Preliminary Draft Report

District Survey Report

For

(Planning & Execution of) Minor Mineral Excavation

CHAIRMAN,

DISTRICT ENVIRONMENTAL IMPACT ASSESSMENT AUTHORITY,

MAHOBA, U.P.

&

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Preface

On January 15th 2016, Ministry of Environment, Forest and Climate Change, Government of India issued a notification and in which Para 7(iii) (a) and Annexure X purpose and structure of District Survey Report has been discussed. District Survey report (DSR) will be prepared in every district for each minor mineral. The District Survey Report will guide systematic and scientific utilization of natural resources, so that present and future generation may be benefitted at large. The purpose of District Survey report (DSR) "*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*".The District Survey report (DSR) will contain mainly data published and endorsed by various departments and websites about Geology of the area, Mineral wealth details of rivers, Details of Lease and Mining activity in the District along with Sand mining and revenue of minerals. This report also contains details of Forest, Rivers, Soil, Agriculture, Road, Transportation and climate etc.

MAHOBA district falls in bundelkhand region of Uttar Pradesh. The district is surrounded by Hamirpur in North, Jhansi in West, Mahoba in East and Madhya Pradesh in South. The total geographical area of the district is 2,884 sq km supporting a total population of 8,76,055 with a density of 300 persons per sq km.[https://en.wikipedia.org/wiki/Mahoba_district] It has 3 blocks and 521 inhabited villages. The average rainfall in the district is 864mm. The main river of the district is Dhasan. The net sown area is

1869.63sq km with 415.61sq km as net irrigated area.

Disclaimer: - The data may vary due to flood, heavy rains and other natural calamities. Therefore, it is recommended that EAC/SEIAA/DEIAA may take into consideration all its relevant aspects / data while scrutinizing and granting EC to the concerned Authority as applicable.

Introduction

Mahoba district lies between 250 01’30” and 250 39’40” north latitude and 790 15’00” and 800 10’30” east longitude. Total geographical area of the district is 2884 sq. km. District headquarter is at Mahoba having 3 (three) number of tehsils and 4 (four) number of blocks. In 2011, MAHOBA had population of 875,958 of which male and female were 466,358 and 409,600 respectively.

The name of the district is derived from 'Mahotsav Nagar', which means the city of great festivals. It is the least populated district of Uttar Pradesh. Mahoba is known for its closeness to Khajuraho and other historic places like Orchha, Jhansi, and Kalinjar. A "Shaheed Mela" is held annually to commemorate the memory of those who rebelled in 1857 mutiny. Majority of people depend upon agriculture for livelihood. The district headquarters are located in Mahoba town. The district is bordered by Hamirpur & Jhansi in the north, the state of Madhya Pradesh in south & east, and Jhansi district & the state of Madhya Pradesh in the west.

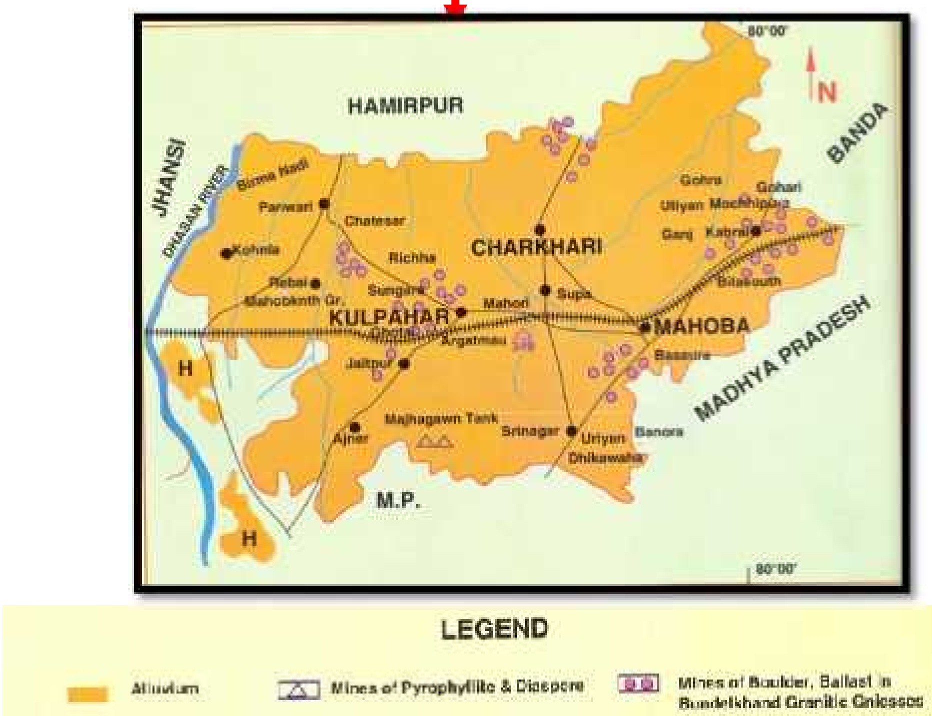
Geographically the area comprises Precambrian Bundelkhand massif dolerites, granites and quartz reefs unconfirmavely overlain by quaternary alluvium. The main and major rivers of the district are Dhasan, Urmil, Birma and Arjun.

Physiographically the area can be divided into two units –

(1) Southern parts having high reliefs with hillocks.

(2) Northern part having relatively low relief with low hillocks.

(Source:mineral.up.nic.in)



Scale 1:250000

Fig. 1: Location map of MAHOBA

General Profile of the district

"Mahoba" A small district in Uttar Pradesh is famous for its glorious past.It is known for its bravery. The story of Veer ALHA and UDAL defines itsimportance in Indian history. There are various places which can createlive glorious moment of that previous time. Mahoba is a city located inthe Indian state of Uttar Pradesh, in Bundelkhand region. Mahoba isknown for its closeness to Khajuraho, Laundi and other historic places likeKulpahar, Charkhari, Kalinjar, Orchha, and Jhansi. The name Mahoba isderived from "Mahotsav Nagar", the city of great festivals. The Bardictradition preserves three other names of the city: Kekaipur, Patanpur and Ratanpur. The existence of the sacred "Ram-Kund" and "Seeta-Rasoi"cave at the Gokhar hill here are said to be monumental to the visit ofRama who widely treated this hill region while in 14 year exile at Chitrakoot. It has population of 8,76,055 (2011 Census), The district wascarved out from the erstwhile Hamirpur district on 11 February 1995 byseparation the erstwhile Mahoba Tehsil from it. In 2006 The Ministry ofPanchayati Raj named Mahoba one of the country's 250 most backwarddistricts (out of a total of 640). It is one of the 34 districts in UttarPradesh currently receiving funds from the Backward Regions Grant FundProgramme (BRGF).

[http://dcmsme.gov.in/dips/2016-17/DIP%20Mahoba%20PKS%201.6.2016.pdf]

Climate Condition

May and the beginning of June are generally thehottest period of the year and maximum temperature in May is about450C and minimum about 28^0C. The heat during the summer is intense.The maximum temperature on individual days sometimes reaches 47^0C ormore. During Cold season minimum temperature sometimes drops down to about 2 or 3^{o}C.[http://dcmsme.gov.in/dips/2016-17/DIP%20Mahoba%20PKS%201.6.2016.pdf]

Rainfall & Humidity

The average annual rainfall is 864 mm. The climate is typical subtropicalpunctuated by long and intense summer. About 87% of the annual rainfall is receivedfrom south-west monsoon. May is the hottest month with temperature shooting upto 47.5^{0}C. With the advance of monsoon by about mid June, temperature starts decreasing. January is usually the coldest month with the temperature going up to 8.3^{0}C. The relative humidity is highest during south-west monsoon ranging between 80% to 85% with its lowest around 30% during peak summer months of April andMay.

Topography & Terrain

The soil consists of the well knownMahoba varieties, Mar, Kabar, Paruaand Rakar. Mar is often called blank cottar soil. Its varies greatly incolour. It contains small lumps of kankar (small stone piece). Kabarrange from a rich dark black to light brown. Its chief characteristics areits extreme adhesiveness, which causes it to quickly dry and cake in tohard blocks. Parua is a light coloured sandy soil, found in many forms. Itis usually less rich in organic matter, but its finer texture makes it moreresponsive to manure and irrigation. Raker is refuse soil which occurs onsloping, where the action of water has tended to denude the earth of allits better qualities. The forest cover an area of 162.12sq km in 2013-14 [http://cgwb.gov.in/District_Profile/UP/Mahoba.pdf], extending over 4.9% of the total geographical area of the district as per land record. Mahoba district is drained by Dhasan, Urmil, Birna and Arjun rivers. Dhasanemanating from Vindhyachal flows through Charkhari tehsil forming the westernboundry of the district.The river

Urmil separates Charkhari and Mahoba tehsil and flows through outto the east. halves, east and west. These rivers and streams constitute the natural drainage lines ofthe district. The Birna a perinial stream nearby divides the district into two equal parts. General climate of the district is healthy and pleasant. Southern part having high relief with hillocksNorthern part relatively lowrelief with lower hillocks. [http://cgwb.gov.in/District_Profile/UP/Mahoba.pdf]

Water Course & Hydrology

The ground water occurrence and availability generally depends upon the water bearing properties of water bearing formation As per report on dynamic ground water resource of Mahoba district as on 31.2.2004. The annual ground water recharge of the district is 47046.58 Ham, the net annual ground water availability is 42341.92 ham. The existing gross ground water draft for all uses is 20978.59 ham. The net ground water availability for future irrigation development is 20863.84 ham. The stage of ground water development is 49.55%. As per the estimates worked out, all the blocks of the district are in 'Safe Category'. Typically they are characterized by their size, shape irregularity and their distribution.

The ground water occurs under water table condition in shallow aquifer whereas the ground water in deeper aquifer occurs under semi confined to confined condition. The shallow aquifer which is being tapped by dugwell occurs upto the depth of above 40 mbgl. The aquifer material is fine to medium sand. The kankar assorted with clay also occur occasionally.

The district being hilly and rocky has little scope for ground water development. The ground water worthy area is very limited (30-35%). Due to uncertainty of ground water availability the ground water development in the district is very low 49.50%. There are 15698 number of private tubewells. The maximum number of private tubewells are found in Jaitpur block (6640) and minimum in Charkhari block (2686). The canal length is 455 Km. in the district irrigating 190 Ha area, indicates that irrigation through surface water has reduced considerably. CGWB has constructed 44 number of tubewells under the exploratory programme. The yield of the tubewell range from negligible to 150 lpm with average draw down of 18.0 metres. A total number of 441 handpumps have been constructed in the district, benefiting a population of 603484.[http://cgwb.gov.in/District_Profile/UP/Mahoba.pdf]

Ground Water Development

The stage of ground water development in the district is 49.55%. Leaving net ground water availability for future irrigation 20863.84 ham. The maximum stage of ground water development is in Jaitpur block 80.79% and minimum in Kabrai block33.91%. All the 4 blocks are in the safe category.

Drainage System

The total geographical area of the district is 2884 km^2. The record height is 500ft. Mahoba district had 16.2 km^2 of forest area. Mahoba district is drained by Dhasan, Urmil, and Burma rivers. Dhasan emanating from Vindhyachal flows through Charkhari tehsil forming the western boundry of the district. Average rain in the district approximate 864 mm. General climate of the district is healthy and pleasant. The net irrigated area is 41561 Ha and the net area sown is 186963 Ha, which shows that 22% area is irrigated and the rest area depends on rainfall. Length of canal in the district is 455 Km. and the number of government tubewells is 03.

Table 1: Drainage System with Description of main rivers

S.No.	Name of River	Area Drained (Sq.Km.)	% Area drained
1.	Dhasan River	8.34	0.290%
2.	Burma River	1.80	0.062%
3.	Urmil River	2.18	0.075%

Table 2: Salient features of Important Rivers and streams

S.No.	Name of River / stream	Total length in the District (in Km)	Place of Origin	Altitude at Origin
1	Dhasan River	25.95	Yamunotri Glacier at Uttarakhand	3293 m
2	Burma River	28.70	-	-
3.	Urmil River	17.74	Jabalpur, Madhya Pradesh	550 m

Dhasan River

Dhasan rivers enters in Mahoba at village Seonrhi and passes through Halbatpura Khangran, Salarpur, Nagaraghar in and out of district boundary. Finally at Kashipur, river Dhasan exits from District Mahoba.

Table 3: List of villages through which river Dhasan passes

S.No.	Name of Place	Elevation
1.	Seonrhi	172
2.	Halbatpura Khangran	172
3.	Salarpur	171
4.	Nagaraghar	171
5.	Bihat	171
6.	Lohargeon	170
7.	Linwa	170
8.	Kashipur	170

Burma River

Burma rivers enters in Mahoba at village Nakra and passes through Naugoan, Buraura, Jarnala in and out of district boundary. Finally at Pipri, river Burma exits from District MAHOBA.

Table 3: List of villages through which river Burma passes

S.No.	Name of Place	Elevation
1.	Nakra	164
2.	Naugoan	164

3.	Buraura	163
4.	Jarnala	162
5.	Bilrari	162
6.	Pahariq	162
7.	Rebai	161
8.	Dulara	161
9.	Kanaura	160
10.	Pipri	160

Urmil River

Urmil rivers enters in Mahoba at village Sijaria and passes through Digaria, Kheoraiya jeyraiya, in and out of district boundary. Finally at Atrar Maaf, river Urmil exits from district Mahoba.

Table 3: List of villages through which river Urmil passes

S.No.	Name of Place	Elevation
1.	Sijaria	213 m
2.	Digaria	216 m
3.	Kheoraiya jeyraiya	221 m
4.	Kaimaha	225 m
5.	Imilia	231 m
6.	Atrar Maaf	236 m

Table 6: List of drains in District MAHOBA

S.No.	Name of Water body	Merges with
1.	Khero Nala	Dhasan River
	Bilwa Nala	
2	Gagna Nala	Burma River
	Bharua Nala	
	Gunchi Nala	
	Urahu Nala	
3.	Bhairon Nala	Urmil River
	Baleco Nala	
	Shyam Nala	

Fauna

Animals depend on forest not only of food but also for habitat. The diversity of fauna living in water and land in the air are found in the State. Since their list is long, mention shall be made here only of important species mainly found in the district:

Fish: Mahaser, Hilsa, Saul, Tengan, Parthan, Rasela, Vittal, Rohu, Mirgal,Kata, Labi, Mangur, Cuchia, Eel, Einghi, Mirror Carp, Trout.

Amphibia: Frog and Toad.

Reptiles: Bamania, Pit-viper, Lizard, Goh, Cobra,Tortoise, Krait, Dhaman and Crocodile.

Aves: Cheel, Vulture, Peacock, Nightingale, Pigeon, Parrot, Owl, Nilkanth and Sparrow.

Mammals: Shrew, Porcupine, Sqirrel, Hare,Mongoose, Cow, Buffalo and Mouse.

Other common species found here are Panther, Sambhar, Cheetal, Kastura, Chinkara, Black Deer, Nilgai, Back-brown Bear, Mountain Goat, Hyena, Hill Dog, Elephant etc. Among the birds Fowl, Pheasant, Partridge, Florican, Duck, Goose and Wader are common.

Flora

The Mahoba district covered mixed variety of vegetation mainly bushes. The tress like Shishum, Neem, Mango tree and Jamun tree, Eucalyptus and Babool are also found in sufficient numbers.

These are Mango (*Mangiferaindica*), Jamun (*Syzygiumcumini*), Asna(*Lagerstroemia parviflora*), Lodh (*Symplocosracemosa*),Chironji (*Buchananialanzan*), Kathal (*Artocarpusheterophyllus*), Dhawa (*Anogeissuslatifolia*), Dhak (*Buteamonosperma*), Ankol (*Allangiumsalvifolium*), Bhavya(*Dilleniaindica*), Tinsa (*Ougeniaoogeinensis*), Bel (*Aeglemarmelos*), Tendu (*Diospyrosmelanoxylon*), Bans(*Dendrocalamusstrictus*), Kasmri (*Gmelinaarborea*),Neem (*Azadirachtaindica*), Sakhua (*Shorearobusta*),Barun (*Cratevaunilocularis*), Mahua (*Madhucalongifoliavar. latifolia*), Tilak (*Wendlandiaexerta*), Ber (*Zizyphusmauritiana*), Aonla (*Phyllanth us emblica*), Kadamb(*Anthocephaluschinensis*), Bent (*Calamusrotung*),Indrajau (*Holarrhenapubescens*), Bijak (*Punicagranatum*), and Neebu (*Citrus aurantifolia*) with other flowering, fruiting and shade giving trees. [http://www.upsbdb.org/pdf/Souvenir2011/8.pdf]

Table 7: Distribution of Forest in MAHOBA

S.No	Name of village (Forest)
1.	Hinna bira (RF)
2.	Seonrhi (RF)
3.	Bihat (RF)

4.	Jaitpur (RF)
5.	Kulpahar (RF)
6.	Indaura (RF)
7.	Karahra Dang (PF)
8.	Salat (PF)
9.	Swasa Muaf (PF)
10.	Joran Alipura (RF)
11.	Bhagaura (RF)
12.	Sagunia Pahar (Rf)
13.	Saitwara (RF)
14.	Lakhaura (RF)
15.	Madho Pahar (RF)
16.	Larpuara (RF)

Land form & Seismicity

In the earthquake zonal map of India the district lies in zone III liable to moderate damage by earthquakes. Although no major earthquake occurred close to it, the tract being not far from the Great Himalayan Boundary fault, experiences the effects of moderate to great earthquake occurring there.No earthquake has been observed in the district during last 200 years. The district has, however experienced on a few occasions’slight tremors.

Soil

In Mahoba district soil has been produced by the weathering of granites. Wellknown Bundelkhand varieties are Mar, Kafur, Parana and Rakar. Clayey and loamysoil is dominant in the district

The soil consists of the well knownMahoba varieties, Mar, Kabar, Paruaand Rakar. Mar is often called blank cottar soil. Its varies greatly incolour. It contains small lumps of kankar (small stone piece). Kabarrange from a rich dark black to light brown. Its chief characteristics areits extreme adhesiveness, which causes it to quickly dry and cake in tohard blocks. Parua is a light coloured sandy soil, found in many forms. Itis usually less rich in organic matter, but its finer texture makes it moreresponsive to manure and irrigation. Raker is refuse soil which occurs onsloping, where the action of water has tended to denude the earth of allits better qualities.

Granite/Gneissic landscape, Hills, Dume/Tors (10-15%slope)

1. Rock outcrops associated with shallow loamy skeletal soils, severely croded and moderate stonness

Undulating Upland/Plateau (3-5% slopes)

2. Moderately shallow, loamy soils severely eroded associated with deep, fine smectite soils and moderately eroded
3. Deep, loamy skeletal soils and moderately eroded and slight stonness associated with moderately shallow loamy skeletal soils and severely eroded

Very gentle sloping uplands

4. Deep, fine, smectitic soils and moderately eroded associated with loamy soils and moderately eroded
5. Deep, fine, smectitic soils and slightly eroded associated with fine soils and moderately eroded

River valley (1-3% slope)

6. Deep, fine smectitic soils and slightly eroded associated with fine smectitic soils and moderately eroded

Alluvial plain,

Isolated Hillocks (15-30% slopes)

7. Rock outcrops associated with shallow loamy-skeletal soils, severely eroded and moderately stonness .

Undulating upland (3-5% slope)

8. Deep, loamy soils, moderately eroded associated with fine smectitic soils and slightly eroded

Very gently sloping uplands with hummocks (1-3%slope)

9. Deep, loamy soils, slightly eroded associated with fine, smectite soils slighdy eroded.
10. Deep, fine smectitic soils, slightly eroded associated with loamy soils and slightly eroded
11. Deep, loamy soils, slightly eroded associated with silty soils, slightly eroded
12. Deep, fine soils, slightly eroded associated with fine smectitic soils and slightly eroded
13. Deep, fine smectitic soils, slightly eroded
14. Deep, loamy soils, moderately eroded associated with fine smectitic soils and moderately eroded

Ravinous Land (5-10% slope)

15. Deep, loamy soils and severely eroded associated with loamy soils and moderately eroded
16. Deep, fine smectitic soils and are moderately eroded associated with fine soils moderately eroded.
17. Deep, loamy soils and moderately eroded

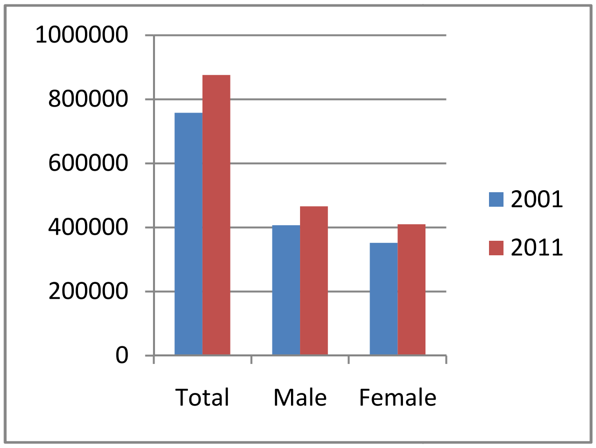
Source :\[http://www.nicra-icar.in/nicrarevised/images/statewiseplans/Uttar%20Pradesh/UP50-Mahoba-26.07.14.pdf]

Fig. 2: Soil map of Mahoba

Demography

In 2011, Mahoba had population of 875,958 of which male and female were 466,358 and 409,600 respectively. The initial provisional data released by census India 2011, shows that density of Mahoba district for 2011 is 279 people per sq. km. Mahoba district administers 3,144 square kilometers of areas.

Population Distribution



Rural Urban Distribution

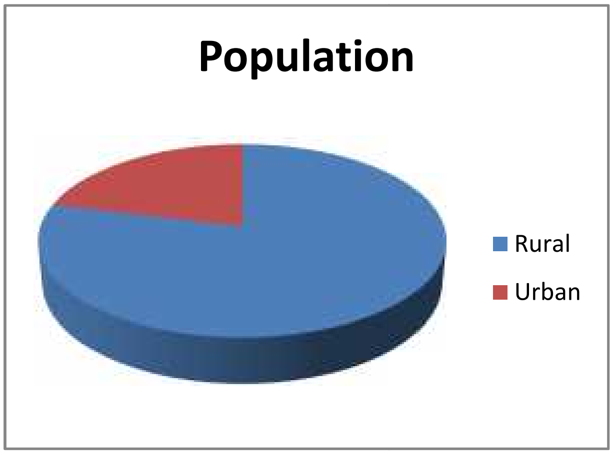


Fig.3:Demography of MAHOBA

Table 8: Demographic details of MAHOBA

Actual population	**875,958**	**Population growth**	19.7 %
(a) Male	466,358	Area Sq. Km.	3,144
(b) Female	409,600	**Density /Km^2**	684
Average literacy	65.3	**Total child population (0-6**	128,129

		years)	
(a) Male literacy	75.8	(a) Male(0-6 years)	67,720
(b) Female literacy	53.2	(b) Female(0-6 years)	60,409
Literates	**488,106**	**Sex ratio(per 1000)**	**878**
(a) Male	302,283	Child sex ratio (0-6 years)	892
(b) Female	185,823	Child Proportion	14.62%

[http://www.censusindia.gov.in/2011census/dchb/0938_PART_B_DCHB_MAHOBA.pdf]

Physiography of the district

Alluvial sediments are the dominant geology within the River and tributary catchment. Alluvial sediments are porous and contaminants within an overlying surface water body will pass easily through the sediments to underlying aquifers. River systems are commonly in direct hydraulic continuity with the underlying groundwater aquifer. Physiographyof the state is closely related to geology and structure and can be divided into three distinct physiographic divisions.

Physiographically the area can be divided into two units –

(1) Southern parts having high reliefs with hillocks.

(2) Northern part having relatively low relief with low hillocks.

Land utilization pattern of the district

The land use pattern (2005-06) in the State has been indicated in the Table below. The total cultivated area of the state is 74.7 million ha. And the gross cropped area is 189.54 millionha. The area sown during rabi is more as compared to area sown in kharif. Land use Pattern in MAHOBAdistrict is given below in Table:

Table9: Land use pattern of MAHOBA

Land use categories	**Area (in million hectare)**
Forest	16.2
Land not available for cultivation	38.8
Culturable waste land	10.3
Fallow land	17.6
Net sown area	141.1
Double Cropped Area	74.7
Gross Cropped Area	189.54
Total	12009.17

Source: Comprehensive - District Agriculture Plan (C-DAP), District Planning Committee MAHOBA (UP)

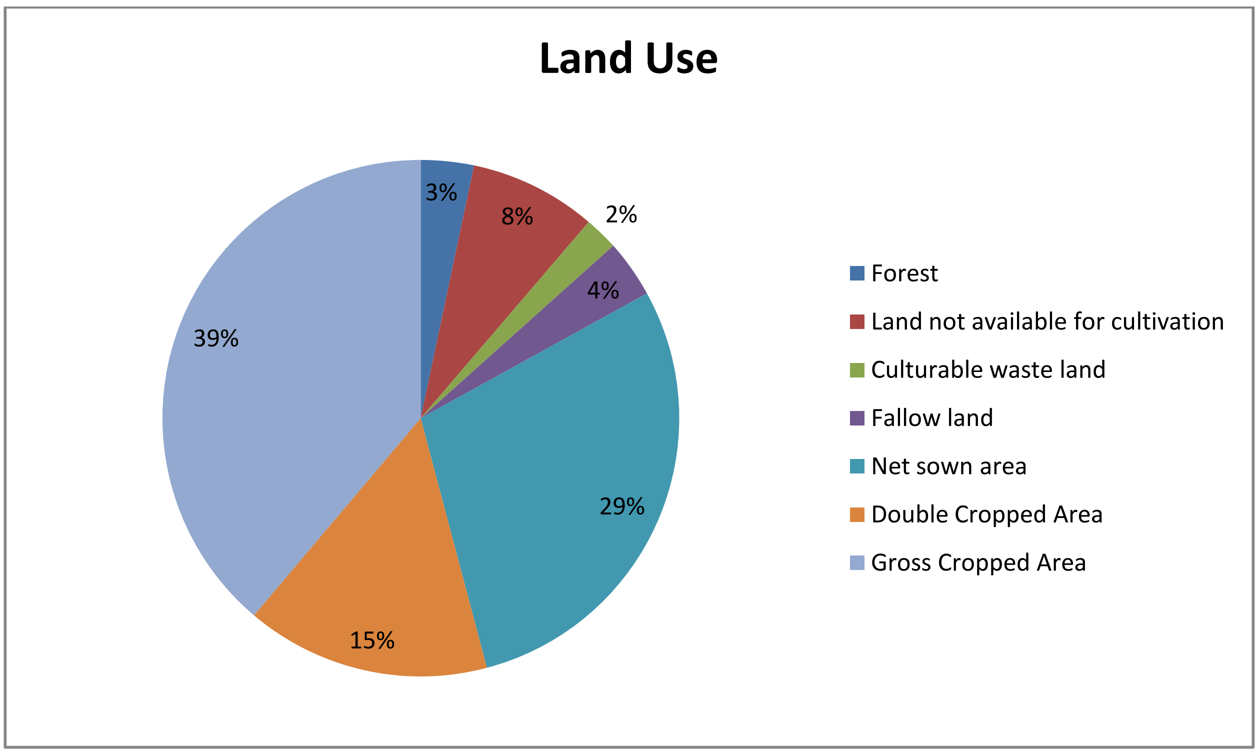


Fig 4: land use pattern

Land use pattern is largely influenced by the available irrigation facilities, which ultimately affect the economy of the area. Irrigation facilitates the intensive use of land resources and results in the increase of Gross Cropped Area and also improves the intensity.

Cropping Pattern

The three main cropping seasons in the district are Kharif and Rabi.Wheat is the main crop and is grown in large parts of the district. The other crops raised in the district include Juar, gram, pea, masoor and sesame. Main fruits grown are mango and guava. The production and productivity of the major crops in the district are summarized below in Table:

Table 10: Cropping pattern of MAHOBA

Crop	Area (ha)	Production (T)
Juar	4200	3500
Wheat	71900	97700
Gram	65400	57000
Pea	25200	18900
Masoor	28600	14000
Sesame	30600	2400

[http://www.nicra-icar.in/nicrarevised/images/statewiseplans/Uttar%20Pradesh/UP50-Mahoba-26.07.14.pdf]

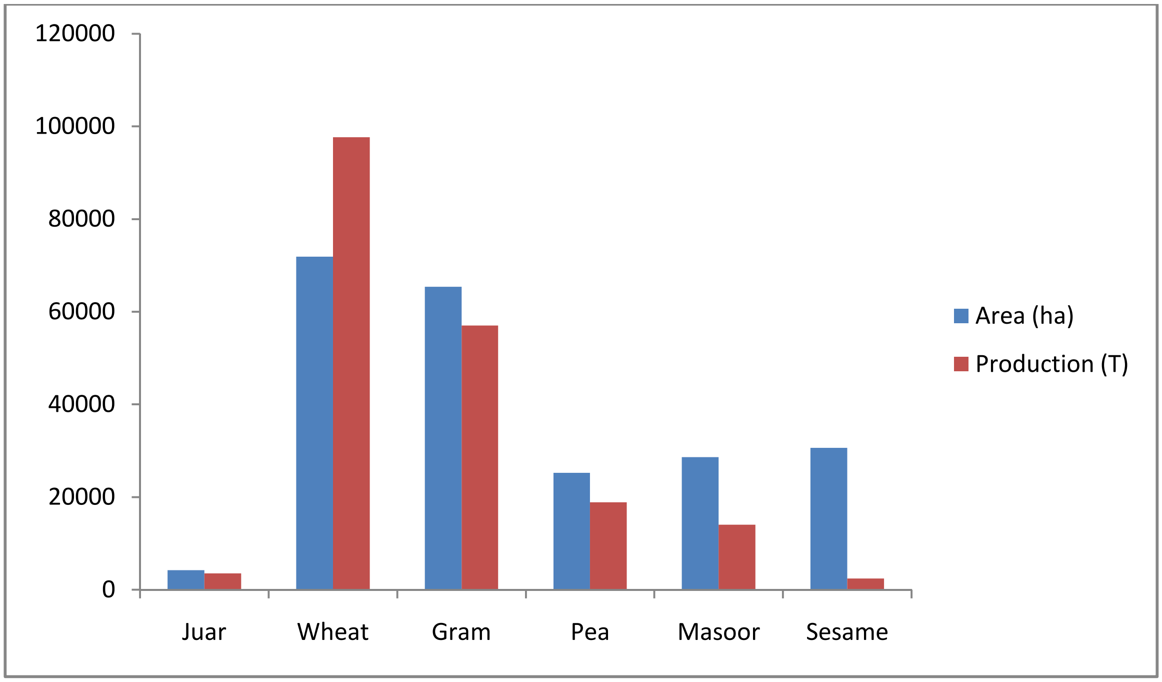


Fig 5: Cropping Pattern of MAHOBA District

Geology

The soil consists of the well known Mahoba varieties, Mar, Kabar, Parua and Rakar. Mar is often called blank cottar soil. Its varies greatly in colour. It contains small lumps of kankar (small stone piece). Kabar range from a rich dark black to light brown. Its chief characteristics are its extreme adhesiveness, which causes it to quickly dry and cake in to hard blocks. Parua is a light coloured sandy soil, found in many forms. It is usually less rich in organic matter, but its finer texture makes it more responsive to manure and irrigation. Raker is refuse soil which occurs on sloping, where the action of water has tended to denude the earth of all its better qualities.

The Bundelkhand massif exposed in parts of U.P. and M.P. covers an area of about 10,000 sq miles. The present paper deals with the petrology of a part of Bundelkhand granite exposed near Mahoba. The age relationship of various rock types , as inferred by the field observation are:

- Dolorite dike, pegmatite and quatz veins
- Fine grained granite
- Spotted granite
- Coarse grained biotite granite
- Xenoliths

The area is famous for the well known NW-SE trending dolerite dykes. Lithologically this region is mainly characterized by different types of granite forming Bundelkhand granite, gneisses, mafic dykes, mafic enclave and metamorphites. The rock type of area can be classified as igneous rocks and metamorphites. Igneous rocks of the area have been classified as acidic and basic varieties where granites are the acidic rocks while dolerite dykes are the basic one. The metamorphites of the area is represented by amphibolites and gneisses (Figure I). The rocks of the area have suffered folding, faulting and shearing

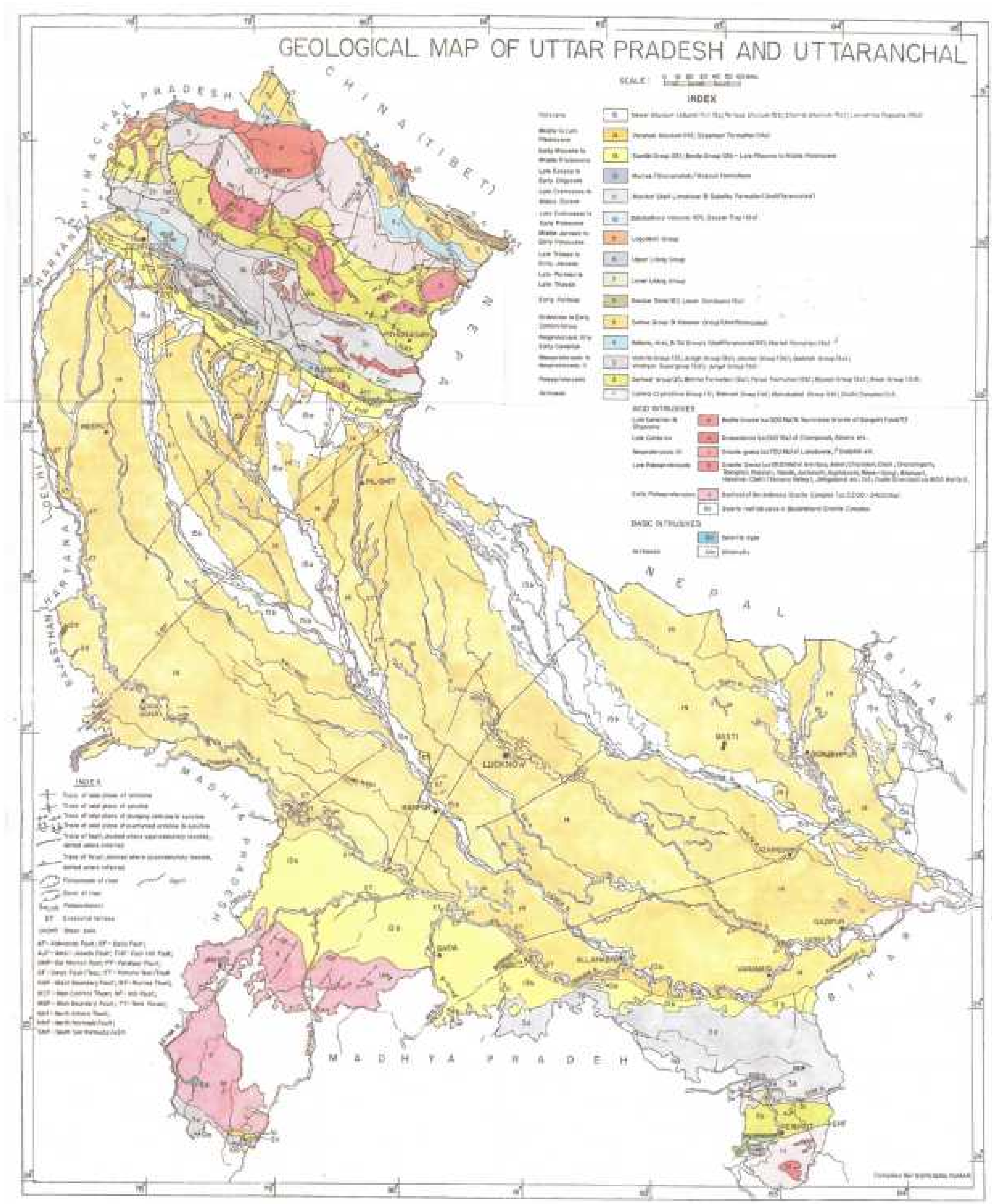


Fig6:Geological map of Uttar Pradesh

Mineral wealth

As per geological and mineral atlas of India sheet no 14, miscellaneous bulletin no-30 and mineral resource map of district the area contained alluvial loam along with some percentage of sand upto a deep layer. Mineral wealth of the district has great significance in terms of socio-economic prosperity and economic base.

Soil

In Mahoba district soil has been produced by the weathering of granites. Well known Bundelkhand varieties are Mar, Kafur, Parana and Rakar. Clayey and loamy soil is dominant in the district.

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Sand – it is obtained from the banks and bars of the river Dhasan and is used extensively for building purposes.

Sand

Sand is the main mineral available in the basin of Dhasan which is used in civil construction work.

Description of Rivers

The main rivers running through the district are Dhasan.

Dhasan River

The Dhasan River is a right bank tributary of the Betwa River. The river originates in Begumganj tehsil of Raisen district in Madhya Pradesh state in central India. The river forms the southeastern boundary of the Lalitpur District of Uttar Pradesh state. Total length of the river is 365 km, out of which 240 km lies in

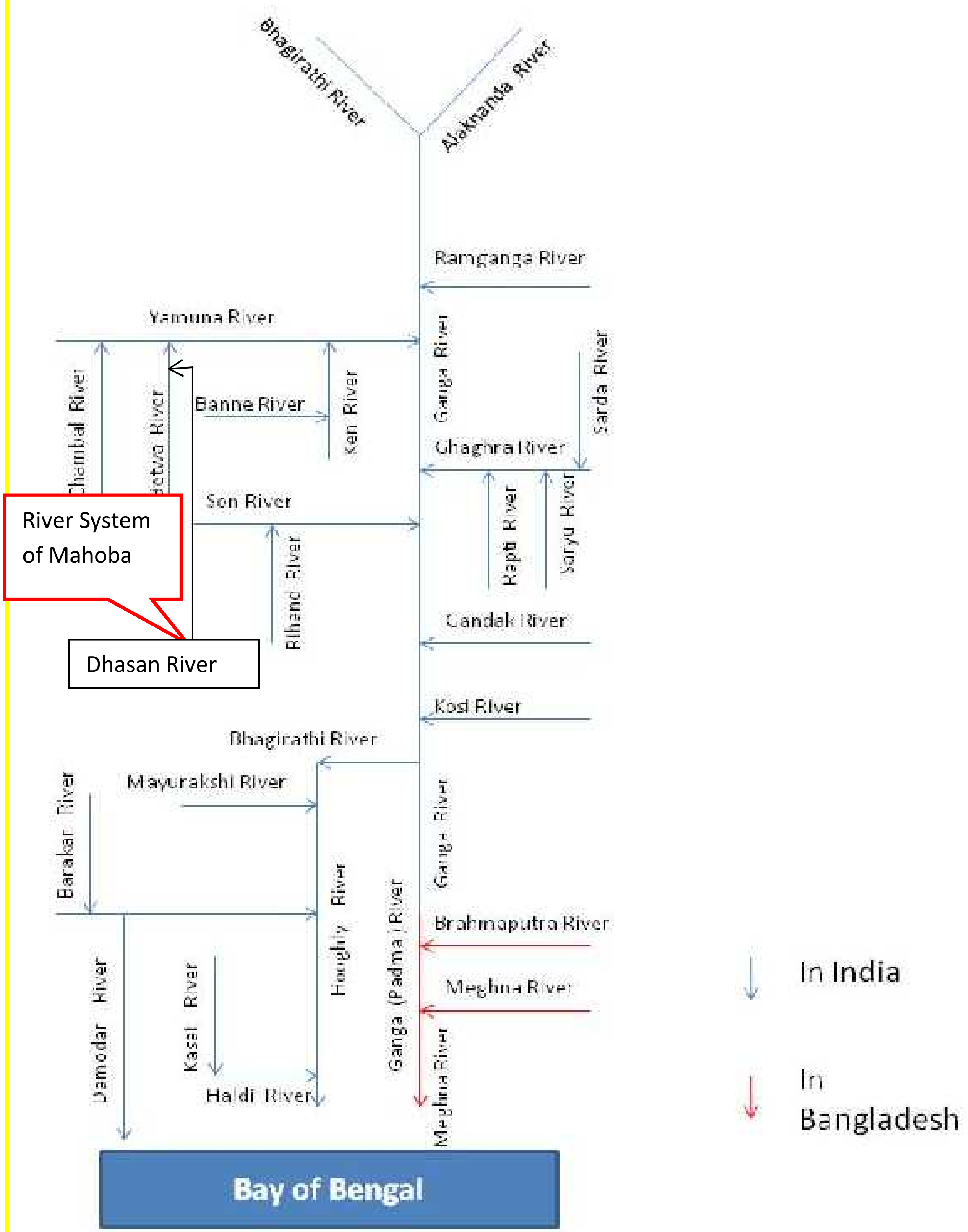


Fig 7: River System of India

Madhya Pradesh, 54 km common boundary between Madhya Pradesh and Uttar Pradesh and 71 km in Uttar Pradesh. The river was known as the Dasharna in ancient period. The Lehchura Dam is built on this river at 2 km from Harpalpur railway station. Residents of nearby villages regard this river as a holy river.

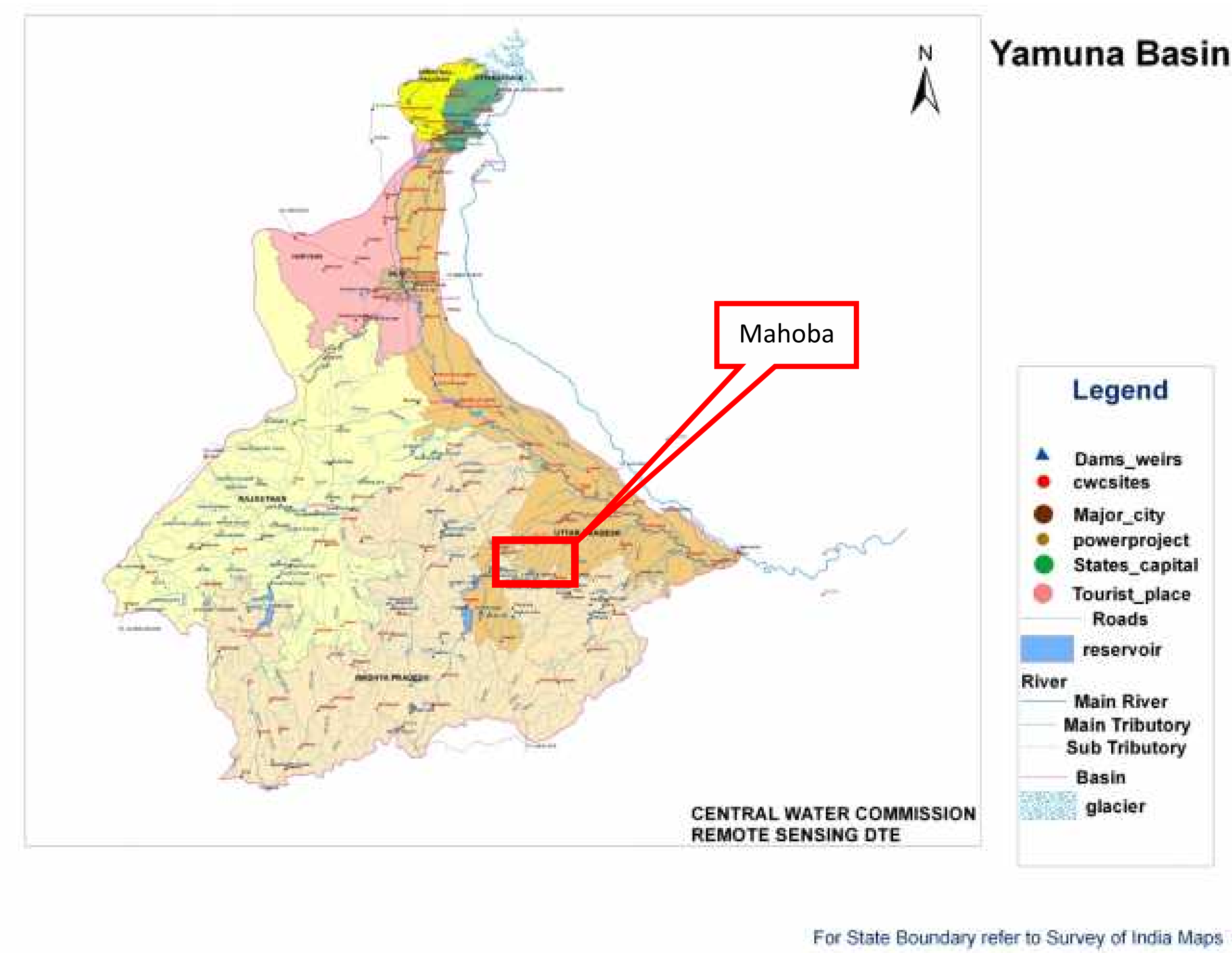


Fig 8: District MAHOBA (part of Yamuna Basin)

[http://www.india-wris.nrsc.gov.in/wrpinfo/index.php?title=Yamuna_River_System]

Table11: Catchments Details of Dhasan River

S.No.	State	Length (in km)
1.	Uttar Pradesh	71
2.	Madhya Pradesh	240

Process of deposition

Sediment transport is critical to understanding how rivers work because it is the set of processes that mediates between the flowing water and the channel boundary. Erosion involves removal and transport of sediment (mainly from the boundary) and deposition involves the transport and placement of sediment on the boundary. Erosion and deposition are what form the channel of any alluvial river as well as the floodplain through which it moves. The amount and size of sediment moving through a river channel are determined by three fundamental controls: competence, capacity and sediment supply. Competence refers to the largest size (diameter) of sediment particle or grain that the flow is capable of moving; it is a hydraulic limitation. If a river is sluggish and moving very slowly it simply may not have the power to mobilize and transport sediment of a given size even though such sediment is available to transport. So a river may be competent or incompetent with respect to a given grain size. If it is incompetent it will not transport sediment of the given size. If it is competent it may transport sediment of that size if such sediment is available (that is, the river is not supply-limited).

Capacity refers to the maximum amount of sediment of a given size that a stream can transport in traction as bedload. Given a supply of sediment, capacity depends on channel gradient, discharge and the calibre of the load (the presence of fines may increase fluid density and increase capacity; the presence of large particles may obstruct the flow and reduce capacity). Capacity transport is the competence-limited sediment transport (mass per unit time) predicted by all sediment-transport equations, examples of which we will examine below. Capacity transport only occurs when sediment supply is abundant (non-limiting). Sediment supply refers to

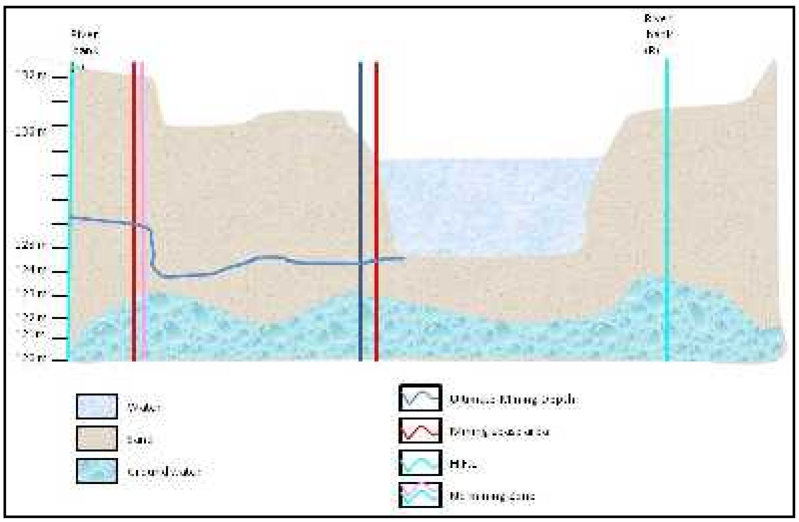


Fig 9: Standard Sand Mining Operation

the amount and size of sediment available for sediment transport. Capacity transport for a given grain size is only achieved if the supply of that calibre of sediment is not limiting (that is, the maximum amount of sediment a stream is capable of transporting is actually available). Because of these two different potential constraints (hydraulics and sediment supply) distinction is often made between supply-limited and capacity-limited transport.

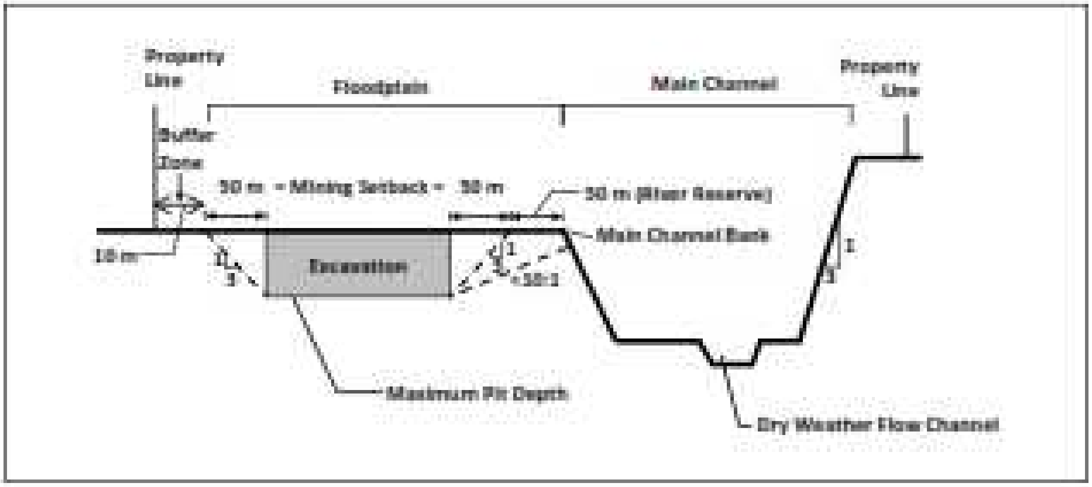


Fig.10: Floodplain Excavation Pit Geometry for Streamlined Floodplain

Most rivers probably function in a sediment-supply limited condition although we often assume that this is not the case. Much of the material supplied to a stream is so fine (silt and clay) that provided it can be carried in suspension, almost any flow will transport it. Although there must be an upper limit to the capacity of the stream to transport such fines, it is probably never reached in natural channels and the amount moved is limited by supply. In contrast, transport of coarser material (say, coarser than fine sand) is largely capacity limited.

Modes of Sediment Transport

The sediment load of a river is transported in various ways although these distinctions are to some extent arbitrary and not always very practical in the sense that not all of the components can be separated in practice:

1. Dissolved load
2. Suspended load
3. Intermittent suspension (saltation) load

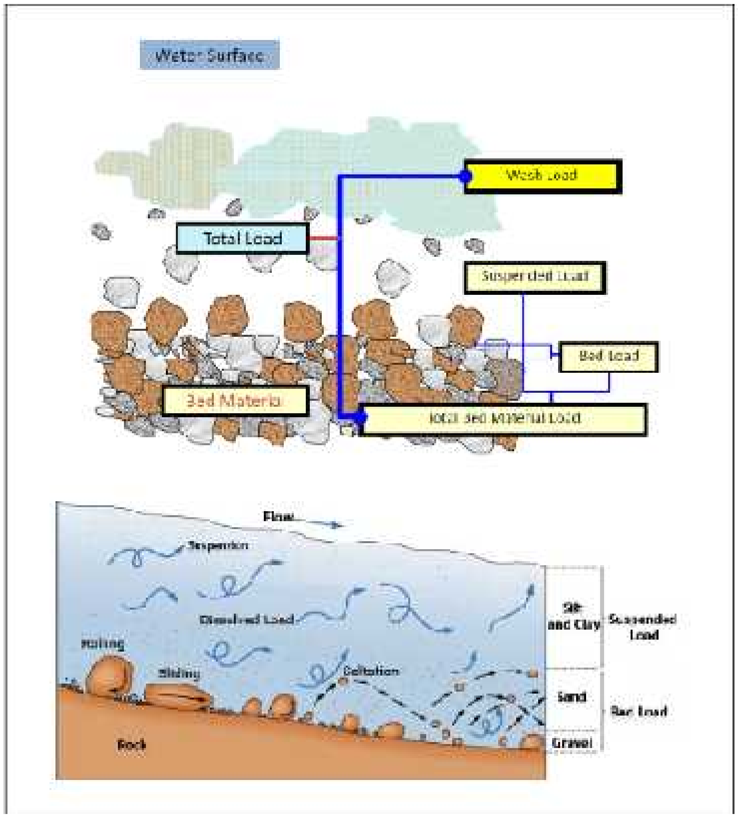
4. Wash load
5. Bed load

Sediment Transport in Rivers

The loose boundary (consisting of movable material) of an alluvial channel deforms underthe action of flowing water and the deformed bed with its changing roughness (bed forms)interacts with the flow. A dynamic equilibrium state of the boundary may be expected when asteady and uniform flow has developed (Nalluri& Featherstone, 2001).The resulting movement of the bed material (sediment) in the direction of flow is calledsediment transport and a critical bed shear stress (t) must be exceeded to start the particlemovement. Such a critical shear stress is referred as incipient (threshold) motion condition,below which the particles will be at rest and the flow is similar to that on a rigid boundary.

Sediment Influx Rate

Sediment influx in Ephemeral streams is generally confined to the beginning of the rainy season as velocity of the water washes down medium to fine sand and silt depending on the velocity and gradient of land. Cobbles, pebbles and boulders will be transported buy only over short distance. Boulders are normally 256 mm and above are normally transported either by dragging action or by saltation.



(Nalluri & Featherstone, 2001).

Fig.11: Sediment Transport in river

Recharge is in two forms, one general deposition of course, medium and fine sand when the velocity of the river water decreases below the carrying capacity.However, flash floods due to heavy rains in the upper reaches often causes rapid transportation of boulder, sand etc., along with silt which can never deposit

.

Recharge Rate: It is dependent upon the following 4 factors

1. Velocity of the water and change of velocity
2. Size of particles
3. Temporary increase in density of carrying media due to presence of silt load.

4. Artificial or natural barriers being encountered within the river course, where due to the sudden check in velocity, materials are deposited.

The numerical sedimentation rate varies from 50cm medium sand to as much as 3m of medium and fine sand where the slope of the river bed is less than 10^0 slope per season. For silt and clay, these only be deposited in the flood area and normally varies between 1-5m over 6 months period.

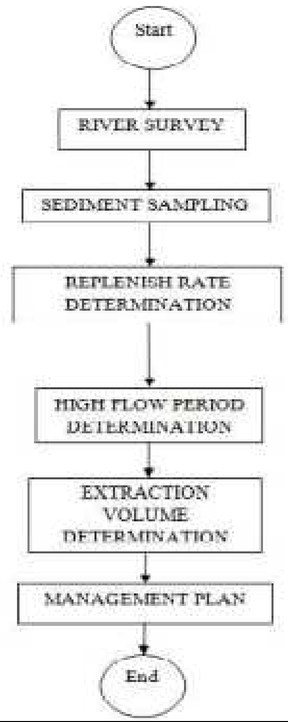


Fig12:Flow chart for volume estimation

Estimation of Sedimentation

The sedimentation rate in India is estimated using empirical formula, actual observed data and reservoir sedimentation survey. The recommended BIS (12182-1987) method has been widely used for reservoir planning.In addition the sediment data is also collected by the state governments on river systems in their respective territories. Thus there is enough data to estimate both the average annual sediment yield and also the distribution of annual sediment yields. There are also situations where the gauging stations provide nested systems of catchments. In these situations data can be used to identify the contribution to the total sediment yield from individual sub-catchments. Though this data is extremely useful and is recommended to be fully used for estimation of sediment rate, the data need to be interpreted with care. The sediment measurements are, in general, based on bottle sample taken from near the water surface. In general, the suspended sediment concentration varies with depth, with the sediment concentration being greatest at the lower levels. This means that the measurement may under estimate the suspended sediment concentrations. The data provides an excellent resource for estimating sediment yield directly.The sediment yield depends on catchment area, the average catchment slope, the lithology of the catchment, the land use, the drainage density, the annual/seasonal precipitation and storm events etc. There are a number of empirical methods developed in USA and still used worldwide to assess sediment erosion like the Universal Soil Loss Equation (USLE), Modified Universal Soil Loss Equation (MUSLE) and Revised Universal Soil Loss Equation (RUSLE). Some work has been done in India and certain empirical relations have been developed linking annual sediment yield with some of these parameters (CWC, 2010).

Estimation of sediment yield from the catchment area above the reservoir is usually made using river sediment observation data or more commonly from the experience of sedimentation of existing reservoirs with similar characteristics. On adopting the first procedure, it is usually necessary (though often not complied within practice) to evolve proper sediment water discharge rating curve and combine it with flow duration (or stage duration curve) based on uniformly spaced daily or shorter time units in case of smaller river basins. Where observed stage/flow data is available for only shorter periods, these have to be suitably extended with the help of longer data on rainfall to eliminate, as far as possible, the sampling errors due to shortness of records. The sediment discharge rating curves may also be prepared from hydraulic considerations using sediment load formulae, that is, modified Einstein's procedure but this has not yet become popular. It is also necessary to account for the bed load which may not have been measured. While bed load measurement is preferable when it is not possible, it is often estimated as a percentage generally ranging from 5 to 20 percent of the suspended load.

However, practical means of measuring bed load of sediment needs to be undertaken particularly in cases where high bed loads are anticipated. To assess the volume of sediment that would deposit in the reservoir, it is further necessary to make estimates of average trap efficiency for the reservoir in question and the likely unit weight of sediment deposits, time averaged over the period selected. The trap efficiency would depend mainly on the capacity inflow ratio but would also vary with location of controlling outlets and reservoir operating procedures. The density of deposited sediment would vary with the composition of the deposits, the location of the deposit within the reservoir, the flocculation characteristics of clay and water and the age of the deposit. For coarse material (0.0625 mm and above), variation of density with location and age may be unimportant but for silt and clay, this may be significant. Normally, a time and space average density of these fractions, applicable for the period under study is required for finding the overall volume of deposits. For this purpose, the trapped sediment for the period under study would have to be classified in fractions by corrections in inflow estimates of the fractions by trap efficiency. Most of the sediment removed from the reservoir should be from the silt and clay fraction. In some special cases, local estimates of densities at a point in the reservoir may be required instead of average density over the reservoir. Estimates of annual sediment yield/sedimentation rate assessed from past data are further required to be suitably interpreted and wherever necessary, the unit rates which would apply to the future period are computed by analysing data for trends or by making subjective adjustments for the likely future changes. Where the contributing drainage area is likely to be reduced by upstream future storages, only such of the projects as are under construction or which have the same priority of being taken up and completed as the project in question are considered for assessing the total sediment yield. Sediment observation data (see IS:18QO-1968*) is necessary if the yield is being assessed from hydrometric data. If observational methods are inadequate, the possibility of large errors should be considered. For drawing conclusions from reservoir re-surveys, it is important that reduction of at least 10 percent or more has been observed in the capacities of the two successive surveys; if this is not done, inaccuracies in the successive surveys will distort the estimation of the capacity reduction between the surveys. If the loss of capacity is small, useful conclusions may not be forthcoming, and in such cases, river sediment measurements with its large observational errors may still provide a better estimate. It is essential to make a proper assessment of sediment yield for reservoir under study taking relevant factors into account (BIS:12182-1987).

A proper assessment of the effects of sediment transport and of the measures that may be necessary for its control requires knowledge of the processes of sediment erosion, transportation, and deposition, and of their interaction with the hydrological processes in the catchment.

Erosion of catchments

The most significant agent for eroding sediments from land is running water. Other agents of land erosion include wind, ice, and gravity. The processes by which water degrades the soil are complicated and depend upon the rainfall properties, soil properties, land slope, vegetation, agricultural methods, and urbanization process. The last two factors account for the most important effects of man's activities on erosion. Empirical equations have been developed for the determination of soil loss(sheet erosion) from agricultural lands. One of them, developed by Musgrave for conditions prevailing in the United States, is given as

$$E = IRS^{1.35}L^{0.35}P^{1.75}$$

Where,

E is the mean annual soil loss, in millimetres

I is the inherent erodibility of the soil, in millimetres

R is a land-cover factor

S is the land slope, in per cent

L is the length of the slope in metres, and

P is the 30-minute, two-year rainfall depth, in millimetres.

The values of the parameters I and R, are determined empirically from regional studies.

Channel erosion

Channel erosion is caused by the forces of the concentrated flow of water. Its rate depends on the hydraulic characteristics of channel flow and on the inherent erodibility of channel materials. In non-cohesive materials, the resistance to erosion is affected by the size, shape, and specific gravity of the particles and by the slope of the bed. In cohesive materials it also depends on the bonding agents. The relationships between the hydraulic variables and the parameters influencing the erodibility of channels are not fully understood and are often expressed by empirical formulae. Stream and river-control works may have a serious local influence on accelerating channel erosion if they cause an increase in channel depth, flow velocity, change the direction of the flow, or reduce the natural sediment load. The latter effect occurs frequently below dams and may persist for many kilometres downstream. Bare land and badlands may develop gullies with rates of advance that can be computed by empirical formulae containing such parameters as the drainage area of the gully, slope of the approach channel, depth of rainfall, and clay content of the eroding soil.

Transportation of sediments in channels

Fine (suspended) sediments transported in rivers originate mainly from the topsoil of the catchment and from the banks of the channels. However, fine sediments also originate from sewage and other return flows for example such sediments comprise about one third of the suspended-sediment load in the lower Rhine river. A large portion of the transported material comes to rest on flood plains, especially upstream from hydraulic structures. The settled material undergoes compaction and other physical and chemical changes that can sometimes prevent its re-erosion by flows that would have carried it previously. A decrease is usually found in the mean annual sediment transported per unit area of the catchment as the area of the catchment increases. The concentration of suspended sediment in runoff is described by various formulae such as

$$\log cs = C \log Q + B$$

in which,

cs is the concentration expressed in weight per unit volume of water,

Q is the water discharge,

C is a dimensionless coefficient, and

B is a function of the rainfall depth of the antecedent discharge or of other meteorological and hydrological variables.

The concentration of suspended sediment varies within the channel cross-section. It is relatively high in the lower portion and may also be non-uniform laterally. So that its sampling at several points or along several verticals of the cross-section is often necessary for obtaining its mean. The mean concentration should be evaluated to yield the total sediment weight per unit time when multiplied by the water discharge. The graph of suspended sediment against time usually has a peak that does not occur simultaneously with the peak discharge. This lag is a result of the specific conditions in a watershed, and no generalization has yet been formulated for the evaluation of this difference.

Bed-load transport

Coarse sediments (bed load) move by sliding, rolling, and bouncing along channels and are concentrated at or near the channel bed. The variables that govern transport are the size and shape of the particles and the hydraulic properties of the flow. As a consequence of the interaction between the hydraulic forces and the coarse sediment, the channel bed assumes different configurations known as plane, ripples, dunes, flat, standing waves, and antidunes. They exert resistance to the flow of water that varies within a wide range and assumes a maximum value for the dune configuration.

Sedimentation

When approaching its mouth, the flow velocity of a river decreases along with its ability to carry sediment. Coarse sediments deposit first, then interfere with the channel conveyance, and may cause additional river meanders and distributaries. The area of the flowing water expands, the depth decreases, the velocity is reduced, and eventually even fine sediments begin to deposit. As a result, deltas may be formed in the upper portion of reservoirs. The deposited material may later be moved to deeper portions of the reservoir by hydraulic processes within the water body. Sediments are deposited in accordance with their settling velocity. A significant concentration of suspended sediments may remain in the water column for several days after its arrival in a reservoir. This may interfere with the use of the stored water for certain purposes, e.g. for water supply or recreation. It should be emphasized that not all of the sediment deposits in a reservoir. A large portion of it remains in the upper zones of the watershed, some is deposited upstream from reservoirs, and some is carried downstream by the released water. The sediment-trapping efficiency in a reservoir depends upon the hydraulic properties of the reservoir, the nature of the sediment, and the hydraulic properties of the outlet. The density of newly deposited sediment is relatively low but increases with time. The organic component in the sediment may undergo changes that may reduce its volume and enhance biochemical processes in the stored water (WMO, 1994). Some of the famous sediment transport equations are:-

1. Dandy – Bolton Equation
2. Modified Universal Soil Loss Equation (MUSLE) developed by Willia ms and Berndt (1977)
3. Yang Equations
4. Engelund-Hansen Equation

Dandy - Bolton formula is often used to calculate the sedimentation yield because :-

- The formula uses catchment area and mean annual runoff as key determinants
- Itdoes not differentiate in basin wide smaller streams and their characteristics.

- Dandy and Bolton equation calculates all types of sediment yield i.e. Sh eet and rill Erosion, gully Erosion, channel Bed and bank erosion and mass movement etc.

DANDY – BOLTON EQUATION

1. Dandy Bolton formula is often used to calculate the sedimentation yiel d.
2. However Computed sediment yields normally would be low for highly

   erosive areas and high for well stabilized drainage basins with high pla nt density because the equations are derived from average values.
3. The equations express the general relationships between sediment yield, run off, and drainage area.
4. Many variables influence sediment yield from a drainage basin. They i nclude climate, drainage area, soils, geology, topography, vegetation an d land use.
5. The effect of any of these variables may vary greatly from one geogra phic location to another, and the relative importance of controlling fact ors often varies within a given land resource area.
6. The accuracy of the sedimentation surveys varied, ranging from reconn aissance type measurements of sediment deposits to detailed surveys co nsisting of closely spaced cross-sections or contours.

Sediment Yield vs. Drainage Area: -

On the average, sediment yield is inversely proportional to the 0.16 power of drainage area between 1 and 30,000 square miles.

Sediment Yield vs. Runoff: -

Sediment yield increased sharply to about 1,860 tons per square mile per ye ar as run-
off increased from 0 to about 2 inches. As runoff increased from 2 to abou t 50 inches, sediment yield decreased exponentially. Because sediment yield must approach zero as runoff approaches zero, a curve through the plotted points must begin at the origin. The abrupt change in slope of a curve thro ugh the data points at Q equals 2 inches precluded the development of a con tinuous function that would adequately define this relationship. Thus, there are two equations derived for when Q was less than 2 inches and when Q was g reater than 2 inches (Dandy &Bolton, 1976)

Method of Mining

a)Extracting gravel from an excavation that does not penetrate the water table and is located away from an active stream channel should cause little or no change to the natural hydrologic processes unless the stream captures the pit during periods of flooding. The exception is that changes in evapotranspiration, recharge, and runoff may create minor changes to the ground-water system, which may in turn affect stream flow.

b) Limiting extraction of material in floodplains to an elevation above the water table generally disturbs more surface area than allowing extraction of material below the water table.

c) In-stream extraction of gravel from below the water level of a stream generally causes more changes to the natural hydrologic processes than limiting extraction to a reference point above the water level.

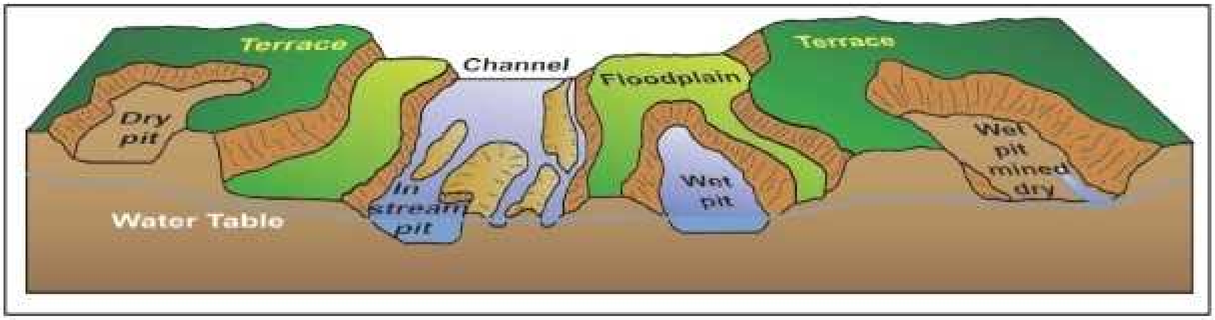


Fig 13: Aggregate extraction can take place in a number of in-stream and near-stream environments

d) In-stream extraction of gravel below the deepest part of the channel (the thalweg) generally causes more changes to the natural hydrologic processes than limiting extraction to a reference point above the thalweg.

e) Excavating sand and gravel from a small straight channel with a narrow floodplain generally will have a greater impact on the natural hydrologic processes than excavations on a braided channel with a wide floodplain.

f) Extracting sand and gravel from a large river or stream will generally create less impact than extracting the same amount of material from a smaller river or stream.

Annual rainfall

The climate is sub-humid and it is characterized by a hot dry summer and a bracing cold season. The average normal rainfall is 843 mm. About 87% of rainfall take place from June to September. During monsoon surplus water is available for deep percolation to ground water. There is a meteorological observatory at Mahoba, the records of which has been taken as representative meteorological condition for Mahoba district. During March to May the air is least humid with relative humidity high in the morning and less in the evening mean. Monthly morning relative humidity is 70% and mean monthly evening relative humidity is 53%. During monsoon season the winds blow predominantly from east or southeast. The mean wind velocity is 5.6 km/hr. The potential evapotranspiration is 1494.00 mm. (Source: Meteorological Department, Government of India, 2010.)

Table 13: Annual Rainfall of MAHOBA district

YEAR	jan	Feb	March	april	may	june	july	aug	sep	oct	Nov	Dec	Annual Total
2012	22.8	2	4	0	0	11.4	199	215.5	112.1	0	0	0	566.8
2013	0	64.6	0	0	0	294.2	182.4	243.4	19.8	64.4	0	2	870.8
2104	44	11	33.6	0	0	5.2	89	76	88.6	7.6	0	24.8	379.8
2015	25.6	13.2	44	17	0	12.2	210	9.8	19.8	12.6	1	5	370.2
2016	5.6	2.2	2.6	0	3.8	20.4	398.6	376.7	27.4	5.8	0	0	843.1

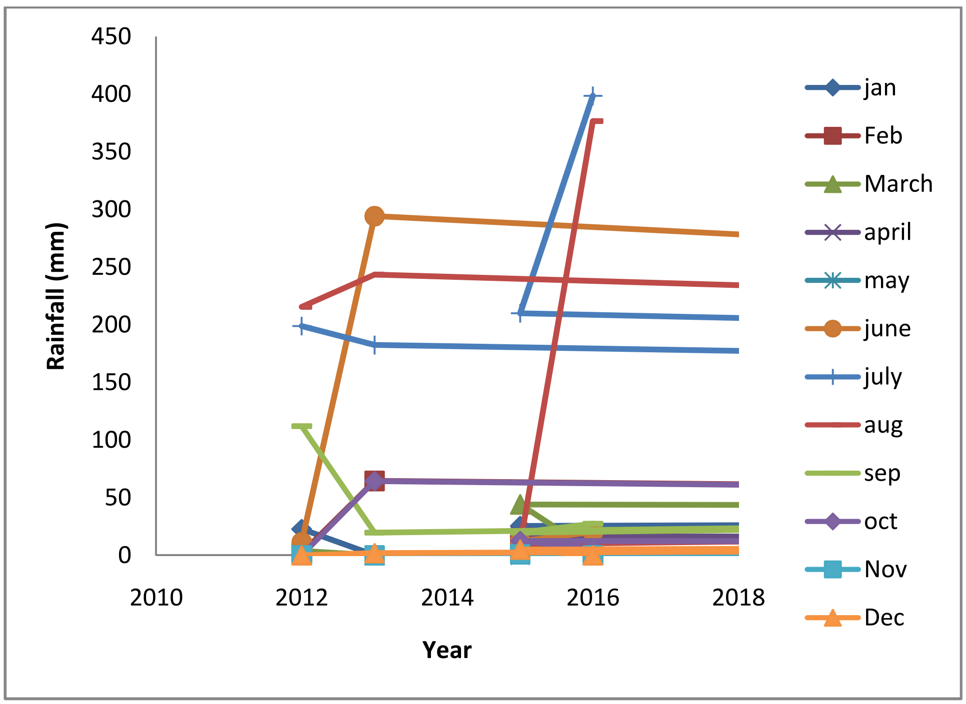


Figure 14: Annual Rainfall Pattern

Overview of mining activity in the district

Sand

Table 15 : Reserve estimation of sand on the banks of Burma river

Total stretch of Burma river area flowing through district Mahoba, U.P	Potential area for mining	Mineable mineral potential (MT)	Total area of Mining Lease in Mahoba, U.P	Average Production in last 03 years (MT)
28.70 km	180 ha	54 lakhs MT	46 ha	22920 MT

The total area of Burma River. is almost 1.80 Km^2, out of which 15-20% of water channel cannot be excavated. Area of existing / proposed mining lease area is 46 ha so the rest of the area i.e. 134 ha. needs to be explored. Additional areas may be further assessed on the basis of various ecological, environmental, social and political considerations. It can be further studied as potential area for mining & revenue generation.

Table 16 : Reserve estimation of sand on the banks of Urmil river

Total stretch of Urmil river area flowing through district Mahoba, U.P	Potential area for mining	Mineable mineral potential (MT)	Total area of Mining Lease in Mahoba, U.P	Average Production in last 03 years (MT)
17.74 km	218 ha	65.40 Lakh MT	8 ha	4,200 MT

The total area of Urmil River. is almost 2.18 Km^2, out of which 15-20% of water channel cannot be excavated. Area of existing / proposed mining lease area is 8 ha so the rest of the area i.e. 210.ha. needs to be explored. Additional areas may be further assessed on the basis of various ecological, environmental, social and political considerations. It can be further studied as potential area for mining & revenue generation.

 # The volume calculated are as reserve up to 3m depth as suggested in Standard Environmental Conditions for Sand Mining in SUSTAINABLE SAND MINING MANAGEMENT GUIDELINES – 2016, issued by MoEF& CC, GOI, Delhi. The mineable volume will be finalized based on the Mine Plan and Environmental Clearance and may vary by 10% to 20% considering the concept of safety and stability of Riverbanks & site situation. And this will form the basis of Final Royalty.

**Considering the density of Sand 1.2g/cm³.*

Table 17: Detail Of Production of Sand / Bajri Or Minor Mineral In LastThree Years In District Mahoba

Sr No.	Year	Production of Minor Mineral (Giiti Boulder) (in Cum)
1.	2014-2015	-
2.	2015-2016	18154999 cum
3.	2016-2017	19385504 cum

Table 18: Details Of Royalty Or Revenue Received In Last Three Years

Sr No.	Year	Revenue Received
1.	2014-2015	Rs. 124775193.00
2.	2015-2016	Rs. 1818743664.00

3.	**2016-2017**	**Rs.2829044333.00**

Table 19: List Of Mining Quarries In The District With Location, Area And Period Of Validity

Sl. No.	Tehsil	River	Village	Khand	Area (Acre)	Name of the Mineral	Estimated Mineable Reserve (cum)
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	Kulpahar	Burma	Pipari, Bhadwara,Kanaura, Gadaura (Partial)	1	5	Sand/Morrum	1600
2	Kulpahar	Burma	Gadaura (Partial), Dulara, Tolapatar, Rivai	2	8	Sand/Morrum	3000
3	Kulpahar	Burma	Tingra-Pahadiya, itaura Buzurg, Chandanhas	3	10	Sand/Morrum	4000
4	Kulpahar	Burma	Bijrari, Mahuaitaura	4	6	Sand/Morrum	2500
5	Kulpahar	Burma	Konia	5	3	Sand/Morrum	1500
6	Kulpahar	Burma	Chatesar, Jamala, Sikandarpura, Gehlaud, Sengarpura, Dhurwasmau, Pahadpura	6	7	Sand/Morrum	3000
7	Kulpahar	Burma	Naugaon, Kasari, Nakra	7	7	Sand/Morrum	3500
8	Mahoba	Urmil	Atrar, Imiliya, Kaimha, Jivraiya-Khivraiya, Digriya, Sijriya	8	5	Sand/Morrum	3000

DISCUSSION

Ordinary earth and Sand has become very important minerals for our society due to its many uses. Ordinary earth can be used for making brick, filling roads, whereas sand may be used as building sites, brick-making, making glass, sandpapers, reclamations, and etc. The role of sand is very vital with regards to the protection of the coastal environment. It acts as a buffer against strong tidal waves and storm surges by reducing their impacts as they reach the shoreline. Clean sand is indeed a rare commodity on land, but common in sand dunes and beaches. The composition of sand is highly variable, depending on the local rock sources and conditions, but the most common constituent of sand in inland continental settings and non-tropical coastal settings is silica (silicon dioxide, or SiO_2), usually in the form of quartz which because of its chemical inertness and considerable hardness, is the most common mineral resistant to weathering and it has become a very important mineral for the expansion of society. Sand is a naturally occurring granular material composed of finely divided rock and mineral particles. River sand is one of the world's most plentiful resources (perhaps as much as 20% of the Earth's crust is sand) and has the ability to replenish itself. River sand is vital for human well being & for sustenance of rivers. Sand mining is a sensitive environmental issue which is taken into the consideration by Geology & Mining Department, Govt. of U.P. and Ministry of Environment & Forest, Climate Change. Govt. of India. Geology & Mining Department, Govt. of U.P. had notified in rule no. 41 of Uttar Pradesh Minor Mineral Concession Rules, 1963 and MoEF &CC in **Standard Environmental Condition For Sand Mining, of SSMMG, 2016** has given minimum distance from the mining lease area are compared and maximum distance permissible from the MLA is given in **Table 17**.

Table 17: Environmental Sensitivity Analysis of Site

S. No.	Feature	Max. distance	Reference
1.	School	50 m	UPMMCR,1963
2.	Hospital	50m	UPMMCR,1963
3.	Road(NH)	100 m	SSMMG,2016
4.	Road(SH)	50 m	UPMMCR,1963
5.	MDR	50 m	UPMMCR,1963
6.	Railway Station	100 m	UPMMCR,1963
7.	Chak Road	10 m	UPMMCR,1963
8.	Bridge or embankment	200 m	UPMMCR, 1963
9.	Water supply /Irrigation scheme	200 m	UPMMCR, 1963

As a resource, sand by definition is ‘a loose, incoherent mass of mineral materials and is a product of natural processes.’ These processes are the disintegration of rocks and corals under the influence of weathering and abrasion. When sand is freshly formed the particles are usually angular and sharply pointed but they grow gradually smaller and more rounded as they become constantly worn down by the wind or water (ISM Envis, Dhanbad)

The “**SUSTAINABLE SAND MINING MANAGEMENT GUIDELINES – 2016**” of MoEF&CC envisages to ensure that sand and gravel mining is done in environmentally sustainable and socially responsible manner; availability of adequate quantity of 21 aggregate in sustainable manner; improve the effectiveness of monitoring of mining and transportation of mined out minerals; conservation of the river equilibrium and its natural environment by protection and restoration of the ecological system; avoid aggradation at the downstream reach especially those with hydraulic structures such as jetties, water intakes, etc.; to ensure 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; to 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; and streamlining the process for grant of environmental clearance for sustainable mining. The MoEF&CC has also issued notifications SO No. 141(E) dated 15.01.2016 and SO No. 190(E) dated 20.01.2016 under Environment (Protection) Act, 1986 on mining of minor minerals and constitution of District Level Environment Impact Assessment Authority and District Level Environmental Appraisal Committee. These notifications have delegated the power to grant environmental clearance for sand mining to an Authority headed by the District Magistrate. These notifications promote use of satellite imagery to decide the site suitable for mining and quantity of sand which can be mined. The MoEF&CC prescribes following procedures for sand mining;

a) Parts of the river reach that experience deposition or aggradation shall be identified first. The Lease holder/ Environmental Clearance holder may be allowed to extract the sand and gravel deposit in these locations to manage aggradation problem.

b) The distance between sites for sand and gravel mining shall depend on the replenishment rate of the river. Sediment rating curve for the potential sites shall be developed and checked against the extracted volumes of sand and gravel.

c) Sand and gravel may be extracted across the entire active channel during the dry season.

d) Abandoned stream channels on terrace and inactive floodplains be preferred rather than active channels and their deltas and flood plains. Stream should not be diverted to form inactive channel.

e) Layers of sand and gravel which could be removed from the river bed shall depend on the width of the river and replenishment rate of the river.

f) Sand and gravel shall not be allowed to be extracted where erosion may occur, such as at the concave bank.

g) Segments of braided river system should be used preferably falling within the lateral migration area of the river regime that enhances the feasibility of sediment replenishment.

h) Sand and gravel shall not be extracted within 200 to 500 meter from any crucial hydraulic structure such as pumping station, water intakes, and bridges. The exact distance should be ascertained by the local authorities based on local situation. The cross-section survey should cover a minimum distance of 1.0 km upstream and 1.0 km downstream of the potential reach for extraction. The sediment sampling should include the bed material and bed material load before, during and after extraction period. Develop a sediment rating curve at the upstream end of the potential reach using the surveyed cross- section. Using the historical or gauged flow rating curve, determine the suitable period of high flow that can replenish the extracted volume. Calculate the extraction volume based on the sediment rating curve and high flow period after determining the allowable mining depth.

i) Sand and gravel could be extracted from the downstream of the sand bar at river bends. Retaining the upstream one to two thirds of the bar and riparian vegetation is accepted as a method to promote channel stability.

j) Flood discharge capacity of the river could be maintained in areas where there are significant flood hazard to existing structures or infrastructure. Sand and gravel mining may be allowed to maintain the natural flow capacity based on surveyed cross- section history.

k) Alternatively, off-channel or floodplain extraction is recommended to allow rivers to replenish the quantity taken out during mining.

l) The Piedmont Zone (Bhabhar area) particularly in the Himalayan foothills, where riverbed material is mined, this sandy-gravelly track constitutes excellent conduits and holds the greater potential for ground water recharge. Mining in such areas should be preferred in locations selected away from the channel bank stretches.

m) Mining depth should be restricted to 3 meter and distance from the bank should be 3 meter or 10 percent of the river width whichever less.

n) The borrow area should preferably be located on the river side of the proposed embankment, because they get silted up in course of time. For low embankment less than 6 m in height, borrow area should not be selected within 25 m from the toe/heel of the embankment. In case of higher embankment the distance should not be less than 50 m. In order to obviate development of flow parallel to embankment, cross bars of width eight times the depth of borrow pits spaced 50 to 60 meters centre-to centre should be left in the borrow pits.

o) Demarcation of mining area with pillars and geo-referencing should be done prior to start of mining.

The above notifications and Guidelines, being notified under the provisions of the Environment (Protection) Act, 1986, have acquired the status of statutory provisions and have to be followed.

GSI Guidelines-Geological Survey of India (GSI) has collated/ formulated considered geo-scientific opinions to address issues pertaining to riverbed gravel/ sand mining. Besides resource extraction, ultimate objectives of riverbed mining should be:-

(i) protection and restoration of the ecological system,

(ii) to prevent damages to the river regime,

(iii) to work out the sediment influx/ replenishment capacity of the river, to restore the riverine configuration (landforms and fluvial geomorphology, such as bank erosion, change of river course gradient, flow regime, etc.),

(iv) to prevent contamination of ground water regime,

(v) to prevent depletion of ground water reserves due to excessive draining out of groundwater, and

(vi) to restore the riparian rights and in-stream habitats.

GSI has identified major hazards caused due to mining of sand/gravel as under:

a) ***Instream habitat***: The impact of mining may result in increase in river gradient, suspended load, sediment transport, sediment deposition, turbidity, change in temperature, etc. Excessive sediment deposition for replenishment/ refilling of the pits affect turbidity, prevent the penetration of the light required for photosynthesis of micro and macro flora which in turn reduces food availability for aquatic fauna. Increase in river gradient may cause excessive erosion causing adverse effect on the instream habitats. B

b) ***Riparian habitat***: This includes vegetative cover on and adjacent to the river banks, which controls erosion, provide nutrient inputs into the stream and prevents intrusion of pollutant in the stream through runoff. Bank erosion and change of morphology of the river can destroy the riparian vegetative cover.

c) *Degradation of Land:* Mining pits are responsible for river channel shifting as well as degradation of land, causing loss of properties and degradation of landscape.

d) *Lowering of groundwater table in the floodplain area:* Mining may cause lowering of riverbed level as well as river water level resulting in lowering of groundwater table due to excessive extraction and draining out of groundwater from the adjacent areas. This may cause shortage of water for the vegetation and human settlements in the vicinity.

e) *Depletion of groundwater:* excessive pumping out of groundwater during sand mining especially in abandoned channels generally result in depletion of groundwater resources causing severe scarcity and affecting irrigation and potable water availability. In extreme cases it may also result in creation of ground fissures and land subsidence in adjacent areas.

f) *Polluting groundwater:* In case the river is recharging the groundwater, excessive mining will reduce the thickness of the natural filter materials (sediments), infiltration through which the ground water is recharged. The pollutants due to mining, such as washing of mining materials, wastes disposal, diesel and vehicular oil lubricants and other human activities may pollute the ground water.

g) Choking of filter materials for ingress of ground water from river: Dumping of waste material, compaction of filter zone due to movement heavy machineries and vehicles for mining purposes may reduce the permeability and porosity of the filter material through which the groundwater is recharging, thus resulting in steady decrease of ground water resources.

The GSI has suggested that riverbed mining may be allowed considering minimization of the above mentioned deleterious impacts. The guidelines of National Water Policy of India should also be followed which states that watershed management through extensive soil conservation, catchment area treatment, preservation of forest, increasing of forest cover and construction of check dams should be promoted. Efforts shall be made to conserve the water in the catchments. Following geo-scientific considerations have been suggested to be taken into account for sand/ gravel mining:-

1. Abandoned stream channels on terrace and inactive floodplains may be preferred rather than active channels and their deltas and floodplains. Replenishment of ground water has to be ensured if excessive pumping out of water is required during mining.
2. Stream should not be diverted to form inactive channel.
3. Mining below subterranean water level should be avoided as a safeguard against environmental contamination and over exploitation of resources
4. Large rivers and streams whose periodic sediment replenishment capacity are larger, may be preferred than smaller rivers.
5. Segments of braided river system should be used preferably falling within the lateral migration area of the river regime that enhances the feasibility of sediment replenishment.
6. Mining at the concave side of the river channel should be avoided to prevent bank erosion. Similarly meandering segment of a river should be selected for mining in such a way as to avoid natural eroding banks and to promote mining on naturally building (aggrading) meander components.
7. Scraping of sediment bars above the water flow level in the lean period may be preferred for sustainable mining.

8. It is to be noted that the environmental issues related to mining of minerals including riverbed sand mining should clearly state the size of mine leasehold area, mine lease period, mine plan and mine closure plan, along with mine reclamation and rehabilitation strategies, depth of mining and period of mining operations, particularly in case of river bed mining.

9. The Piedmont Zone (Bhabbar area) particularly in the Himalayan foothills, where riverbed material is mined. This sandy- gravelly track constitutes excellent conduits and holds the greater potential for ground water recharge. Mining in such areas should be preferred in locations selected away from the channel bank stretches. Areas where channel banks are not well defined, particularly in the braided river system, midstream areas should be selected for mining of riverbed materials for minimizing adverse effects on flow regime and instream habitat.

10. Mining of gravelly sand from the riverbed should be restricted to a maximum depth of 3m from the surface. For surface mining operations beyond this depth of 3m (10 feet), it is imperative to adopt quarrying in a systematic bench- like disposition, which is generally not feasible in riverbed mining. Hence, for safety and sustainability restriction of mining of riverbed material to maximum depth of 3m.is recommended.

11. Mining of riverbed material should also take cognizance of the location of the active channel bank. It should be located sufficiently away, preferably more than 3m away (inwards), from such river banks to minimize effects on river bank erosion and avoid consequent channel migration.

12. Continued riverbed material mining in a given segment of the river will induce seasonal scouring and intensify the erosion activity within the channel. This will have an adverse effect not only within the mining area but also both in

upstream and downstream of the river course. Hazardous effects of such scouring and enhanced erosion due to riverbed mining should be evaluated periodically and avoided for sustainable mining activities.

13. Mineral processing in case of riverbed mining of the sandy gravelly material may consist of simple washing to remove clay and silty area. It may involve crushing, grinding and separation of valueless rock fragments from the desirable material. The volume of such waste material may range from 10 to 90%. Therefore, such huge quantities of mine wastes should be dumped into artificially created/ mined - out pits. Where such tailings / waste materials are very fine grained, they may act as a source of dust when dry. Therefore, such disposal of wastes should be properly stabilized and vegetated to prevent their erosion by winds.

14. Identification of river stretches and their demarcation for mining must be completed prior to mining for sustainable development.

15. The mined out pits should be backfilled where warranted and area should be suitably landscaped to prevent environmental degradation.

16. Mining generally has a huge impact on the irrigation and drinking water resources. These attributes should be clearly evaluated for short-term as well as long-term remediation (MoWR,2017)

SUMMARY

Table 22: Present Status of Mining

Potential area for Mining	Sand	
	Burma River	Urmil River
Mineable mineral Potential	22920 MT	4,200 MT

Total existing / proposed area for Mining	**46 ha**	**8 ha**

The total area of Burma River is almost 1.8 Km^2, out of which 15-20% of water channel cannot be excavated. Area of existing / proposed mining lease area is 46 ha so the rest of the area i.e. 134 ha. needs to be explored. The total area of Urmil River. is almost 2.18 Km^2, out of which 15-20% of water channel cannot be excavated. Area of existing / proposed mining lease area is 08 ha so the rest of the area i.e. 201 ha. needs to be explored. Additional areas may be further assessed on the basis of various ecological, environmental, social and political considerations. It can be further studied as potential area for mining & revenue generation.

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