

Chapter 2

About Study area

Purba Medinipur district is the southernmost region of the West Bengal state. The geographical extension is about 21°36'35" to 22°30'44" north latitude and 87°25'37" to 88°12'30" east longitude. Purba Medinipur district is delimited by Paschim Medinipur district on the north and westward; Odisha state (some part) on the westward; Rupnarayan and Hooghly river on the east; Bay of Bengal on southern part (Figure 2.1). The district, Purba Medinipur extends over a span of 4061 sq. km (Purba Medinipur Official website), which is near about 5.31 % of West Bengal state (<https://en.wikipedia.org/>, 2018)

The entire district has 4 sub-divisions (Tamluk, Haldia, Egra and Contai), 5 statutory towns (Panskura, Tamluk, Haldia, Egra and Contai) and 20 census towns. The detail about present population status and their administrative set up are given in Table 2.1 and 2.2.

Table 2.1: Population status of Purba Medinipur district

Sl. No	Item	Sub-Division			
		Tamluk	Haldia	Contai	Egra
1	Area (In Sq. Km.)	1091.90	734.90	1261.20	973.42
2	Population	1567458	820149	1202047	827723
	a) Male	806563	421895	616288	423576
	b) Female	760895	398254	585759	404147
3	Scheduled Caste	178018	137420	205744	117815
	a) Male	91317	70311	105103	60189
	b) Female	86701	67109	100641	57626
4	Scheduled Tribe	15370	3298	2903	4936
	a) Male	7796	1661	1451	2513
	b) Female	7574	1637	1452	2423
5	Population density (km ²)	1436	1116	953	850
6	No. of Households	295590	154775	213754	153711
7	Total No. of Literates	1239049	660504	988401	652974
	Literates (in %)	79	81	82	79
	a) Male	711060	374062	560508	376340
	In %	88	89	91	89
	b) Female	527989	286442	427893	276634
	In %	69	72	73	68

Source: Purba Medinipur District official website

Table 2.2: Administrative set up of Purba Medinipur district

Sub-Divisions	C.D. Blocks	No. of Villages	Census Towns
Tamluk	Tamluk	87	Goasafat, Anantapur, Dakshin Baguan, Kakdihi, Shantipur, Kolaghat, Amalhara, Mihitikri, Kharisha, Kotbar and Ershal
	Sahid Matangini	13	
	Panskura-I (Kolaghat)	12	
	Panskura-II	28	
	Moyna	10	
	Nandakumar	46	
	Nandigram-III (Chandipur)	19	
Haldia	Mahishadal	41	Garh Kamalpur, Nandigram, Ashadtalya, Barda
	Nandigram-I	7	
	Nandigram-II	2	
	Sutahata	42	
	Haldia	-	
Egra	Patashpur-I	37	Benudiya and Hinchha Gerya
	Patashpur-II	15	
	Bhagawanpur-I	40	
	Egra-I	19	
	Egra-II	9	
Kanthi (Contai)	Khejuri-I	17	Basantia and Khadalgobra
	Khejuri-II	68	
	Bhagawanpur-II	22	
	Ramnagar-I	21	
	Ramnagar-II	26	
	Kanthi-I (Contai-I)	4	
	Kanthi-II (Deshapran)	-	
	Kanthi-III (Contai-III)	17	

Source: West Bengal drinking water sector improvement project report, 2015.
District action plan for disaster preparedness, Purba Medinipur, 2016.

Purba Medinipur district is distinguished for its geographical attitude, physiographic variance, agro-climatic surrounding and cultivation, social composition etc. The brief climatic conditions, physiographic and regional setting, communication details, socio-economic environmental details etc are depicted below.

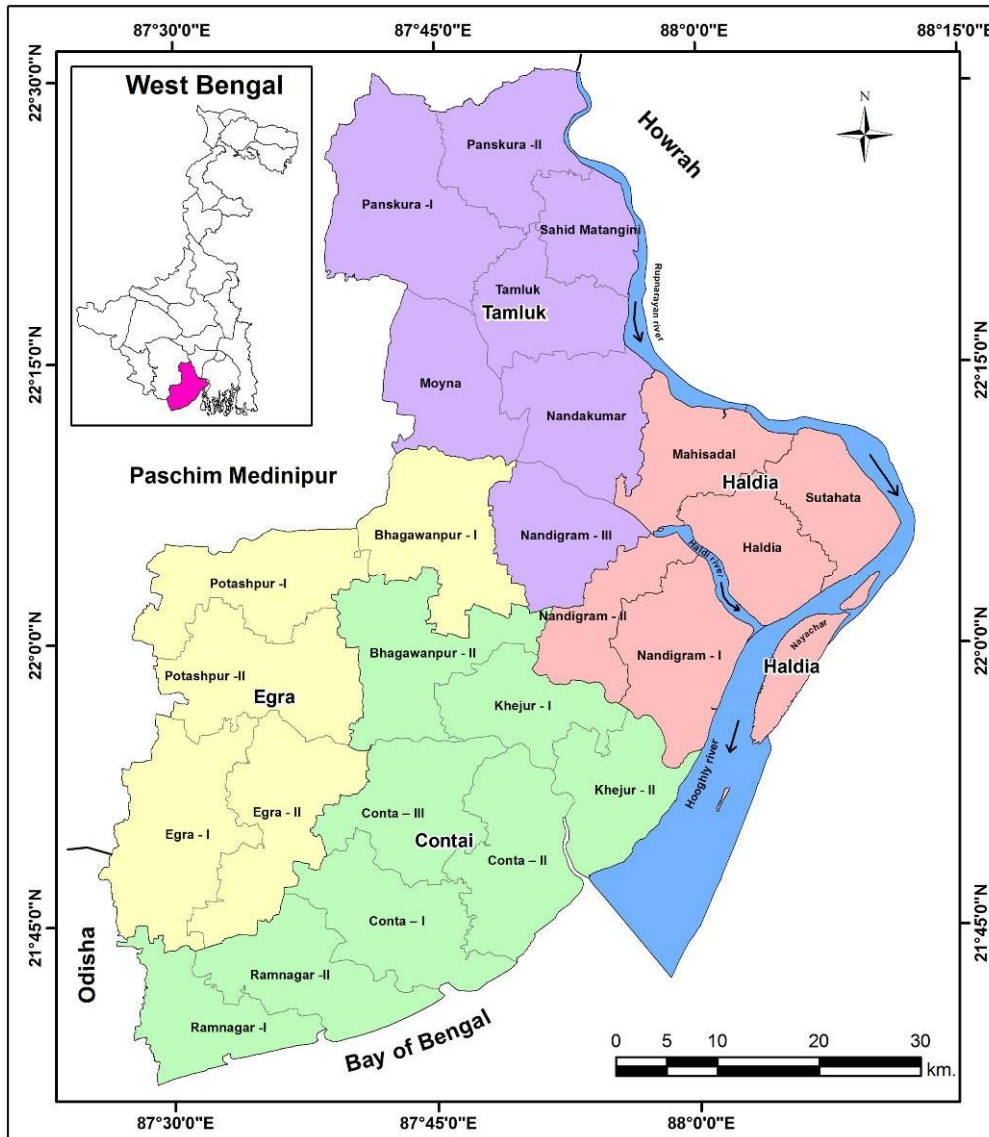


Figure 2.1: Location map of the study area

2.1. Geographical indicators

2.1.1 Physiography

Geographically this district is sub divided into two parts. One is flat plains or lower Indo-Ganges plain and another is coastal plains. The flat plains are observed at the eastern, northern and western part of the district. On the other hand coastal plains, that is observed at 65.5 km. long coastal stretch at southern part of the district. This coastal area is formed by Aeolian and Fluvial sediment deposition (Debnath and Roy, 2015).

Mostly the district is characterized by flat terrain. The elevation of the study area ranges from 3 to 10 m above mean sea level (MSL). The 10 m elevation above MSL is in

northern ward and southern ward from 3 m to 4 m, which is slowly thought to have sunk into the Bay of Bengal (Duari, 2017). The physiographic depositions of the Purba Medinipur district are mainly characterized by alluvial plain, coastal plain and sand dune (Figure 2.2).

Alluvial plain	:	Recent Flood Plain Pardeltaic Fan Surface Mature deltaic Plain
Coastal plain	:	Younger deltaic Plain Coastal Plain
Sand Dune	:	Sand Dune

Geomorphologically the area Deshapran, Kanthi/Contai etc, have micro topographical variation (Obi Reddy, 2017; Das and Dandapath, 2014). A significant series of coastal dunes (palaeo shoreline) stretching from West-South-West to East-North-East direction, which are observed at Contai and Ramnagar blocks. The newer sand dunes are almost flat with beach face around 200 m to 1000 m (Bauri and Upadhyay, 2016). The older dunes (Nearly flat) are affecting by enduring settlements of the local villages (Das, 2015, Das et al., 2017).

2.1.1.1 Contai plain

The innermost and southern region (Moyna, Nandigram, Contai etc.) of the district is known as Contai plain. The alluvial deposited is the main character of this region. The western parts of this area are characterized by undulating.

2.1.1.2 Digha coastal plain

Digha coastal plain is characterized by sandy soil, which exhibited the sand dunes, coastal and sea beach, embankment in Kanthi and Ramnagar region. It extends from Rasulpur river mouth to Subarnarekha river mouth.

2.1.1.3 Lesser Kasai plain

The lower eastern part of the Kasai river plain is mainly deltaic nature due to tidal influences and active flow. A small unit of Panskura, Tamluk, Nandigram, Sutahata, Haldia etc. falls in this physiographic character.

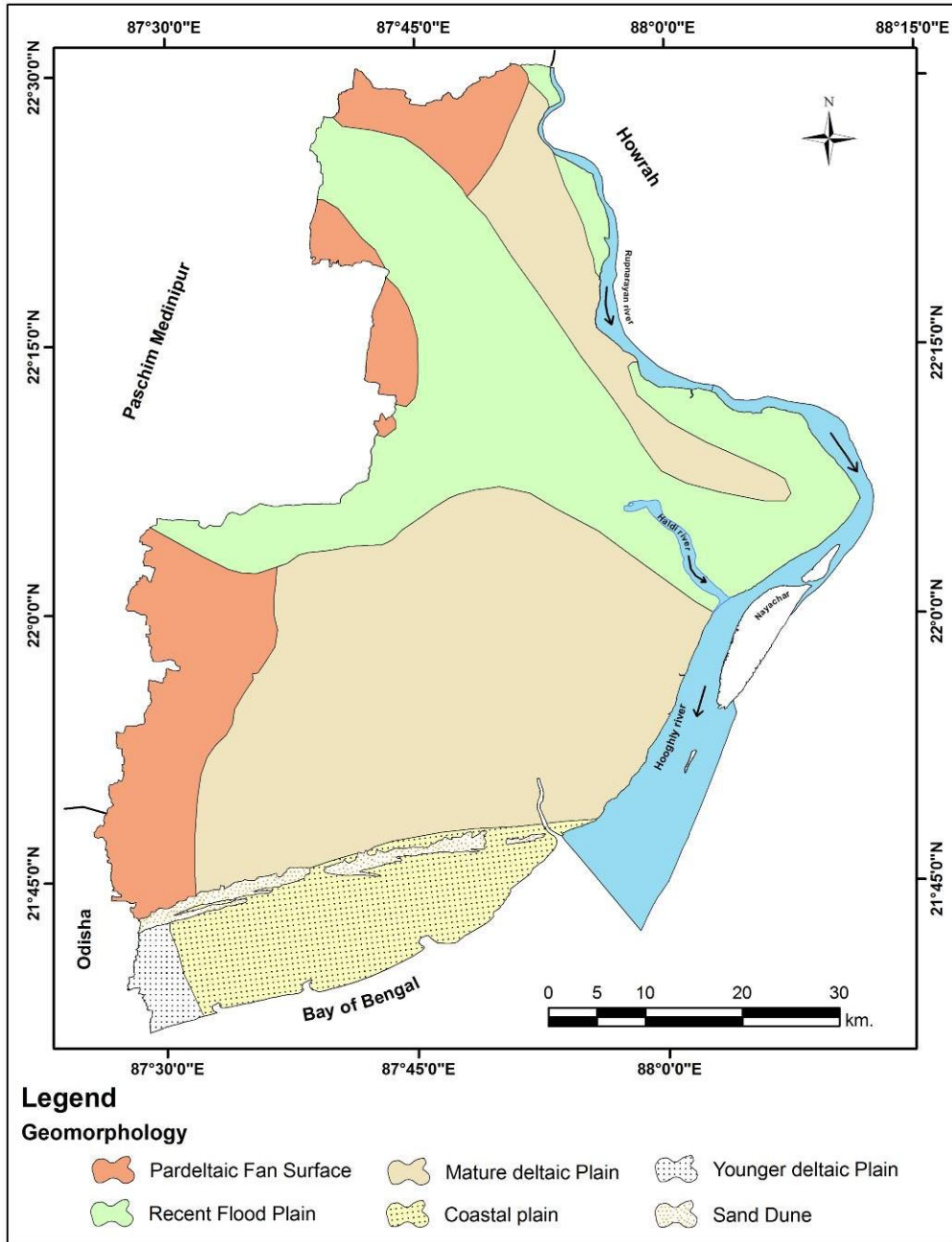


Figure 2.2: Physiographic units of the study area

The maps of physiographic units are collected from NRDMS centre, Purba Medinipur district. Further, these physiographic information's are modified with the reference of Landsat 8 (OLI) satellite data. Due to yearly flood and dynamic coastal plain, the modifications of the physiographic units are necessary. The Figure 2.2 is showing the modified physiographic units of the study area.

2.1.2 Slope and Drainage

According to Panda (2014), the slope is an angular distance between two locations. The slope has an important key role in the surface runoff as the distribution of drainage network also uses gravity and slope to flow water (Faiia, 1982; Panda et al., 2014). The area has been characterized by gentle slope (0-6 degree) from north to south towards Bay of Bengal. The slope of the coastal area like Deshapran, Kathi, Contai etc are sub divided by very gently sloping plain (1-3 degree) and nearly level plain (0-1 degree) (Obi Reddy, 2017; Mondal, 2012).

The entire drainage system in abound from the north-west or west to east and south-east due to topographical slope of the area. Haldia, Rasulpur and Rupnarayan etc., are affluent tidal tributaries of Hooghly. Mainly drainage system of the district is controlled by Haldi, Rupnarayan, Rasulpur, Kaliaghai and Pakibani sub-basin (Table 2.3). Drainage map of the study area is shown in Figure 2.3.

Table 2.3: Main drainage system of the Purba Medinipur district

Major rivers	Flows form	Joins or end	Major tributaries
Kaliaghai	Trickles out from Dudhkundi of Jhargram	Kangsabati	Kapaleswari, Deuli, Baghai and Chandia
Haldi	Formed by joining of Kaliaghai and Kangsabati river	Hooghly river	Kaliaghai & New Cossye
Rupnarayan	Formed by joining of Shilabati and Dwarkeshwar river	Hooghly river	Kana, Darakeswar, Polashpai, Durbachaty
Rasulpur	Formed by joining of Bagda, Sarpai and Madhakhali river	Hooghly river	-
Pakibani	Paschim Medinipur district	Bay of Bengal	-

Source: West Bengal drinking water sector improvement project report, 2015.
Annual flood report of irrigation & waterways department, 2014.

Hooghly receives the river Rupnarayan as a major tributary that flowed of the tide from the Bay of Bengal. The river Haldi subdivided the district Purba Medinipur into Tamluk and Nandigram-Rasulpur drainage area. The details about the drainage pattern of the Purba Medinipur district are presented on Figure 2.3.

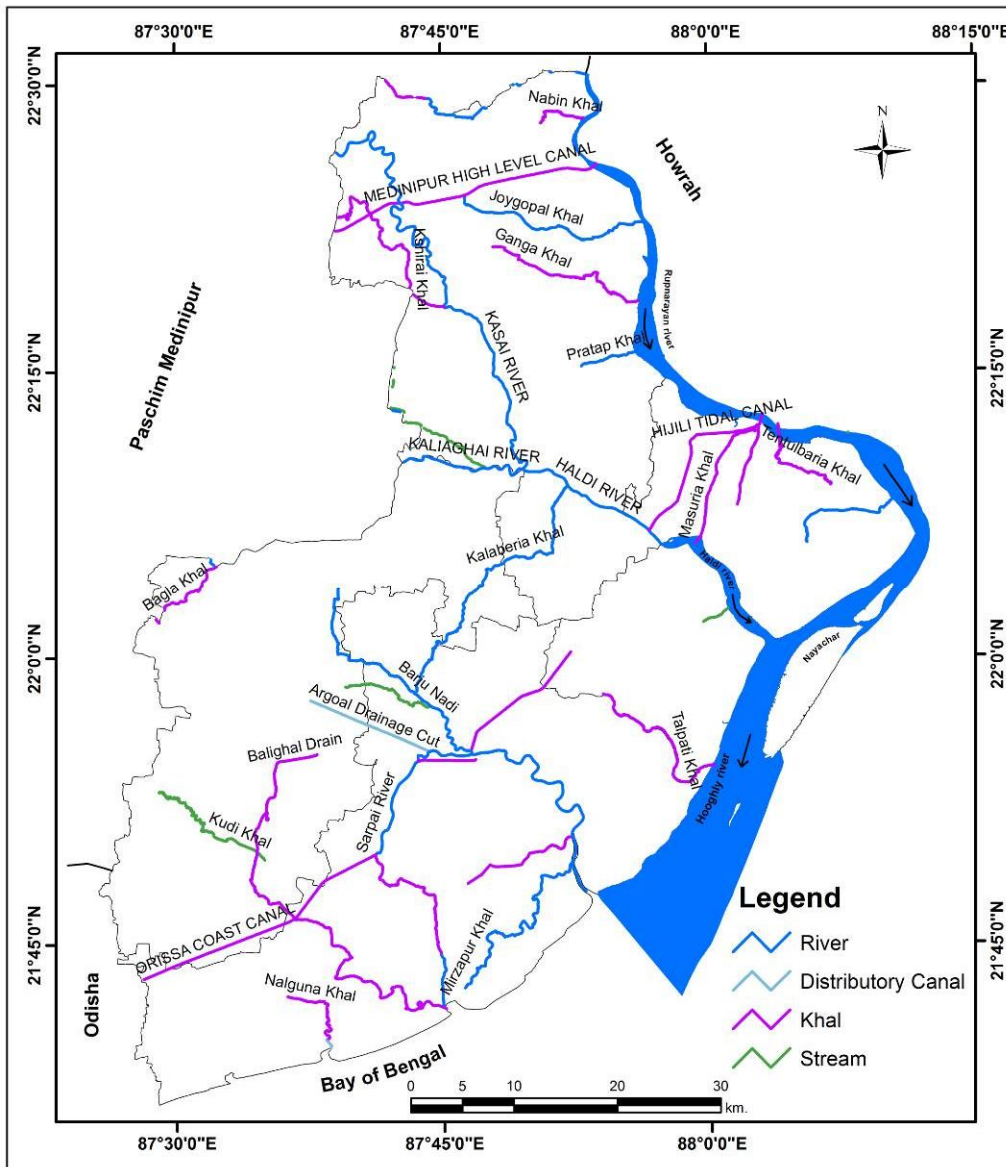


Figure 2.3: Drainage network system of the Purba Medinipur district

2.1.3 Soil

The flat plains, which are formed by alluvium deposit but the coastal plain, which are consists by younger and coastal alluvial deposits of sand (Mandal et al., 2013; Sahu, 2014). The soil of the flat plain consists by sediments made up clay and silt materials which are poor permeability of water (Pattanayak et al., 2015). As the area is located in the flood prone region, the amount of clay content is deposited in flood period (Das, 2017).

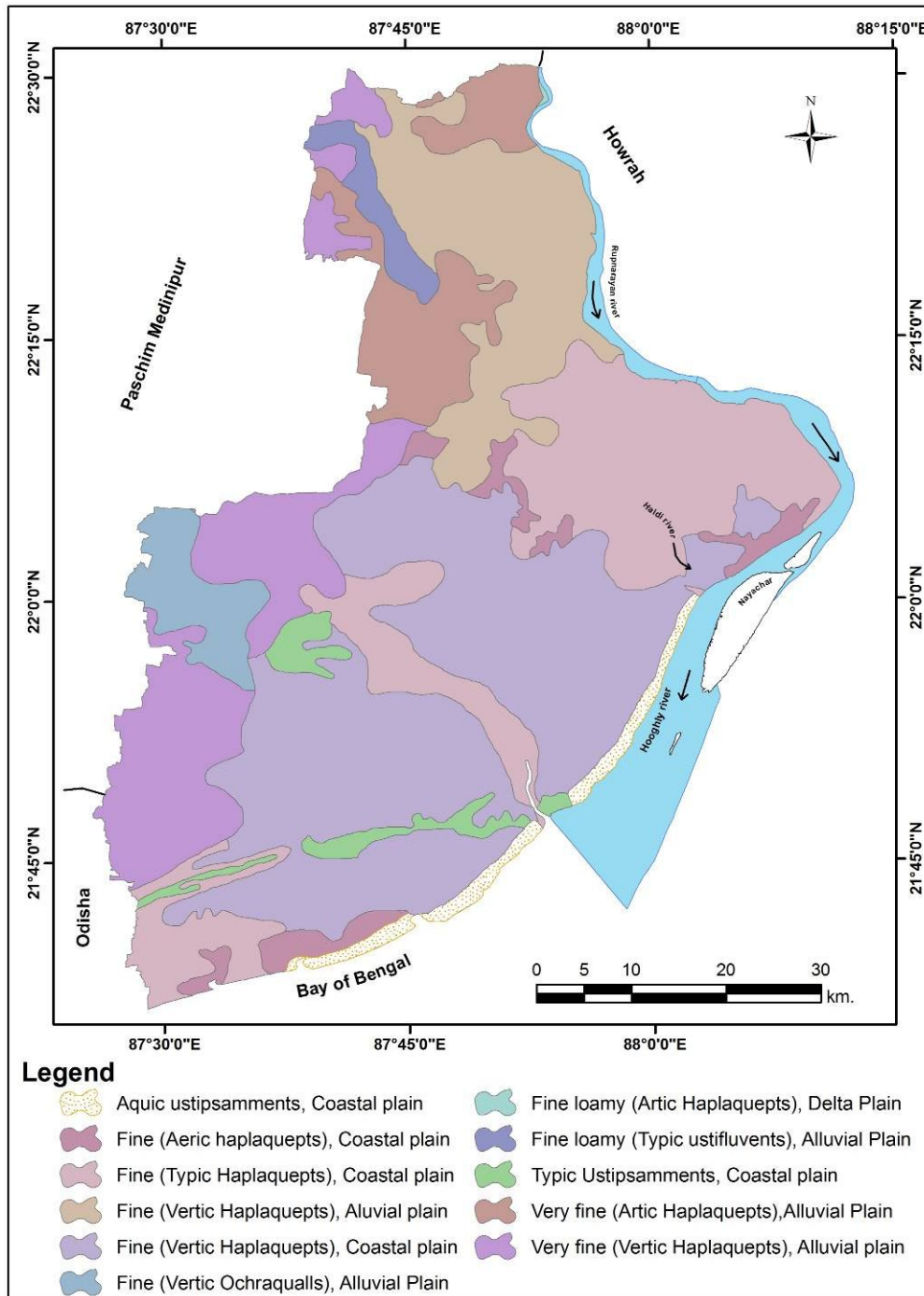


Figure 2.4: Soil map of the study area
Source: NRDMS centre, Purba Medinipur

There are six regional variations of soils like sandy, loamy, sandy-loamy, clay, sandy-clay, clay-loamy and other. The average pH of the soil is 4.5 to 7.8 (Office of the deputy director of agriculture, Purba Medinipur district; Halder and das, 2012). Therefore, the 60% area is covered by clay or clay-loamy dominating soil like Saheed Matangani, Tamluk, Panskura and Kolaghat blocks etc (Figure 2.4). The Deshapran, Kathi, Contai

etc. area consist of alluvium parent materials which were developed by recent tertiary deposit (Obi Reddy, 2017). The coastal area is engaged by the coastal alluvial and older alluvial soils which are mainly sandy and sandy-loamy type (Purkait et al., 2017). The costal beach consists of fine sand, silt and clay (Debnath and Roy, 2015). The soil composition of the coastal area has been presented in table 2.4. The detail about the soil distribution of study area has been presented in Figure 2.4.

Table 2.4: Coastal soil composition of Purba Medinipur district

Soil materials	Grain size in mm.	percentages
Sand	0.2 - 0.06	67.00
Silt	0.06 - 0.002	16.40
Clay	< 0.002	07.60

Source: Debnath and Roy, 2015

2.1.4 Weather and Climate

The climate of the study area is tropical by its properties of geographical location. It is a vehement summertime which is characterized by plump humidity about all the year and well diversified rainfall during the monsoon season. The climate may be divided into four seasons of the year (Table 2.5). Sometimes flood occurs during the Monsoon.

Table 2.5: Climatic seasons of the year

Months	Season
March - May	Hot Summer
June - September	Monsoon
October - November	Autumn or retreating Monsoon
November - February	Winter

The average annual temperatures are ranging from 10°C to 34°C. The mean monthly temperatures and rainfall over the some past years are presented below (Table 2.6 and 2.7).

Table 2.6: Year wise monthly temperature (°C) in Purba Medinipur district

Month	2010		2011		2012		2013		2014	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
January	24	12	25	13	25	15	25	17	26	13
February	28	19	28	17	29	17	28	16	28	17
March	31	24	31	22	31	23	32	28	31	22
April	33	27	32	25	33	26	33	25	34	26
May	33	27	33	26	34	27	33	27	34	27
June	33	28	32	27	34	28	33	27	34	28

July	32	27	32	27	32	27	..	..	32	27
August	32	27	31	26	32	26	..	..	32	27
September	32	26	31	26	..	..	33	26	33	27
October	31	24	33	24	32	23	31	24	33	24
November	31	21	30	19	29	19	..	..	30	18
December	26	14	30	10	26	14	27	19	27	14

Source: Meteorological Department, GOI.

Table 2.7: Year wise monthly rainfall (mm) in Purba Medinipur district

Month	Average rainfall	2010	2011	2012	2013	2014
January	11	-	3	56	2	0
February	27	16	10	9	5	72
March	40	1	13	1	1	10
April	52	1	76	47	31	6
May	128	94	112	43	191	187
June	273	178	309	116	290	236
July	312	266	272	310	292	354
August	359	295	384	249	436	464
September	296	246	335	368	365	298
October	124	125	24	79	465	102
November	36	5	-	25	-	0
December	8	17	-	39	-	0
Total	1666	1244	1538	1342	2078	1729

Source: Meteorological Department, GOI.

2.1.5 Land Use/ Land Cover (LU/LC)

The LU/LC map of the research area has been prepared from Sentinel-2 B and Landsat 8 (OLI) data. The ortho-rectification process has been applied for point to point scale correction of the image by using ERDAS imagine software package. After ortho-rectification processes the visual interpretation and on-screen digitization (by Arc GIS software package) techniques has been applied to generate actual LU/LC information (Figure 2.5). The Survey of India (SOI) toposheet reference is also been used to generate LU/LC map.

The agricultural land, built-up/settlement, forest cover, wasteland, river and water bodies etc., are the major categories of land uses. The detail information about LU/LC has been given in table 2.8.

Table 2.8: Detail LU/LC information of the study area

LU/LC Unit	Description
Agriculture Land	The land mainly used for farming
Build Up	An area of human habitation
Forest	Characterized by vegetation and trees types, differ by density.
Wasteland	Barren or uncultivated land.
River and Water body	Natural and manmade water body

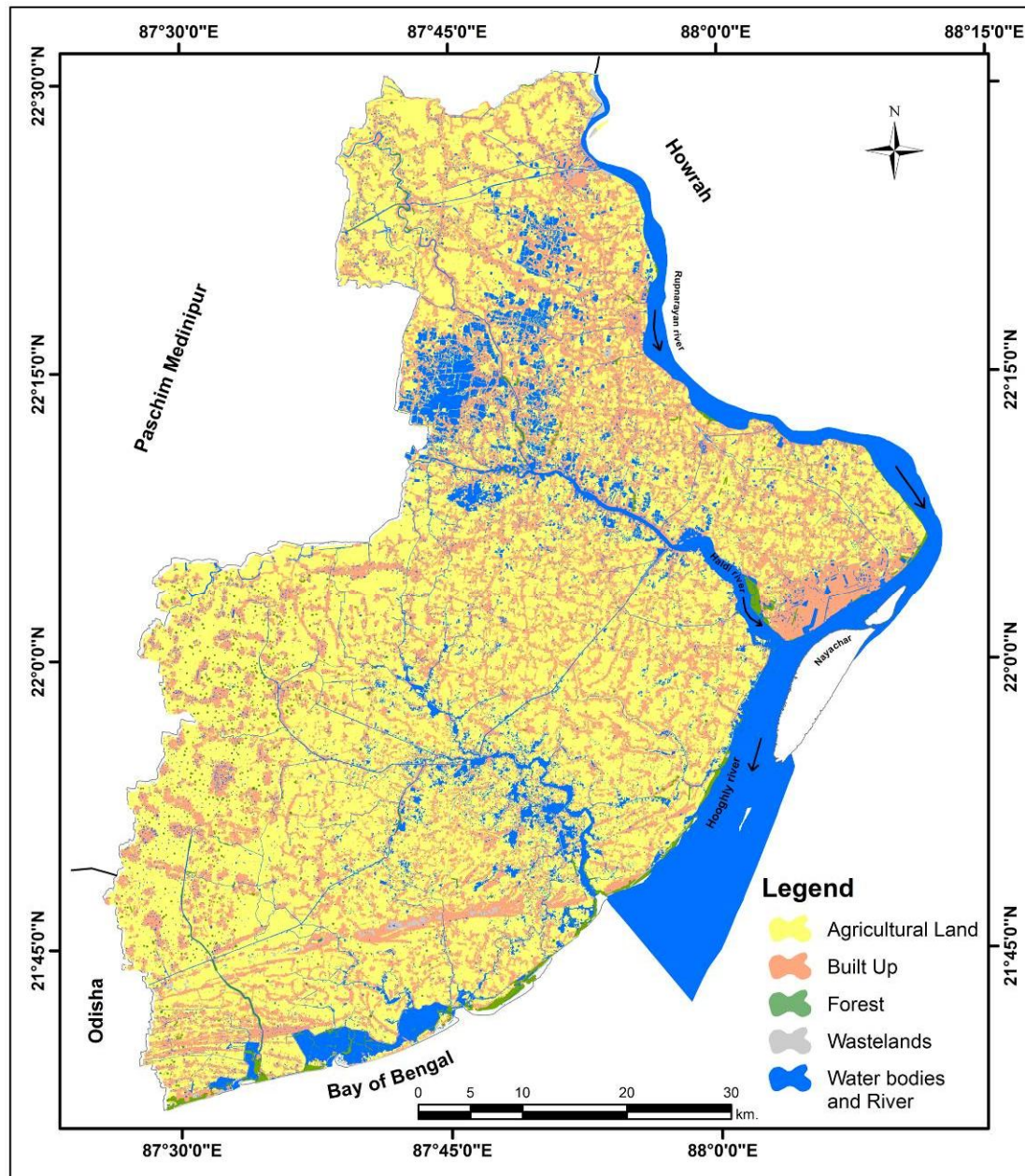


Figure 2.5: LU/LC distribution of the study area

2.1.6 Road and Rail Network

The entire road network is mainly SH (State Highway) and other roads except NH (National Highway), in some parts of the region. The Kolaghat (NH-6) and Haldia are connected by NH-41. NH-41 (length of is 116 km) is passing through Mahisadal, Nandakumar, Tamluk blocks etc. National Highway-6 passes through the northward border of the district. This NH-6 connects the Panskura and Kolaghat blocks to Kolkata. The road NH 116B starts from NH-41 (Nandakumar) and ends at Chandaneswar (Balasore, Orissa) passes through Contai and Digha of Purba Medinipur district (Ministry of Road Transport and Highways, 2012).

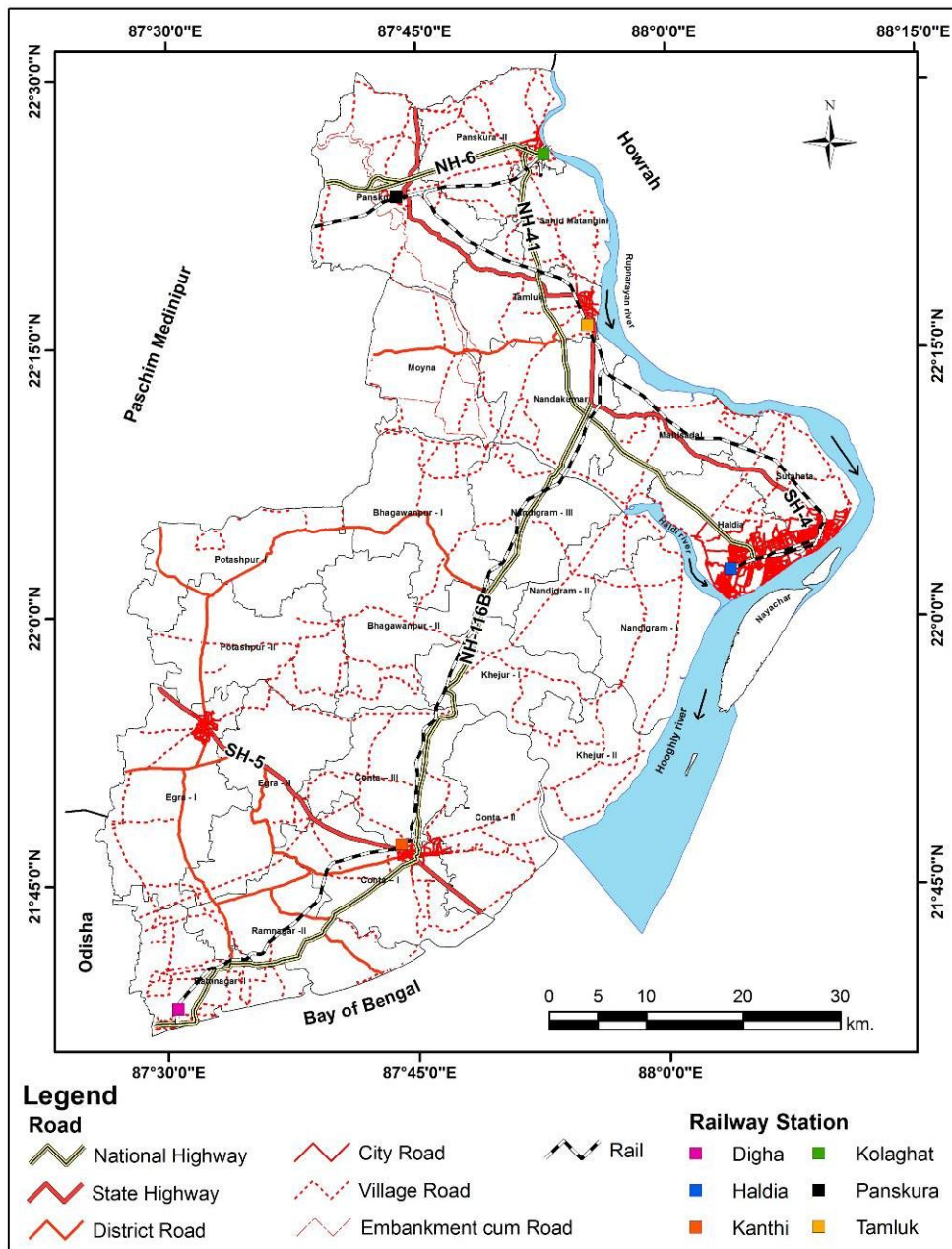


Figure 2.6 Road and rail network connectivity of the study area

SH-4 adjoins the Digha Foreshore to Jhalda (Purulia), going through Contai Municipality, Chandipur, Nandakumar, Tamluk and Panskura Municipality. The 163 km out of 466 km (total length) of SH-4 is within Purba Medinipur district. SH-5 adjoins the Contai to Rupnarayanpur (Bardhamann) going through Egra Municipality, Madhabpur (Egra-II), Belda (Paschim Medinipur). The 42 km. out of 376 km (total length) of SH-5 is within this district.

The district already has rail linkage for transport and connectivity. The Howrah is well connected with Haldia and Digha through Panskura of the South Eastern Railways (SER). Howrah-Haldia railway, which is passing through Mahishadal, Nandakumar, Tamluk, Panskura and Kolaghat blocks from east towards north-west direction from the Haldia. Howrah-Digha railway, which is passing through Ramnagar, Contai, Khejuri, Tamluk, Panskura and Kolaghat blocks from south towards north direction from Digha. The details about the road and rail networks are depicted in Figure 2.6.

2.2. Important places of the study area

The main industrial area of Purba Medinipur district is Haldia, surrounded by the Rupnarayan, Hooghli and Haldi rivers. The main focal point of this area is Haldia port, which is approximately 90 km. from Kolkata port on Hooghli river (Figure 2.7).

Another important place is seaside resort town, Digha (Guin, 2015). Digha is a famous tourist place of Ramnagar-I block which is located at costal area of Bay of Bengal and 183 km from Kolkata. Old and New Digha are popular for beaches and Asia's largest marine aquarium, science museum. There is a regular fishing harbor and virgin beach namely Shankarpur, 14 kilometers from Digha covered by Casuarina plantation (Figure 2.7).

The name Junput is famous for fishing and Government Fish Technological Station, nearly 35 km. from Digha. The Boguran Jalpai and Haripur sea beaches are 15 km. away from digha and 20 km from Junput. Another one is Talsari, small delta familiar land near West Bengal-Odisha state border (remotely 5 km. from Digha) on the Bay of Bengal.

On the other hand the historical places of Tamluk (Tamluk Sub-Divisions) and Sutahata, Mahisadal (Haldia Sub-Divisions) are located in this district (Figure 2.7).

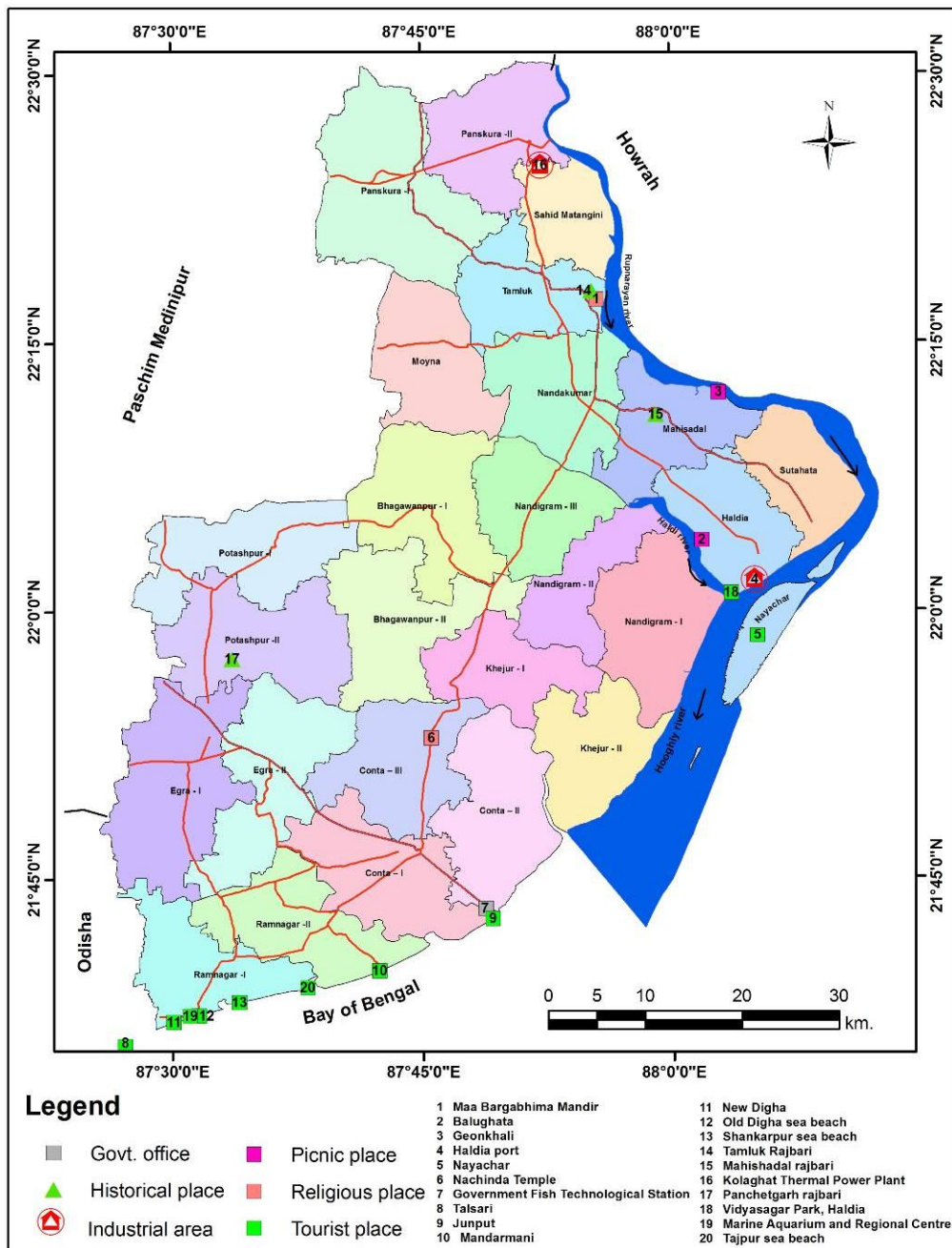


Figure 2.7 Some important places of the study area

2.3 Statistical overview of fisheries sector of Purba Medinipur district

The inland fisheries have showed relatively modest growth over the past few decades globally. Therefore, the production from inland fisheries has grown equally fast. West Bengal contributes significantly to the production of indigenous fish in our country and

aquaculture is very common in Purba Medinipur district (Dutta et al., 2016). The detail block wise statistical overview of net area (ha.), number of engaged person and production (qtl.) experiences of aquaculture sector in Purba Medinipur district are listed in table 2.9.

Table 2.9 Statistical overview of fisheries sector of Purba Medinipur district

Block	Net area (ha.)				No of engaged person				Production (qtl.)			
	2010-11	2011-12	2012-13	2013-14	2010-11	2011-12	2012-13	2013-14	2010-11	2011-12	2012-13	2013-14
Tamluk	831	832.5	825	876	4155	4163	4100	4126	34902	22530	31100	33375.6
Sahid Matangini	590	591	576	510.3	2950	2955	2860	2860	24780	27910	22128	19442.4
Panskura-I	828	831	800.6	757.73	4140	4155	3940	3940	34776	32060	24400	28869.3
Panskura-II	800	802.5	780.5	766.69	4000	4010	4000	4112	33600	35600	23410	29210.8
Moyna	1312	1322	1375.25	1425.45	6560	6610	7000	6890	55104	41050	55500	54309.6
Nandakumar	764	770.6	775.3	712.5	3820	3853	3880	3880	32088	30440	28260	27146.3
Nandigram-III	1300	1302.5	1204.5	1050	6500	6512	6440	6440	52000	52300	42330	40005
Mahishadal	896	902	910	870	4480	4510	4400	4458	37632	32100	29300	33147
Nandigram-I	1263	1265.5	1285.5	1050.45	6315	6328	6210	6520	50520	45130	39560	40022.1
Nandigram-II	700	703.25	700	600	3500	3520	3200	3355	29400	32550	21500	22860
Sutahata	600	603.6	590.4	473.1	3000	3018	3030	3030	25200	30850	19120	18025.1
Haldia	628.25	630.5	630	750.3	3141	3154	3100	3156	26376	27980	20900	28586.4
Potashpur-I	1862	1865.3	1900	1845.53	9318	9330	8350	8350	74480	57930	58900	70314.5
Potashpur-II	805.2	807.5	825	825	4025	4038	4025	4025	33810	31740	24750	31432.5
Bhagawanpur-I	1020	1024.25	1035	900.23	5100	5125	5200	5668	42840	41720	31050	34298.6
Egra-I	814	815.6	815.4	735.15	4070	4080	4000	1990	34188	28150	28450	28009.2
Egra-II	1162	1170.7	1130.6	2700.45	5810	5855	6720	6720	46480	43470	36910	102887.1
Khejuri-I	750	752.5	750.5	720.15	3750	3765	3615	3615	31500	28870	24510	27437.7
Khejuri-II	744	747.4	743.4	705.38	3720	3738	3730	3730	31248	26750	22300	26874.8
Bhagawanpur-II	1000	1003.25	1000.2	877.95	5000	5018	5050	5050	42000	36500	34500	33449.9
Ramnagar-I	603.8	605.8	610.8	548.03	3015	3030	2870	2870	26460	27370	20300	20879.8
Ramnagar-II	675	678.5	678.5	735.56	3375	3395	3300	3300	28350	22530	24350	28024.9
Contai-I	1120	1125.8	1120	1050.53	5600	6130	6000	6225	44800	41200	42720	40025
Contai-II	667	669.5	680.5	675.19	3335	3350	3150	3150	28014	20230	25410	25724.6
Contai-III	566.8	570.4	600.7	750.6	2835	2855	2755	2755	23772	26270	23060	28597.9

Source: District Statistical Handbook, Purba Medinipur, 2010-2014.

2.4 Summary

This chapter described the background of the study area. The entire district has 4 sub-divisions, 25 blocks, 5 statutory towns, and 20 census towns. According to the census

report (2011), Purba Medinipur district had a population of 50, 95,875 with density of 1081 persons per km². These areas are well connected by NH-41, NH-6, NH-116B, SH-4 and 5 roads with important railway connectivity. The dendritic drainage pattern is characterized in this area. The average annual temperatures are ranging from 10°C to 34°C and maximum rainfall occurs in August months. The soils of this area are mainly alluvium and coastal deposit with gentle slope (0-3%). The entire area is covered by plane topography with some degraded sand dunes.

All geospatial databases have been created in ARCMAP (GIS Software) with the help of NRDMS data information & others sources. The Road, LU/LC information's etc. were vectorized and updated from Sentinel-2B and Landsat 8 (OLI) image data. This chapter also shows the statistical overviews of aquaculture sector. The used data, detail of field sample collection and brief methodology of this research work has been presented in the next chapter.