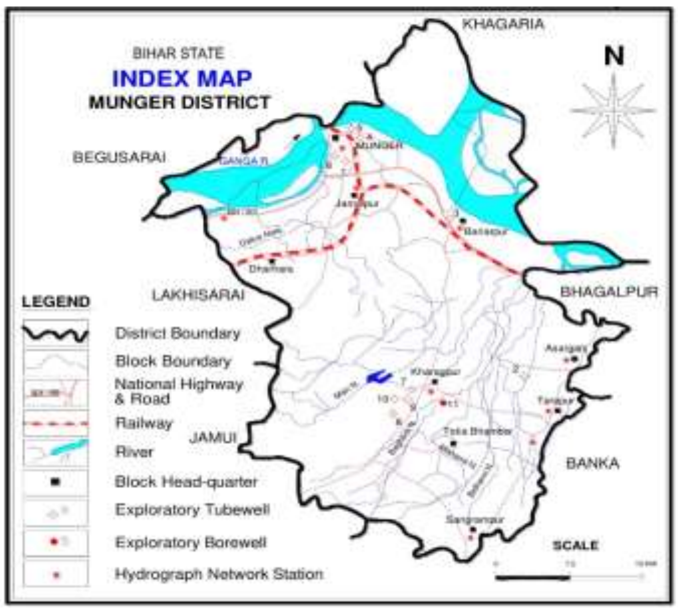
बिहार सरकार

DISTRICT SURVEY REPORT OF MUNGER

12/21/2017

Sand and Brick Earth Mining

As per Notification no. S.O.141 (E) New Delhi, the 15th January, 2016 of Ministry of Environment Forest and Climate change, Government of India



Submitted to

The Under Secretary
Mines & Geology Department, Government of Bihar

Prepared by

INSTITUTE OF ENVIRONMENT & ECO- DEVELOPMENT

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PREFACE

The Ministry of Environment, Forests & Climate Change (MoEFCC), Government of India, made Environmental Clearance (EC) for mining of minerals mandatory through its Notification of 27th January, 1994 under the provisions of Environment Protection Act, 1986. Keeping in view the experience gained in environmental clearance process over a period of one decade, the MoEFCC came out with Environmental Impact Notification, SO 1533 (E), dated 14th September 2006. It has been made mandatory to obtain environmental clearance for different kinds of development projects as listed in Schedule-1 of the Notification.

Further, In pursuance to the order of Hon'ble Supreme Court dated the 27th February, 2012 in I.A. No.12- 13 of 2011 in Special Leave Petition (C) No.19628-19629 of 2009, in the matter of Deepak Kumar etc. Vs. State of Haryana and Others etc., prior environmental clearance has now become mandatory for mining of minor minerals irrespective of the area of mining lease; And also in view of the Hon'ble National Green Tribunal, order dated the 13th January, 2015 in the matter regarding sand mining has directed for making a policy on environmental clearance for mining leases in cluster for minor Minerals, The Ministry of Environment, Forest and Climate Change in consultation with State governments has prepared Guidelines on Sustainable Sand Mining detailing the provisions on environmental clearance for cluster, creation of District Environment Impact Assessment Authority and proper monitoring of minor mineral mining using information technology and information technology enabled services to track the mined out material from source to destination.

The DEIAA and DEAC will scrutinize and recommend the prior environmental clearance of mining of minor minerals on the basis of District Survey Report. This will a model and guiding document which is a compendium of available mineral resources, geographical set up, environmental and ecological set up of the district and replenishment of minerals and is based on data of various departments, published reports, journals and websites. The District Survey Report will form the basis for application for environmental clearance, preparation of reports and appraisal of projects. The Report will be updated once every five years.

OBJECTIVES

The main objective of the preparation of District Survey Report (as per the Sustainable Sand Mining Guideline) is to ensure the following –

- Identification of areas of aggradations or deposition where mining can be allowed; and
- Identification of areas of erosion and proximity to infrastructural structures and installations where mining should be prohibited and calculation of annual rate of replenishment and allowing time for replenishment after mining in that area.
- Identification of mineral wealth in the district.

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CHPATER-1

Introduction

As per Gazette Notification of 15th January, 2016 of Ministry of Environment, Forest and Climate Change a survey shall be carried out by the District Environment Impact Assessment Authority (DEIAA) with assistance of Irrigation department, Drainage department, Forest department, Mining department and Revenue department in district of preparation of District Survey Report as per the sustainable sand mining guidelines to ensure identification of are of aggradations or deposition where mining can be allowed, and identification of areas of erosion and proximity to infrastructural structures and installation where mining should be prohibited and calculation of annual rate of replenishment and allowing time for replenishment after mining in that area.

Every effort has been made to cover sand mining locations, areas and overviews of mining activity in the district with all the relevant features pertaining to geology and mineral wealth in replenish-able and non-replenish-able areas of rivers, stream and other sources. The mineral potential is calculated based on field investigation taking coordinates of the area and gather all relevant information and geology of the catchment area of the river or stream. Also gather all data for bricks mining, taking area coordinates with local soil quality, availability of soil etc. Also as per the site condition and location depth of mineable mineral is defined. The area of removal of mineral in the river and stream is decided on geomorphology and other factors, it can be 50% to 60% of the area of a particular river or stream. Similarly for bricks mining all data gathered. Other constituents like clay and slit are excluded as waste while calculating the mineral potential of particular river or stream. This District Survey Report shall form the basis of application for environmental, preparation of reports and appraisal of projects. The report shall be updated once every 5 years.

The district is located in the southern part of Bihar state with Munger town as its headquarters on the southern bank of the river Ganga. The district has geographical area of 1419.7 sq km accounting for 3.3% of the Bihar state. It lies between 24^0 59’ N to 25^0 30’ latitudes and 85^0 16’ to 86^0 42’ E longitudes. The district is bounded on the north by Khagaria, on the west by Lakhisarai and Begusarai districts, in the east by Bhagalpur, while in south it is bounded by Banka and Jamui districts. The district is divided into three subdivisions and nine developmental blocks (figure-1) for administrative and development point of view. There are 903 villages in the district having total population of 1359054 as per census 20101 Munger is one of the historic towns of Bihar, known to be ruled by Karna. Its ruler Mir Kasim fought one of the last battles before East India Company captured the eastern India.

Basin/sub-basin, Drainage

The Munger district forms a part of Badua-Chandan, Sunder-Gumani sub-basin of the Ganga Basin. The Kharagpur Hill is a prominent landscape as a distinct watershed. Western half of Kharagpur hills forms part of Phalgu-Kiul Sub-basin. The district is having moderate to low drainage density. Dendritic and rectangular drainage patterns are dominating in the hilly regions, while in the plain area the pattern is parallel to sub-parallel. Major rivers of the district are Ganga, Man, Belharni and Mahana. The Ganga flows to the east, but it takes northward turn near Munger town. Other rivers flow towards NNE and join the Ganga. Except the Ganga River, all are ephemeral in nature, having meager water during lean periods.

Irrigation Practices

The agricultural activity is by and large confined to the traditional Kharif cultivation due to lack of adequate irrigation system. The principal crops of the district are Paddy, Wheat and Lentils. As per the statistics of the year 2004-2005 (Govt. of Bihar) the gross irrigated area is about 39983 ha. The cultivable area of district is 64691 ha where 26623 ha is irrigated by deep and shallow tube wells and 13316 ha by canals. Conjunctive use of surface and ground waters can bring the desired development in this water scarce district.

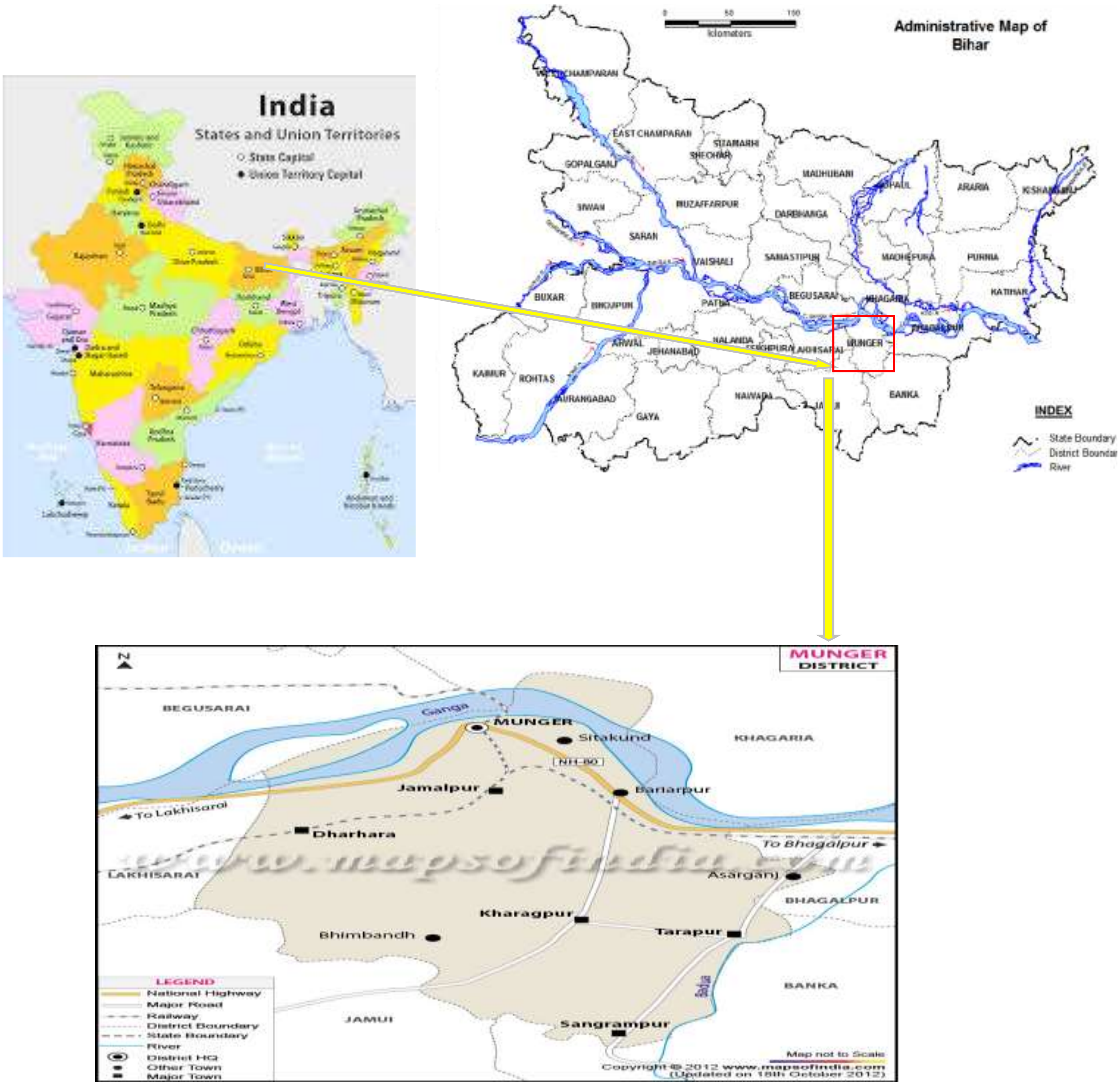


Figure: 1.1 Index Map of Munger District

Figure: 1.1 Present Locations / Sub-division / Block wise Map of Munger District

The district is divided into subdivisions and blocks which are as under

	Geographical area (SqKm)	**1419.7**
	Administrative Division	
i	Number of Tehsil/ Block	09
ii	Number of Punchyat/Villages	903
iii	Population (As on 2011 Census)	1359054
iv	Average Annual Rainfall (mm)	1231

Demography of Munger District

An official Census 2011 detail of Munger, a district of Bihar has been released by Directorate of Census Operations in Bihar. Enumeration of key persons was also done by census officials in Munger District of Bihar.

In 2011, Munger had population of 1,367,765 of which male and female were 729,041 and 638,724 respectively. In 2001 census, Munger had a population of 1,137,797 of which males were 607,730 and remaining 530,067 were females. Munger District population constituted 1.31 percent of total Maharashtra population. In 2001 census, this figure for Munger District was at 1.37 percent of Maharashtra population.

There was change of 20.21 percent in the population compared to population as per 2001. In the previous census of India 2001, Munger District recorded increase of 20.34 percent to its population compared to 1991.

Source: Census of India 2011

Geomorphology and Drainage PatternMunger

Considerable work has been done on hydrogeology of the district since independence. The Central Ground Water Board has carried out hydrogeological survey and exploration in the district. Under exploration programme a total of 17 nos. of wells have been drilled, where 11 wells are exploratory and 06 are observation wells. Out of 17 wells 04 are located in alluvial areas, 12 in marginal alluvium and one in hard rock. Regular monitoring of nine hydrograph stations of the district is being carried out four times a year, since 1975 by CGWB. This has generated invaluable data on water level fluctuation and chemical quality of ground water. Ground water resources of the district have been estimated (GEC-1997, norm) in the year 2009. The estimation has highlighted the stage of ground water development as 33.3% in the district.

Source: Centre for Ground Water Board (CGWB)

Road Network:

District Headquarters Munger is well connected by road network. Road network map shows the connectivity of Munger District to other district.

Figure 1.2 Road / Rail Network Map of Munger District

Source: Census of India 2011

Rail Network:

Munger is well connected with Bhagalpur and Patna to district in Bihar as well India.

Airport:

Jaiprakash Narayan International Airport, Patna is major airport well connected by raod and rail route.

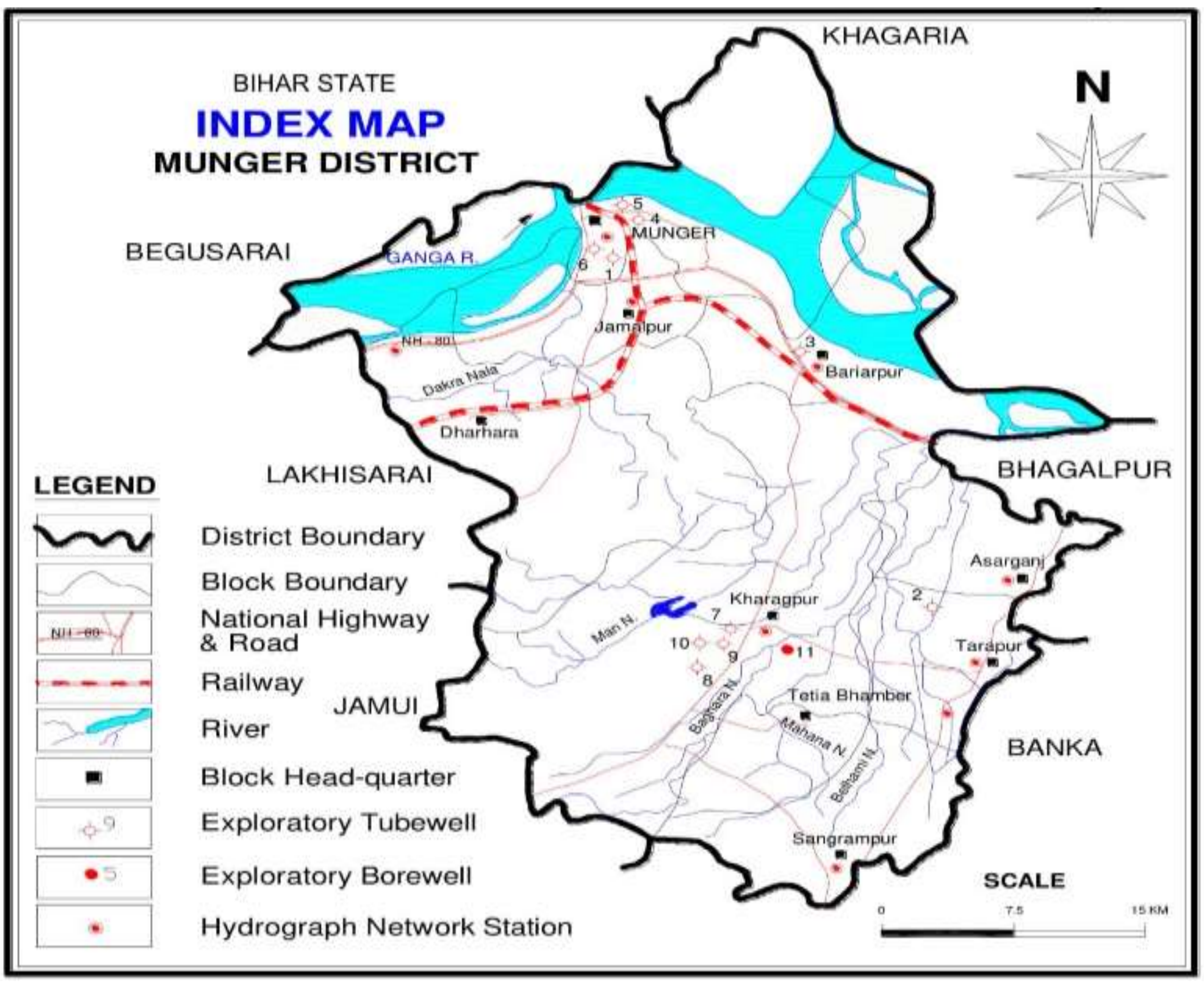
CHAPTER - 2

Overview of Mining Activity of District

Topography and General Geology:

The sand deposits of Munger district of Bihar broadly form part and parcel of the flood plains of Ganga River as whole formed since geological Area.The State of Bihar is transecting by a no. of rivers. The individual river basins and their catchment areas is shown in Figure no. 2.1 below.

The various sand mining lease areas (also referred to as sand ghats) lie in the river bed of river Sone which is a major tributary of river Ganga. They are formed in the Quaternary period of central Bihar Plains- the OAG (Older Alluvium Group) forming the highest terrace, in the Son-Ganga alluvial tract, and NAG (Newer Alluvium Group) forming younger terraces, as older Flood Plains, are exposed all along the Alluvial Upland.



Ganga Valley Plains:

Munger District is located in the southern part of Bihar and its headquarters is located on the southern bank of river Ganges. Munger district occupies an area of 1,419 square kilometres (548 sq mi), comparatively equivalent to Russia's Urup Island.

Approach to Sand Mining:

River sand mining is a common practice as habitation concentrates along the rivers and the mining locations are preferred near the markets or along the transportation route, for reducing the transportation cost. River sand mining can damage private and public properties as well as aquatic habitats. Excessive removal of sand may significantly distort the natural equilibrium of a stream channel.

Main objectives of Sustainable Sand Mining:

- To ensure that sand and gravel mining is done in environmentally sustainable and socially responsible manner.
- To ensure availability of adequate quantity of aggregate in sustainable manner.
- To improve the effectiveness of monitoring of mining and transportation of mined out material:
- Ensure conservation of the river equilibrium and its natural environment by protection and restoration of the ecological system.
- Avoid aggradations at the downstream reach especially those with hydraulic structures such as jetties, water intakes etc.
- Ensure that the rivers are protected from bank and bed erosion beyond its stable profile.
- No obstruction to the river flow, water transport and restoring the riparian rights and in stream habitats.
- Avoid pollution of river water leading to water quality deterioration.
- To prevent depletion of ground water reserves due to excessive draining out of ground water.

- To prevent ground water pollution by prohibiting sand mining on fissures where it works as filter prior to ground water recharge.

- To maintain the river equilibrium with the application of sediment transport principles in determining the locations, period and quantity to be extracted
- Streamlining and simplifying the process for grant of environmental clearance (EC) for sustainable mining.

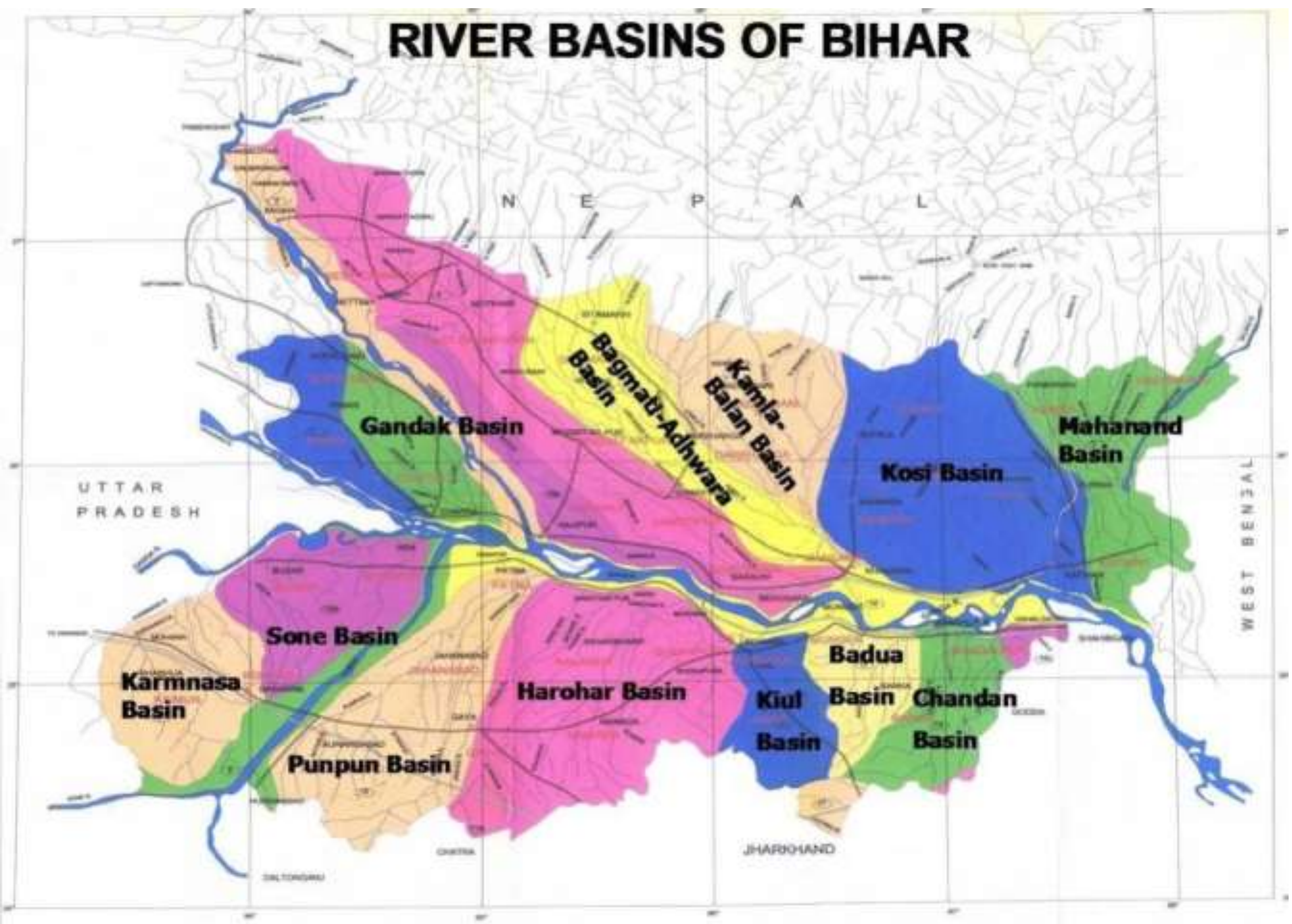


Figure 2.1 River Basin Map of Bihar

Table No.1: Tributaries of Ganga River considered for Sediment Deposition

River	Tributaries	Catchment area in sq. km
Ganga	Main Ganga, Yamuna, Rāmgangā, Gomti, Ghaghra, Tons, Sone, Gandak	7,01,089

Source:Flood Hazards of North Bihar Rivers, Indo Gangetic Plains, Sinha et al.

CHAPTER - 3

List of Mining Leases in the District with location, area and period of validity

Sl. No.	Mining Unit Block Location	Area (In Hect.)	Period (In Yrs)	Name Of Minor Minerals	Name of Granted of Minerals Concession	Annual Capacity as per E.C. /Mining Plants/Tor in lakh MT.	Present Status
1	MARWA GHAT (BADHUA RIVER)	5.40	5	YELLOW SAND	M/s N.M.Food Products Sri Naresh Gupta (proprietor) 48, G-Block, Ganganagar, Rajsthan-335001	247860 MT	This sand Ghat lease area is available now and minable situation in present time.
2	TARAPUR GHAT (BADHUA RIVER)	4.60	5	YELLOW SAND	-Do-	211140 MT	This Sand Ghat Lease Area is Fail in Present Time.
3	BIGMA GHAT (BADHUA RIVER)	6.70	5	YELLOW SAND	-Do-	307530 MT	This sand Ghat lease area is available now and minable situation in present time.
4	KUMARSHAR GHAT (BADHUA RIVER)	10.54	5	YELLOW SAND	-Do-	4837986 MT	This sand Ghat lease area is available now and minable situation in present time.
5	TULSIPUR 1 & 2 (MAHANI RIVER)	7.45	5	YELLOW SAND	-Do-	341955 MT	This sand Ghat lease area is available now and minable situation in present time.

6	THAIBAI GHAT (BADHUA RIVER)	5.0	5	YELLOW SAND	-Do-	229500 MT	This sand Ghat lease area is available now and minable situation in present time.
7	KHAUHA GHAT (BADHUA RIVER)	1.30	5	YELLOW SAND	-Do-	59670 MT	This sand Ghat lease area is available now and minable situation in present time.
8	MANIYA GHAT (BADHUA RIVER)	11.70	5	YELLOW SAND	-Do-	537030 MT	This sand Ghat lease area is available now and minable situation in present time.
9	RANADHI GHAT (BADHUA RIVER)	8.30	5	YELLOW SAND	-Do-	380970 MT	This sand Ghat lease area is available now and minable situation in present time.
10	CHOTKI MOHALI GHAT (GANGA RIVER)	14.70	5	WHITE SAND	-Do-	674730 MT	This sand Ghat lease area before GPS Coordinates is fail now in this present time. So new GPS coordinates generated by IEED for this lease area.
11	GHOR GHAT (GANGA RIVER)	5.74	5	WHITE SAND	-Do-	263466 MT	This Sand Ghat lease area is fail in this present time.
12	SHAKARPUR GHAT (GANGA RIVER)	13.60	5	WHITE SAND	-Do-	624240 MT	This Sand Ghat lease area is fail in this present time.
13	TIKARAMPUR GHAT (GANGA RIVER)	6.70	5	WHITE SAND	-Do-	307530 MT	This sand Ghat lease area is available now and minable situation in present time.

14	LAL DARWAJA GHAT (GANGA RIVER)	5.60	5	WHITE SAND	-Do-	257040 MT	This sand Ghat lease area is available now and minable situation in present time.
15	KALAN RAMPUR GHAT (GANGA RIVER)	7.50	5	WHITE SAND	-Do-	344250 MT	This sand Ghat lease area is available now and minable situation in present time.
16	BARDHA GHAT (GANGA RIVER)	10.40	5	WHITE SAND	-Do-	477360 MT	This Sand Ghat lease area is fail in this present time.
17	KALISTHAN BARIYAPUR GHAT (GANGA RIVER)	6.40	5	WHITE SAND	-Do-	293760 MT	This sand Ghat lease area is available now and minable situation in present time.

CHAPTER - 4

Details of Royalty or Revenue received in last three years

Sr.	Year	Revenue (In Lakh Rs.)
1	2014-15	614.88
2	2015-16	546.56
3	2016-17	593.83
Total		**1755.27**

CHAPTER - 5

Details of Royalty or revenue received from sand minerals in last three years

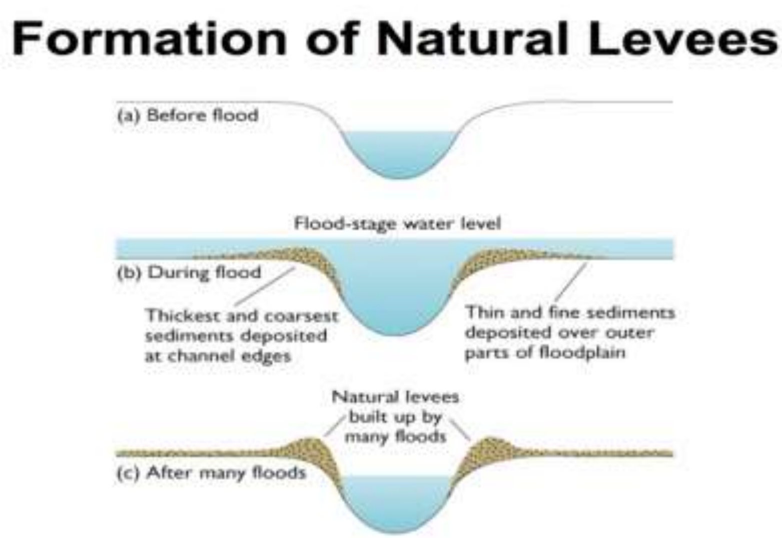
Sr.	Year	Production
1	2014-15	NIL (Mining Closed)
2	2015-16	NIL (Mining Closed)
3	2016-17	NIL (Mining Closed)

CHAPTER - 6

Process of Deposition of Sediments in the rivers of the District

Process- Sediment is a naturally occurring material that is broken down by processes of weathering and erosion, and is subsequently transported by the action of wind, water and/or by the force of gravity acting on the particles. Sediments are most often transported by water. Sediment is transported based on the strength of the flow that carries it and its own size, volume, density, and shape. Stronger flows will increase the lift and drag on the particle, causing it to rise, while larger or denser particles will be more likely to fall through the flow.

Deposition is the processes where sediment being transported by a river is deposited. Deposition occurs when a river loses energy. This can be when a river enters a shallow area (this could be when it floods and comes into contact with the flood plain) or towards its mouth where it meets another body of water.



Rivers flood on a regular basis. The area over which they flood is known as the floodplain and this often coincides with regions where meanders form. Meanders support the formation of flood plains through lateral erosion.

When rivers flood the velocity of water slows. As the result of this the river's capacity to transport material is reduced and deposition occurs. This deposition leaves a layer of sediment across the whole floodplain. After a series of floods layers of sediment form along the flood plain.

Larger material and the majority of deposition occurs next to the river channel. This is the result of increased friction (with the flood plain) causing the velocity of the river to slow and therefore rapidly reduce its ability to transport material. This leaves a ridge of higher material next to the river channel on both banks of the river known as a levee.

If the upwards velocity approximately equal to the settling velocity, sediment will be transported Downstream entirely as suspended load. If the upwards velocity is much less than the settling velocity, but still high enough for the sediment to move, it will move along the bed as bed load by rolling, sliding, and saltating (jumping up into the flow, being transported a short distance then settling again). If the upwards velocity is higher than the settling velocity, the sediment will be transported high in the flow as wash load.

As there are generally a range of different particle sizes in the flow, it is common for material of different sizes to move through all areas of the flow for given stream conditions.

The various factors governing the occurrence and deposition of sand is country rock i.e. geological disposition, climate, and rainfall, water load physical parameters of river and velocity of water current. Rivers have a lot of energy and because they have energy, they do stuff. The obvious things rivers do with their energy is flow but, besides this, they also transport load, erode load and erode the channel through which they flow. Erosion is the breaking down of material by an agent. In the case of a river, the agent is water. The water can erode the river's channel and the river's load. A river's load is bits of eroded material, generally rocks, which the river transports until it deposits its load.

Capacity & Competence Rivers can only carry so many loads depending on their energy. The maximum volume of load that a river can carry at a specific point in its course is called the age river's capacity. The biggest sized particle that a river could carry at a specific point is called the river's competence. Deposition to transport load a river needs to have energy so when a river loses energy it is forced to deposit its load. There's several reasons why a river could lose energy. If the river's discharge is reduced then the river will lose energy because it isn't flowing as quickly anymore. This could happen because of a lack of precipitation or an increase in evaporation. Increased human use (abstraction) of a river could also reduce its discharge forcing it deposit its load. If the gradient of the river's course flattens out, the river will deposit its load because it will be travelling a lot slower. When a river meets the sea a river will deposit its load because the gradient is generally reduced at sea level and the sea will absorb a lot of energy. As rivers get nearer to their mouths they flow in increasingly wide, gentle sided valleys. The channel increases in size to hold the extra water which the river has to receive from its tributaries. As the river gets bigger it can carry larger amounts of material. This material will be small in size, as larger rocks will have broken up on their way from the mountains. Much of the material will be carried in suspension and will erode the river banks by abrasion. When rivers flow over flatter land, they develop large bends called meanders. As a river goes around a bend most of the water is pushed towards the outside causing increased erosion. The river is now eroding sideways into its banks rather than downwards into its bed, a process called lateral erosion. On the inside of the bend, in contrast, there is much less water. The river will therefore be shallow and slow-flowing. It cannot carry as much material and so sand and shingle will be deposited.

This is called a point bar or slip off slope Due to erosion on the outside of a bend and deposition on the inside, the shape of a meander will change over a period of time. Notice how erosion narrows the neck of the land within the meander. In time, and usually during a flood, the river will cut right through the neck. The river will then take the new, shorter route. The fastest current, called the thalweg, will now tend to be in the centre of the river, and so deposition is likely to occur in gentler water next to the banks. Eventually deposition will block off the old meander to leave an oxbow lake. The oxbow lake will slowly dry up, only refilling after heavy rain or during a flood. Streams lose velocity and make deposits when their gradient decreases, when the volume of water decreases, when there is an increase in cross section, when they encounter obstructions, or when they enter still water. They deposit alluvial fans, alluvial cones, piedmont alluvial plains, channel fill, bars, flood plains and deltas.

Rivers in the Gangetic plains have a habit of meandering, i.e., changing course. In India this is a prominent feature of rivers which swell in the monsoon, occasionally suddenly, and the torrential movement carves out a new course in the soft alluvial plain. The Ganga River, in munger, has meandered and migrated northwards in the munger area. This migration has resulted in deposition of earth on the south [right] bank of the river and created a massive space of a few hundred hectares between the urban development line and the active river channel.

A river system can be divided into three subsystems:

- ✓ **Collecting system** (branches) -- consisting of a network of tributaries in the headwater region, collects and funnels water and sediment to the main stream.
- ✓ **Transporting system** (trunk) -- the main trunk stream, which functions as a channel way through which water and sediment move from the collecting area toward the ocean. (Erosion and deposition also occur in a river's transporting system)
- ✓ **Dispersing system** (roots) -- consists of a network of distributaries at the mouth of a river (delta), where sediment and water are dispersed into an ocean, a lake, or a dry basin

Removal of washed in Silt Load

Geologically, the district forms part of the vast Indo-Gangetic alluvial tract. The origin of the IndoGangetic tract as a whole is now attributed to the sag in the earth crust formed in the upper Eocene times between Gondwana land and the raising of Himalaya belt. The economic minerals found in the district are Sand, Soil and Kankar.

The sand deposits being an integral part of the dynamic river system to which it belongs. Therefore, as a part of natural cycle, the monsoon flow of every river carries with it replenishment of silt and washed out soil and clay from upstream areas in the catchment. This silt shall be removed during the sieving of sand before it is loaded into truck/tipper/trailer to carry to the consumers.

Sand mining is critical to infrastructure development around the globe. Sand is an essential minor mineral used extensively across the country as a useful construction constituent and variety of other uses in sports, agriculture, glass making (a form of sand with high silica content) etc. The rivers are the most important source of Sand. It acts as source of transportation and deposition of sand etc.

Local Geology of the Area

The river sand exposed in the river beds of Ganga, Godavri and surrounding areas is the product of the deposition of the sediments brought and deposited in the flood plains of River Ganga. These sediments are of recent geological formation. The litho-units exposed within the river and surrounding areas have formed as water borne sediments brought by flood water during rainy season every year and deposited in riverbed. The litho units encountered in the riverbed and surrounding areas belongs to the Shivalik super groups. The size of the sediments towards the source i.e. host rock is course and at the tale end of the river the grain size is reduced to smaller sizes resulted in the formation of clay beds. The following sequences have been observed in the area, i.e. Top soil/ Alluvium followed by sand deposition (as shown in the figure below).

Sand and silt are deposited in the middle of the river whereas fine sand and soil are deposited at the fringe of the riverbanks. Soil/ alluvium varying in thickness from 0.20m to 0.60m constitute the top horizons in the area suitable for agriculture. River Ganga meanders through the area exposing the alluvium and soil at the banks. Sand is found in the river bed up to a depth of more than 3.0 m. The major part of bed remains dry as water flows in a single stream during the non-monsoon seasons. Only during rainy seasons the entire flood plain has water, when there will be no mining done.

Origin & Control of Mineralization (Annual Replenishment of Mineral in River Bed Area/Sedimentation)

Sedimentation, in the geological sciences, is a process of deposition of a solid material from a state of suspension or solution in a fluid (usually air or water). Broadly defined it also includes deposits from glacial ice and those materials collected under the impetus of gravity alone, as in talus deposits, or accumulations of rock debris at the base of cliffs. The term is commonly used as a synonym for sedimentary petrology and sedimentology.

Sedimentation is generally considered by geologists in terms of the textures, structures, and fossil content of the deposits lay down in different geographic and geomorphic environments. The factors which affects the "Computation of Sediment":

a) Geomorphology & Drainage Pattern: The following geomorphic units plays important role:

- Structural Plain
- Structural Hill
- Structural Ridge
- Denudation Ridge & Valley
- Plain & Plateau of Gangetic plain
- Highly Dissected pediment

- Undissected pediment

b) Distribution of Basin Area River wise

c) Drainage System/Pattern of the area, Rainfall & Climate: Year wise Rainfall data for previous 10 years of Gangetic Basin/River

e) As per Dandy & Bolton study "Sediment Yield" can be related to

- Catchment Area and
- Mean Annual Run-off

Sand is an essential minor mineral used extensively across the country as a useful construction constituent and variety of other uses in sports, agriculture, glass making (a form of sand with high silica content) etc. It is common knowledge that minerals are non-renewable but this form of mineral naturally gets replenished from time to time in a given river system and is very much interrelated to the hydrological cycle in a river basin.

Sand mining has become a widely spread activity and does not require a huge set up or technology, the number of ventures has increased extensively and it has become a footloose industry in itself but the backward-forward linkages are becoming stronger as many are getting employed as well as the construction activity / industry requires this mineral at consistent rates. Riverine environmental systems are unique in themselves and provide environmental services, natural resources to meet variety of needs of urban and rural communities. The Rivers originating from the Himalayas bring with them lots of aggregate materials whereas as they move downstream, only finer elements / minerals like sand are found in abundance.

CHPATER-7

General Profile of the District

i)	**Geographical area (Sq Km)**	**1419.7**
Administrative Division		
i)	Number of Tehsil/ Block	09
ii)	Number of Punchyat/Villages	903
iii)	Population (As on 2011 Census)	1359054
iv)	Average Annual Rainfall (mm)	1231

2. GEOMORPHOLOGY

	Major physiographic unit:		**Hill, Pediplain, Alluvial Plain**
	Major Drainages:		Ganga, Belharni, Man, Mahana
3.	LAND USE (SqKm)		
	a)	Forest area:	285.24
	b)	Net area sown:	468.69
	c)	Cultivable area:	646.91

4.	**MAJOR SOIL TYPE**	**Entisols and Alfisols**	
5.	AREA UNDER PRINCIPAL CROPS	Paddy, Wheat, Lentils	
6.	IRRIGATION BY DIFFERENT SOURCES	Area	No.
	(Areas Sqkm and Number of Structures)		
	Dugwell	0.43	-
	Tubewell/Borewell	266.23	-
	Tank/ponds	-	-
	Canals	133.16	-
	Other sources	-	-
	Net irrigated area	-	
	Gross irrigated area	399.83	

7. NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (2011)

	No of Dug wells	**08**
	No of Piezometers	Nil
9.	HYDROGEOLOGY	
	Major Water bearing formation	a) Hard rock/fissured formation of Quartzite

		and Phyllite.
		b) Unconsolidated
		Sediment of Alluvium
		Plain.
	(Pre-monsoon Depth to water level during	3.04 to 10.91
	2011) m bgl.	
	(Post-monsoon Depth to water level during	0.68 to 8.55
	2011) m bgl.	
	Long term water level trend in 10 yrs (2002-2011) in m/yr	

10. GROUND WATER EXPLORATION BY CGWB

	(As on 31-03-2013)	
	No of wells drilled (EW, OW, PZ, SH, Total)	19, 10, Nil, 01
	Depth range (m)	50-234
	Storativity (S)	$3.0X10^{-5}$ -$5.0X10^{-3}$
	Transmissivity (m^2/day)	10 - 500
11.	GROUND WATER QUALITY	
	Presence of Chemical constituents more than	Fluoride (2-6 ppm)
	permissible limit (e.g EC, F, As, Fe)	
	Type of water	Potable

12. DYNAMIC GROUND WATER RESOURCES(as on 31st March 2009)- in mcm

	Annual Replenishable Ground water	**309.07**
	Resources	
	Net Annual Ground Water Draft	89.68
	Projected Demand for Domestic and industrial	28.88
	Uses up to 2025	
	Stage of Ground Water Development	33.3%
13.	AWARENESS AND TRAINING ACTIVITY	
	Mass Awareness Programmes organized	01
	Date:	30th March, 2005
	Place:	Town hall, Munger
	No of participant :	Over five hundred
	Water Management Training Programmes	Nil
	organized	

14. EFFORT OF RTIFICIAL RECHARGE & RAIN

	WATER HARVESTING	
	Project completed by CGWB(No & Amount	Nil
	spent)	
	Project under technical guidance of CGWB	Nil
	(Numbers)	

15.	GROUND WATER CONTROL AND	
	REGULATION	
	Number of OE Blocks	Nil
	Number of Critical Blocks	Nil
	Number of Blocks notified	Nil
16.	MAJOR GROUND WATER PROBLEMS AND	Geogenic contamination
	ISSUES	of ground water with
		fluoride and source
		Finding.

Source: Centre for Ground Water Board (CGWB)

CHPATER-8

Land Utilization Pattern in the district: Forest, Agriculture, Horticulture, Mining

	MAJOR SOIL TYPE	**Entisols and Alfisols**	
1.	AREA UNDER PRINCIPAL CROPS	Paddy, Wheat, Lentils	
2.	IRRIGATION BY DIFFERENT SOURCES	Area	No.
	(Areas Sqkm and Number of Structures)		
	Dugwell	0.43	-
	Tubewell/Borewell	266.23	-
	Tank/ponds	-	-
	Canals	133.16	-
	Other sources	-	-
	Net irrigated area	-	
	Gross irrigated area	399.83	

CHPATER-9

Physiography of the District

Geomorphology

Munger district is situated in the Eastern Bihar alluvial plains..The district has a diverse landscape ranging from hills to flood plains. The major geomorphic units are rocky upland, pediplain and alluvial plain .

a) **The Kharagpur Hill tract:** it constitutes dominantly elevated andrugged landmasses, except south surrounded on all sides by alluvial plains. The Ganga flows along its northern tip. The altitude of hills varies from 500 to 250 m a msl. It comprises mainly quartzite and phyllite of Kharagpur Formation. The rock of Kharagpur Formation has undergone multi phase tectonic deformation, which has given rise to many types of deformational structures. Thermal springs are common in Kharagpur Hills and these springs emerge from fissures in highly jointed or sheared quartzites.

b) **Pediplain:** represented by the area formed by coalescence of thepediment and thus forms rolling topography and comprises residual soil overlain by mixture of sheet wash deposits.

c) **Alluvial Plain:** Older Alluvial Plain is represented in major part ofTarapur, Asarganj and part of Sangrampur blocks and it is made up of sediments derived from the denudation of Chota Nagpur Plateau and Kharagpur Hills. The thickness of this alluvium in Khaira village is about 40m, while in the east it is reduced considerably. Northern part of the district is represented by Younger Alluvial Plain and confined within few km from the river Ganga. Locally, this is called Diara area. Relief of Diara area is level to very gentle undulating ground. The mighty Ganga meanders in these parts and usually these land masses are flooded during middle of July to the end of September. Alluvial thickness is more in diara area. A tube well drilled by CGWB up to a depth of 235m bgl, located at Herudiara village, confirms the huge thickness of sediments. Natural levee, flood basin (Tal) and crevasse splays are common landforms along the river Ganga. The relief of alluvial plain on an average is 30 to 65 m above mean sea level.

Soils

The Munger district consists mainly of Entisols and Alfisols type of soils under different lithological and pedogenic conditions. (a) Younger alluvial soil of entisols group of soil is restricted on either side of river Ganga, mainly on northern and southern Ganga plain. It is deficient in nitrogen, phosphoric acid and humus. Texturally these soils are sandy to loamy sand and pH value being on the alkaline side, it occurs mainly in diara area. (b) Older alluvial soils of alfisols group of soil are developed mainly in the marginal area along northern border of hard rock terrain i.e. south of Ganga. (c) Red sandy soil of alfisols group of soils occurs in major part of district especially in central part of the district. It has poor fertility and is suitable for high land crop.

CHPATER-10

Climate and Rainfall

Rainfall and Climate

The average annual rainfall of the district is 1231 mm and about 80% of the rainfall is received during June to September by south-west monsoon. The climate of the district represents a transition between dry and extreme climate of northern India and the warm and humid of West Bengal. There are three distinct seasons in a year. The winter starts from November and last till end February. The summer starts by March end and lasts through May to mid June and the monsoon sets in thereafter which continues till September. In the summer, temperature rise up to 42^0C, while in winter it dips down 2^0C.

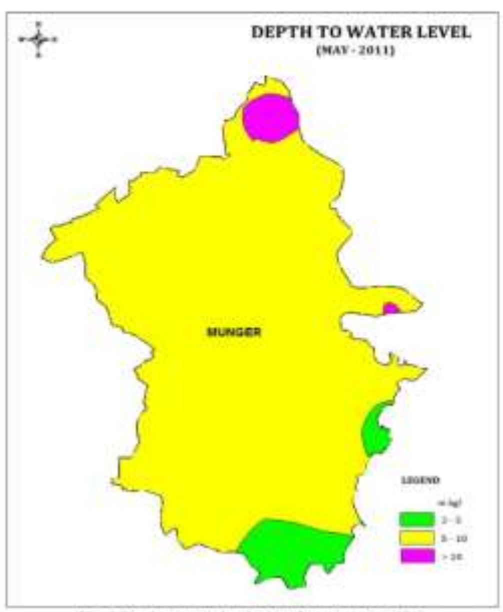


Fig. 2 Depth to water level map of pre-monsoon 2011.

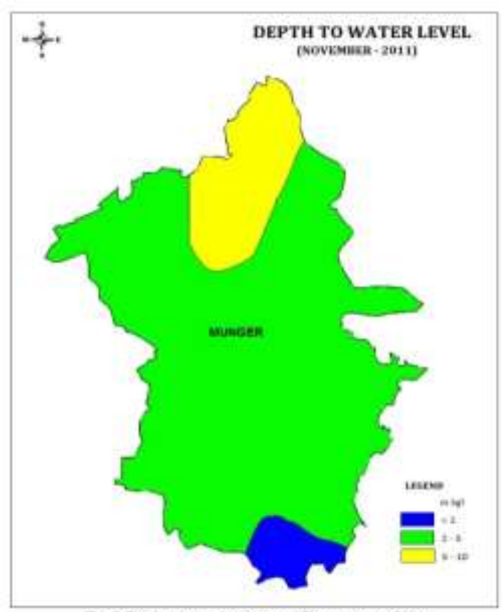


Fig. 3 Depth to water level map of Post-monsoon 2011

CHPATER-11

Geology and Mineral Wealth

Geology

(i) Regional Geology

Regionally, the area constitutes a part of the Ganga River Basin. The north-eastern part is predominantly characterized by sedimentary lithology in the Sub-Himalayan zone comprising Subathus, Dagshais, Kasaulis and Siwaliks. A general Regional stratigraphic sequence of the area is given below

Geological Succession and their geographic distribution

The Tertiaries are exposed in Masan area of North Champaran District, as series of low hillocks. They represent Upper Siwaliks of the Sub-Himalayas and consist of sandstone and clay stone, disturbed by folding and thrust faulting. The entire sequence here occurs as an inlier in the alluvial terrain. The Quaternary of North Bihar Plains, between the tortuous course of Ganga and Himalayan foothills, are represented by Older Alluvium Group (OAG) (Bhangar) and Newer Alluvium Group (NAG) (Khader).The OAG is represented by Mirganj Formation, Khajauli Formation and Madhubani Formation in Gandak basin, Gandak- Kosi interfluve and Kosi basin, respectively. The NAG includes the Vaishali Formation, the Jainagar Formation and Purnea Formation in Gandak basin, Gandak-Kosi interfluve and Ganga-Kosi-Mahananda interfluve. In the whole region the uppermost formation is the Present Flood Plains, Diara formation, Channel Bars and Sand Dunnes. In central Bihar Plains the OAG forming the highest terrace, in the Son-Ganga alluvial tract, and NAG forming younger terraces, as Older Flood Plains, are exposed all along the Alluvial Upland. The Present Flood Plain deposits are confined with then channels. The Vindhyans, in Bihar, are exposed in Rohtas and Bhabhua districts as scarps and plateau. They comprises gritty to fine cemented sandstones, shales, flagstones, quartzites, sandy siltstones, limestone breccias and porcellanites, the shales often being pyritiferous. The Gondwana rocks occur as sporadic outlier basins, in the parts of Nalanda district. The main rock types are sandstones, fine to coarse or gritty sandstone, ironstone, shales, Carbonaceousshales, coal seams and boulder beds. They are largely cemented, jointed, fractured, faulted and intruded by dykes and sills. Along the northern fringe of the Chotanagpur Granite Gneiss Complex are low-grade supracrustals covering the Kharagpur hills, Rajgir hills and Gaya hills referred to as the Satpura Range, comprises schists, ferruginous phyllite, quartzite and phylliticshales. The Bihar Mica belt comprises a sequence of folded hornblende schists, amphibolite, mica-schist, quartzite and calc-silicates intruded by circular to oval shaped granitic plutons, dolerites, pegmatites and quartz veins. There are many old mines of mica in this belt. The Archaeans are the oldest rock formation in the state. The most predominant rock type is mainly of gneisses and granitic rocks with lesser amount of schists, quartzites, basic intrusives and pegmatoides. They are exposed in Aurangabad, Gaya, Nawada, Jamui, Bhagalpur and Banka districts.

Source: Centre for Ground Water Board (CGWB)

(ii) Local Geology of the area

The river sand exposed in the river beds of Ganga, Godavri and surrounding areas is the product of the deposition of the sediments brought and deposited in the flood plains of River Ganga. These sediments are of recent geological formation. The litho-units exposed within the river and surrounding areas have formed as water borne sediments brought by flood water during rainy season every year and deposited in riverbed. The litho units encountered in the riverbed and surrounding areas belongs to the Shiwalik super groups. The size of the sediments towards the source i.e. host rock is course and at the tale end of the river the grain size is reduced to smaller sizes resulted in the formation of clay beds. The following sequences have been observed in the area, i.e. Top soil/ Alluvium followed by sand deposition (as shown in the figure below).

Sand and silt are deposited in the middle of the river whereas fine sand and soil are deposited at the fringe of the riverbanks. Soil/ alluvium varying in thickness from 0.20m to 0.60m constitute the top horizons in the area suitable for agriculture. River Ganga meanders through the area exposing the alluvium and soil at the banks. Sand is found in the river bed up to a depth of more than 3.0 m. The major part of bed remains dry as water flows in a single stream during the non-monsoon seasons. Only during rainy seasons the entire flood plain has water, when there will be no mining done.

Hydrogeology

The area is underlain by unconsolidated formation which is quarternary to Upper quarternary of age group. Lithologically, the district is made up of recent alluvium, clay, silt, sand, gravel pebbles with concentration of calcareous materials. From the groundwater potential point of view the entire district falls under good to very good category.

The presence of kankar (nodules of $CaCO_3$) and fine sand at places render the top clay zone semi-pervious in nature, where ground water occurs under phreatic condition. These aquifers are made up of fine to medium grained sand occasionally coarse with thin layers of gravel at places. The depth to piezometric surface in the area varies from 6.25m to 16.30m. The deep tube wells tapping these deeper aquifers have yield from 3260 m^3/hr to 1500 m^3/hr. with a drawdown of 6 m. The transmissivity of the aquifer varies from 3786 m^2/day to 14133 m^2/day.

Source: Centre for Ground Water Board (CGWB)

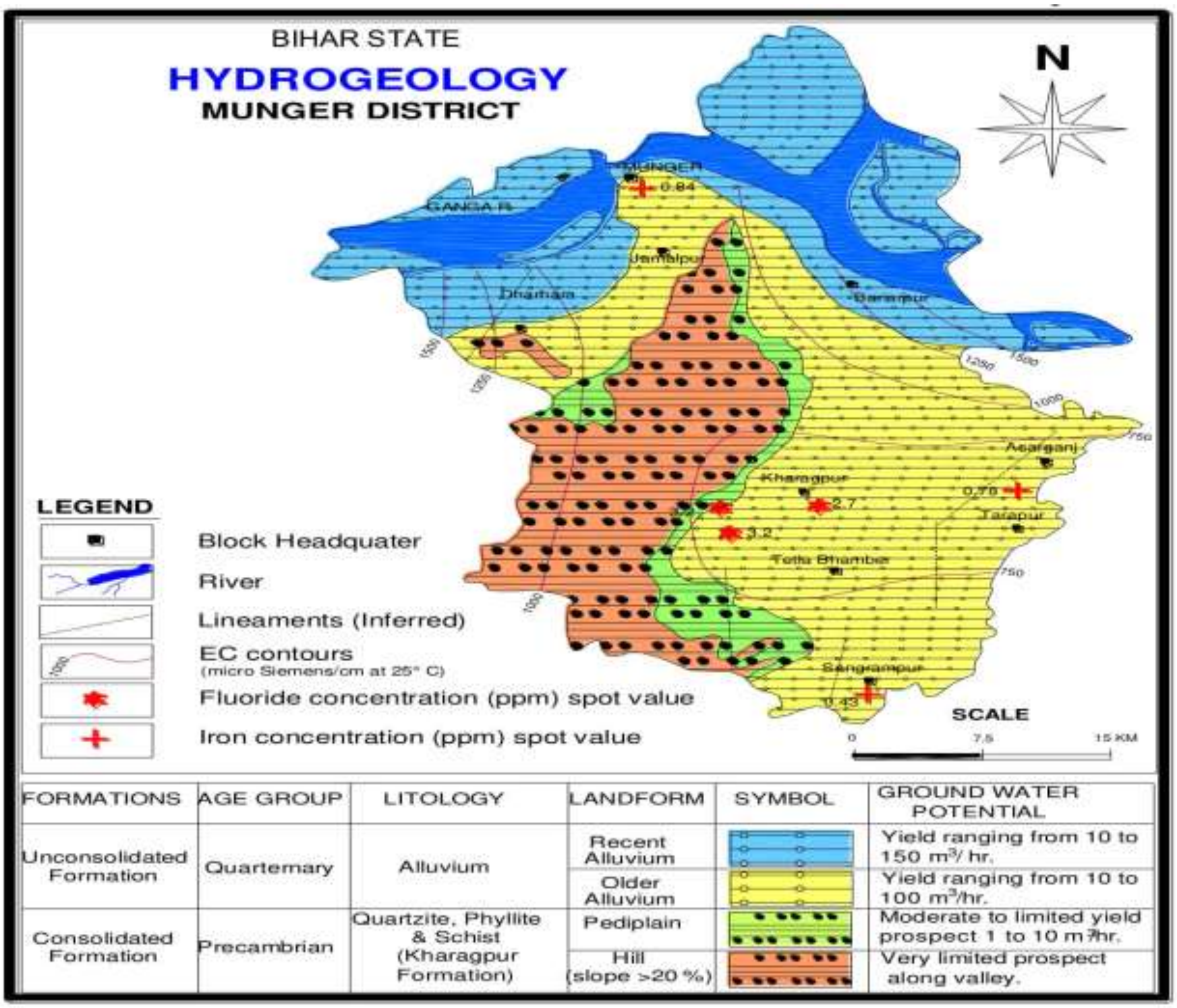


Figure 11.1: Hydrogeological Map of Munger District

Chapter-12

Drainage System with Description of Main Rivers.

Salient Features of Important Rivers and Streams:

Total Area of Rivers in Munger District: - 1419.7Sq. Km.

Sl. No.	Name of the River	Area drained (sq. Km.)	% Area drained in the District
1	Ganga	113.00	7.95%
2	Belharna	1.00	0.07%
3	Mahani	1.25	0.09%
4	Badua	1.40	0.10%
Total		116.65	8.21%

Chapter-13

Salient Features of Important Rivers and Streams

Total Area of Rivers in Munger District: -1419.7 Sq. Km.

Salient Features of Important Rivers and Streams:

Sl. No.	Name of the River of Stream	Total Length in the District (in Km)	Place of Origin	Altitude at Origin
1	Ganga	55 km	KutlupurDiara	36 meters
2	Belharna	22 km	Sangrampur	86 meters
3	Mahani	26 km	Samda	83 meters
4	Badua	14 km	Kumarsar	77 meters

Chapter-14

Methodology Adopted for Calculating of Mineral Potential

The mineral potential is calculated based on field investigation and geology of the catchment area of the river/ streams. As per the policy of the State and location, depth of minable mineral is defined. The area for removal of mineral in a river or stream can be decided depending on geo-morphology and other factors, it can be 50% to 60% of the area of a particular river/stream. Other constituents like clay and silt are excluded as waste while calculating the mineral potential of particular river/ stream.

The specific gravity of each mineral constituent is different. While calculating the mineral potential, the average specific gravity is taken as 2.25.

The quantum of deposition varies from stream to stream depending upon factors like catchment lithology, discharge, river profile and geomorphology of the river course. There are certain geo-morphological features developed in the river beds such as channel bar, point bar etc. where annual deposition is more even two to three meters.

Calculation is based on the methodology given in sustainable guideline of SUSTAINABLE **SAND MINING MANAGEMENT GUIDELINES-2016**..The mineral potential is calculated based on field investigation and geology of the catchment area of the river/ streams. As per the policy of the State and location, depth of minable mineral is defined. The quantum of deposition varies from stream to stream depending upon factors like catchment lithology, discharge, river profile and geomorphology of the river course. There are certain geomorphological features developed in the river beds such as channel bar, point bar etc. where annual deposition is more even two to three meters.

The details are given below:

Sl. No.	River of Stream	Portion of the river or stream recommended for mineral concession	Length of area recommended for mineral concession (in Kilometer)	Width area recommended for mineral concession (in M)	Area recommended for mineral concession (In Square Meter)	Mineable Mineral Potential (In Metric Tonne) 60% of total Mineral
1	Ganga	55 km	55 km	2054	112970000	3111.19
2	Belharna	22 km	22 km	45	990000	27.26
3	Mahani	26 km	26 km	48	1248000	34.37
4	Badua	14 km	14 km	100	1400000	38.56
Total		**117 KM**	**117 KM**	**2247 M**	**116608000**	**3211.38 Lakh MT**

Mineral Potential is calculated in Following Way:

Mineral Potential

Sand (MT)	Total Mineable Mineral Potential(MT)
3211.38Lakh MT	**3211.38Lakh MT**
Annual Deposition (30%)	
963.41 Lakh MT	**963.41 Lakh MT**

Chapter-15

Status of Brick Earth Mining in Munger

BRICK KILNS IN BIHAR

The state of Bihar is developing rapidly. In the five year period from 2004 to 2009 Bihar's Gross Domestic Product (GDP) has grown by 11.03% and between 2001 and 2011 there has been a significant increase in urbanization with the number of towns increasing from 120 to 213 according to the latest census. This has been possible through investment in various sectors, especially the construction sector. If this growth rate needs to be sustained, the demand for quality building materials will increase manifold. In rural areas too, Bihar faces challenges with the need for over 7.5 billion bricks over the next five years to meet the rural housing gap. A field study was conducted in 5 districts on Bihar to understand the present scenario of the brick industry and to assess the market potential and barriers for introducing energy efficient technologies for walling materials. The major brick producing districts of Bihar is Patna, Nalanda, Siwan, Muzaffarpur, Sitamarhi, East and West Champaran, Darbhanga, Samastipur and Madhubani. With over 5,700 authorized brick kilns the state produces around 17 billion bricks per year. The brick sector in Bihar is growing at a rate of 9%, however it continues to be dominated by traditional technology - the Fixed Chimney Bulls Trench Kiln (FCBTK). Unlike the rest of India (except Punjab, Haryana, Uttar Pradesh and West Bengal) the state of Bihar is the only state which has transformed the brick firing technology from movable to fixed chimney.

A list of Bricks Kilns is attached – Annexure - II

Status of Brick Kilns in Munger District

S No	No of operational Units of Brick Kilns in Munger districts during Financial Year (2016-17)	No of Units of Brick Kilns in Munger Identified by IEED
1	**44**	**67**

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