	10000	10000
114	Lekai Gaon	Development of Knowledge District (92 Ha)	9000	4000	2500	2500
115	Hilolbam Gaon	Development of Knowledge District (64 Ha)	7000		3500	3500
116	Sapekhati Gaon	Development of University (80 ha)	7200		4000	3200
		Recreational				
117	Jokai R.F.	Development of Botanical Garden (18 Ha)	300	100	200	
118	Charbandi Chuk Zarua	Development of District Sport Centre cum Complex (9 Ha)	900	450	450	
119	Lepetkata	Development of District Sport Centre cum Complex (15 Ha)	1200		800	400
120	Chota Bogpara	Development of District Level Park (10 Ha)	1000	500	500	
121	Kushia Khana gaon	Development of Cultural Complex (70 Ha)	7000		3000	4000
122	Niz Khanikar	Development of Science City (20 ha)	5000	2000	2000	1000
123	Niz Khanikar	Development of Stadium (10 ha)	8000	4000	4000	
124	Mohmari Gaon	Development of Theme Park (120 ha)	120000	50000	50000	20000
125	Near Jokai R.F.	Development of Theme zoo (95 ha)	5000	2000	2000	1000
126	Mohmari Gaon	Development of Exibition Ground (30Ha)	1000	500	500	
127	Dibrugarh Planning Area	Development of Water Sport Activity at Burhi Dihing water Body	100	75	25	
128	Hanchora	Development of eco-village tourism at Hanchora	500			500
129	Dibrugarh Planning Area and Surrounding Region	Development of Spiritual Circiut (Development of Infrastructure at BJagannath Temple, Radha Krishna Temple, Maira Mora than, Aai Than, in Dibrugarh Planning Area)	200	100	50	50
		Industrial Area				
130	Tepor Gaon Pathar and Chnagmari Gohain gaon	Development of Industrial Estate – I (300 Ha)	35000		25000	10000
131	Niz Lahowal	Development of Industrial Estate – II (100 Ha)	9000	5000	4000	

12.5.2 TOTAL INVESTMENT PROPOSAL

The Master Plan of Dibrugarh Planning Area will require a total public and private sector investment of approx. Rs .5447.08 crores till horizon year 2045. The summation of all the costs of sectoral level plans provide the total estimate as detailed in Table below.

Table 249 Summation of Sectoral Investment Plan for Dibrugarh Planning Area

Sr.No.	Sector	Sector wise Investment Plan (Crores)
1	Traffic and Transportation	792.40
2	Physical Infrastructure	231.70
3	Social Infrastructure	417.50
4	Commercial Development	130.20
5	Recreational	1502.00
6	Environment and Ecology	80.00
7	Mixed use/Neighbourhood centres	1853.28
8	Industrial	440.00
Total		**5447.08**

(Source: Consultant Compilation)

12.6 RESOURCE MOBILISATION

Availability of adequate resources is essential for the successful implementation of the Master Plan. This demands rejuvenation of urban centers to attract more and more investments in those areas. Implementation of the Master Plan requires huge amount of financial resources and it is impossible for the Planning Authority to bear such huge amount of money. There are certain fiscal mechanisms that can be adopted for mobilizing the financial resources.

Land remains the critical element of urban development and accordingly can be leveraged to raise resources for urban development and implementation of the DMP. Land values remains closely linked with the use to which the land is put and permission is granted to use the land in urban context. From the experiences, it is found that the only mechanism to fund the urban infrastructure is to undertake and promote planned development either by the parastatal agencies or by the private, cooperative, corporate sectors. Both these mechanisms can be leveraged by Development Authority to raise resources/ implement the DMP provided the legal framework permits the same and authorizes the Authority to regulate it.

12.6.1 LAND BASED FINANCING MECHANISMS

Apart from the government grants or development funds from the upper tiers of government, the ULBs would require adequate funds from their own sources to meet the objectives of facilitating urban development. Thus, it is inevitable for any local body to generate revenue. Table below shows categorywise sources of revenue of ULBs in India. Most of the ULBs use tax sources and grants to finance their activities, while the other sources of revenue are often ignored or not tapped to the potential that exists. For example, public debt available from market – both institutional and individual/retail investors – is rarely accessed to finance the creation of new urban development infrastructure.

Table 250 Municipal Revenue Sources in Indian states/ULBs

Revenue Head/Category	Sources of Revenue
Tax Revenue	Property Tax, Advertisement Tax, Tax on Animals, Vacant Land Tax, Taxes on Carriages and Carts
Non-Tax Revenue	User Charges, Municipal Fees, Sale & Hire Charges, Lease amounts
Other Receipts	Sundry receipts, Law charges costs recovered, Lapsed deposits, Fees, Fines & Forfeitures, Rent on Tools & Plants, Miscellaneous Sales etc.
Assigned (Shared) Revenue	Entertainment Tax, Surcharge on Stamp duty, Profession Tax, Motor Vehicles Tax
Grant-in-aids	(i) Plan Grants made available through planned transfers from upper tier of Government under various projects, programmes and schemes (ii)Non-Plan Grants made available to compensate against the loss of income and some specific transfers
Loans	Loans borrowed by the local authorities for capital works etc. – HUDCO, LIC, State and Central Governments, Banks and Municipal Bonds

(Source: Mohanty P.K., 'Financing Urban Infrastructure: Some innovative Practices of Resource Mobilisation, CGG working paper, June 2003)

Municipal Resource mobilization needs not only strengthening the existing revenue sources but also using other sources of revenue. Therefore, both conventional and non-conventional sources need to be tapped to the extent possible within the City. The ULBs may benchmark their levy and utilization with reference to the better performing peers within the State as well as outside it. The ULBs may use the general principles of users pay, beneficiaries pay and polluters pay to the justification such that the citizens are well aware of the need for their contribution towards larger societal cause. Table below shows conventional and non-conventional resources that can be tapped by the ULBs.

Table 251 Conventional and non-conventional revenue resources

Sr.No	Service Revenue Source	Conventional Source	Non-Conventional Source
1	Property Related	Composite PropertyTax	Vacant Land Tax, Service Taxes, Surcharge on Land Registration Duty
2	Water Supply Related	Water Charges	Water Supply Donations, Water Supply Connection Charges, Water Benefit Tax, Water Betterment Charges
3	Sewerage Related	Sewerage Charges	Sewerage Donations, Sewerage Connection Charges, Sewerage Benefit Tax, Sewerage Betterment Charges
4	Solid Waste Management Related	Conservancy Charges	Bulk Garbage Collection Charges
5	Town Planning Related	Building Permit Fee, Development Charges	Betterment Charges; External Betterment Charges; Open Space Contribution; Impact fee; Transferable Development Right; Premium FSI, Sub-division charges; Planning Permission Betterment
6	Engineering Related	No Sources	Road Cutting Charges, Street Tax, Frontage Tax, Cess on Infrastructure, Motor Vehicle Tax/Surcharge on Tax on Petrol and Diesel
7	Trade Licensing Related	Trade Licensing Fee	Business License Fee
8	Advertisement Related	Advertisement Tax	Hoarding Charges, Advertisement Placement Fees, Cable TV Fee, TV Advertisement Charges
9	Shops and Establishment Related	Shop Room rent	Royalty on Auctions

(Source: Mohanty P.K., 'Financing Urban Infrastructure: Some innovative Practices of Resource Mobilisation, CGG working paper, June 2003)

- **Change of Land Use Charges for change of land use from one use to another:** The landuse conversion charge is determined by the newly permitted landuse of that area which is capable of yielding a better income for the land owner.
- The Assam Town & Country Planning Act, 1959 provides for levying Development Charges on landowners. Where permission for a change in the use or development of any land or building is granted in the whole or any part of the planning area, and such change or development is capable of yielding a better income to the owner, the Planning Authority may levy a charge not exceeding 1/3rd of the estimated increase in the value of the land or building in the prescribed manner for permitting such change in use or development.
- **FAR:** Intensity of land utilization depending upon Floor Area Ratio (FAR). Higher FAR means higher order of charges to be paid –tradable FAR.
- **Internal Development Charges and External Development Charges (IDC and EDC):** Instrument of development charges have been used extensively to recover the cost of providing new service and infrastructure in areas proposed to be covered by Master Plans. This mechanism has helped in providing development within the approved colonies in terms of roads, water supply, sewerage, sanitation, drainage, electricity etc. besides the social infrastructures involving education, health care, landscape etc. without involving any cost to the Planning Authority as these costs are loaded as integrated part of pricing of developed plots which are made available to people after development.
- In addition to internal development charges, charges for external development are also collected by development agencies. These charges include the cost of providing city level services involving arterial / ring roads, bypasses, under bridges /over bridges, water treatment plants, sewage treatment plants, major electrical network, trunk services, city level healthcare, education and other services. This is done through the process of working out total cost of development, as per the proposals defined in the development in the master plan. Based on the total developed area under different uses, external development cost is worked on the unit basis of area which is then charged from the developers while granting permission for development. External Development Charges (EDC) is then pooled in the City Development Fund which is then used for funding various projects prepared as per the provisions of the development plan.
- **Vacant land taxes:** levied on vacant land kept within the urban limits to minimize speculation and raise money on account of non-utilization of urban services.
- **Tax on land value increase:** Land values continue to increase in urban context due to various development projects undertaken by the Planning Authority (for eg. GIS Based Master Plan) and economic phenomenon of rise in general prices. A basic objective of Land Value Increment Tax is to capture some of this increase for the benefits of the community. This kind of tax is widely used in numbers of countries including Italy, Malaysia, Australia, Korea, Canada and New Zealand.
- **Planning Charges:** Since preparation of master plan, zonal plan and working out detailed schemes and granting planning permission involves expenditure on the part of Planning Authority, accordingly they can be recovered as integral part of the planning permission so as to raise resources. Further, this approach will help in effective implementation of the Master Plan through increased intervention of planning system.
- **Sale or lease of publicly held land:** Public land assets are sold to private parties. This mechanism requires a detailed inventory of government land, market valuation and strategic decisions about the best use of a particular land. Auctions shall be open for the disposal of land. The provision for this mechanism is given in Section 34 of Assam Town and Country Planning Act 1959.
- **Remunerative Projects:** Planning Authority should take up remunerative projects which augment financial

positions and generate revenue for the Authority and subsequently social infrastructure projects can be taken up out of the funds generated from the same. Income from remunerative projects is in the form of rental income from properties like shopping complexes, market fees, parking fee and income from other real assets owned by the DDA.

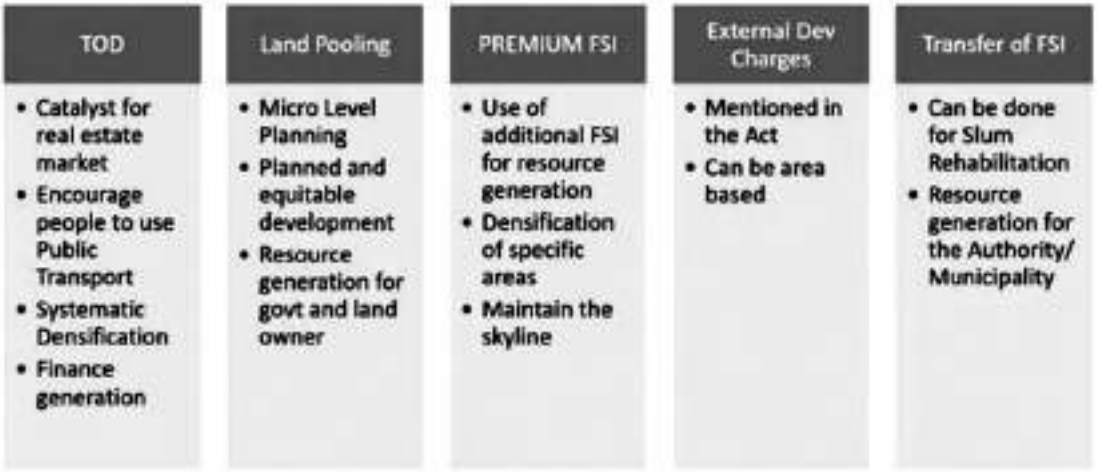


Figure 169 Resource Mobilization

The ULBs need to exploit various land based revenues, which have greater implication to urban growth and development and concomitant problems like slum formation, redevelopment, rehabilitation and resettlement. The funds realized from land based revenue sources can be effectively deployed for the improvement of urban poor people living in the slum areas. Several of these sources may already exist in the ULBs but the potential of the same may not have been exploited to fullest extent. Also, there are several other forms of revenues (or, variants of revenues) that need to be tapped and exploited.

12.6.2 INVOLVING PRIVATE SECTORS

Considering the enormity of urban development, requirement of enormous resources, level of service/ infrastructure required to ensure appropriate quality of life in Dibrugarh, it will be critical to involve large number of reputed players in the urban development process in order to ensure effective implementation of master plan. With limited resources available with the parastatal agency, achieving the objective of the comprehensive development plan and its effective implantation appears to be a remote possibility. Accordingly, it will be desirable to make private sector as an active and supportive partner in the process of development and implementation of the Master Plan 2045.

Mechanism of involving private sector will have to be defined clearly in a transparent manner through well-defined policy and legal framework in order to remove any mismatch or ambiguity. Level playing fields have to be created between Private and Public sectors so as not to put private sector in a position of disadvantage. A supportive and exclusive mechanism/ framework will have to be put in place to provide time bound clearance to the private sector development, meeting all the defined norms, standards and conditions of development. Attempt should be made to attract reputed developers in the state in order to usher a new era and culture of urban development. Minor developers should be avoided in order to minimize the chances of mushrooming planned development and ensure provision and development of integrated city level services. Minimum chunk of land to be developed should be defined which can be sustained as self -contained neighbourhoods having all basic amenities of services, physical / social infrastructures to meet the day to day needs of residents. Well-defined standard of development shall form integral part of such development, so that uniformity of development is ensured.

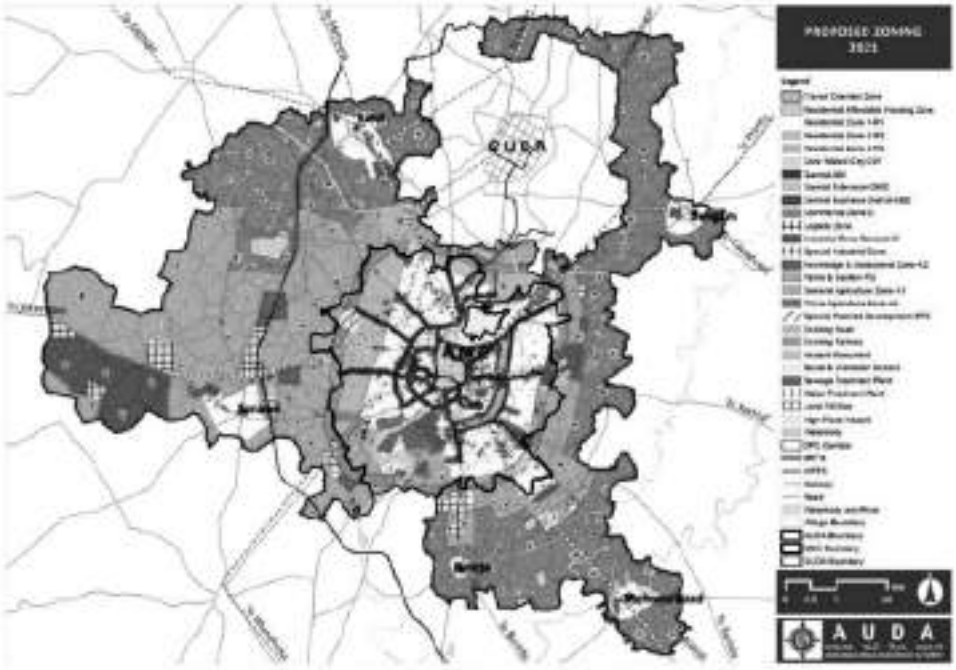
Licensing of developers would be integral and critical part of involving private developers in order to ensure their liability for the development works taken up by them. Legal, institutional and procedural framework for involving private sector in urban development / implementation of master plan needs to be worked out on the basis of detailed study carried out of the pattern adopted by states of Haryana, Punjab, Uttar Pradesh, Maharashtra, Gujarat (where they have put in place successful models of urban development involving private sector. However, such model would need modification depending on the conditions existing in the Dibrugarh to make it successful operationally.

12.6.3 BEST PRACTICES

Land Management Process- Gujarat As the city grows, more land in the surrounding regions gets transformed from rural to urban uses. In the absence of an effective mechanism, this transformation is haphazard and results in congestion and low levels of infrastructure provision. To ensure planned new growth, most cities rely on largescale land acquisition and development of planned layouts. However, this becomes difficult with the increase in land values as well as the active resistance to displacement by displaced landowners. Therefore, it has become imperative to introduce more fair, equitable and inclusive methods of land consolidation that cause minimal displacement if at all. The good example of such a mechanism is from the land process of Gujarat.

Urban planning in Gujarat is a two-step process as prescribed in the GTPUDA and its Rules. The first step is to prepare a "Development Plan" (DP) for the entire city or development area. The second step is to prepare "Town Planning Schemes" (TPS) for smaller portions of the development area for which the Development Plan is prepared.

1. Development Plan (DP)



- Provides Overall Development Framework
- Overall Direction of Urban Expansion
- Land use Zoning
- City level road network
- City Level Infrastructure (Utilities & Amenities)
- Reservations of Land for other Public Purposes
- Reservations of Land for Housing for Urban Poor
- Transport Planning
- Development Control Regulations (DCRs)

2. Town Planning Scheme (TP)

- It is an effective instrument for implementation of Master plan
- It is whole to part- Master plan is Macro level and Town planning schemes is a Micro level planning
- Land Reconstitution- Large chunk of land can be acquired for public purpose through reconstitution of land
- neighbourhood Level Road Network
- Local Level Infrastructure Implementation
- Costs are distributed; all owners loose same proportion of land; Benefits are shared
- Public inputs are sought; grievances are redressed

Before TP Scheme

After TP Scheme

12.6.3.1 Public- Private Partnership for Road Infrastructure Development – Ahmedabad

Sardar Patel ring road in Ahmedabad demonstrates how PPP models can be used effectively for city Infrastructure development. AUDA has managed to implement a project of such large scale in a brief period of time and set an example for other Development Authorities and ULBs to replicate this success story. Ahmedabad Urban development Authority (AUDA) has developed BOT model to carry out Phase-II development of Ring road.

Private Sector was involved for all technical inputs from initial stage of the project including Planning, technical and financial feasibility studies, surveys, detailed design, construction, supervision and construction quality control to achieve efficiency.

Private participation was involved for following work:

- Junction development
- Plantation along the road
- Toll tax collection
- Signage development

BOT Model use for Ring road:

BOT model shows an integrated partnership between AUDA and the private party, enabling AUDA to transfer responsibility of design, procurement, construction, operation and maintenance of the road and its facilities to the private party.

The private company generates revenue by collecting fees in the form of toll tax from people using the ring road during the operation and maintenance period.

Key Learning's:

- A participatory approach results in creation of urban infrastructure in a rapid and efficient manner.
- Professional approach to planning and implementation of infrastructure projects.
- Land development through TP scheme leads to an equitable and easy mechanism to acquire land for infrastructure project.

12.6.3.2 Public- Private Partnership (PPP) For Affordable Housing- Rajasthan

Public private Partnership (PPP) is merging as an efficient model for delivery of services across various sectors. The concept of PPP in housing sector has evolved widely in order to meet large demand of housing.

PPP approach allows state agencies to overcome resource deficit, improve cost recovery and increase supply of houses based on demand. The public sector owns controls and regulates the use of land which is the most valuable resource for any housing project.

New Initiatives was launched under the affordable Housing Policy, 2009 for using PPP model in Rajasthan. Different PPP models were adopted for meeting the emerging housing demand.

Model: 1 Mandatory Provision

- Private developers to reserve 15% of the dwelling units or 5% of the residential area whichever is higher to be used for EWS/LIG housing in each of their township/Group Housing schemes

Model: 2 Private Developers on Private Land

- Developer to construct G+3 EWS / LIG flats on 25-40% land owned by him
- These flats should be handed over to Govt. at pre-determined price
- Developer gets additional FAR, twice the permissible limit on entire plot
- Additional FAR can be utilised on remaining plot area or exchanged for TDR
- Waiver of EDC, Plan approval fees, Conversion charges; lower stamp duty

Model: 3 Private Developers on Acquired Land

- Selected developer can take up construction of EWS/LIG/MIG-A flats on the land
- acquired by ULBs
- Land would be made available to developer on payment of compensation
- (Land acquisition cost + 10% Administration charges)

Model: 4 Private Developers on Government Land

- Government land to be offered free of cost to the developer to be selected through an open bidding process
- Developer offering maximum number of EWS/LIG flats, free of cost to the ULB would be awarded the project. At least 50% houses should be of EWS category
- Developer shall be free to use the remaining land as per his choice for residential purpose with 10% of commercial use.

Various incentives to Developers are as follows:

- FAR- Double the permissible Floor Area Ratio
- Complete waiver of external Development Charges, Building Plan Approval Fees, Conversion charges & reduction in stamp duty
- Commercial use upto 10% of plot area
- Fast track approval of the project within 30 days
- Buy back of flats by nodal agency of the government at predetermined prices

Key Learning's:

- Shortage of affordable housing is emerging as a major challenge for the government, which can be tackled through a series of measures and policy guidelines
- Joint approach brings together the technical and managerial expertise of the private sector with the accountability and fair pricing of the public sector to improve the housing delivery.

12.7 RECOMMENDATIONS & PLANNING POLICY

12.7.1 IMPORTANCE OF PLANNING POLICY GUIDELINES

It is necessary to create an appropriate policy framework for transfer of Government Land to Development Authorities, allotment of land and properties by Development Authorities, establishment of Master Plan Infrastructure Development Fund and institutional mechanism required for implementation of Master Plan proposals and regulatory framework in an effective and efficient manner.

Master Plan of a city and surrounding areas is usually the guiding force for Urbanization. In context of Dibrugarh, it is the DMP, the statutory document for guiding the process of Urbanization of larger urban areas. The DMP creates a long-term vision for development of a city and peripheral areas and provides frame work for organized Urban Development.

The present system of implementation of DMP lacks coordination and an integrated mechanism, which has thrown up following challenges. Firstly, the process of Urbanization requires vacant lands, both government and private, to be developed for the purpose of urban settlements through the process of land assembly and planning. This process should be equitable, effective, and efficient and time bound. In absence of Policy tools like Transferable Development Rights (TDRs), land pooling mechanisms etc., optimum results could not been achieved. Secondly, to roll out all projects contained in DMP, mobilization of financial resources at unprecedented level is required. Successful DMP implementation will require seamless coordination between land allotment, assembly, management, planning and development activities. the task of building and expanding a city to the projected population will require involvement of multiple stakeholders including various departments of Government; therefore, same requires an effective Institutional Mechanism for steering and guiding the process. The challenge of environmentally sustainable and climate proofing of the development needs to be addressed by developing regulatory mechanisms for protection of waterbodies, canals, river, Sustainable Urban Transport strategies through Transit Oriented Development etc.

12.7.2 GENERAL ISSUES ASSOCIATED WITH INDIAN CITIES RELATED TO PLANNING POLICY

The growth of India's urban population has not been accompanied with proportionate increases in urban infrastructure and service delivery capabilities. Cities in India face a range of challenges to meet demand and supply gaps in urban regions, in such areas as water, waste management, energy, mobility, the built environment, education, healthcare and safety. The challenges may exacerbate further if timely and adequate action is not taken. The concept of a planned urban administration is yet to be addressed in India's cities and severe supply and demand gaps are driving cities towards a planned approach to tackle urbanization. Piecemeal efforts have been made but they lack the thrust to address mega issues. Urban India faces challenges across sectors, with some requiring immediate attention and others requiring long-term action.

Rapid urbanization in India has led to increased demands for providing state-of-art infrastructure in Urban Local Bodies (ULBs) and the ULBs are continually looking for new sources of funds in order to meet the requirements of creating and upgrading infrastructure. ULBs have to play a crucial role in implementing the urban rejuvenation programmes, but they lack the resources to execute the programmes. Inadequate institutional capacity, inadequate revenues, a lack of collaboration between multiple planning and administration bodies lead to improper implementation of planning policies. Such issues for are described below

Poor collaboration among Planning and Administrative Bodies

The urban governance structure is fragmented in India. At one end of the spectrum lie such cities as Ahmedabad, in which the ULB provides all services, and at the other end are cities such as Bangalore, in

which over 10 agencies are involved in providing urban services. Agencies involved in the planning and administration include ULBs, parastatals, state government agencies and development authorities, among others. With each agency under a different leader, the goals of the agencies are often unaligned, which leads the city to operate in siloes.

Insufficient Capacity

The institutional challenges create a vicious cycle. The inadequate resources coupled with a poor governance structure and archaic processes result in inadequate and low-quality service delivery. Such service delivery attracts lower user charges and compliance that further degrades urban governance and finance.

Inadequate Revenue Base

The ULBs are thus constrained in the absence of funding sources for urban development projects. The major source of revenue for urban local governments are property taxes and user charges but low charge out rates and poor compliance in the payment of charges and taxes have led to financial dependence on the state government.

With declining sources of revenue, local governments must seek funds from the state governments even to fund operational expenses such as the salaries of employees.

Promoting Public-Private Policy Frameworks

PPPs for urban development have had mixed results in India. Urban rejuvenation programmes have encouraged private-sector participation but the following issues must be resolved to attract the best firms:

- Project funding is a challenge with low user charges and insufficient other value capture mechanisms. Although ULBs are not financially independent, they must make projects financially viable through adequate funding mechanisms.
- The sharing of risks in public-private partnership projects has often been suboptimal with revenue risk often passed on to the private sector.
- Government agencies have limited capacity to perform the preparatory work required to develop projects appropriately. The lack of time to ensure good-quality project development could result in reduced private sector interest, mispricing, cost escalation or delays in execution.
- Outstanding and delayed payments to the private sector have resulted in a loss of confidence, aggravated by long-standing disputes.

12.7.3 APPROACH ADOPTED TO DERIVE PLANNING POLICY

To derive the planning policy, certain approach was adopted. The first step was to collect the primary data and secondary data for the planning area. For obtaining Primary data, Household survey as well as Transportation survey was conducted. Apart from these, interaction with government officials, institutions, NGOs, various stakeholders were held to understand strengths, weaknesses, opportunities and threats for the planning area. Secondary data for Demography, Environment, Heritage, Tourism, Economic base, Physical Infrastructure, Social Infrastructure, Housing, Traffic & Transportation etc. were collected from various government departments. The satellite imagery was procured from NRSC, Hyderabad to generate scientific base map. Village wise cadastral maps, Town Survey Sheets, FMB sketches were also procured to be the part of seamless base map. Existing land Use survey was conducted to earmark accurate existing land use on base map.

Simultaneously, analysis for demography, economy, Physical Infrastructure including water supply, sewage, solid waste management and drainage, Social Infrastructure including education, health, recreation,

government organisation etc., Heritage & Tourism, Traffic & Transportation, Housing, Environment were carried out. Considering the population growth in the study region, village level analysis was done to understand the urbanisation pattern. Last four decades for the villages were analysed along with availability of physical as well as social infrastructure. All the existing available infrastructure facilities based on primary and secondary survey were analysed. After thorough analysis and clear understanding, the policies proposed by Government of India were also studied and incorporated according to the study region.

After analysing village level situation of planning area, consulting various stakeholders, options and strategies for planning area are derived. Growth Centres, Growth Points and Transit nodes were identified based on the analysis carried out to give the proposal for future development. Based on the Growth Centres, Growth Points and Transit nodes, circulation pattern of the planning area is proposed with proper hierarchy of roads. The land use based proposals are given at three levels such as overall Dibrugarh planning area, conurbation area and rural area. Various government projects such as AMRUT, CIDF (City Infrastructure Development Fund) are incorporated in the proposal of DMP 2045.

By looking into the issues for implementing planning policy for Dibrugarh such as multiple disciplinaries for development works, lack of proper coordination among government departments etc., the planning policy for implementation of Traffic & Transportation proposals, Proposals of Public & Semi Public uses, proposals of Environment preservation, to develop affordable housing in planning area, for heritage conservation and for various development projects are derived.

12.7.4 PLANNING POLICY

12.7.4.1 Planning Policy for implementation of Traffic & Transportation Proposals

To derive the planning policy for implementation of traffic & transportation proposals, issues of this sector should be kept in to consideration. Key issues found across the planning area are not upto the mark designed intersections, lack of road hierarchy, absences of dedicated sufficient parking space around key institutions & nodes, bottlenecks along major roads and pedestrian traffic conflict issues.

By looking into the future demand for the roads for the projected population, the roads proposed for widening are proposed in such a way that it minimizes disturbances to the surrounding plot owners. The road widening is proposed within the DMB with maximum possible manner. The new linkages are proposed wherever the missing links are identified. It is also proposed in such a manner that it does not disturb surrounding settlement. The proposals for road widening and new linkages are described in detail in chapter 7.13. Peripheral outer ring road and missing link roads are proposed to connect the different enclaves to avoid the haphazard traffic flow of Dibrugarh region. These proposed roads are identified and studied extensively on the ground, analyzed and verified such that the maximum length of the roads falls under the jurisdiction of Government of Dibrugarh. To enhance the orderly growth through the transportation network system TOD concepts is also applied to have the sustainable development in the study region. Proposals of Public Transportation, Transit nodes, road widening proposals, proposal for new linkages are derived after Transport study. Parking locations are identified in DMB area to manage the traffic congestion within core area.

The other proposals of Traffic & Transportation sector such as transit nodes should be implemented through Land acquisition under the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (LARR). The proposals of road widening, new linkages and parking are to be implemented through the said act.

12.7.4.2 Planning Policy for implementation of Public & Semi-Public uses

To derive the planning policy for implementation of proposals of Public & Semi Public uses, issues of this sector should be kept in to consideration. Looking in to the broader level, Dibrugarh Planning Area is having sufficient educational and healthcare facilities. Dibrugarh University, Assam Medical College and Hospital, DHS Kanoi College,ITI Dibrugarh, S.D Sahewalla Memorial School of Nursing and Gyan Vigyan Acedemy etc. are very renowned institutions of District level existing in Dibrugarh. The villages of the planning area are also having sufficient health and educational facilities. For the future requirement of the projected population, Public & Semi Public land uses are proposed in planning area.

The Public & Semi Public land uses are proposed on Government Land for easy implementation of public services. This will minimize the hurdles faced during land transaction. As Public & Semi Public land uses are proposed on Government Land, it will be executed at a faster rate. For proposals earmarked over private land, concerned authority such as Education Department, Health Department, PWD, Police Department, Fire Department etc. can take the land on lease and develop it for the public purpose.

12.7.4.3 Planning Policy for implementation of Environmental proposals

To derive the planning policy for implementation of environmental proposals, issues of this sector should be kept in to consideration. From the Existing Land use survey, it was observed that the Water bodies of planning area are deteriorating due to various reasons like encroachments around water bodies, solid waste dumping, disposal of untreated wastewater etc. Brahmaputra, Sessa and Burhi Dihing river are some of the important waterbodies which supports for the drinking and agricultural purposes in the system. But due to the rapid urbanization and pressure on the real estate, it is also observed that there is disturbance in the interconnectivity of channels which leads to the deterioration of the waterbodies. Apart from this, the natural drainage pattern of the town is disturbed by anthropogenic activities viz. encroachment on the drains/waterbodies, dumping of solid waste, disposal of untreated wastewater etc in DTP Drain, Chenglijan and Rajabheta Drain. As a result, various issues arise, like flooding, drying of water bodies, water logging etc. These issues can be addressed by providing buffer area on both the sides of the canals. This buffer area would also help us to maintain the canals without any hindrances. Apart from this, due to rapid urbanization, land under agricultural activities are decreasing. Decline in land under agriculture is to be controlled in such areas of the planning area.

Hence, the buffers are proposed around water bodies within conurbation area and outside conurbation area. Canals and rivers are also proposed to be protected with conservation buffers. Such buffers are mentioned below:

Table 232 Proposed buffer around waterbody

Sr. No.	Particulars	Proposed Buffer
1.	Cheglijan Drain	20m
2.	Maijan Lake	20m
3.	Burhi Dihing River	30m
4.	Sessa River	50m
5.	Brahmaputra River	50m

There is a lack of green spaces/recreational area in the planning area. Thus, after the detail study the city level and neighbourhood level parks/playgrounds are proposed. Bhurbhuri Gaon 3 and Timona Gaon are known as the Rice bowl of the planning area. Hence, it is imperative to preserve this rich and fertile agricultural land. This area is preserved by declaring dedicated agriculture zone under DMP – 2045 and Regulated Development will be allowed in certain parts of this area. Untreated wastewater/industrial effluent

should not be allowed to discharge in any natural drains/waterbodies. Underground sewerage network has to be provided with adequate sewage treatment facilities.

The land belongs to such buffer area should be developed under strict regulations. Strict monitoring for the implementation of buffer area should be followed. Regulated development with special permission from DDA will be allowed in such buffer areas. Existing structures in the buffer areas shall remain as it is. Permission for redevelopment on site of existing structures or renewation may be obtained from DDA. Permission for any new development may be obtained from DDA in consultation with T&CPD, Dibrugarh.

12.7.4.4 Planning Policy for implementation of Affordable Housing in planning area

Owning a house is considered a big issue in today's societies. As such, an exact measure of housing affordability is essential to ensure the need for shelter. Housing is the basic human needs; it is also one of the most important components of urban economic development in any country. In addition, the socioeconomic stability of a country is always depending on the housing affordability of the country. For this reason, housing is a valuable asset that always has a great impact on societal wellbeing. Housing affordability became greater focus in every society; and the affordability problem with regard to housing market is one of the most controversial issues within most developed and developing countries.

It is observed that the price of all kind of housing have been increasing exorbitantly, which indicate that the investment in housing sector is unable to match pace with the increasing demand for housing. Given the importance of housing, there are several issues which need to be tackled to promote the provision of this basic need in Dibrugarh. Rapid urbanization and rural to urban migration has led to a substantial shortage of housing in the region. The direct result of this is the concentration of informal settlements in the city. Given that the shortage in housing is concentrated at the bottom of the pyramid, the sector can play an important role in the socio-economic development.

Moreover, with the rapid urbanization and significant increase in the housing demand, housing sector is considered to be the Engine of immense potential giving a push to the economy because of its link with the employment generation and livelihood. Therefore, provision of housing can make a significant difference in income of families, both in rural and urban areas.

Public Housing in Singapore – a successful model

Today, more than 80% of Singapore's population is living in public flats, with 93% of them owning their flats. Because of this, the public housing model of Singapore is considered as one of the most successful examples of affordable housing models in the world. The Housing and Development Board (HDB) is Singapore's public housing authority and a statutory board under the Ministry of National Development. As Singapore's sole housing agency, the HDB is unique in its organizational structure, function, and approach to housing. It operates like a single, comprehensive source for housing development and coordinates planning, land acquisition, construction, financing, and policy for housing in Singapore. By centralizing its public housing effort, Singapore has avoided the problems of government silos and fragmentation of duties that are associated with multi-agency implementation.

The unique aspect of Singapore's housing model is that emphasis is on ownership rather than rental. Affordability is ensured through a set of modalities, including the provision of different unit sizes, progressive mortgage payments (based on income levels), low interest rates and government subsidies. For example, government subsidizes low-income groups and first-time buyers for buying houses. Till date, HDB has developed more than 900,000 flats in Singapore, which have been given to Singaporeans.

Housing for All by 2022 – A National Mission

In June 2015, the Union Cabinet chaired by the Prime Minister gave its approval to the "Housing for All by 2022" - National Mission for Urban Housing to address the issue of affordable housing in urban areas. National Urban Housing Mission seeks to meet the gap in urban housing units by 2022 through increased private sector participation and active involvement of the States. It has four broad components or verticals out of which credit linked subsidy would be implemented as a Central Sector Scheme and not a Centrally Sponsored Scheme.

a) Slum rehabilitation of Slum Dwellers with participation of private developers using land as a resource - The Centre would provide a grant of INR 1 lakh per house to the state for deployment in the development of any slum rehabilitation project

b) Promotion of affordable housing for weaker section through credit linked subsidy - An interest subsidy of 6.5% on housing loans will be provided to EWS/LIG categories, which can be availed upto a tenure of 15 years.

c) Affordable housing in partnership with Public & Private sectors - Central assistance at the rate of INR 1.5 lakh per house for the EWS category will be provided.

d) Subsidy for beneficiary-led individual house construction or enhancement- Central assistance at the rate of INR 1.5 lakh per house for the EWS category will be provided

12.7.4.5 Planning Policy for Heritage conservation

The heritage buildings in the core city area are being converted in to modern style building which lead them to loss of heritage value of the French rule. These buildings must be preserved as it is as they are with the great heritage importance. The heritage conservation in Core city area can be done through Transfer of Development Rights (TDRs). TDRs are given for preservation of heritage landmark buildings and is a way to compensate the property owners for loss in revenue on their properties. Transfer of Development Rights (TDR) is a zoning technique used to permanently protect cultural resources by redirecting development that would otherwise occur on these resource lands to areas planned to accommodate growth and development.

Transfer of Development Rights programs enable landowners within cultural resource areas to be financially compensated for choosing not to develop some or all of their lands. These landowners are given an option under municipal zoning to legally sever the "development rights" from their land and sell these rights to another landowner or a real estate developer for use at another location.

The land from which the development rights have been severed is permanently protected through a conservation easement or other appropriate form of restrictive covenant, and the development value of the land where the transferred development rights are applied is enhanced by allowing for new or special uses, greater density or intensity, or other regulatory flexibility that zoning without the TDR option would not have permitted.

Establishing a TDR program involves the following basic steps:

- Establish the TDR option and administrative provisions. Use of TDRs must be established as a voluntary option.
- Establish the area of high resource conservation value
- Determine the number of TDRs allocated to each landowner within the high resource conservation area (usually a simple mathematical formula – e.g., one TDR for every five (5) acres)
- Establish the procedure for severance of TDRs

- Provision of the use of a Deed of Transferable Development Rights document
- Establish the procedure for conservation of heritage buildings
- Establish the receiving area (area or areas planned to accommodate growth). Potential receiving areas can be residential, commercial, industrial, or institutional in character, or any combination thereof.

12.7.4.6 Framework for application of Value Capture Finance (VCF) methods to projects

VCF seeks to enable States and city governments raise resources by tapping a share of increase in value of land and other properties like buildings resulting from public investments and policy initiatives, in the identified area of influence.

The different instruments of VCF are; Land Value Tax, Fee for changing land use, Betterment levy, Development charges, Transfer of Development Rights, Premium on relaxation of Floor Space Index and Floor Area Ratio, Vacant Land Tax, Tax Increment Financing, Zoning relaxation for land acquisition and Land Pooling System.

Some Indian cities through state urban regulations have been developing and exercising some of VCF mechanisms – The Mumbai Metropolitan Region Development Authority (MMRDA) and City and Industrial Development Corporation Limited (CIDCO) have used different Value Capture methods including Betterment levy to finance infrastructure development in the urbanizing areas. Tamilnadu and Maharashtra have made Land Value Tax applicable to urban areas too under which increase in land value is tapped through increased revenue tax. West Bengal has formulated a system to capture gains from land use conversion. Area based Development charges are being resorted to in Andhra Pradesh, Gujarat, Maharashtra, Tamilnadu and Madhya Pradesh. Karnataka, Gujarat and Maharashtra have made enabling provisions for enabling Transfer of Development Rights to buy additional FSI/FAR.

Value Capture Methods

- **Land Value tax** – considered the most ideal value capture tool which apart from capturing any value increment, helps stabilize property price, discourage speculative investments and is considered to be most efficient among all value capture methods. Maharashtra and Tamilnadu, through state laws have expanded the scope of this mechanism to cover urban land also. Globally, land value tax is widely used in Denmark, Australia and New Zealand.
- **Fees for changing Land use (agriculture to non-agriculture)** – land revenue codes provide for procedures to obtain permission for conversion of land use from agriculture to nonagricultural use.
- **Betterment levy** – one-time upfront charge on the land value gain caused by public infrastructure investment.
- Impact fees are the fees levied from the owners with illegal construction to get them converted into authorized development.
- **Vacant Land Tax (VLT)** — applicable on those landowners who have not yet initiated construction on their lands. In Andhra Pradesh, the Greater Hyderabad Municipal Corporation (GHMC) imposes a tax of 0.5% of the registration value of the land if not used exclusively for agriculture purpose or is vacant without a building.
- **Tax Increment Financing (TIF)** — one of the most popular Value Capture tools in many developed countries, especially the United States. In TIF, the incremental revenues from future increases in property tax or a surcharge on the existing property tax rate is ring-fenced for a defined period to finance some new investment in the designated area. Tax Increment Financing tools are especially useful to finance new investments in existing habitations. Some of the Smart City Proposals have planned for TIF in their

area-based developments (ABD).

- **Land pooling System (LPS)** — a form of land procurement where all land parcels in an area are pooled, converted into a layout, infrastructure developed, and a share of the land, in proportion to original ownership, returned as reconstituted parcels. In India, States such as Gujarat and Haryana have used land assembly programs where the owners agree to exchange their barren lands for infrastructure-serviced smaller plots. Gujarat has used these tools to guide the development of Ahmedabad city and its surrounding infrastructure.

Framework for application of VCF methods to projects

Project initiation - At the time of initiation of the project the rules and regulations governing Value Capture in the Union Territoty need to be studied and possibilities.

Planning - The area of influence of the project will be the area in which land and property values are expected to increase due to project location. The starting point is the value impact assessment in the area of influence, which should form a part of the Detailed Project Report (DPR). Next, stakeholders who will benefit from the setting up of the project will have to be identified and consultations held with them right from the stage of project initiation.

Design and Strategy - The Value Capture methods for funding project need to be identified and these methods have to be put in place by the State Governments. This will include the type and number of VCF tools to be applied, methods of assessing, levying and collecting the incremental value generated, time period during which the VCF tools will be in operation, etc.

Execution and Operation - The value capture method for the project should be implemented and an efficient mechanism for monitoring of fund management put in place. Regular monitoring and evaluation of the project progress will have to be established and put in the public domain. Figure below gives the details of the steps to be taken by the Central/State Governments and their agencies at the time of doing projectfeasibilitystudies.

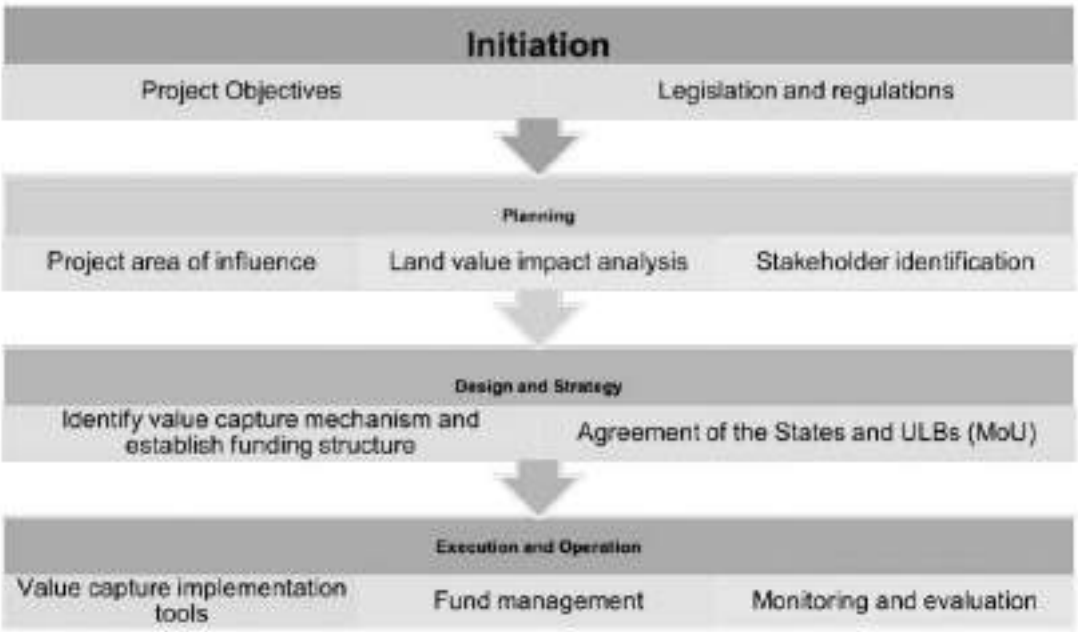


Figure 1&9 Steps required for Project based VCF policy framework

12.8 URBAN DESIGN GUIDELINES

Urban design is the discipline through which planning and architecture can create or renew a sense of local pride and identity. It has great potential for enhancing the visual image and quality of Neighbourhoods by providing a three-dimensional physical form to policies described in a omprehensive plan. Urban design is process of giving shape to built environment which may address group of buildings of specific character, important streets public spaces etc. This will make urban areas functional, more attractive and sustainable. It focuses on design of the public realm, which is created by both public spaces and the buildings that define them. Urban design is done at various scales viz. at macro scale of urban structure in terms of planning/ zoning, transportation and infrastructure networks to the micro scale in terms of street furniture, lighting etc. This section deals with urban design guidelines or certain important areas viz. core area of city, areas with environmental significance, special heritage areas etc. These guidelines direct the process of revitalization, planning, design and management of such areas.

12.8.1 KEY CONSIDERATIONS FOR ENTIRE DMPA 2045

Few considerations are stated below which are essential to arrive at a basis for formulating Urban Design guidelines for urban fabric:

Design Places for People: To make urban places more functional and acceptable these places must be safe, comfortable, vibrant, varied attractive and distinctive.

Design to Enrich Existing context: To enrich qualities and context of existing urban places. This means encouraging a distinctive response that arises from and complements its setting and applies at every scale region, city, town, neighbourhood and street.

Design to enhance accessibility: To make places easily accessible and which are well integrated physically and visually with its surroundings.

Work with Landscape: Design should be such as to strike a balance between natural and manmade environment and utilize each intrinsic resource and character viz. climate, landform, landscape and ecology

Design with Usage of Mixed Forms: Stimulating, enjoyable and convenient places meet a variety of demands from the widest possible range of users and social groups. The design element should weave together different building forms, uses and densities.

Economic Viability: For projects to be, developable and well cared for, they must be economically viable, well managed and maintained. This means understanding the market considerations of developers, ensuring long-term commitment from the community and the local authority, defining appropriate delivery mechanisms and seeing this as part of the design process.

Design for Change: Design needs to be flexible enough to respond and adapt to future changes in use, lifestyle and demography. This means designing for energy and resource efficiency; creating flexibility in the use of property, public spaces and the service infrastructure and introducing new approaches to transportation, traffic management and parking.

12.8.1.1 Vision

To guide physical development towards a desired scale and character that is consistent with the social, economic and aesthetic values of the City.

12.8.1.2 Urban Design Objectives

- To ensure that new development makes a positive contribution to sustainability and the urban fabric
- To enhance and protect the landscape qualities
- To enrich the distinct topographic and landscape qualities and characteristics of the town
- To ensure that all development responds positively to the existing patterns of urban form and character, the landscape qualities, historic and cultural elements and social dimensions and aspirations of the town.
- To reinforce the structure and image of the town as an attractive place to live, do business, recreate and as a tourist attraction.
- To ensure that the declared arterial network of transport and movement corridors makes a positive contribution to town's image.

12.8.1.3 Components of Urban Design

The following aspects need to be considered to arrive at the basis for policies affecting the urban fabric:

- Areas of significance in built environment.
- Visual integration of the city.
- Policy for tall buildings.
- Policy on unhindered access movement, parking and pedestrian realm.
- Policy on Hoardings, Street furniture and Signage.
- Urban Design Scheme.
- Policy for design of pedestrian realm.
- City structure plan and Urban Design objective.
- Policy for conservation of Heritage Precincts Buildings and Zones.

12.8.1.4 Significant Areas of Built Environment

In DMP, following significant areas are identified that needs special urban design consideration.

- New Housing/ neighbourhood development
- Waterfront Development – Brahmaputra River
- Heritage Development
- City Gateways
- Streetscapes

New Housing Schemes/ NEIGHBOURHOOD Development

Built Character:

Group Housing is a cluster or group of attached homes around common lawns, gardens, or play areas. Such areas should provide residents with both private and common outdoor spaces. These common spaces can also foster social interaction amongst residents, between residents of Group Housing. This should be designed to maintain a sense of privacy yet to allow for interaction between neighbors. Yards and entry courtyards when abutting a street or common space should be separated through physical elements such as open or low fencing, screens, and low hedges or walls.

If pocket park areas are provided, they should reflect character of neighbourhood and contain elements such as lawn, children's play areas etc. When a Group Housing area is enclosed by neighbourhood scale streets, multiple perimeter or street corner gardens may connect multifamily residents with the surrounding neighbourhood better than internalized common space. If feasible these common spaces should be easily observable from unit windows. These common spaces share common area supervision responsibilities among a close-knit group of neighbors.

Category of Development

High rise low density The category is defined by the development where there is more of a marginal space between highrise buildings in form of pedestrianisation, recreational spaces, buffers etc. This kind of development shall be reviewed as Low density because per person to space ratio comparatively is higher.

High rise High density The category is defined by the development where there is a little marginal space between high-rise buildings. This kind of development shall be reviewed as high density because per person to space ratio is comparatively lower.

Low rise low density The category is defined by the development where there is more marginal space between low-rise buildings. This kind of development shall be reviewed as Low density because per person to space ratio is comparatively high.

Low rise High Density The category is defined by the development where there is a little marginal space between low-rise buildings. This kind of development shall be reviewed as high density because per person to space ratio is comparatively low.

Following needs to be encouraged:

- For new Residential Development create edge or boundary conditions in neighbourhood for creating a sense of enclosure
- Buildings along the street compatible with other neighbourhood types in the immediate vicinity.
- Buildings which harmonize with the surrounding neighbourhood.
- Parking areas removed from primary pedestrian zones.
- Cluster of houses around a common open space with appropriate landscaping. Following needs to be discouraged:
- Buildings that don't relate physically or visually to adjacent shared spaces.

Circulation

The vehicular circulation system generally includes internal circulation drives with parking areas. Important streets should be enhanced with streetscapes and sidewalks. The experience of moving on these roads can be enhanced through use of various elements such as street lighting, roadside plantation, and development of important Junctions etc. Pedestrian circulation should be promoted through provision of walkways and direct connections to adjacent streets.

- For important routes being used by Tourists, devices such as information kiosks, directional signs and maps can be used to help tourists easily locate their destinations.
- For major roads, individual road solutions shall be given to complement abutting land uses with controlled densities, roadside plantation etc.
- Neighbourhood streets should be designed to provide safe and convenient access for vehicles and pedestrians and to relate to the type of neighbourhood and uses through which the streets travel. They

should provide safe and attractive designs including composition of street landscaping with sidewalks/ paths. neighbourhood streets can provide a visual experience and lower the speed of local traffic by aligning with a neighbourhood focal point such as a park, a fountain or a sculpture.

- Street patterns should interconnect and encourage easy access from one neighbourhood to another & also discourage high speed travel. Individual streets should maintain adequate travel ways for emergency and service vehicle access.

Following needs to be encouraged:

- Destination assistance devices such as information kiosks, and directional signs for tourists.
- Roads relating to a neighbourhood focal point such as a street passing by a pocket park, terminating at a vista point, or interrupted by a fountain.
- Visual screening of parking areas.
- Contiguous pedestrian routes.
- Interconnected but low speed neighbourhood streets.
- Landscaping in the right of way that relates to the adjacent uses.
- Perimeter road patterns compatible with the adjacent neighbourhood street system.
- Low speed traffic techniques such as intersection at focal points.

Following needs to be discouraged:

- Parking areas located between buildings and pedestrian oriented streets.
- Pedestrian circulation patterns that discourage walking to neighbors or community destinations.
- Random curvilinear streets.

Landscaping

Landscaping should be used to soften the mass of buildings and to provide usable common space for residents. The use of elements such as evergreen groundcover and small shrubs around common spaces can add variety and delineate boundaries while allowing for surveillance. When hard surfaces are predominant feature, visual relief and interest can be provided through use of plantations such as plants with flowers and special interest plants. Common park space should be located so that it is visible to residents and accommodate a variety of activities for differing age groups.

Following needs to be encouraged:

- Trees that provide year-round visual interest such as evergreen groundcover & hardy landscaping plantings.
- Landscaping solutions such as parks/gardens in large open areas which add depth and space.
- Elements such as low walls, fences, screens, or hedges to delineate outdoor spaces.
- Adequate use of garden lighting to accentuate landscaping and pathways in the evening.
- An uninterrupted flow of landscaping between buildings and the streets by placing elements
- Abutting streets, trails or common spaces fence styles, such as low or open fences that encourage interaction between private and public spaces.

- Paving solutions for driveways and public walkways that complement the architectural and landscape character of the area such as stone, masonry or concrete.
- Following needs to be discouraged:
- High walls and solid fences adjacent to pathways or shared open space.

12.8.1.5 Water Front Development

There is scope for development of Brahmaputra and Burhi Dihing waterbody using urban design tool, the existing image of these areas can be transferred into a new livable and environmental friendly image. While developing areas near water bodies the following urban design guidelines needs to be considered.

- Development around and adjacent to water bodies in Dibrugarh should be taken up in a sensitive manner.
- Integrated development on lakefronts with the natural environment to preserve and enhance views, and protect areas of natural drainage.
- Minimise grading to maintain the natural topography, while contouring any landform alterations to blend into the natural terrain.
- Screen development adjacent to natural features as appropriate so that development does not appear visually intrusive, or interfere with the experience within the open space system. The provision of enhanced landscaping adjacent to natural features could be used to soften the appearance of or buffer development from the natural features.
- Use building and landscape materials that blend with and do not create visual or other conflicts with the natural environment
- Design and site buildings to permit visual and physical access to the natural features from the public right-of-way.
- Encourage location of entrances and windows in development adjacent to open space to overlook the natural features.
- Protect views from public roadways and parklands to natural canyon, resource areas, and scenic vistas.
- Preserve views and view corridors along and/or into waterfront areas from the public right-ofway by decreasing the heights of buildings
- Provide public pedestrian, bicycle, and equestrian access paths to scenic view points, parklands, and where consistent with resource protection, in natural resource open space areas.
- Provide special consideration to the sensitive environmental design of roadways that traverse natural open space systems to ensure an integrated aesthetic design that respects open space resources. This could include the use of alternative materials such as "quiet pavement" in noise sensitive locations, and bridge or roadway designs that respect the natural environment.
- Special considerations should be given to the appropriate scale, height and disposition of building blocks along the waterfront to avoid blockage of sea/land breezes and prevailing winds.

12.8.1.6 Public Spaces

Public spaces include public plazas, squares or other gathering spaces in each neighbourhood center. neighbourhood centre is a geographically localised community within a larger city, where members of a community tend to gather for group activities, social support, public information, and other purposes. They may sometimes be open for the whole community or for a specialized group within the greater community.

District centers, commercial areas, Public/ Semipublic and Recreational Areas in Master Plan demands Proper Campus Planning and care to maintain the protocol of the city.

Organised Informal Market/Food Plazas

To stop encroachment of all types of Informal markets, Master Plan have provided organized spaces for informal markets, hawkers, handicraft shops etc. these markets will be majorly located in District Centers and Core areas.

The informal and organized sector is a major source of employment in the economic fabric of the city for which the following approach is proposed:

- Earmarking of 'Hawking' and 'No Hawking' Zones at neighbourhood and cluster levels.
- The weekly markets to be identified and planned / developed.
- New areas for informal trade to be developed and integrated with housing, commercial, institutional and industrial areas.
- Provision of common basic services like toilets, water points, etc.
- Institutionalizing designs of stalls, push-carts and mobile vans.
- Design outdoor open areas as "outdoor rooms," developing a hierarchy of usable spaces that create a sense of enclosure using landscape, paving, walls, lighting, and structures.
- Design such markets/ haats to accommodate a variety of artistic, social, cultural, and recreational opportunities including civic gatherings such as festivals, markets, performances, and exhibits.
- Consider artistic, cultural, and social activities unique to the neighbourhood and designed for varying age groups that can be incorporated into the space.
- Use landscape, hardscape, and public art to improve the quality of markets/ haats.
- Encourage the active management and programming of these markets.
- Design outdoor spaces to allow for both shade and the penetration of sunlight.
- Frame parks and plazas with buildings which visually contain and provide natural surveillance into the open space.
- Involvement of NGOs envisaged.
- Address maintenance and programming.

12.8.1.7 City Gateways

Road:

- Non-residential public buildings with pleasing appearance should be located on entry corridors.
- Attractive landscape should be developed in accordance with the highway landscape norms.
- Segregation of goods and passenger vehicles at the entry point through separate lanes to improve the visual environment.
- **Rail:**
- Enhancing visual experience for commuters through appropriate landscape along railway tracks. This can be done by growing colorful plantations along railway corridors, keeping wide grazing lands, mounting flags at the entry of railway stations.
- Reconstruction / redevelopment of existing stations should be undertaken through comprehensive Urban Design schemes.
- Attractive designs should be evolved for new stations.

Air:

- Designing landmarks, nodes, edges of the city in a manner that they can be recognized outstandingly in aerial views. This can be achieved by composing and contrasting scale, color, landscape of structure and boundary with surrounding area.
- Natural and built environment should be revitalized to give an impression of global city.
- The overall green cover in this zone should be enhanced and protected.

12.8.1.8 Streetscape

Hoardings & Signage:

- Hoardings, sign boards, directional boards, bill boards, neon sign bards, balloons, banners etc. have become symbols of present day urban scape and important instruments of outdoor publicity and public information. These, if located properly and aesthetically, may enhance the visual quality of the city. Otherwise, these may cause hazards, obstruction and visual pollution etc.
- Design signage to effectively utilize sign area and complement the character of the structure and setting
- Architecturally integrate signage into design.
- Include pedestrian-oriented signs to acquaint users to various aspects of a development.
- Place signs to direct vehicular and pedestrian circulation.
- Post signs to provide directions and rules of conduct where appropriate behavior control is necessary.
- Design signs to minimize negative visual impacts.
- Address community-specific signage issues in community plans, where needed.
- A major cause for present day chaos on the roads is that the road infrastructure, signage and road markings are not in accordance to the standards laid down by the Motor Vehicle Rules and Highway Code.
- Safety of road users shall be one of the prime consideration while planning / designing of road network

and infrastructure.

- Appropriate road signage and markings are excellent means of educating road users about road safety rules and road discipline and add to the road beautification. These prevent the deviant behaviour of motorists and at the same time provide useful route related information.
- Concerned road owning agencies shall be responsible for installing the appropriate road signage and markings on regular basis.

Street Furniture:

- Public art is an important part of the urban spatial experience, which can be incorporated in the form of functional objects such as street furniture and paving designs.
- Street furniture should be designed sensitively considering the land use, intensity of activity and other identified design districts. Their design must also reflect respect to pedestrians and physically challenged people.
- Access provisions for the physically challenged should be made from the street to overcome curb heights, rain water gratings etc.
- Locate street trees in a manner that does not obstruct ground illumination from streetlights.
- Shade paved areas, especially parking lots.
- Parking spaces close to the entrance should be reserved for physically challenged.
- Exclusive parking bays are proposed near major intersections as part of road R/W with adequate landscaping to provide for parking of mobile repair vans, PCR vans, ambulances, cranes, fire tenders and other public utility vehicles.

Street Frontage:

- Create street frontages with architectural and landscape interest to provide visual appeal to the streetscape and enhance the pedestrian experience.
- Locate buildings on the site so that they reinforce street frontages.
- Relate buildings to existing and planned adjacent uses.
- Ensure that building entries are prominent, visible, and well-located.
- Maintain existing setback patterns, except where community plans call for a change to the existing pattern.
- Establish or maintain tree-lined residential and commercial streets. Neighbourhoods and commercial corridors in the town that contain tree-lined streets present a streetscape that creates a distinctive character.
- Minimize the visual impact of garages, parking and parking portals to the pedestrian and street facades.

Pedestrian Friendly City:

- Major work centres, where large number of pedestrian networks emerge and culminate, should have enhanced facilities for the pedestrians.
- This will lead to more sensitive and intricate design of street furniture, making major image able components part of daily urban experience.

- Design landscape bordering the pedestrian network with new elements, such as a new plant form or material, at a scale and intervals appropriate to the site. This is not intended to discourage a uniform street tree or landscape theme, but to add interest to the streetscape and enhance the pedestrian experience.
- Use effective lighting for vehicular traffic while not overwhelming the quality of pedestrian lighting.
- Pedestrian networks affect spaces in a very distinctive way.
- Establishment of pedestrian networks in any area reveals its vitality.
- They provide richness in terms of spatial experience and community interaction etc.

Transit Integration:

- Provide attractively designed transit stops and stations that are adjacent to active uses, recognizable by the public, and reflect desired neighbourhood character
- Design safe, attractive, accessible, lighted, and convenient pedestrian connections from transit stops and stations to building entrances and street network
- Provide generous rights-of-way for transit, transit stops or stations.
- Locate buildings along transit corridors to allow convenient and direct access to transit stops/stations.

Parking:

- Reduce the amount and visual impact of surface parking lots
- Encourage placement of parking along the rear and sides of street-oriented buildings.
- Avoid blank walls facing onto parking lots by promoting treatments that use colors, materials, landscape, selective openings or other means of creating interest.
- Design clear and attractive pedestrian portico/pathways and signs that link parking and destinations.
- Locate pedestrian pathways in areas where vehicular access is limited.
- Avoid large areas of uninterrupted parking especially adjacent to community public view sheds.
- Build multiple small parking lots in lieu of one large lot.
- Retrofit existing expansive parking lots with street trees, landscape, pedestrian paths, and new building placement.
- Promote the use of pervious surface materials to reduce runoff and infiltrate storm water.
- Use trees and other landscape to provide shade, screening, and filtering of storm water runoff in parking lots.

Utilities:

- Minimize the visual and functional impact of utility systems and equipment on streets, sidewalks, and the public realm.
- Convert overhead utility wires and poles, and overhead structures such as those associated with supplying electric, communication, community antenna television, or similar service to underground.
- Design and locate public and private utility infrastructure, such as phone, cable and communications boxes, transformers, meters, fuel ports, back-flow preventors, ventilation grilles, grease interceptors, irrigation valves, and any similar elements, to be integrated into adjacent development and as inconspicuous as

possible.

- To minimize obstructions, elements in the sidewalk and public right of way should be located in below grade vaults or building recesses that do not encroach on the right of way (to the maximum extent permitted by codes).
- If located in a landscaped setback, they should be as far from the sidewalk as possible, clustered and integrated into the landscape design, and screened from public view with plant and/or fencelike elements.
- Traffic operational features such as streetlights, traffic signals, control boxes, street signs and similar facilities should be located and consolidated on poles, to minimize clutter, improve safety, and maximize public pedestrian access, especially at intersections and sidewalk ramps. Other street utilities such as storm drains and vaults should be carefully located to afford proper placement of the vertical elements.

12.8.1.9 District Centres

A District Centre has been envisaged as a multiple service providing campus, catering to surrounding urban area. The core commercial area such as Wholesale markets, shopping complexes, office buildings, etc. shall be reviewed as a District Centre. The similar definition does not imply to the informal markets but if the informal markets are part of any above category that shall be reviewed and organized in District centre. There are few common components that should dealt through Urban Design perspective to maintain and enhance the ultimate urban character and image.

1. Landscape
2. Parking
3. Pedestrian Movement
4. Public Spaces
5. Unique Building Character

General Guidelines:

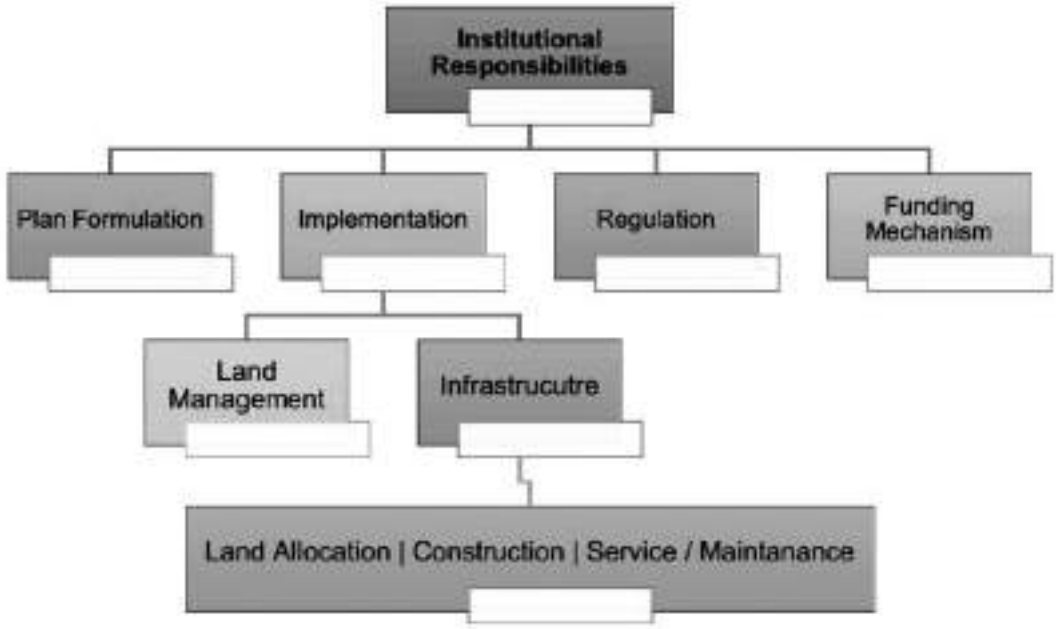
- The area provided for landscape as part of the district centre should weave through the entire district centre to create a pleasant environment.
- Detailed Urban Design and Landscape Schemes should be prepared to integrate Public Transport Terminals, safe pedestrian walkways, parking areas, recreational and cultural areas, etc.
- The envelope, FAR, architectural features of the District Center buildings should be merged with surrounding area.
- A certain percentage of open area should be made mandatory in district center design so that it can be used as recreational area, exhibition purpose or any local festivals.
- Continuity of the sidewalks should be maintained in terms of the width, surface treatment, curb cuts, tree and street furniture locations, for the pedestrians and disabled.
- A district centre should be accessible from the surrounding residential areas through the pedestrian approach or by subways etc. The intermediate public transport should be introduced to increase the mobility within the City Centre.
- An adequate parking should be provided in District Center.
- Provision of common basic services like Public toilets, water points, etc.

- Signage and lighting: for visual accessibility, district center should be provided with proper lighting system and signages. As Dibrugarh is tourist destination, signages in English as well as Hindi should be promoted.
- Use of alternative renewable sources of energy should be encouraged for new buildings (especially those of commercial or institutional nature), traffic signals and public signage, etc
- Planned district centres in city (forming a multi nodal city structure) can be best utilized for creating public spaces and through these, District Centers City will be livelier, inviting and livable.
- As per the proposal of Govt. of India, few free wi-fi zones should be provided in order to encourage the Digital India.

13 INSTITUTIONAL FRAMEWORKS

13.1 PROPOSED INSTITUTIONAL FRAMEWORK

Institutional Responsibilities contain Master Plan formulation, effective implementation, strict monitoring of following General Development Regulations and funding mechanism. For effective implementation, available land resource is to be managed very judiciously and infrastructure is to be provided along with proper maintenance from time to time. As mentioned in Chapter 12.6, it is proposed to have Dibrugarh Municipal Board (DMB) with same jurisdiction of Conurbation Area for



obtaining substantial funds from State Government as well as Central Government, which will lead to effective implementation of the Master Plan. For better implementation of Master Plan, responsibilities are to be allocated very judiciously.

The various projects identified for Dibrugarh Development Authority (DDA) and the concerned Government Departments in line with the Vision statement – 2045 for Dibrugarh Planning Area are detailed in Table below.

Table 253 Institutional Framework for Project Implementation

Sl. No.	Location	Project Name	Concerned Department
		Urban Development	
1	Core area of Dibrugarh Town	Urban Renewal of Core Old Areas of Dibrugarh Town	DMB, DDA
2	Core area of Dibrugarh Town	Development of Heritage Buildings of Dibrugarh Town	DMB, DDA
3	Distributed in Town	Rehabilitation of Slums dwellers along Brahmaputra river and on Water Bodies located in Planning Area	DMB, Housing Board
4	Dibrugarh Planning Area	Green Belt around Industrial area and Wetlands	DDA, PWRD
5	Tingkhong Gaon	Neighbourhood Centre at Ward 15 (9.3 Ha)	DDA, Housing Board, Revenue Dept,
6	Subha Chuck Gaon	Neighbourhood centre at Subha Chuck Gaon (9.26 Ha)	DDA, Housing Board, Revenue Dept,

7	No. 122 Burahajar Konwar Gaon	Neighbourhood Centre at No. 122 Burahajar Konwar Gaon (7.8 Ha)	DDA, Housing Board, Revenue Dept,
8	No. 1 Mancotta	Neighbourhood centre at No. 1 Mancotta (5.08 Ha)	DDA, Housing Board, Revenue Dept,
9	Niz Mankatta Gaon (CT)	Neighbourhood Centre at Niz Mankatta Gaon (5.31 Ha)	DMB, DDA, Housing Board, Revenue Dept,
10	Mohpowalimora Gohain Gaon (OG)	Neighbourhood centre at Mohpowalimora Gohain Gaon (7 Ha)	DDA, Housing Board, Revenue Dept,
11	Mahmaripather Gaon	Neighbourhood Centre at Mahmaripather Gaon (8 Ha)	DDA, Housing Board, Revenue Dept,
12	Lepetkata Gaon	Neighbourhood centre at Lepetkata Gaon (11.04 Ha)	DDA, Housing Board, Revenue Dept,
13	Lekai Gaon	Neighbourhood centre at Lekai Gaon (6 Ha)	DDA, Housing Board, Revenue Dept,
14	Konwar Kheroni Gaon	Neighbourhood centre at Konwar Kheroni Gaon (13.4 Ha)	DDA, Housing Board, Revenue Dept,
15	Japara Gaon	Neighbourhood centre at Japara Gaon (7 Ha)	DDA, Housing Board, Revenue Dept,
16	Hatimura Gaon	Neighbourhood centre at Hatimura Gaon (12 Ha)	DDA, Housing Board, Revenue Dept,
17	Hahchora Gaon	Neighbourhood centre at Hahchora Gaon (12 Ha)	DDA, Housing Board, Revenue Dept,
18	Ghitira Pather	Neighbourhood centre at Ghitira Pather (6 Ha)	DDA, Housing Board, Revenue Dept,
19	Dibruwal Changmai Gaon	Neighbourhood centre at Dibruwal Changmai Gaon (12.56 Ha)	DDA, Housing Board, Revenue Dept,
20	Bhurbhuri Gaon No. 3	Neighbourhood centre at Bhurbhuri Gaon No. 3 (12.11 Ha)	DDA, Housing Board, Revenue Dept,
21	Chengamari Tekela Gaon	Neighbourhood centre at Chengamari Tekela Gaon (8 Ha)	DDA, Housing Board, Revenue Dept,
22	Ward 4	Affordable Housing (2 Ha)	DMB, DDA, Housing Board, Revenue Dept,
23	Tinsukia Gaon	Affordable Housing (3 Ha)	DDA, Housing Board, Revenue Dept,
24	No. 2 Bhurbhuri Gaon	Affordable Housing (9.5 Ha)	DDA, Housing Board, Revenue Dept,
25	No. 150 Dibruwal Dihingia Gaon	Affordable Housing (21 Ha)	DDA, Housing Board, Revenue Dept,
26	No. 1 Mancotta	Affordable Housing (2 Ha)	DDA, Housing Board, Revenue Dept,
27	No 186 Binoi Gutia	Affordable Housing (11 Ha)	DDA, Housing Board, Revenue Dept,
28	Mankota 1/159 No. RR (A) pt	Affordable Housing (2 Ha)	DDA, Housing Board, Revenue Dept,
29	Mahmaripather Gaon	Affordable Housing (13 Ha)	DDA, Housing Board, Revenue Dept,
30	Jokai Region	Affordable Housing (11 Ha)	DDA, Housing Board, Revenue Dept,
31	Hatimura Gaon	Affordable Housing (3 Ha)	DDA, Housing Board, Revenue Dept,
32	Dewanberi Bengali Gaon	Affordable Housing (5 Ha)	DDA, Housing Board, Revenue Dept,
33	Chamoguri Kasari Gaon	Affordable Housing (15 Ha)	DDA, Housing Board, Revenue Dept,
		Public Semi Public Places	
34	Niz Khanikar	Administrative Block (50 ha)	DDA
35	Jalan Tea Estate, Convoy Road	International Convention Centre (ICC) (2.5 ha)	DDA
36	Boggara Gaon	District Library	DDA
		Water Supply System	
37	Dibrugarh Planning Area (DMPA)	Preparation of DPR for Water Supply System for Dibrugarh Planning Area	Water Resource Dept., PHE Dept., DMB, DDA
38	Existing Dibrugarh Town	Water Supply System sanctioned under AMRUT	Water Resource Dept., PHE Dept., DMB, DDA

39	Existing Dibrugarh Development Authority Area	Improvement of Water Supply System of Dibrugarh	Water Resource Dept., PHE Dept., DMB, DDA
40	Dibrugarh Planning Area	Hand Pump water Distribution System	Water Resource Dept., PHE Dept., DMB, DDA
		Power	**Power**
41	Existing Dibrugarh Master Plan Area	Renovation and modernization of 33/11 KV and 11 KV / 440 V sub- stations	State Electricity Board, DMB, DDA
42	Existing Dibrugarh Master Plan Area	Installation of new transformers and capacity augmentation of existing transformers	State Electricity Board, DMB, DDA
43	Existing Dibrugarh Master Plan Area	Metering of All connections	State Electricity Board
44	Existing Dibrugarh Master Plan Area	Installation of a HVDS (High Voltage Distribution System)	State Electricity Board, DMB, DDA
45	Dibrugarh Planning Area 2045	Preparation of DPR for Power Supply System for Dibrugarh Planning Area	State Electricity Board, DMB, DDA
		Sewerage System	
46	Dibrugarh Planning Area	Preparation of DPR for Sewerage System for Dibrugarh Planning Area	PHE Dept., DMB, DDA
47	Dibrugarh Planning Area	Laying of Sewer Network for Planning Area	PHE Dept., DMB, DDA
48	Konwar Handique Gaon	Construction of STP (35 MLD) on 4 Hectare of Land	PHE Dept., DMB, DDA
49	Dewanbari Bengali Gaon	Construction of STP (35 MLD) on 5 Hectare of Land	PHE Dept., DMB, DDA
50	Bhurbhuri Gaon No. 3	Construction of STP (35 MLD) on 5 Hectare of Land	PHE Dept., DMB, DDA
51	Joksl T.E Co. 29/143 ORR	Construction of STP (25 MLD) on 5 Hectare of Land	PHE Dept., DMB, DDA
		Solid Waste Management	
52	Dibrugarh Planning Area	Improvement and Modernization of Solid Waste Collection, Transportation and Disposal System of Dibrugarh	DMB, DDA
		Drainage System	
53	Dibrugarh Planning Area	Preparation of DPR for Drainage System for Dibrugarh Planning Area	PHE Dept., DMB, DDA, Revenue Dept.
54	Dibrugarh Town	Cleaning and maintenance of existing main drains	PHE Dept., DMB, DDA, Revenue Dept.
55	Dibrugarh Planning Area	Laying of Roadside drains in new proposed areas within Dibrugarh Planning Area	PHE Dept., DMB, DDA, Revenue Dept.
56	Dibrugarh Town	Construction and Improvement of Existing Storm Water Drains	PHE Dept., DMB, DDA, Revenue Dept.
57	Dibrugarh Planning Area	Slope protection, Improvement, Construction, Repair & Restoration	PHE Dept., DMB, DDA, Revenue Dept.
		Water Bodies	
58	Dibrugarh Planning Area	Repair and Renovation of Water Bodies in Planning Area	Revenue and Water Resource Dept., DMB, DDA
59	Dibrugarh Planning Area	Development of Green Conservation Belt around all water bodies	Revenue and Water Resource Dept., DMB, DDA
60	Dibrugarh Planning Area	Development of Brahmaputra River Front Under Progress (Bank Stabilization Work)	Revenue and Water Resource Dept., DMB, DDA
61	Dibrugarh Planning Area	Development of Burhi Dihing river with joggers track as recreational zone	Revenue and Water Resource Dept., DMB, DDA
62	Dibrugarh Planning Area	Development of water sport complex as recreational zone	Revenue and Water Resource Dept., DMB, DDA

63	Bhurbhuri Gaon No. 2	Rejuvenation of Kathbil with organized open space	Revenue and Water Resource Dept., DMB, DDA
		Traffic and Transportation	
64	Dibrugarh Town	Repair and Renovation of Existing Road Network of Dibrugarh Town	DMB, NHAI, PWD
65	Ward 9	Improvement and Conservation of old Dibrugarh Town Railway Stations	Railway Dept., DMB
66	Tepar Gaon Pathar	Development of Dhemalgaon Railway Staion	Railway Dept., DMB
67	Changmai Goria Gaon	Development of ISBT (26 Ha)	Railway Dept., DDA
68	No. 172 Tepar Gaon Pather	Development of Intermediate Freight Complex (60 Ha)	Revenue Dept., DDA
69	Bairagimath Kachari Gaon	Development of Bus Terminal (14 Ha)	Revenue Dept., DDA
70	Patra Gaon	Development of Bus Terminal (9 Ha)	Revenue Dept., DDA
71	Tinsukia Gaon	Development of Bus Terminal (8.5 Ha)	Revenue Dept., DDA
72	Dhargatoli Gaon	Development of Bus Terminal (7 Ha)	Revenue Dept., DDA
73	Bhurbhuri Gaon No. 3	Development of Bus Terminal (25 Ha)	Revenue Dept., DDA
74	Ward 19	Development of Jalan nagar Bus Terminal	Revenue Dept., DDA
75	Lepetkata Kachari Gaon	Development of Truck Terminal (35 Ha)	Revenue Dept., DDA
76	Bokel Bari Tea Estate	Development of Truck Terminal (10 Ha)	Revenue Dept., DDA
77	Bhurbhuri Gaon No. 3	Development of Truck Terminal (6.25 Ha)	Revenue Dept., DDA
78	Dibrugarh Planning Area	Preparation of DPR on City Mobility Plan	DDA
79	Dibrugarh Planning Area	Construction of City Ring Road	PWD (Roads)
80	Dibrugarh Planning Area	Construction of Outer Ring Road	PWD (Roads)
81	Dibrugarh Planning Area	Improvement of Traffic Signal facility in Dibrugarh Planning Area	DMB, DDA
82	Dibrugarh Planning Area	Augmentation of City Bus Fleet	DMB, DDA
83	Dibrugarh Planning Area	Construction of Non-motorised Transport facilities (Footpaths & Cycle Tracks & Cycle Parking)	DMB, DDA
84	Bairagimath Kachari Gaon	Construction of Cycle parking near Bus stand	DMB, DDA
85	Bairagimath Kachari Gaon	Construction of Multi level Parking at Banipur Railway Station	DMB, DDA
86	Ward 9	Development of Multilevel Car Parking near Town Railway Station	DMB, DDA
87	Ward 6	Development of off- street Car Parking	DMB, DDA
88	Ward 5	Development of off- street Car Parking	DMB, DDA
89	Ward 4, Near Jalan Tea Estate	Construction of off-Street Parking	DMB, DDA
90	Banipur Railway Station	Construction of Road Over Bridge on road near Banipur Railway Station	PWD, Railway, DMB, DDA
91	Mancotta Road	Construction of Road Over Bridge on Railway Track	PWD, Railway, DMB, DDA
92	Bypass Road, Khanikar Cross road	Dvelopment of Khanikar Fly over on Dibrugarh Bypass Road	PWD (Roads)
93	Bogpara	Dvelopment of Bogpara Fly over on Dibrugarh Bypass Road	PWD (Roads)
94	Nh-37, Borboruah Point	Dvelopment of Fly over at Borboruah Point towards Bypass road	PWD (Roads)
95	NH-15, Sukafa Point	Dvelopment of Fly over at Sukafa Tiniali from Bogibil	PWD (Roads)
		Commercial	
96	Bokul Gaon	Development of Commercial/ District Centre (31 Ha)	DDA

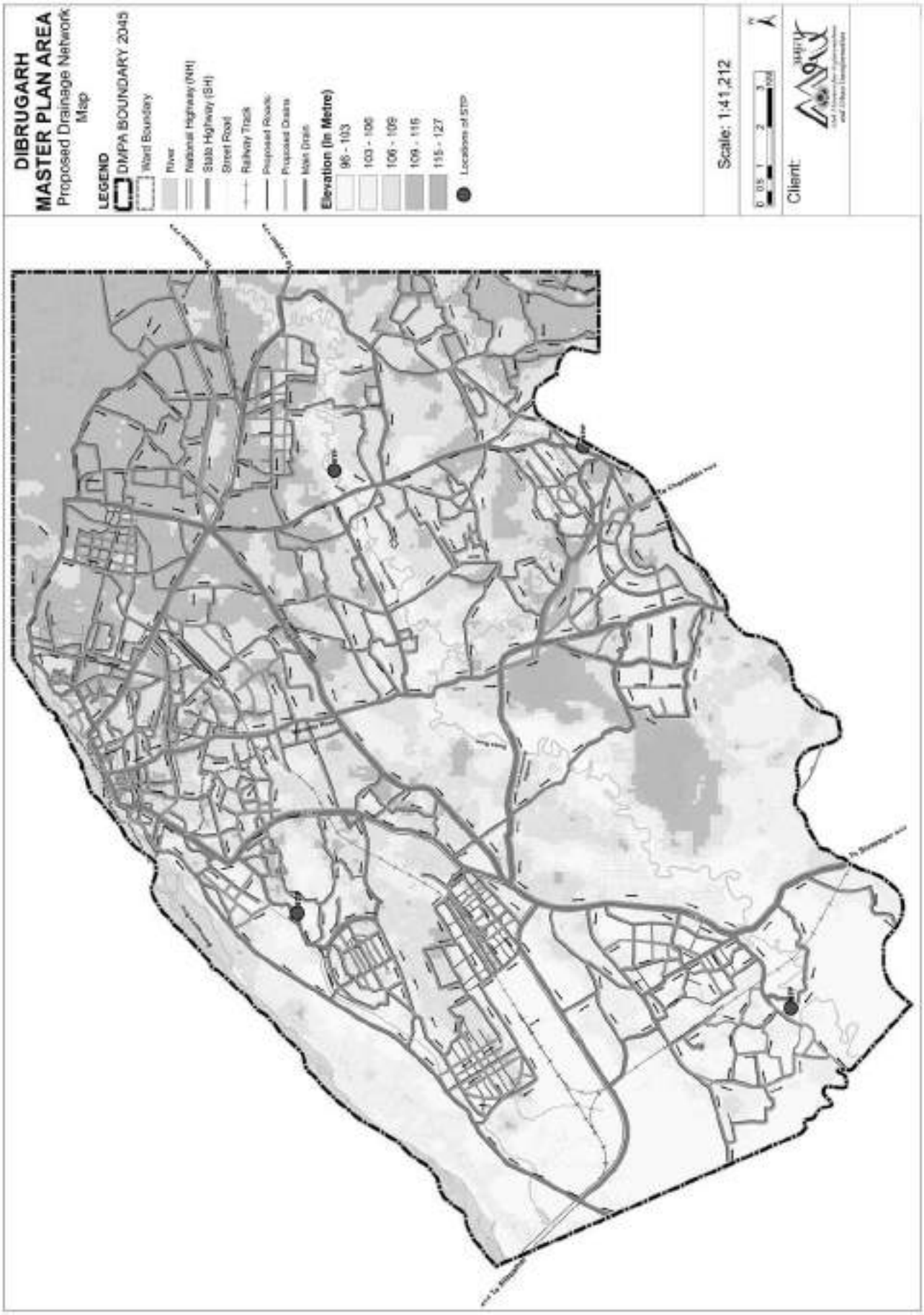
97	Patra Gaon	Development of Commercial/ District Centre (20 Ha)	DDA
98	Chengmari Tekela Gaon	Development of Commercial/ District Centre (15 Ha)	DDA
99	Hiloibam Gaon	Development of Integrated Commercial Centre (40 Ha)	DDA
100	No. 2 Bhurbhuri Gaon	Development of Integrated Commercial Centre (11 Ha)	DDA
101	Ward 4	Development of Vending Zone (2 Ha)	DDA
102	No 186 Binoi Gutia	Development of Vending Zone (10 Ha)	DMB
103	Mohmari Gaon	Development of Vending Zone (8 Ha)	DDA
104	Bhurbhuri Gaon No. 3	Development of Vending Zone (14 Ha)	DDA
105	Changmai Goria Gaon	Development of Wholesale and Trade Centre (15 Ha)	DDA
106	Bhurbhuri Gaon No. 3	Development of Wholesale and Trade Centre (10 Ha)	DDA
		Social Infrastrucutre	
107	Garudharia Gaon No. 1	Development of Multi-Specialist Intermediate District Hospital (13 Ha)	Health Dept., DDA
108	Lahowal Chah Bagicha	Development of Multi-Specialist Intermediate District Hospital (14 Ha)	Health Dept., DDA
109	No 186 Binoi Gutia	Development of Multi-Specialist Intermediate District Hospital (7 Ha)	Health Dept., DDA
110	Bhurbhuri Gaon No. 3	Development of Health Centre (13 Ha)	Health Dept., DDA
111	No. 150 Dibruwal Dihingia Gaon	Development of Health Centre (13 Ha)	Health Dept., DDA
112	Sapekhati Gaon	Development of Health Centre (11 Ha)	Health Dept., DDA
113	Bogpara Gaon	Development of Knowledge District (142 Ha)	Education Dept., DDA
114	Lekai Gaon	Development of Knowledge District (92 Ha)	Education Dept., DDA
115	Hiloibam Gaon	Development of Knowledge District (64 Ha)	Education Dept., DDA
116	Sapekhati Gaon	Development of University (80 ha)	Education Dept., DDA
		Recreational	
117	Jokai R.F.	Development of Botanical Garden (18 Ha)	DDA
118	Charbandi Chuk Zarua	Development of District Sport Centre cum Complex (9 Ha)	DDA
119	Lepetkata	Development of District Sport Centre cum Complex (15 Ha)	DDA
120	Chota Bogpara	Development of District Level Park (10 Ha)	DDA
121	Kushia Khana gaon	Development of Cultural Complex (70 Ha)	DDA
122	Niz Khanikar	Development of Science City (20 ha)	DDA, Tourism
123	Niz Khanikar	Development of Stadium (10 ha)	DDA, Tourism
124	Mohmari Gaon	Development of Theme Park (120 ha)	DDA, Tourism
125	Near Jokai R.F.	Development of Theme zoo (95 ha)	DDA
126	Mohmari Gaon	Development of Exibition Ground (30Ha)	DDA, Tourism
127	Dibrugarh Planning Area	Development of Water Sport Activity at Burhi Dihing water Body	DDA, Tourism
128	Hanchora	Development of eco-village tourism at Hanchora	DDA, Tourism
129	Dibrugarh Planning Area and Surrounding Region	Development of Spiritual Circiut (Development of Infrastructure at BJagannath Temple, Radha Krishna Temple, Maira Mora than, Aai Than, in Dibrugarh Planning Area)	DDA, Tourism

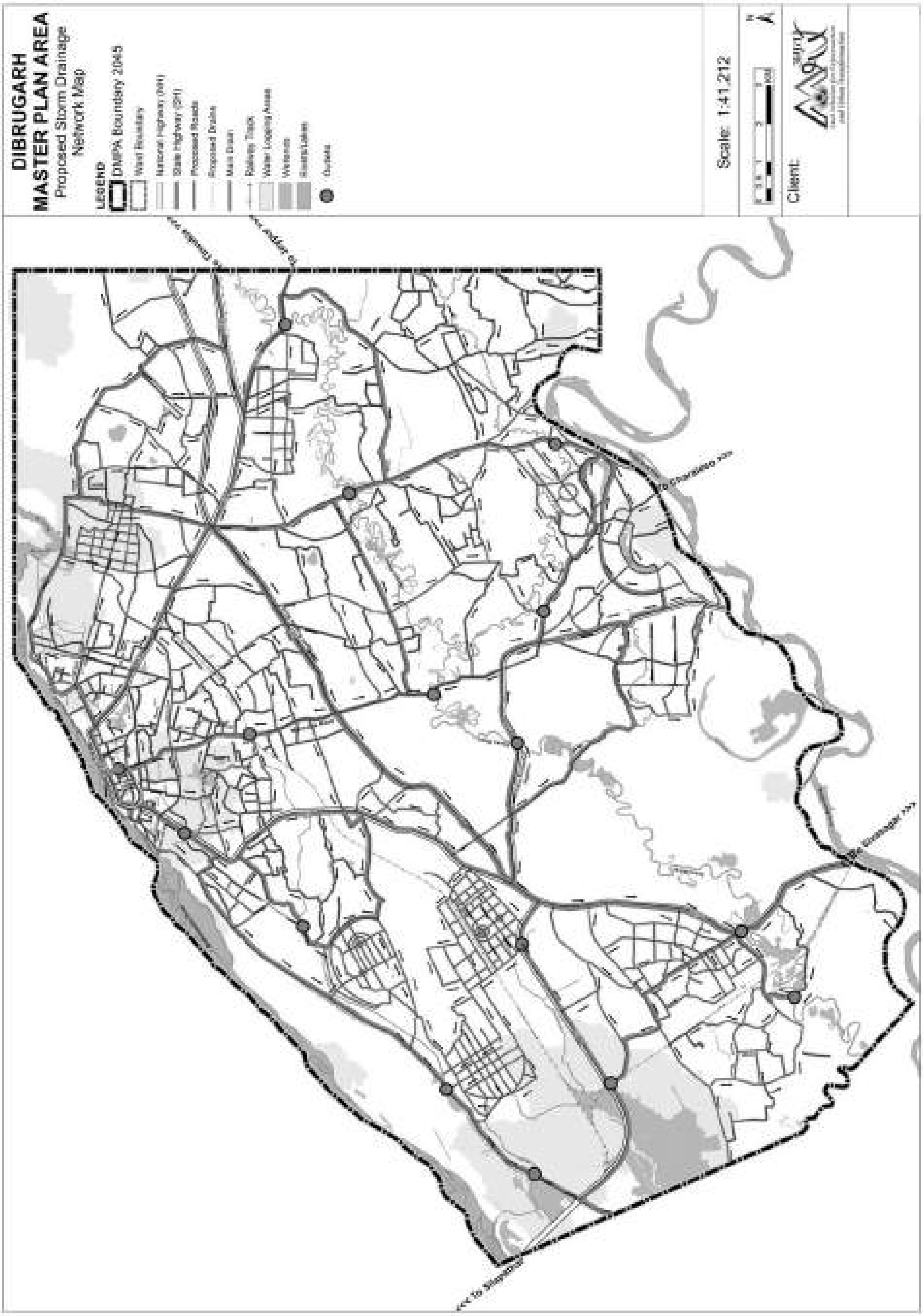
		Industrial Area	
130	Tepor Gaon Pathar and Chnegmari Gohain gaon	Development of Industrial Estate – I (300 Ha)	Revenue, DDA and AIDCL
131	Niz Lahowal	Development of Industrial Estate – II (100 Ha)	Revenue, DDA and AIDCL

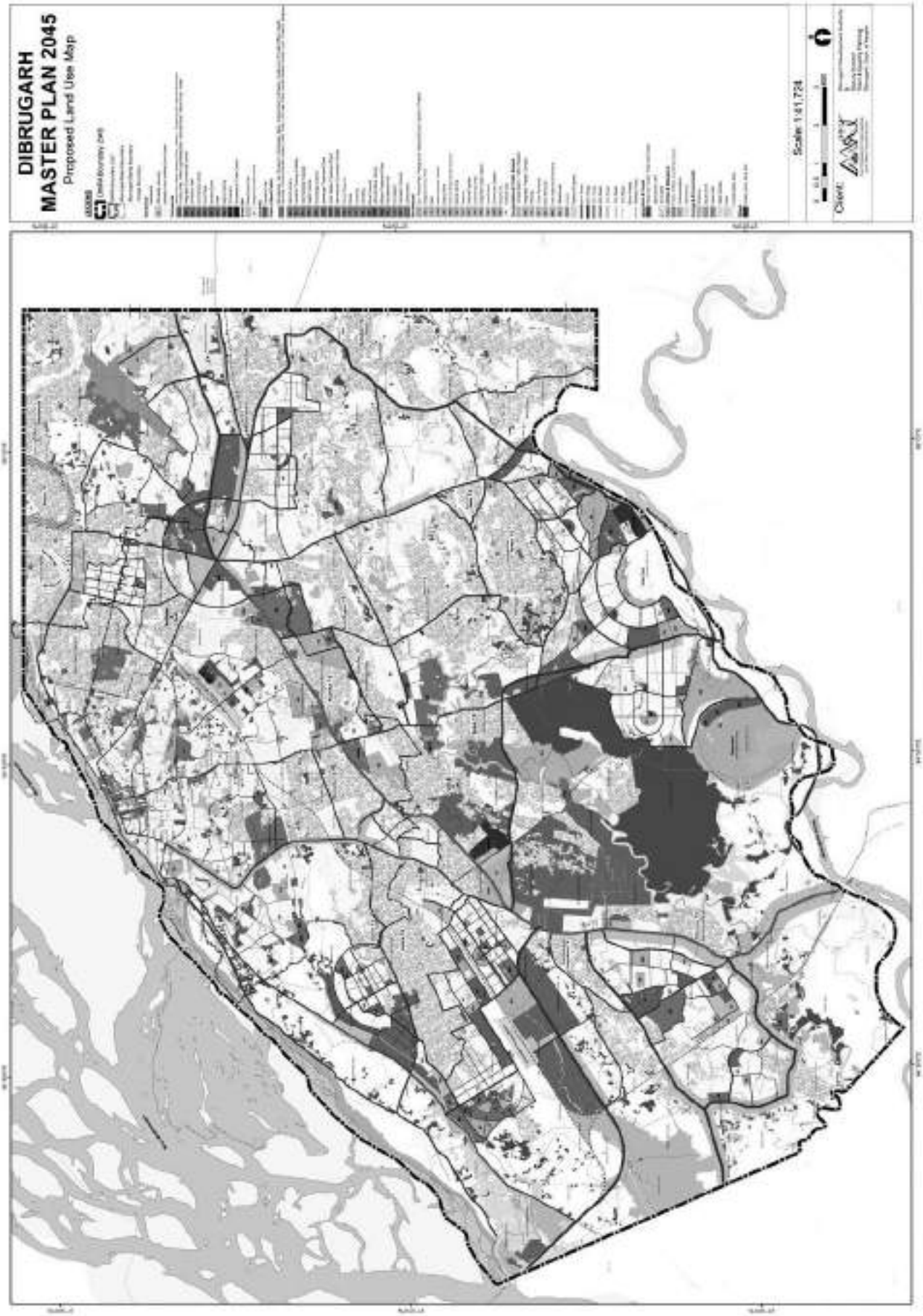
13.2 ROLE OF MUNICIPAL CORPORATION IN DMP 2045

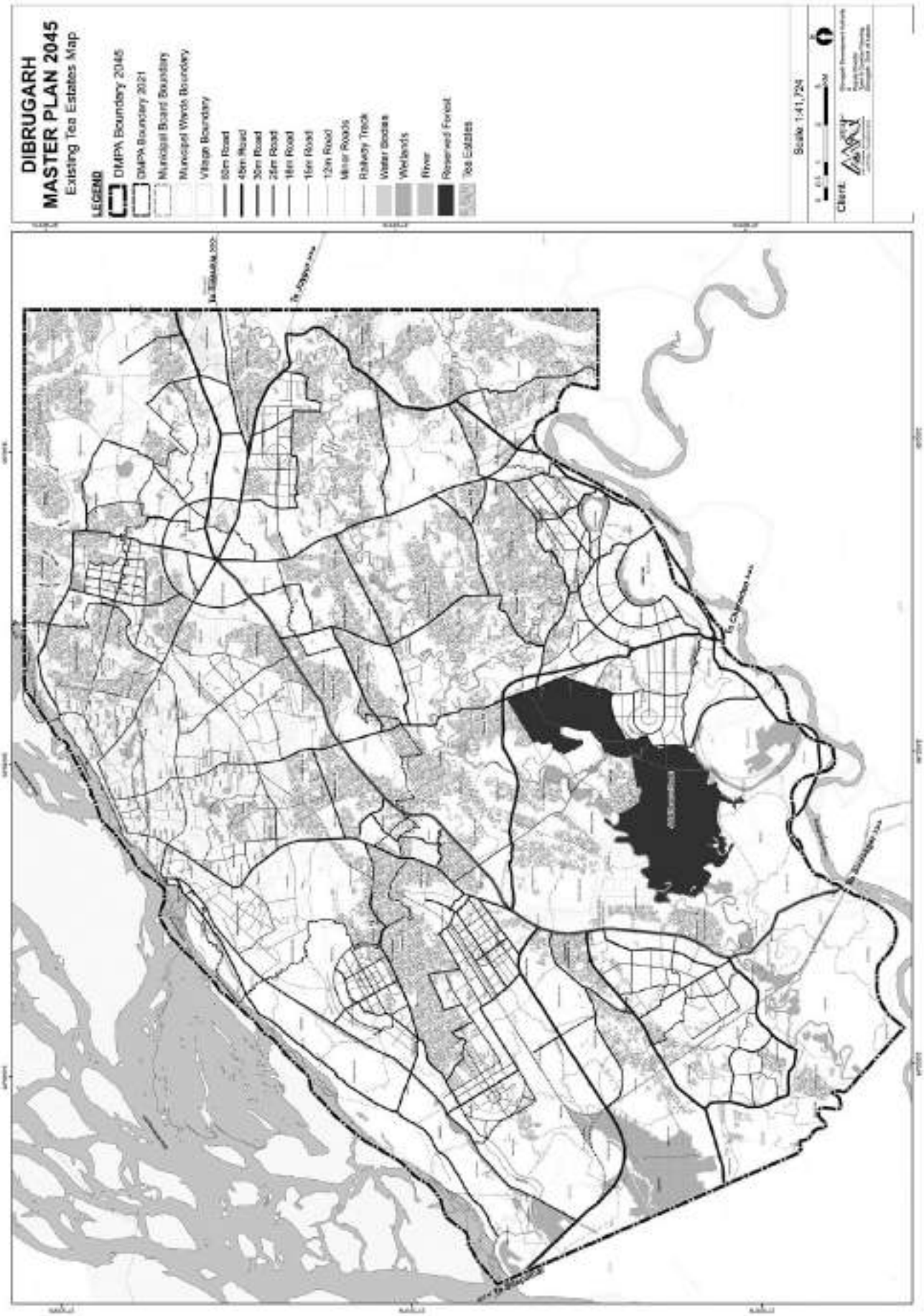
Municipal Board will be responsible for operation and maintenance works in water supply, sewerage, storm water drainage, Solid Waste Management, DP & TP roads and street lighting. The other responsibilities are described below:

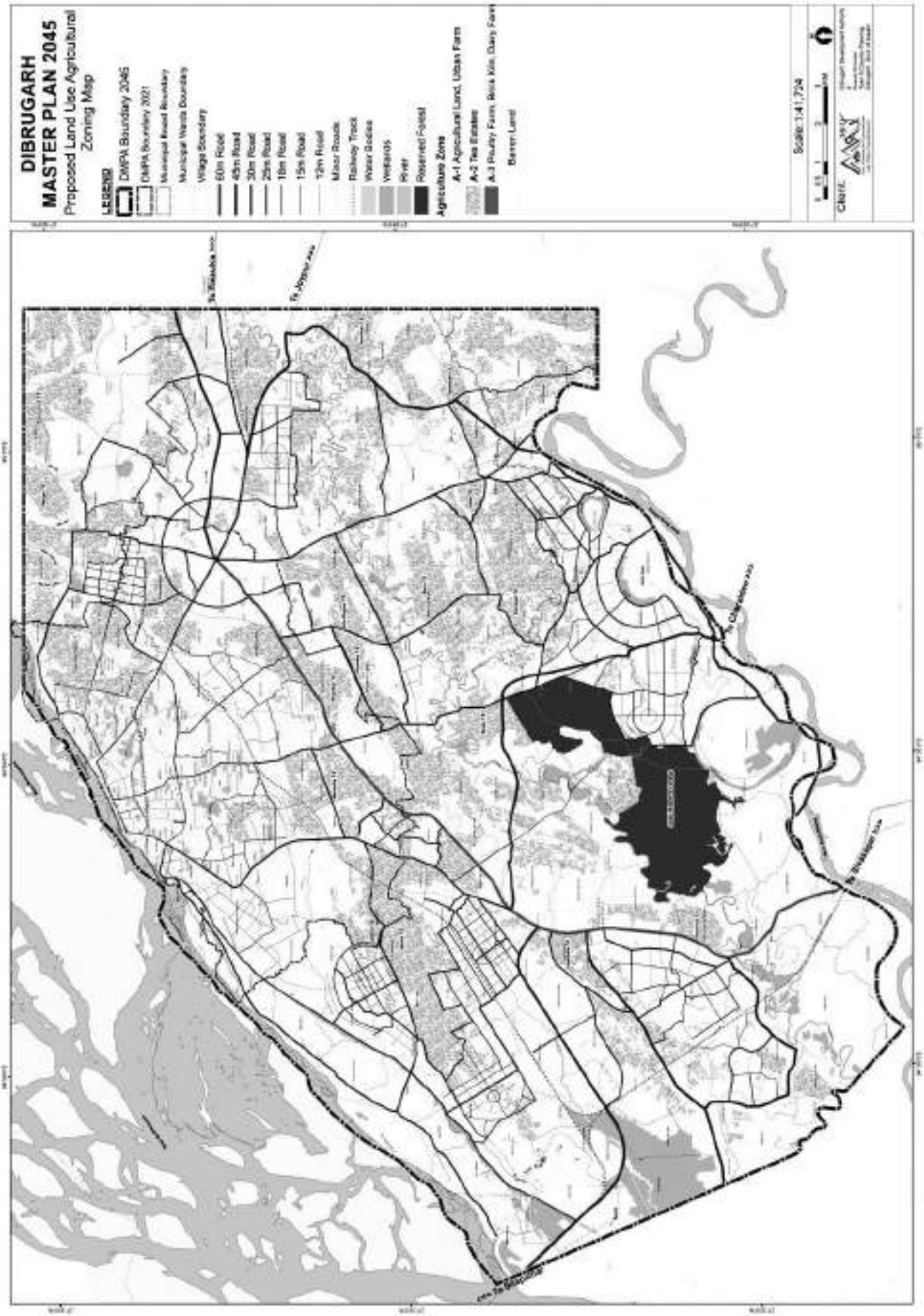
- The construction, diversion, maintenance and improvement of streets, bridges, squares, gardens, tanks, ghats, wells, channels, drains, latrines and urinals;
- The watering and cleaning of streets;
- Lighting;
- Water-supply;
- Conservancy including sewage disposal;
- Acquiring, keeping and equipping of open spaces for public purposes;
- Planting and preservation of trees;
- Construction of dwelling houses;
- Maintenance and improvement of education;
- Construction and maintenance of hospitals, dispensaries, orphanages, maternity houses, dharmasalas, guest houses etc.;
- Promotion of vaccination;
- Prevention of the spread of dangerous diseases;
- Construction and maintenance of municipal markets and slaughter houses;
- Assistance to public libraries;
- Giving of relief in time of famine, scarcity or any other natural calamity;
- Urban Planning including town planning;
- Disposal of the dead animals or bodies;
- Establishment and maintenance of burial grounds;
- Implementation of the planning in the municipal area as a part of the Development Plan;
- Regulation of slaughter houses and tanneries;
- Fire Services;
- Urban forestry and protection of the environment;
- Safeguarding the interest of the weaker section;
- Slum improvement and up-gradation;
- Promotion of urban amenities; Registration of births and deaths;
- Regulation of slaughter houses and tanneries;
- Adult education and non-formal education;
- Health and family planning;
- Welfare of SC and ST;
- Maintenance of municipal markets;
- Maintenance of monuments and historical places;
- Clearing Public Street and places; etc

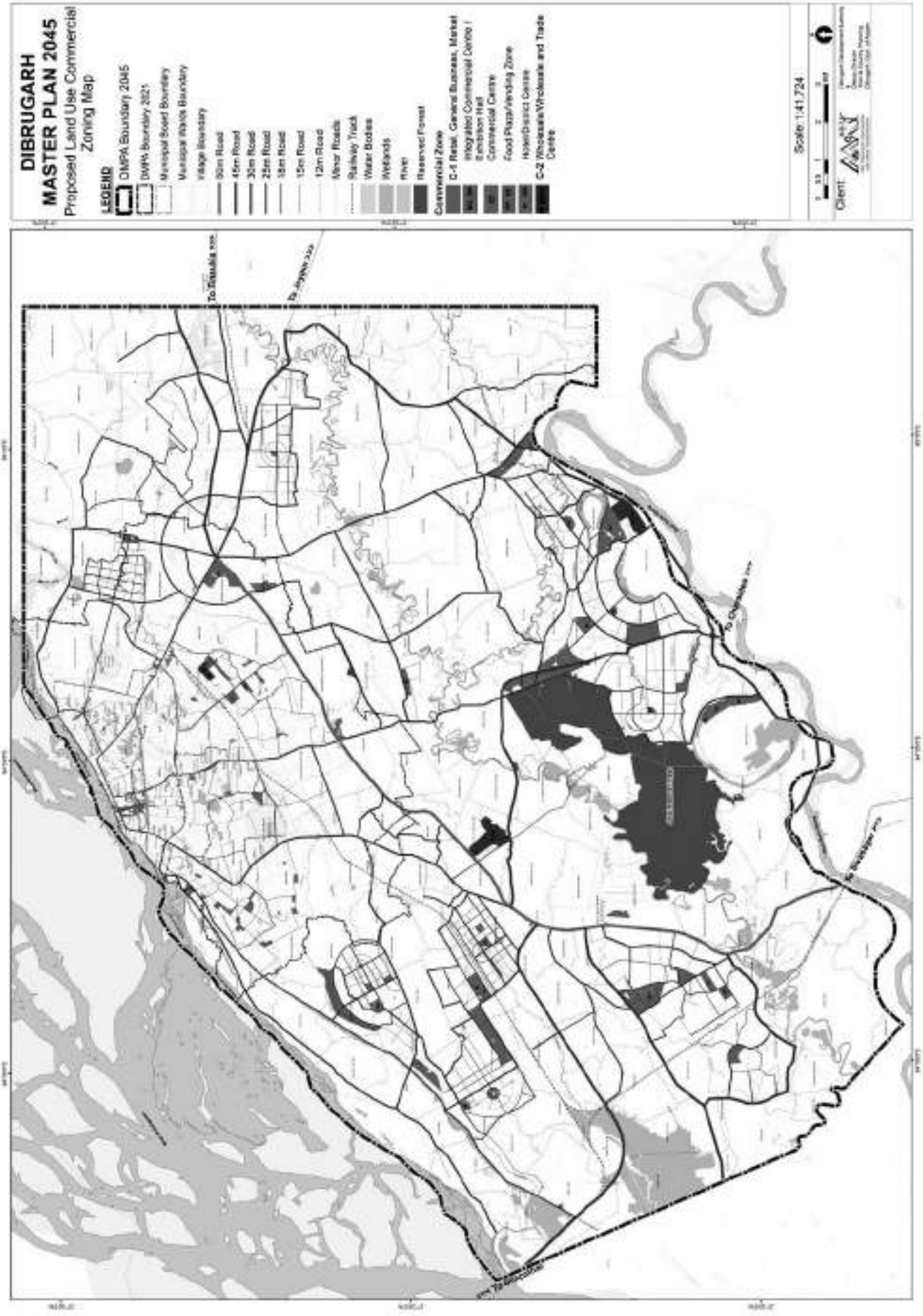

DIBRUGARH
MASTER PLAN AREA
Proposed Drainage Network Map
LEGEND
DMPA BOUNDARY 2045
Ward Boundary
River
National Highway (NH)
State Highway (SH)
Street Road
Railway Track
Proposed Roads
Proposed Drains
Main Drain
Elevation (in Metre)
96 - 103
103 - 106
106 - 109
109 - 115
115 - 127
Locations of STP
Scale: 1:41,212
Client:

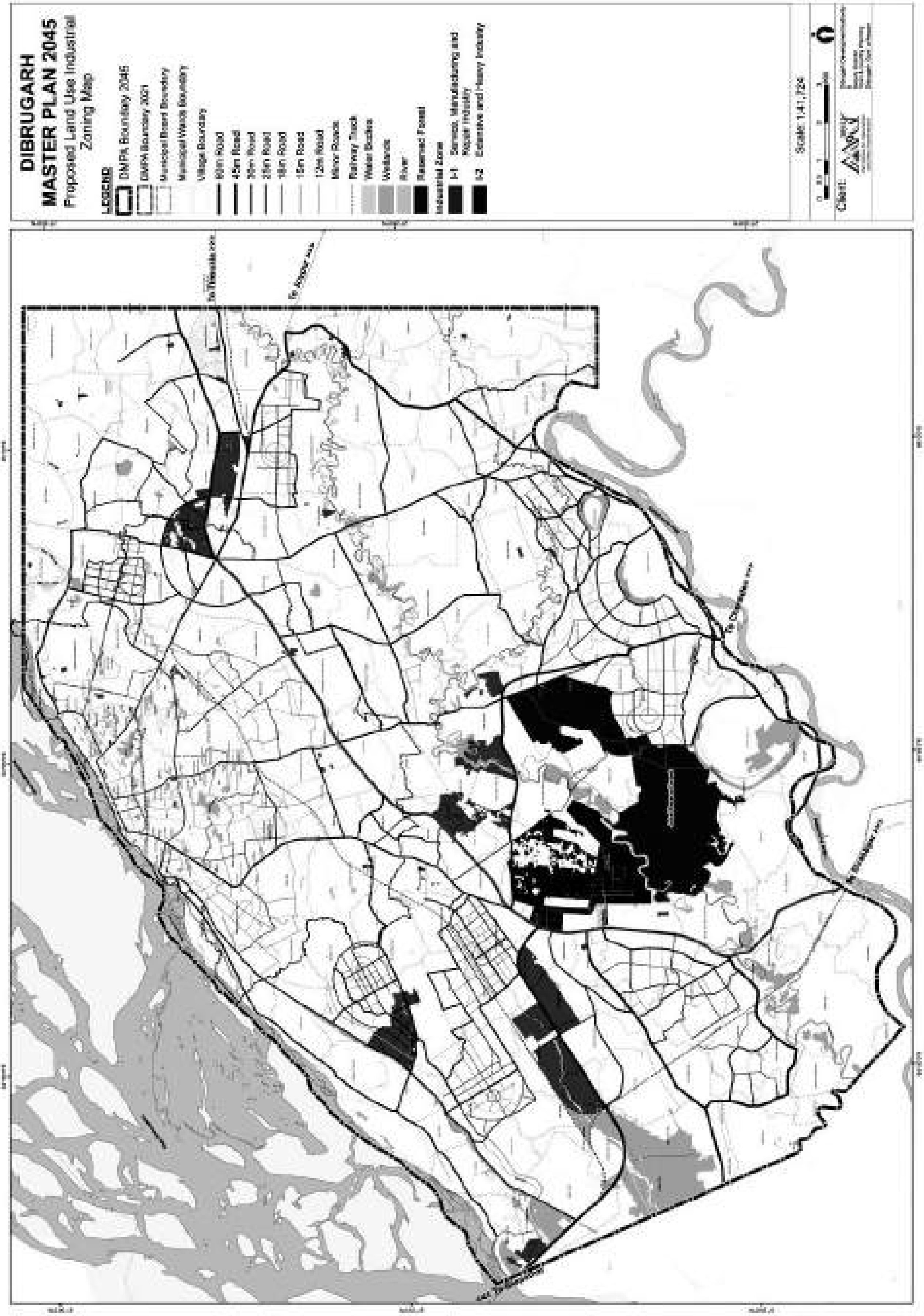

DIBRUGARH
MASTER PLAN AREA
Proposed Storm Drainage
Network Map
LEGEND
DMPA Boundary 2045
Scale: 1:41,212
Client:

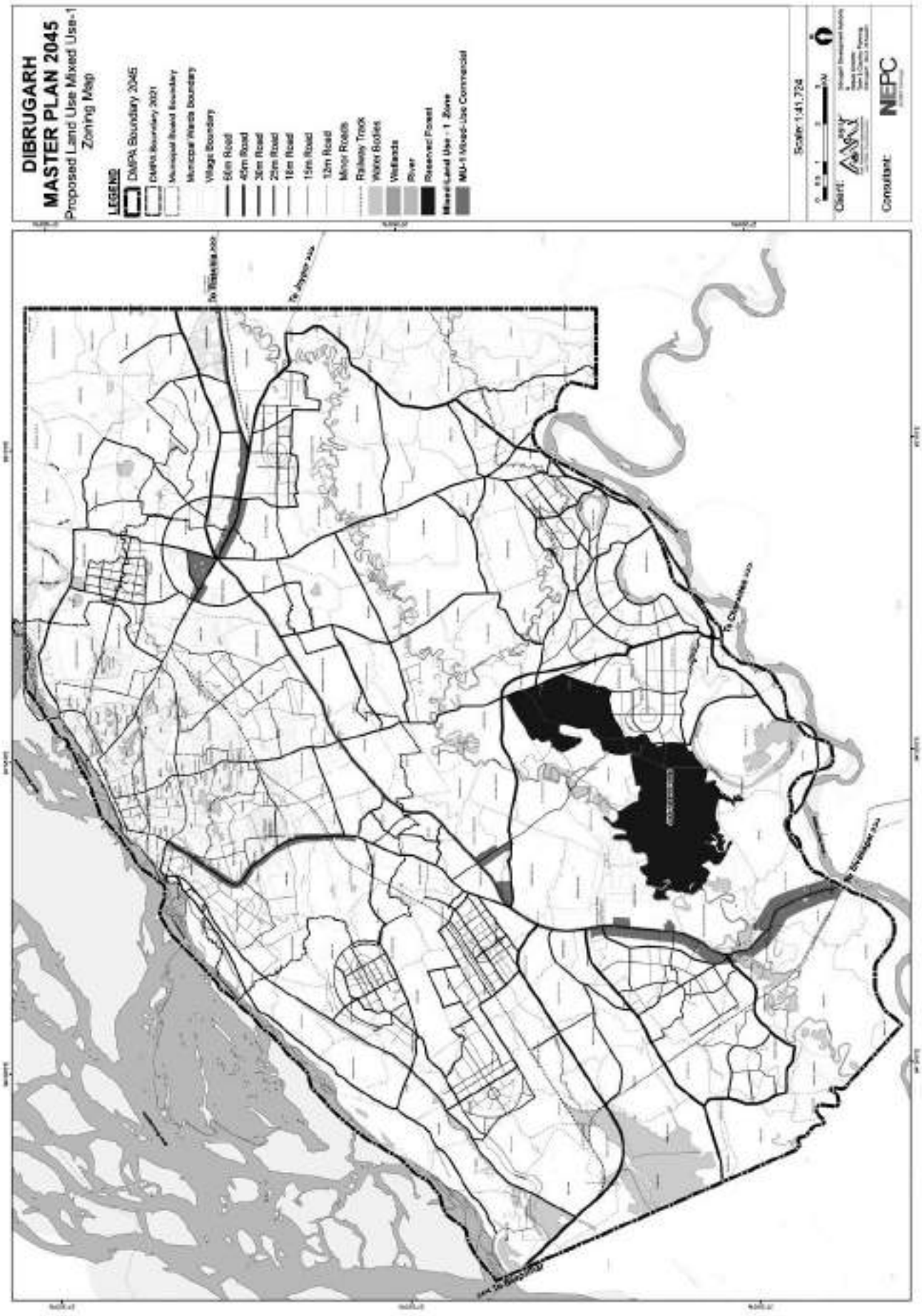

DIBRUGARH
MASTER PLAN 2045
Proposed Land Use Map
Scale 1:61,724

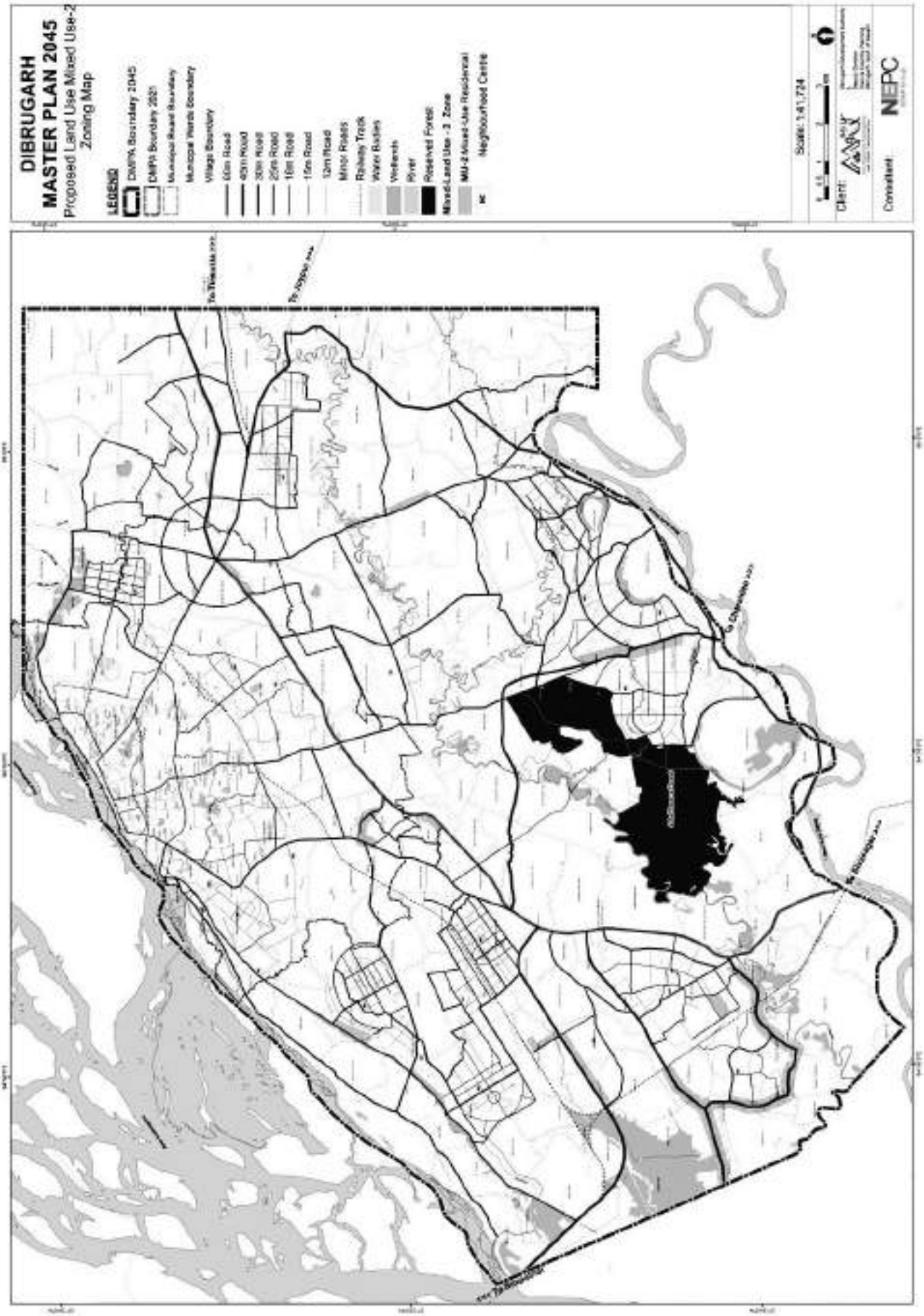

DIBRUGARH
MASTER PLAN 2045
Existing Tea Estates Map
LEGEND
DMPA Boundary 2045
DMPA Boundary 2021
Municipal Board Boundary
Municipal Wards Boundary
Village Boundary
60m Road
45m Road
30m Road
24m Road
18m Road
15m Road
12m Road
Minor Roads
Railway Track
Water Bodies
Wetlands
River
Reserved Forest
Tea Estates
Scale 1:41,724
Client

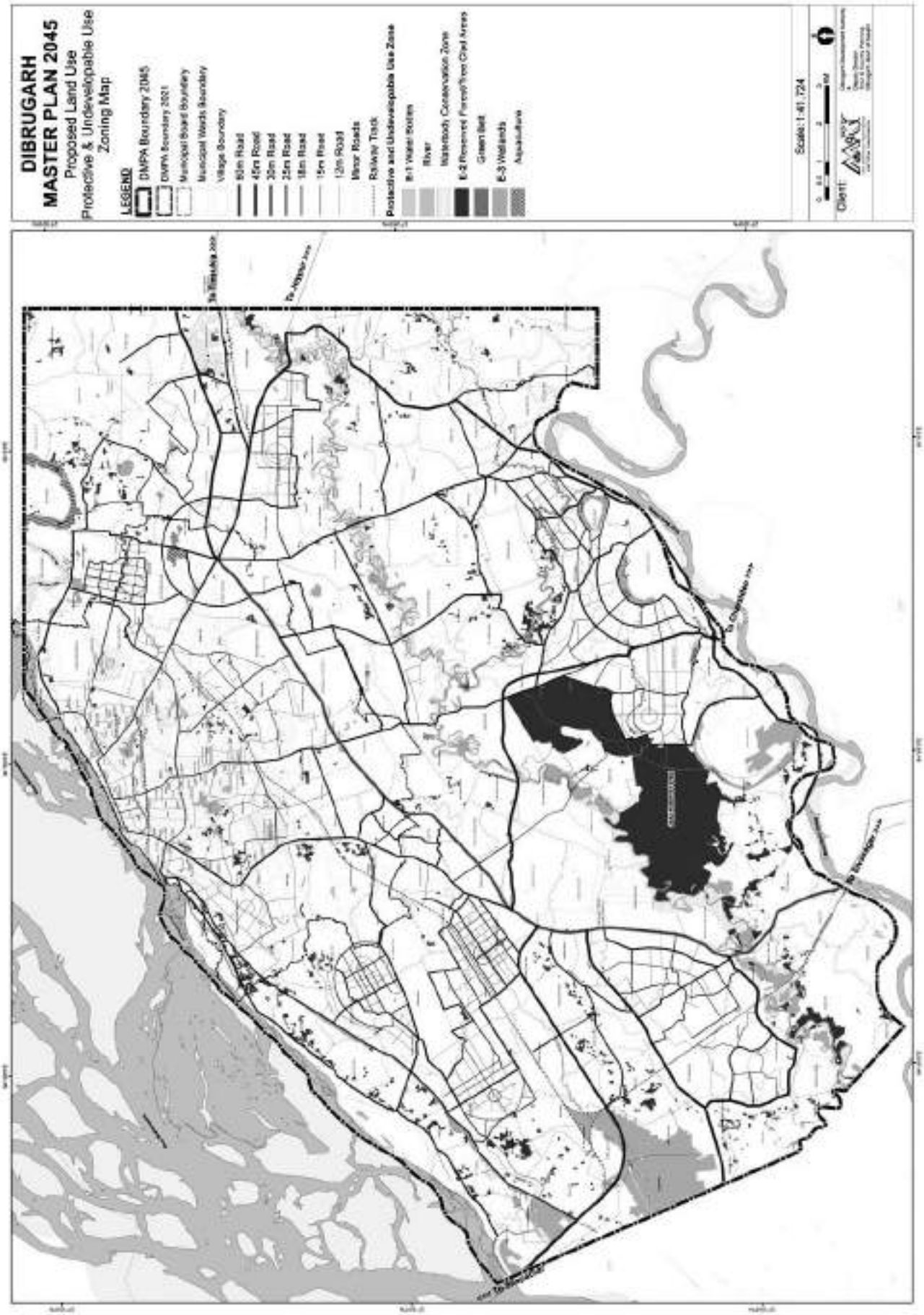

DIBRUGARH
MASTER PLAN 2045
Proposed Land Use Agricultural
Zoning Map
LEGEND
DMPA Boundary 2045
DMPA Boundary 2021
Municipal Ward Boundary
Village Boundary
60m Road
45m Road
30m Road
25m Road
18m Road
15m Road
12m Road
Minor Roads
Railway Track
Water Bodies
Wetlands
River
Reserved Forest
Agriculture Zone
A-1 Agricultural Land, Uttaas Farm
A-2 Tea Estates
A-3 Poultry Farm, Brick Kiln, Dairy Farm
Barren Land
Scale 1:41,724
Client

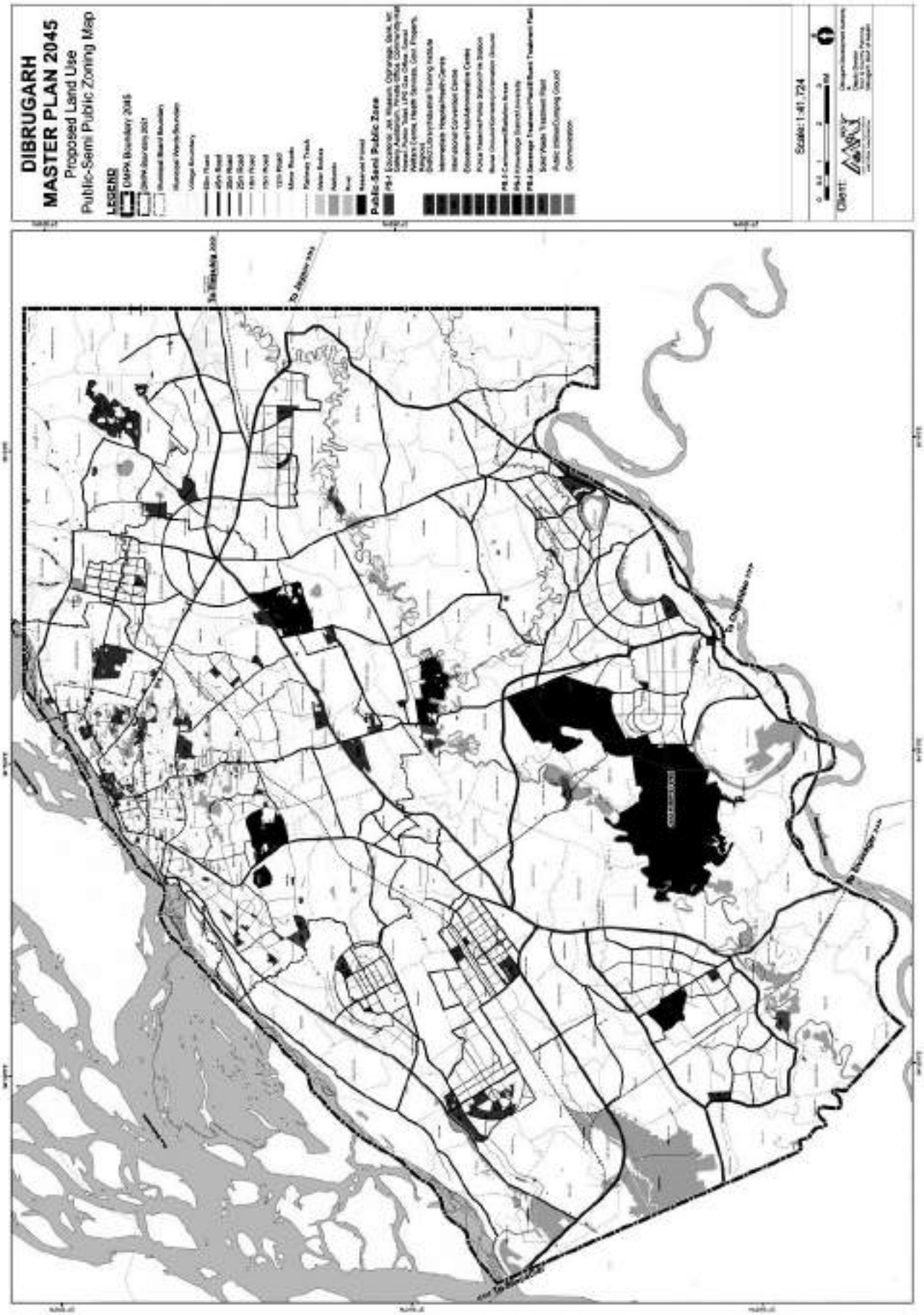

DIBRUGARH
MASTER PLAN 2045
Proposed Land Use Commercial
Zoning Map
LEGEND
DMPA Boundary 2045
DWPA Boundary 2021
Municipal Board Boundary
Municipal Wards Boundary
Village Boundary
90m Road
45m Road
30m Road
25m Road
18m Road
15m Road
12m Road
Minor Roads
Railway Track
Water Bodies
Wetlands
River
Reserved Forest
Commercial Zone
C-1 Retail, General Business, Market
Integrated Commercial Centre /
Exhibition Hall
Commercial Centre
Food Plaza/Vending Zone
Hotel/District Centre
C-2 Wholesale/Wholesale and Trade
Centre
Scale 1:41,724
Client

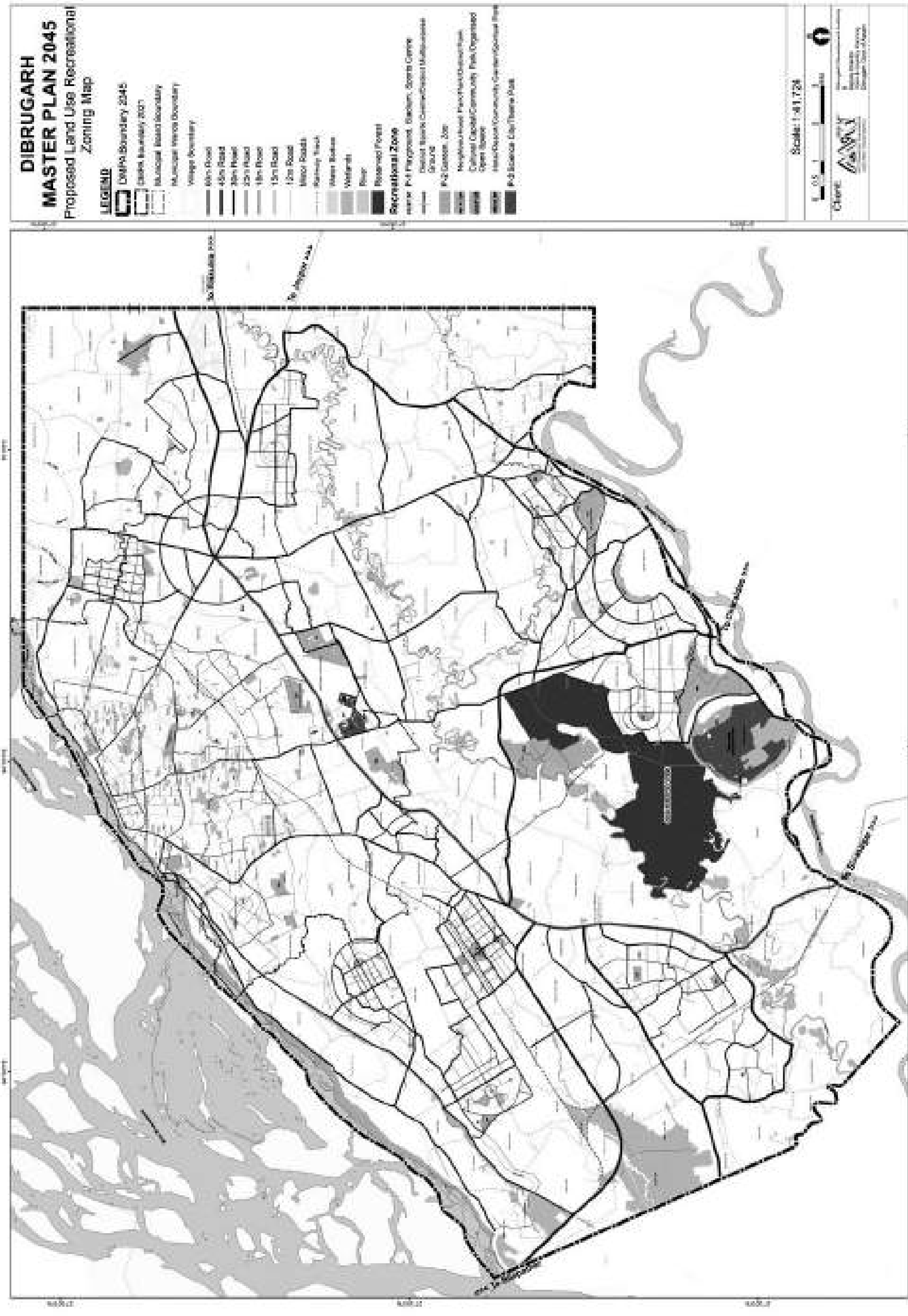

DIBRUGARH
MASTER PLAN 2045
Proposed Land Use Industrial
Zoning Map
LEGEND
DMPA Boundary 2045
DMPA Boundary 2021
Municipal Board Boundary
Municipal Wards Boundary
Village Boundary
60m Road
45m Road
30m Road
25m Road
18m Road
15m Road
12m Road
Minor Roads
Railway Track
Water Bodies
Wetlands
River
Reserved Forest
Industrial Zone
I-1 Service, Manufacturing and Repair Industry
I-2 Extensive and Heavy Industry
Scale: 1:41,724
Client:

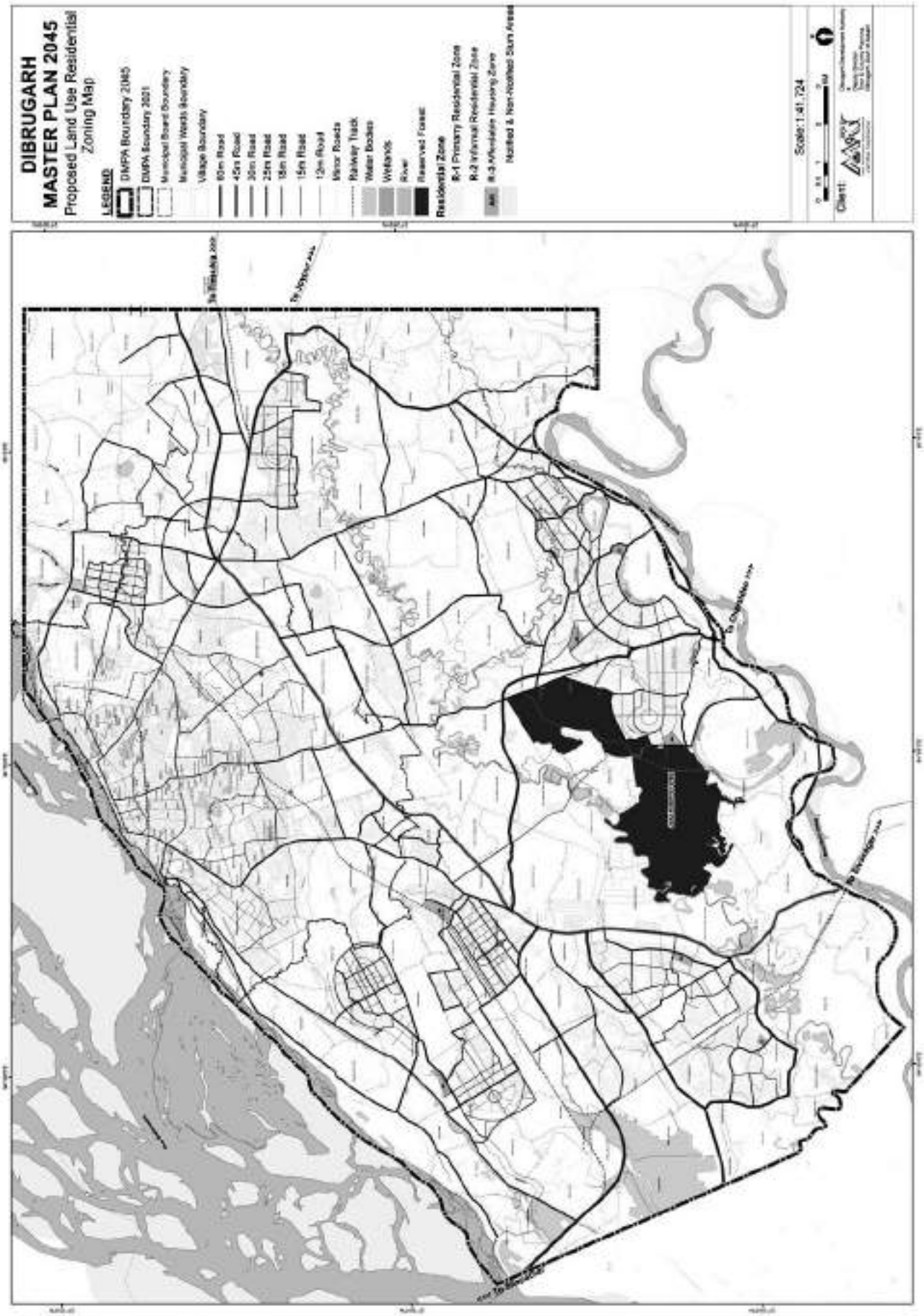

DIBRUGARH
MASTER PLAN 2045
Proposed Land Use Mixed Use-1
Zoning Map
LEGEND
DMPA Boundary 2045
DMPA Boundary 2031
Municipal Board Boundary
Municipal Wards boundary
Village Boundary
60m Road
40m Road
30m Road
25m Road
18m Road
15m Road
12m Road
Minor Roads
Railway Track
Water Bodies
Wetlands
River
Reserved Forest
Mixed Land Use - 1 Zone
MU-1 Mixed-Use Commercial
Scale 1:41,724
Client:
Consultant:
NEPC

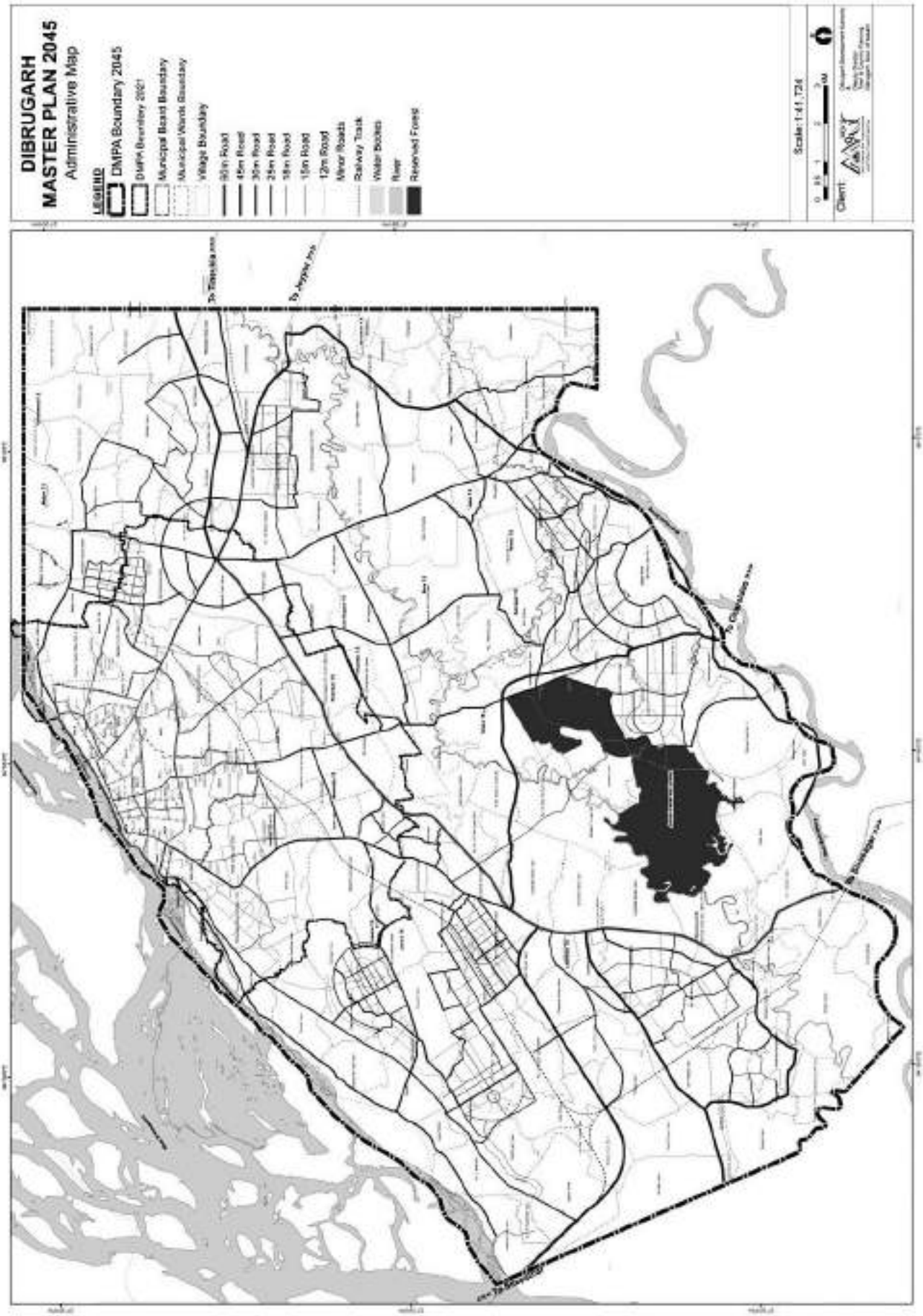

DIBRUGARH
MASTER PLAN 2045
Proposed Land Use Mixed Use-2
Zoning Map
LEGEND
DMPA Boundary 2045
DMPA Boundary 2025
Municipal Ward Boundary
Village Boundary
60m Road
45m Road
30m Road
25m Road
18m Road
15m Road
12m Road
Minor Roads
Railway Track
Water Bodies
Wetlands
River
Reserved Forest
Mixed-Land Use - 2 Zone
MU-2:Mixed-Use Residential
Neighbourhood Centre
Scale: 1:41,724
Client:
Consultant:
NEPC

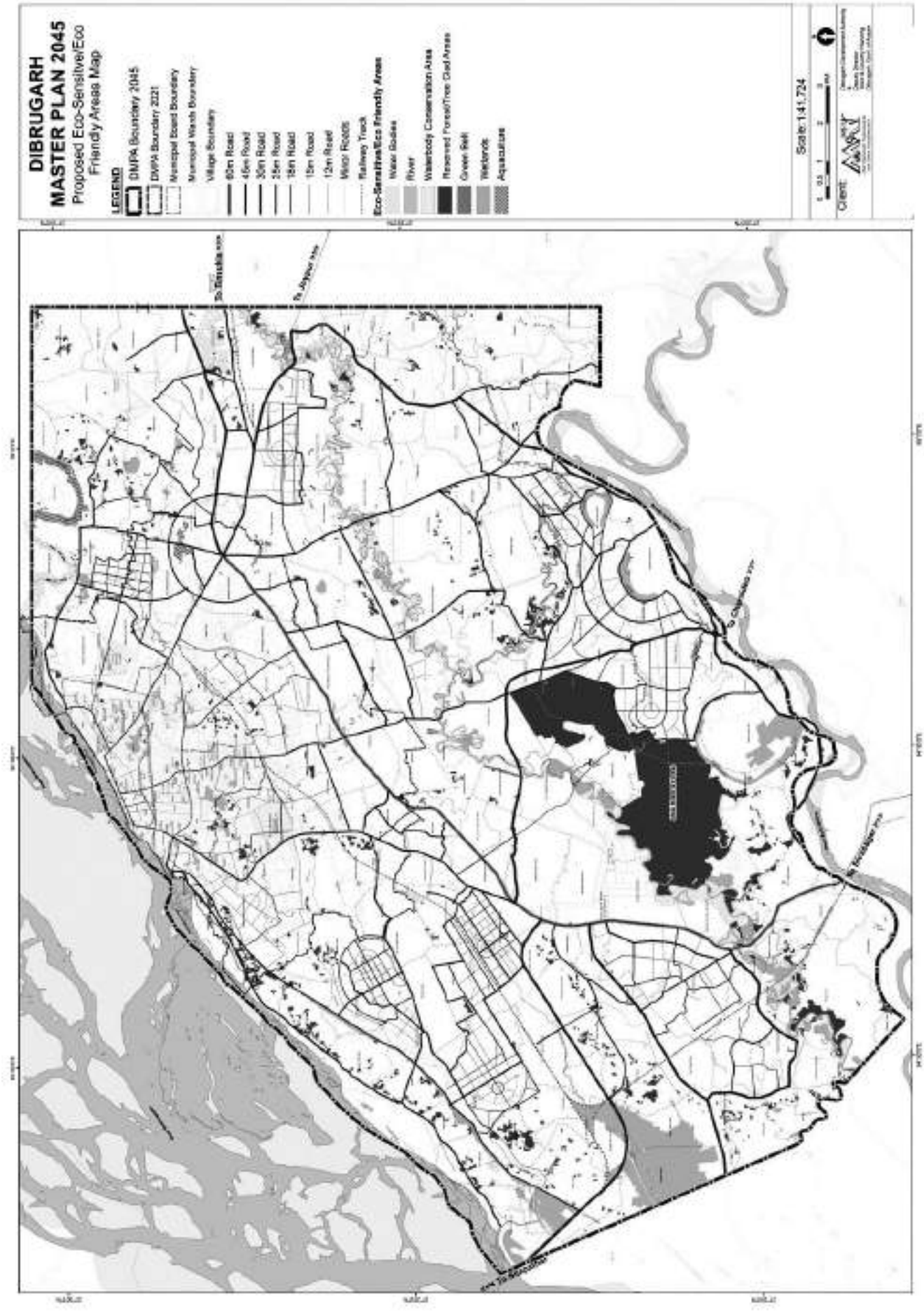

DIBRUGARH
MASTER PLAN 2045
Proposed Land Use
Protective & Undevelopable Use
Zoning Map
LEGEND
DMPA Boundary 2045
DMPA Boundary 2021
Municipal Board Boundary
Municipal Wards Boundary
Village Boundary
60m Road
45m Road
30m Road
24m Road
18m Road
15m Road
12m Road
Minor Roads
Railway Track
Protective and Undevelopable Use Zone
E-1 Water Bodies
River
Waterbody Conservation Zone
E-2 Reserved Forest/Tree Clad Areas
Green Belt
E-3 Wetlands
Aquaculture
Scale:1:41,724
Dlert

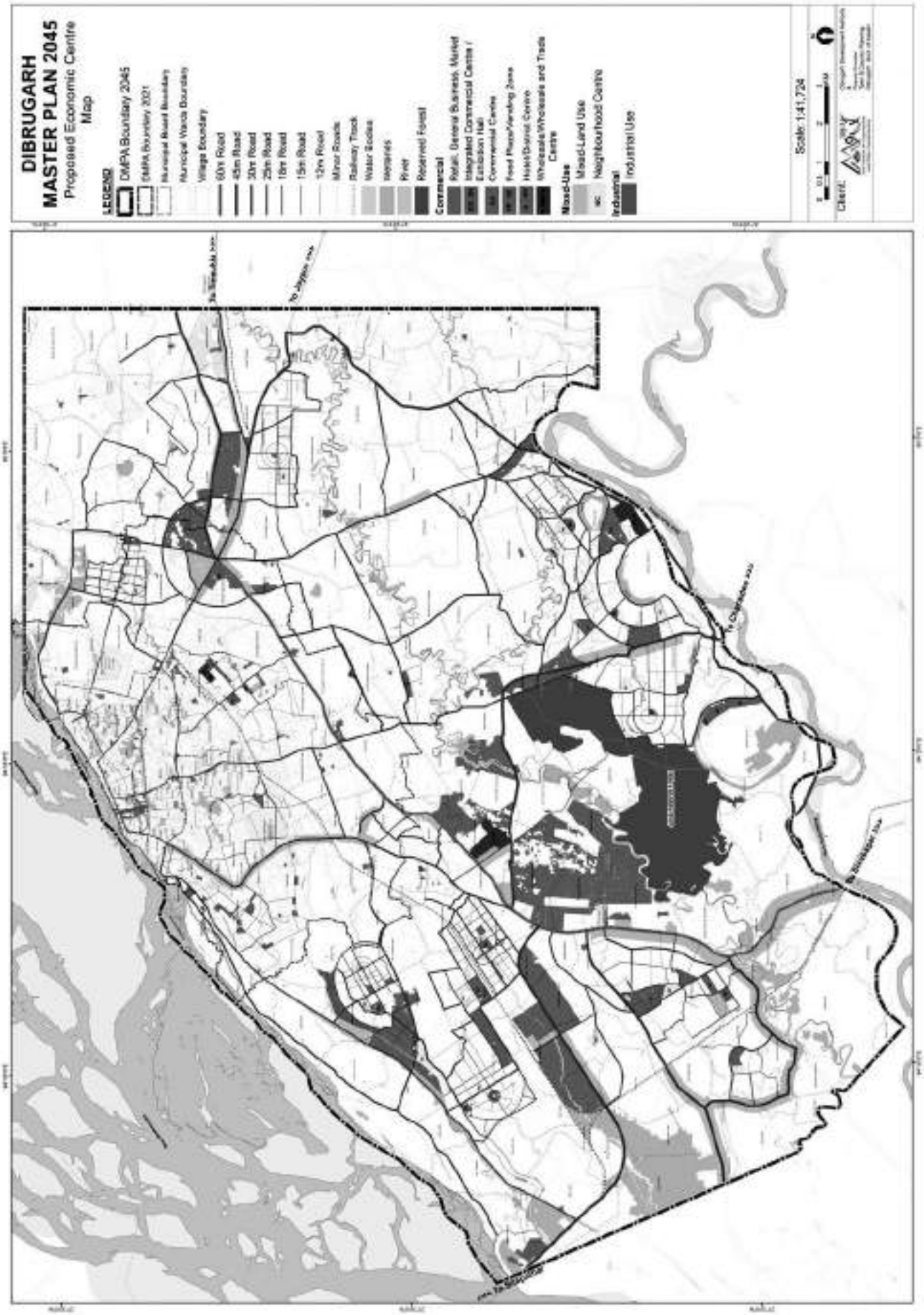

DIBRUGARH
MASTER PLAN 2045
Proposed Land Use
Public-Semi Public Zoning Map
LEGEND
Public-Semi Public Zone
Scale:1:41,724
Distt.

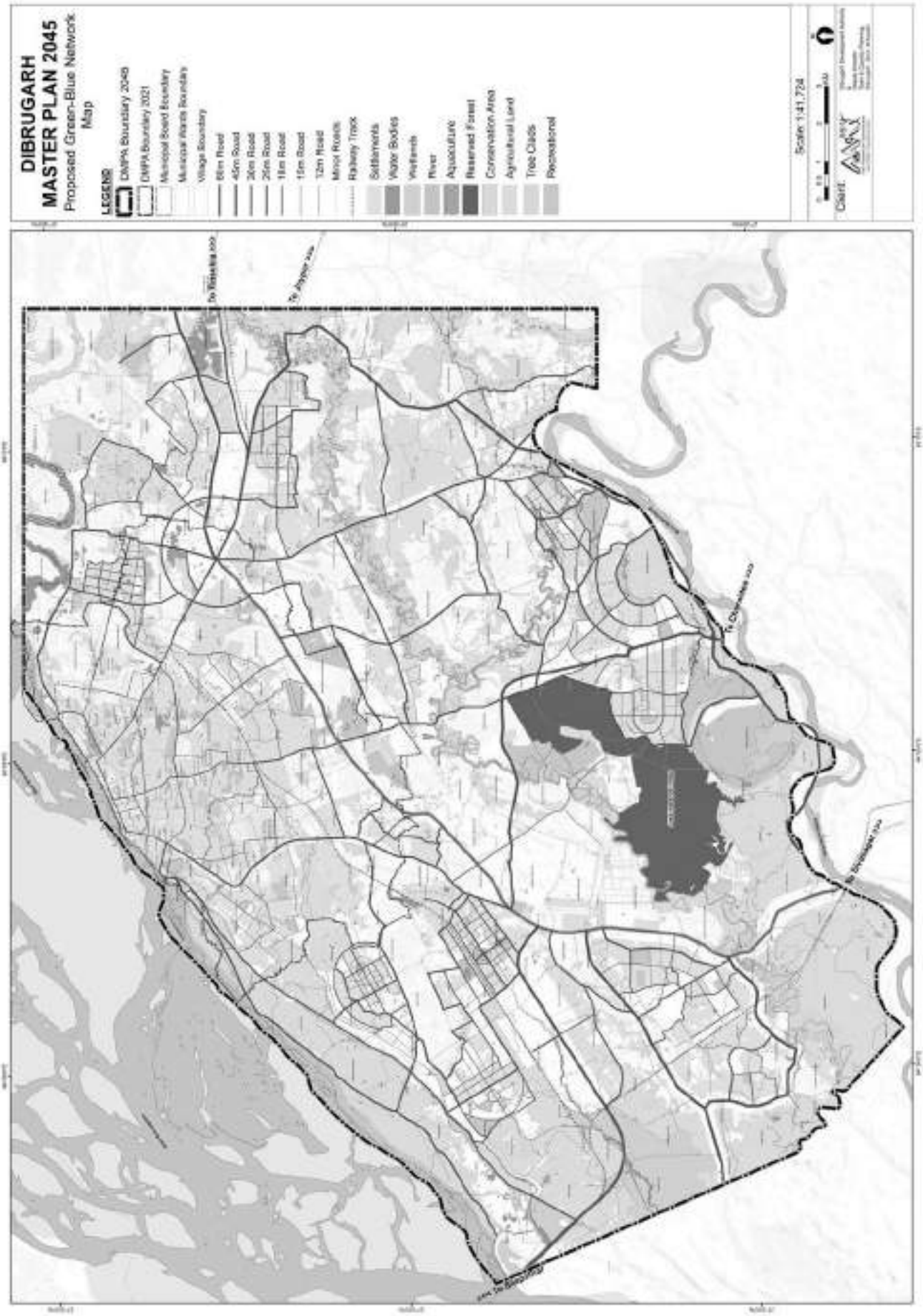

DIBRUGARH
MASTER PLAN 2045
Proposed Land Use Recreational Zoning Map
LEGEND

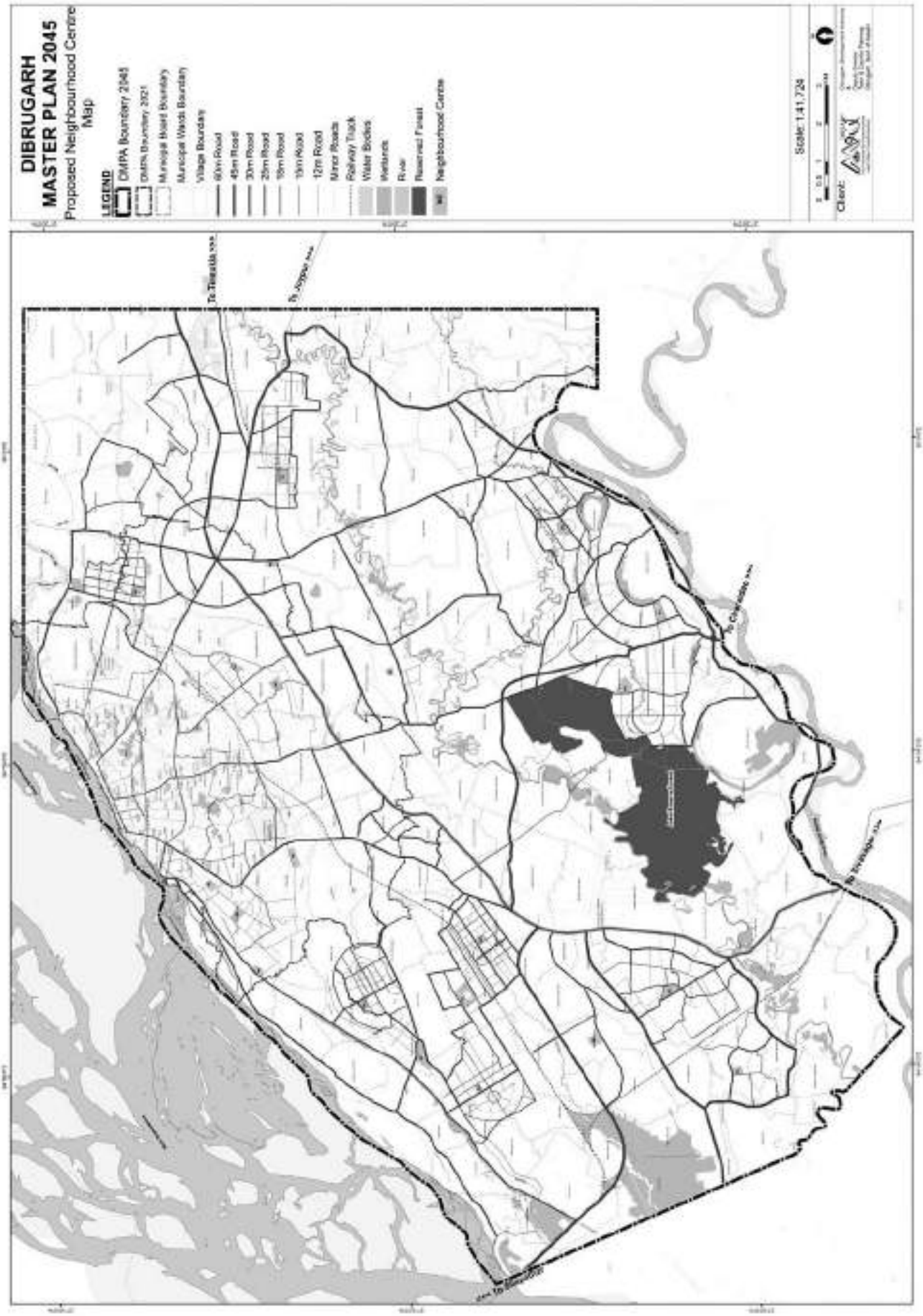

DIBRUGARH
MASTER PLAN 2045
Proposed Land Use Residential
Zoning Map
LEGEND
DMPA Boundary 2065
DMPA Boundary 2031
Municipal Board Boundary
Municipal Wards Boundary
Village Boundary
60m Road
45m Road
30m Road
25m Road
18m Road
15m Road
12m Road
Minor Roads
Railway Track
Water Bodies
Wetlands
River
Reserved Forest
Residential Zone
R-1 Primary Residential Zone
R-2 Informal Residential Zone
R-3 Affordable Housing Zone
Notified & Non-notified Slum Areas
Scale:1:41,724
Dibrugarh


DIBRUGARH
MASTER PLAN 2045
Administrative Map
LEGEND
DMPA Boundary 2045
DMPA Boundary 2001
Municipal Board Boundary
Municipal Wards Boundary
Village Boundary
60m Road
45m Road
30m Road
24m Road
18m Road
15m Road
12m Road
Minor Roads
Railway Track
Water Bodies
River
Reserved Forest
Scale-1:41,724
Client


DIBRUGARH
MASTER PLAN 2045
Proposed Eco-Sensitive/Eco Friendly Areas Map
LEGEND
DMPA Boundary 2045
DMPA Boundary 2021
Municipal Board Boundary
Municipal Wards Boundary
Village Boundary
60m Road
45m Road
30m Road
25m Road
18m Road
15m Road
12m Road
Minor Roads
Railway Track
Eco-Sensitive/Eco Friendly Areas
Water Bodies
River
Waterbody Conservation Area
Reserved Forest/Tree Clad Areas
Green Belt
Wetlands
Aquaculture
Scale:1:41,724
Client


DIBRUGARH
MASTER PLAN 2045
Proposed Economic Centre Map
LEGEND
DMPA Boundary 2045
DMPA Boundary 2021
Municipal Board Boundary
Municipal Wards Boundary
Village Boundary
60m Road
45m Road
30m Road
25m Road
18m Road
15m Road
12m Road
Minor Roads
Railway Track
Water Bodies
Wetlands
River
Reserved Forest
Commercial
Retail, General Business, Market
Integrated Commercial Centre / Exhibition Hall
Commercial Centre
Food Plaza/Vending Zone
Hotel/Tourist Centre
Wholesale/Wholesale and Trade Centre
Mixed-Use
Mixed-Land Use
Neighbourhood Centre
Industrial
Industrial Use
Scale: 1:41,724
Client:


DIBRUGARH
MASTER PLAN 2045
Proposed Green-Blue Network Map
LEGEND
DMPA Boundary 2045
DMPA Boundary 2021
Municipal Board Boundary
Municipal Wards Boundary
Village Boundary
80m Road
45m Road
30m Road
25m Road
18m Road
15m Road
12m Road
Minor Roads
Railway Track
Settlements
Water Bodies
Wetlands
River
Aquaculture
Reserved Forest
Conservation Area
Agricultural Land
Tree Cladd
Recreational
Scale 1:41,724
Client:


DIBRUGARH
MASTER PLAN 2045
Proposed Neighbourhood Centre Map
LEGEND
DMPA Boundary 2045
DMPA Boundary 2021
Municipal Ward Boundary
Municipal Wards Boundary
Village Boundary
60m Road
45m Road
30m Road
25m Road
18m Road
12m Road
Minor Roads
Railway Track
Water Bodies
Wetlands
River
Reserved Forest
Neighbourhood Centre
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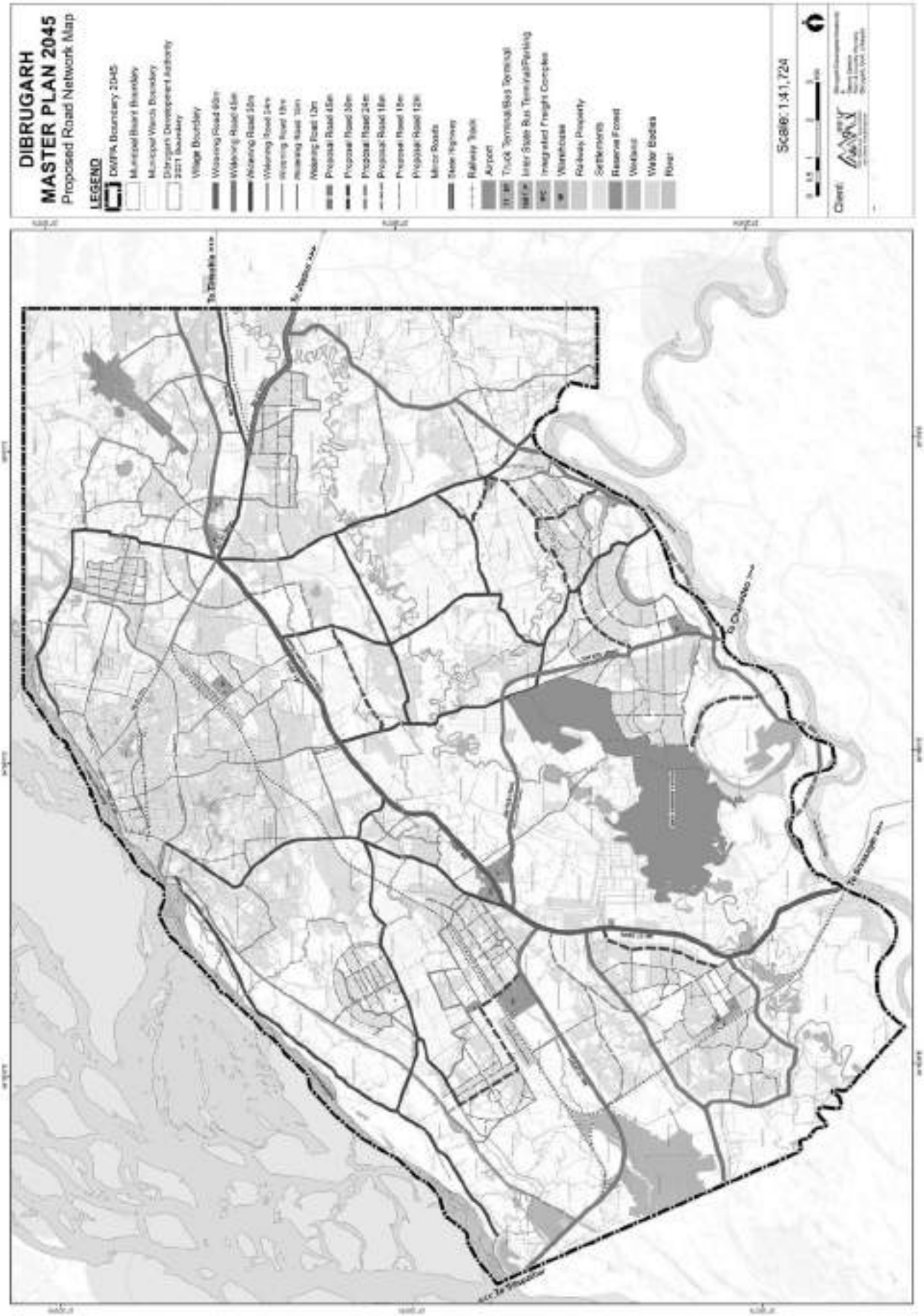
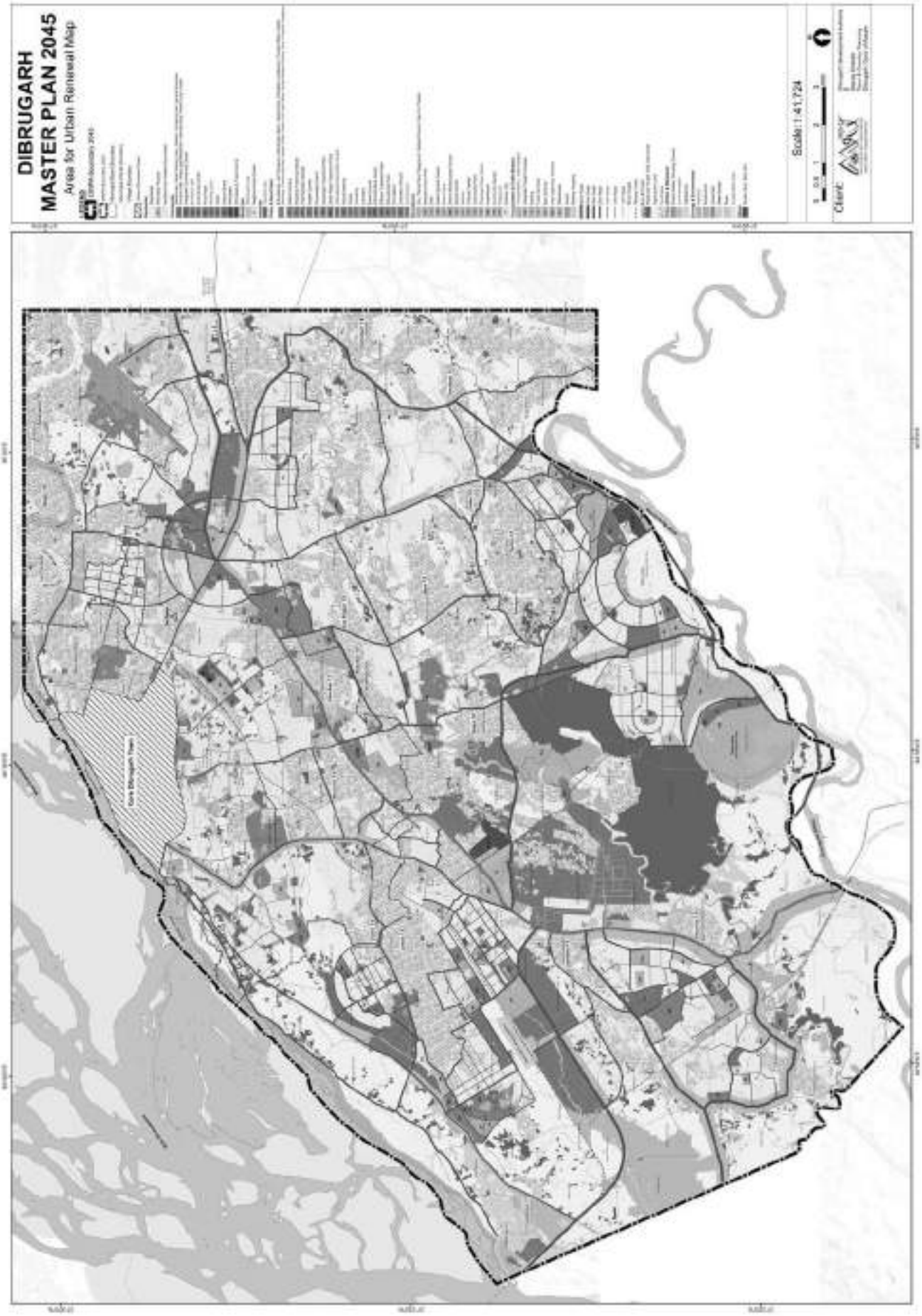

DIBRUGARH
MASTER PLAN 2045
Proposed Road Network Map
LEGEND
DMPA Boundary 2045
Municipal Board Boundary
Municipal Wards Boundary
Dibrugarh Development Authority 2011 Boundary
Village Boundary
Widening Road 60m
Widening Road 45m
Widening Road 30m
Widening Road 24m
Widening Road 18m
Widening Road 15m
Widening Road 12m
Proposal Road 45m
Proposal Road 30m
Proposal Road 24m
Proposal Road 18m
Proposal Road 15m
Proposal Road 12m
Minor Roads
State Highway
Railway Track
Airport
Truck Terminus/Bus Terminal
Inter State Bus Terminal/Parking
Integrated Freight Complex
Warehouse
Railway Property
Settlements
Reserve Forest
Wetland
Water Bodies
River
Scale: 1:41,724
Client: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MASTER PLAN 2045
Area for Urban Renewal Map
Scale 1:41,724
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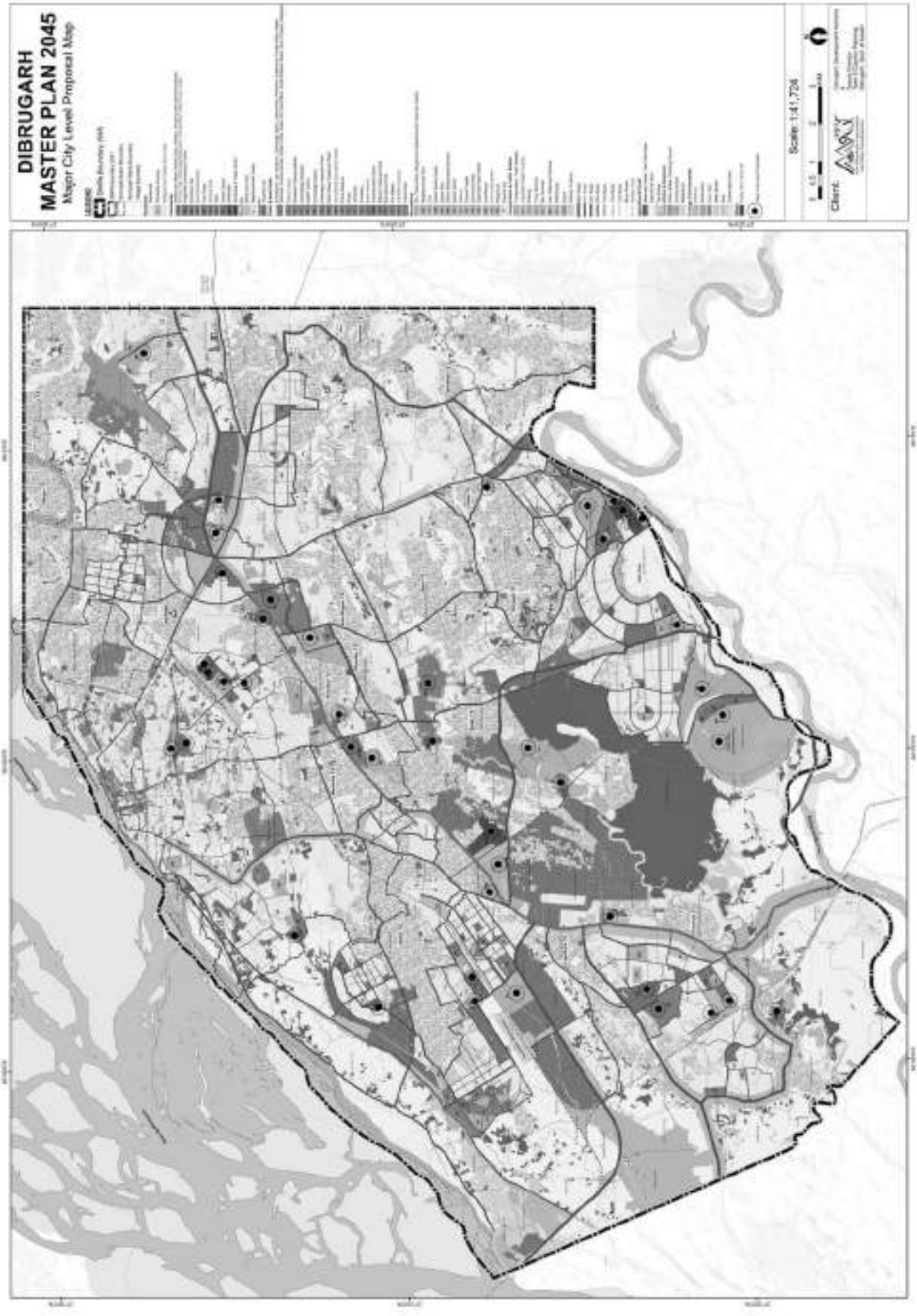
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MASTER PLAN 2045
Major City Level Proposal Map
Scale: 1:41,724
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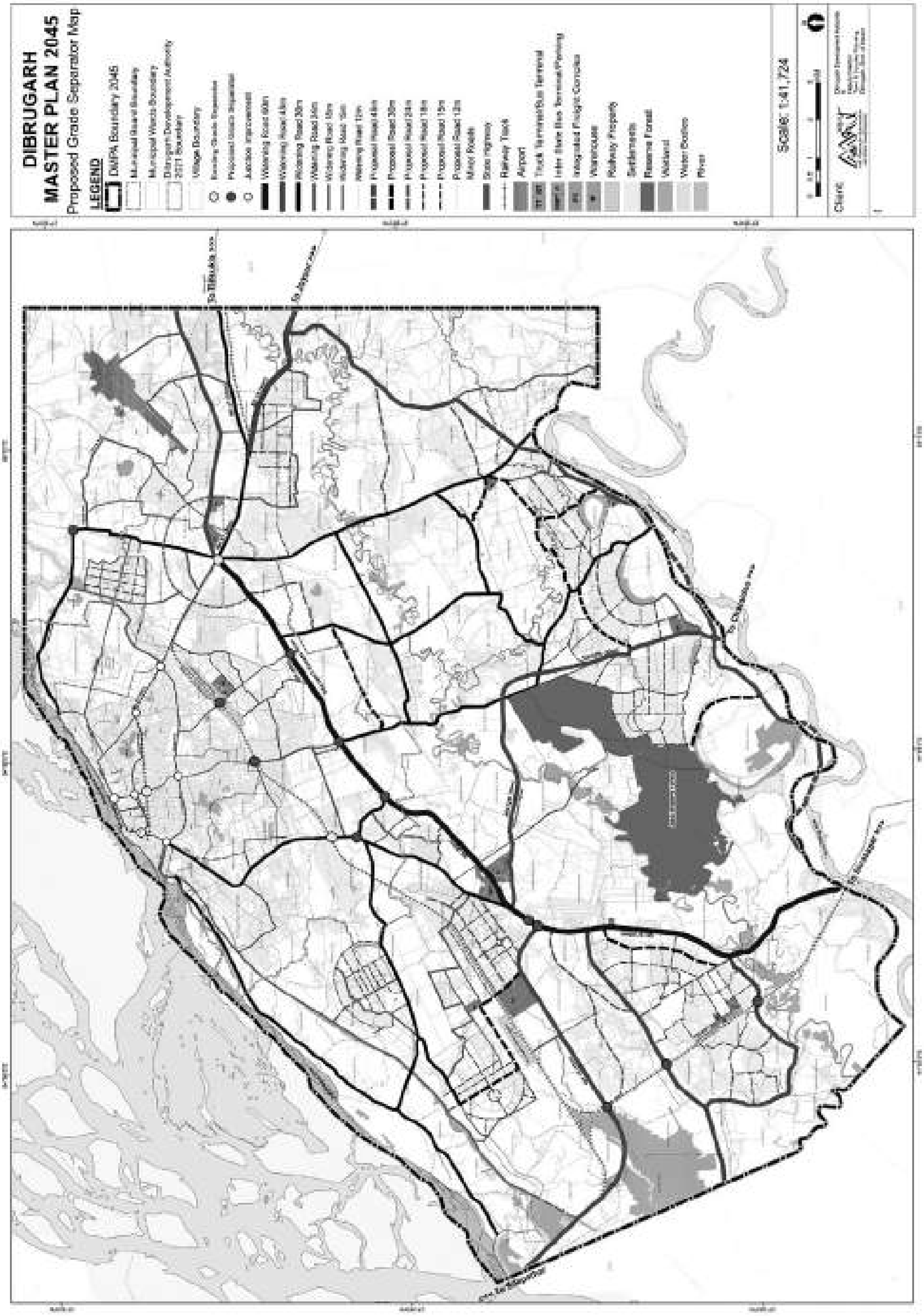
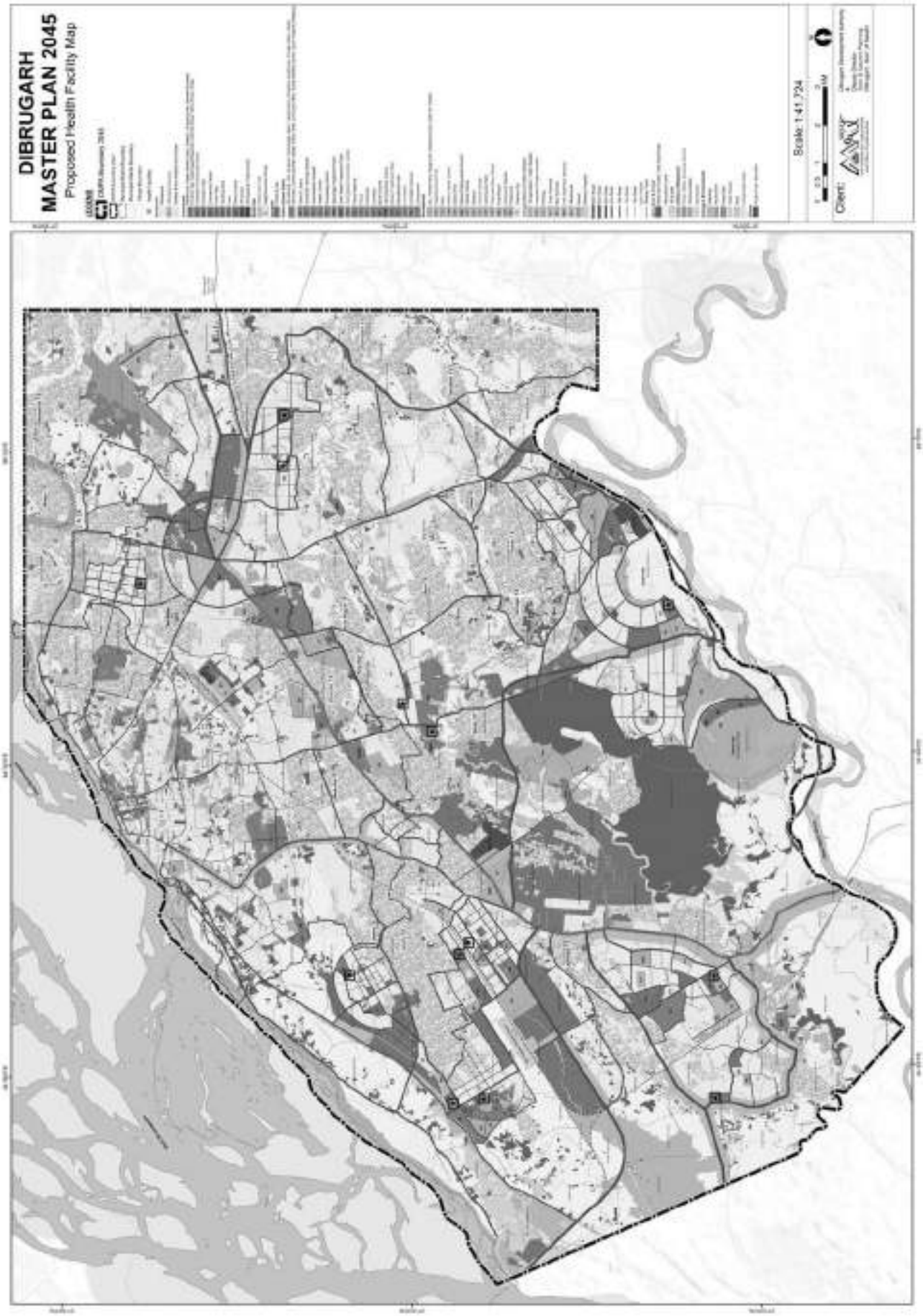

DIBRUGARH
MASTER PLAN 2045
Proposed Grade Separator Map
LEGEND
DMPA Boundary 2045
Scale: 1:41,724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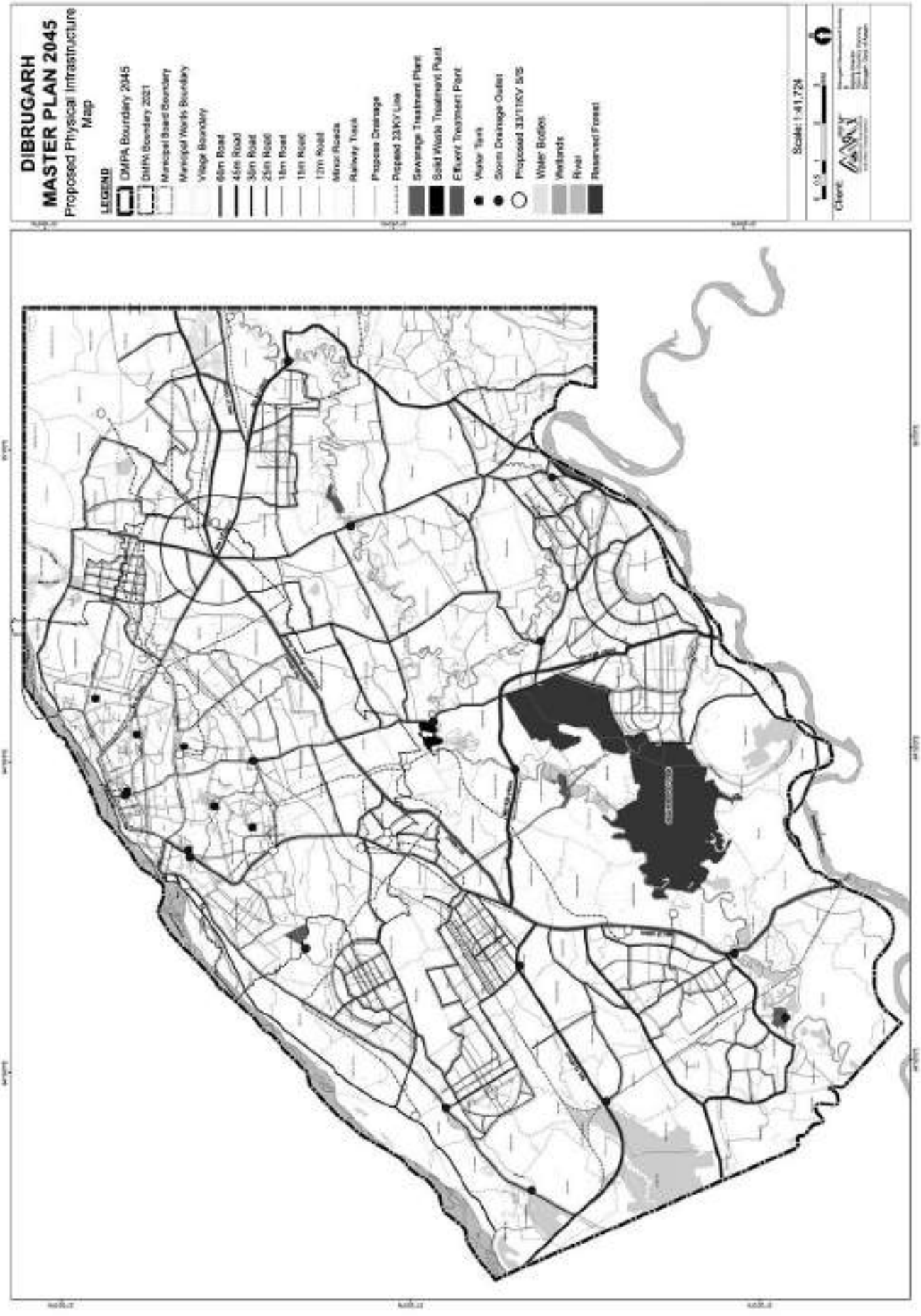
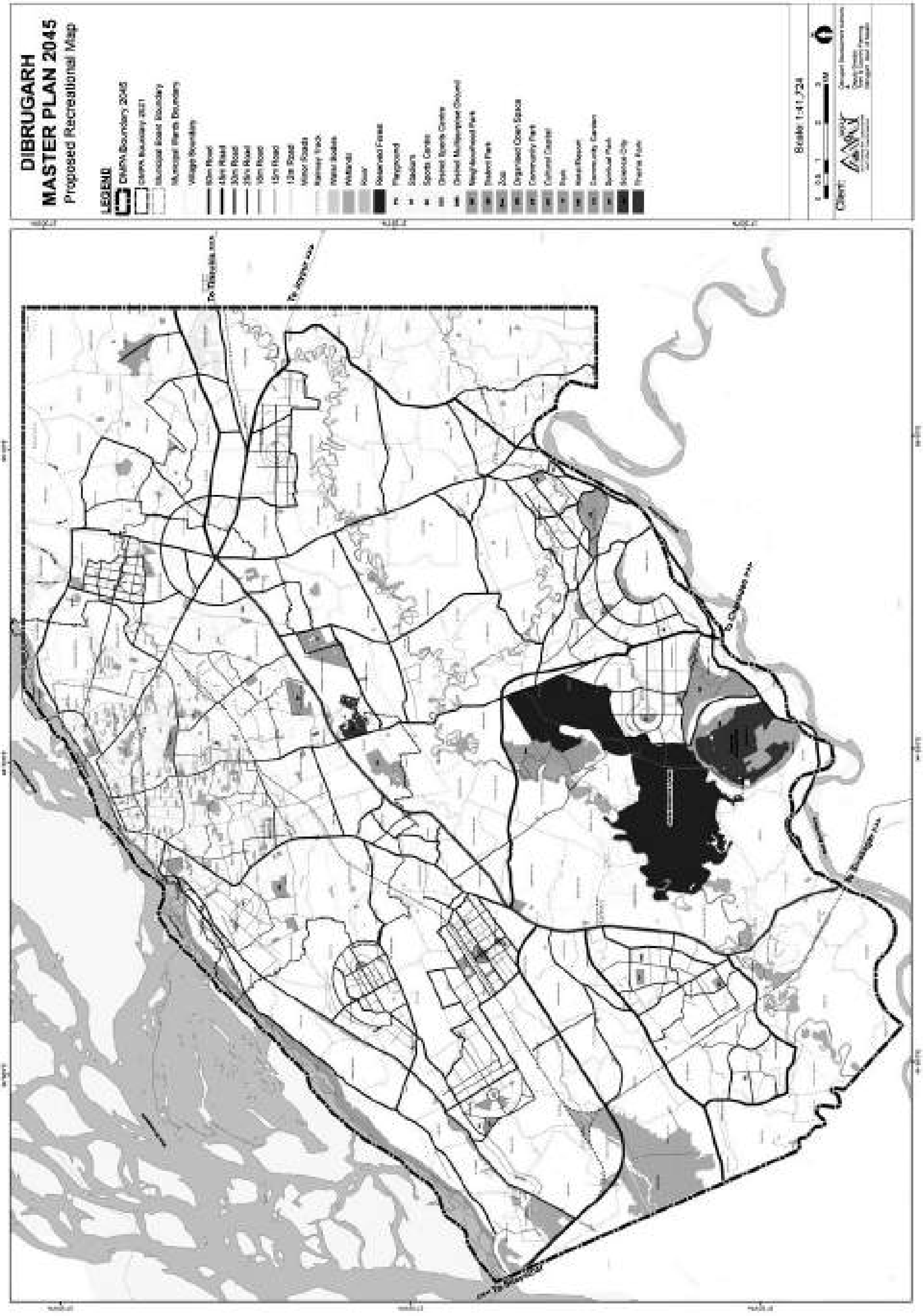
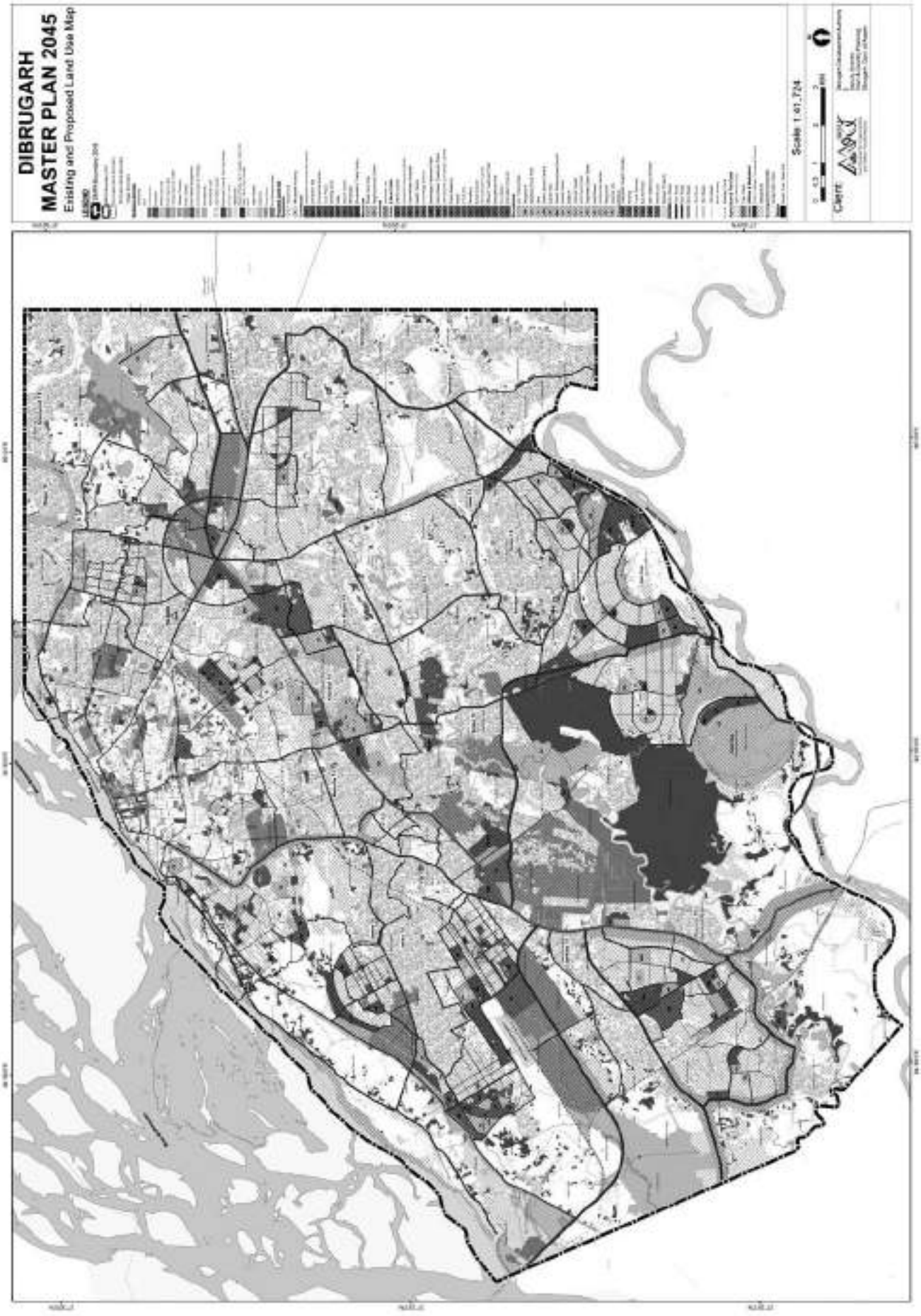
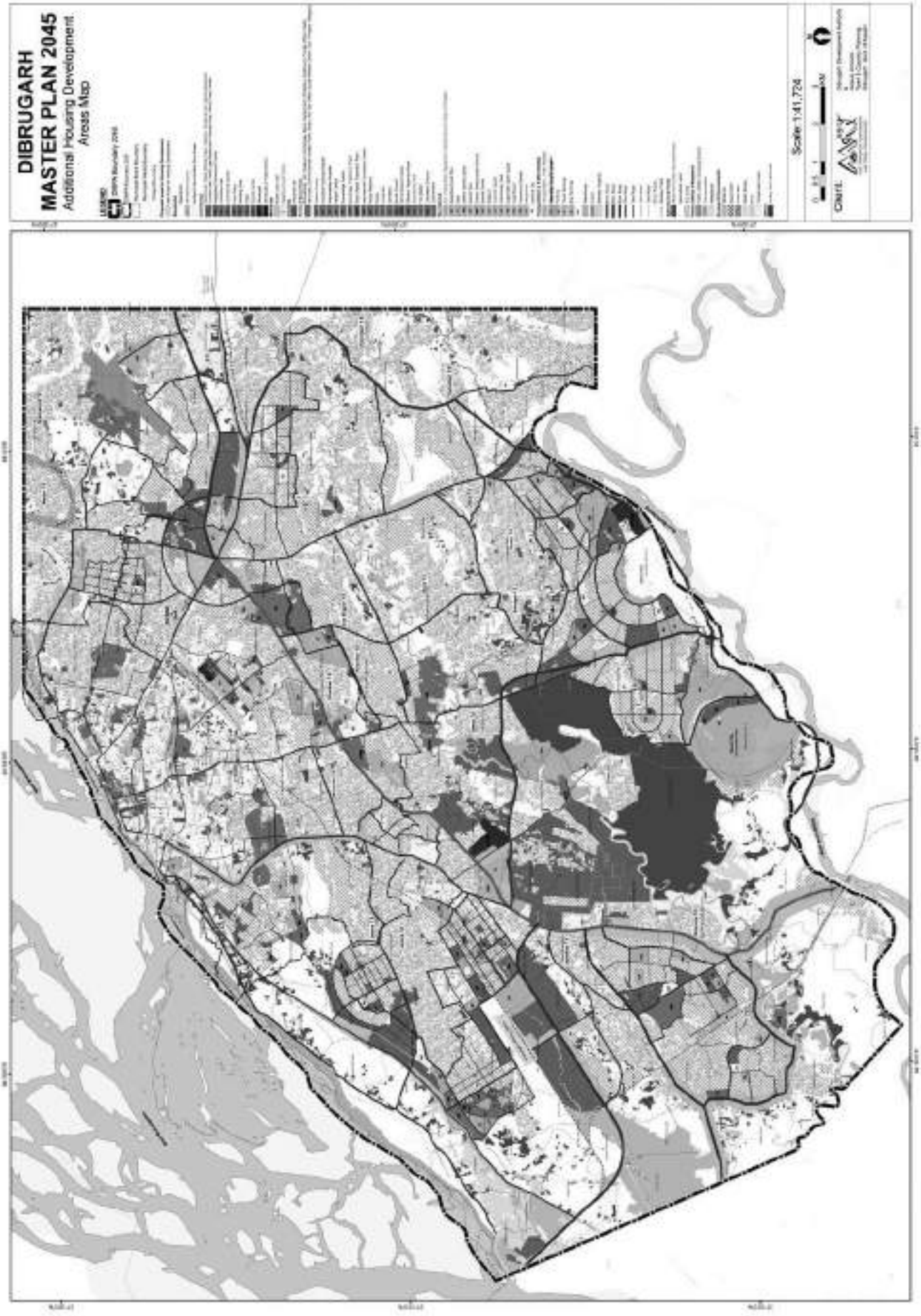
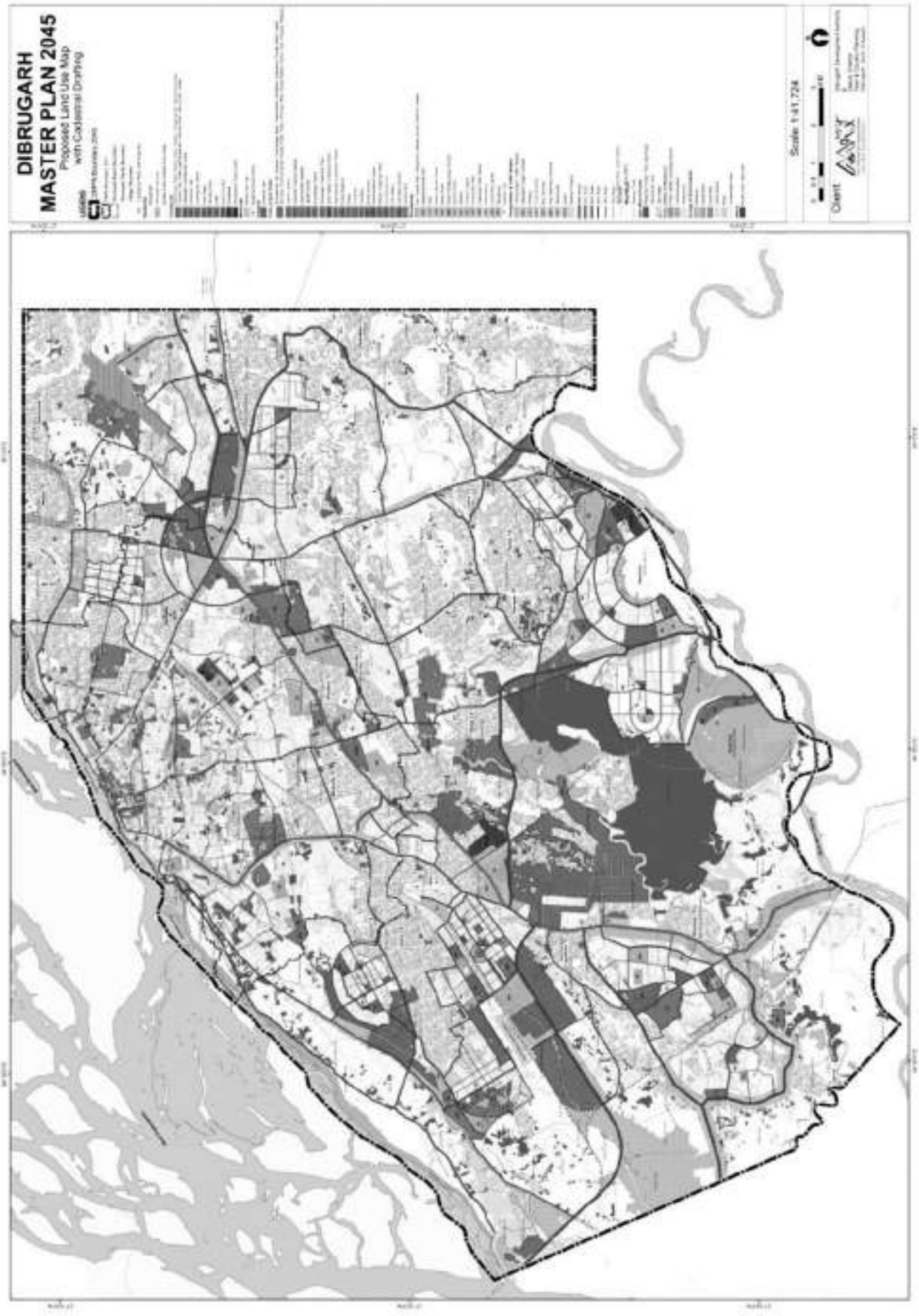
MASTER PLAN 2045
Proposed Health Facility Map
Scale: 1:41,724
Client:

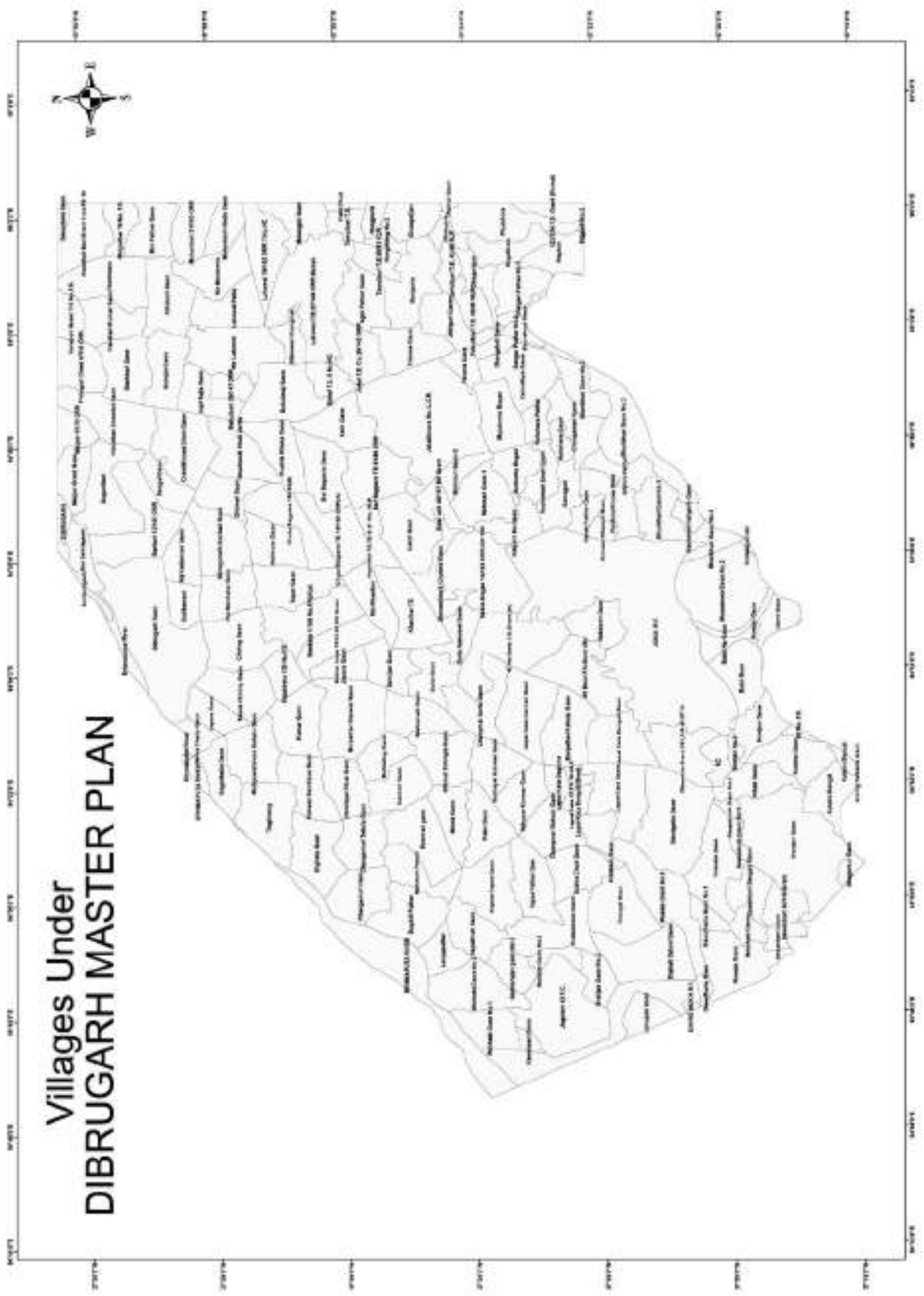

DIBRUGARH
MASTER PLAN 2045
Proposed Physical Infrastructure Map
LEGEND
DMPA Boundary 2045
DMPA Boundary 2021
Municipal Board Boundary
Municipal Wards Boundary
Village Boundary
60m Road
45m Road
30m Road
25m Road
18m Road
15m Road
12m Road
Minor Roads
Railway Track
Propose Drainage
Reposed 33KV Line
Sewerage Treatment Plant
Solid Waste Treatment Plant
Effluent Treatment Plant
Water Tank
Storm Drainage Outlet
Proposed 33/11KV S/S
Water Bodies
Wetlands
Rivet
Reserved Forest
Scale: 1:41,724
Client


DIBRUGARH
MASTER PLAN 2045
Proposed Recreational Map
LEGEND


DIBRUGARH
MASTER PLAN 2045
Existing and Proposed Land Use Map
LEGEND
Scale 1:61,724


DIBRUGARH
MASTER PLAN 2045
Additional Housing Development Areas Map
Scale 1:41,724


DIBRUGARH
MASTER PLAN 2045
Proposed Land Use Map
with Cadastral Drafting
Scale 1:41,724
Client


Villages Under
DIBRUGARH MASTER PLAN

Acronyms

AADT	Average Annual Daily Traffic
AASU	All Assam Students Union
ABD	Area Based Development
ABITA	Assam Branch Indian Tea Association
ADT	Average Daily Traffic
AGCL	Assam Gas Company Limited
AHP	Affordable Housing in Partnership
AIDCL	Assam Industrial Development Corporation Ltd.
AIR	All India Radio
AL	Agriculture Land
AMC	Assam Medical Collage
AMCH	Assam Medical Collage & Hospital
AMR	Automated Meter Readers
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
AMSL	Above Mean Sea Level
APDCL	Assam Power Distribution Company Limited
ASDMA	Assam State Disaster Management Authority
ASI	Archaeological Survey of India
ASTC	Assam State Transport Corporation
AUDA	Ahmedabad Urban Development Authority
AUIIP	Assam Urban Infrastructure Investment Program
BCPL	Brahmaputra Cracker and Polymer Limited
BDO	Block Development Officer
BGL	Below Ground Level
BIS	Bureau of Indian Standards
BLC	Beneficiary Led Construction
BMW	Bio-Medical Wastes
BOD	Biological Oxygen Demand
BOT	Built Operate and Transfer
BPL	Below Poverty Line
BRTS	Bus Rapid Transit System
BUL	Built Up Land
CBD	Central Business District
CDMP	City Disaster Mitigation Plan
CEO	Chief Executive Officer
CHPEEO	Central Public Health and Environmental Engineering Organisation
CIDCO	City and Industrial Development Corporation
CIDF	City Infrastructure Development Fund
CLSS	Credit Linked Subsidy Scheme
CNA	Central Nodal Agencies
CO	Circle Officer
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board

CPHEEO	Central Public Health and Environmental Engineering Organisation
CPSU	Central Public Sector Undertaking
CPT	Central Place Theory
CPWD	Central Public Work Department
CRC	Central Relief Commissioner
CSMC	Central Sanctioning And Monitoring Committee
CSS	Centrally Sponsored Scheme
CT	Census Town
CTC	Crush-Tear-Curl
CVC	Classified Volume Counts
DBRT	Dibrugarh Town
DC	Deputy Commissioner
DCR	Development Control Regulation
DD	Deputy Director
DDA	Dibrugarh Development Authority
DDIPR	District Directorate of Information and Public Relations
DDMA	District Disaster Management Authority
DDMP	District Disaster Management Plan
DDPC	Dibrugarh District Planters' Club
DEM	Digital Elevation Model
DEOC	District Emergency Operational Centre
DIB	Dibrugarh
DIPRO	District Information & Public Relations Officer
DM	Disaster Management
DMB	Dibrugarh Municipal Board
DMP	Dibrugarh Master Plan
DMPA	Dibrugarh Master Plan Area
DNPL	Duliajan Numaligarh Pipeline Ltd
DP	Development Plan
DPR	Detail Project Report
DPT	Dibrugarh Town Protection
DTO	District Transport Office
DTP	Dibrugarh Town Protection
ECS	Equivalent Car Space
EDC	External Development Charges
ESR	Elevated Service Reservoir
ETP	Effluent Treatment Plant
EWS	Economical Weaker Section
FAR	Floor Area Ration
FCI	Food Corporation of India
FMB	Field Measurement Book
FREMAA	Flood And River Erosion Management Agency Of Assam
FSI	Floor Space Index
GDCR	General Development Control Regulation
GHMC	Greater Hyderabad Municipal Corporation

GIS	Geographic Information System
GLSR	Ground Level Storage Reservoir
GOI	Government of India
GOSS	Ground Operational Support System
GTPUDA	Gujarat Town Planning and Urban Development Act
HCF	Heavy Chemical Fectory
HCM	Heavy Construction Machinery
HCV	Heavy Commercial Vehicle
HDB	Housing and Development Board
HFAP	Housing for All Plan
HH	House Hold
HIG	Higher Income Group
HMV	Heavy Motor Vehicle
HQ	Head Quarter
HUDCO	High Voltage Distribution System
HVDS	Internal Development Charges
ICC	International Convention Centre
IDC	Internal Development Charges
IEC	Information, Education and Communication
IHHL	Individual Household Latrine
IIT	Indian Institute of Technology
IMD	India Meteorological Department
INR	Indian Rupees
INTACH	Indian National Trust for Art and Cultural Heritage
IPDS	Integrated Power Development Scheme
IPT	Intermediate Public Transfer
IRC	Indian Road Congress
ISBT	Inter-State Bus Terminus
ISRO	Indian Space Research Organisation
ISSR	In-situ Slum Rehabilitation
IT	Information Technology
ITI	Industrial Training Institute
KLD	Kilo Litre per Day
KM	Kilo Metre
KV	Kilo Volt
LARR	Land Acquisition, Rehabilitation and Resettlement
LAX	Los Angeles International Airport
LCV	Light Commercial Vehicle
LIC	Life Insurance Corporation
LIG	Low Income Group
LMV	Light Motor Vehicle
LPCD	Litre Per Capita per Day
LPG	Liquefied Petroleum Gas
LPS	Land Pooling System
MAV	Multi Axle Vehicle

MB	Municipal Board
MCV	Medium Commercial Vehicle
MFF	Multitranche Financing Facility
MFZ	Multi Functional Zones
MHA	Ministry of Home Affairs
MIG	Medium Income Group
MLA	Members of the Legislative Assembly
MLD	Million Liter per Day
MMRDA	Mumbai Metropolitan Region Development Authority
MNC	Multinational Corporation
MNES	Ministry of Non-Conventional Energy Sources
MP	Member of Parliament
MPA	Master Plan Area
MSL	Mean See Level
MSME	Micro Small and Medium Enterprises
MSW	Municipal Solid Waste
MT	Metric Tonnes
MW	Mega Watt
NAAC	National Assessment and Accreditation Council
NAMP	National Air Quality Monitoring Programme
NBC	National Building Code
NBSS	National Bureau of Soil Survey
NCC	National Cadet Corps
NDMA	Nagaon Disaster Management Authority
NDRF	National Disaster Response Force
NE	North-East
NERPSIP	North Eastern Region Power System Improvement Project
NGO	Non Governmental Organization
NH	National Highway
NHAI	National Highways Authority of India
NHB	National Housing Bank
NMT	Non Motorised Transport
NNRMS	National Natural Resources Management System
NPV	Net Present Value
NRL	Numaligarh Refinery Limited
NRSC	National Remote Sensing Centre
NSS	National Service Scheme
NTU	Nephelometric Turbidity unit
NUSI	National Union of Seafarers of India
NWMP	National Water Monitoring Program
OD	Origin- Destination
OG	Out Growth
OHT	Over Head Tank
PCB	Pollution Control Board
PCBA	Pollution Control Board Assam

PCR	Police Control Room
PCU	Passanger Car Unit
PET	Polyethylene Terephthalate
PHC	Public Health Centre
PHE	Public Health Engineering
PIA	Public Interest Area
PLU	Proposed Land Use
PMAY	Pradhan Mantri Awas Yojana
PPH	Person Per Hector
PPP	Person Per Household
PPPP	Public Private Partnership
PSP	Public & Semi-Public
PUC	Pollution Under Control
PWD	Public Work Department
PWRD	Public Work Road Department
PWSS	Pipe Water Supply Scheme
RAY	Rajivgandhi Awas Yojana
RCC	Reinforced Cement Concrete
RERA	Real Estate Regulatory Authority
ROB	Road Over Bridge
ROW	Right of Way
RRT	Rapid Response Team
SAR	Search & Rescue
SC	Scheduled Caste
SDO	Sub Divisional Officer
SDRF	State Disaster Response Force
SHG	Self Help Group
SLSMC	State Level Sanctioning and Monitoring Committee
SOP	standard Operating Procedure
SPV	Special Purpose Vehicle
ST	Scheduled Tribe
STP	Sewerage Treatment Plant
SW	Solid Waste
SWM	Solid Waste Management
SWTP	Solid Waste Treatment Plant
TC	Town Committie
TDR	Transferable Development Right
TDS	Total dissolved solids
TIF	Tax Increment Financing
TOD	Transit Oriented Development
TP	Town Planning
TPD	Tonnes Per Day
TPETC	Tai Phake Eco-tourism Camp
TPS	Town Planning Scheme
TSDF	Treatment Storage and Disposal Facility

TVC	Traffic Volume Count
UDAY	Ujwal DISCOM Assurance Yojana
ULB	Urban Local Body
UNCHS	United Nations Centre for Human Settlements
UNDP	United Nations Development Programme
URDPFI	Urban and Regional Development Plans Formulation and Implementation
UT	Union Territory
VAMBAY	Valmiki Ambedkar Awas Yojana
VCF	Value Capture Finance
VLMCC	Village Land Management and Conservation Committee
VLT	Vacant Land Tax
WFPR	Work Force Participation Rate
WPR	Workforce Participation Rate
WTE	Waste-to-Energy
WTP	Water Treatment Plant

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