IN THE HON'BLE NATIONAL GREEN TRIBUNAL

PRINCIPAL BENCH, NEW DELHI

ORIGINAL APPLICATION 1220 OF 2024

IN THE MATTER OF:

Yadram Singh **…Applicant**

Versus

Union of India & Ors **…Respondent**

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Through

Date:07.05.2025
Place:NewDelhi

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REPLY ON BEHALF OF MEMBER SECRETARY, SEIAA, UTTAR PRADESH. ALONG WITH SUPPORTING AFFIDAVIT.

MOST RESPECTFULLY SHOWETH:

1. That the Ministry of Environment and Forest, Government of India, by its notification dated 14-09-2006 (as amended) has made Prior Environmental Clearance a mandatory pre-condition for the establishment or expansion of any project or activity listed in the Schedule appended thereto, including all new projects, all expansions or modernisations that cross threshold limits, and any change in product-mix beyond the specified range, the objective being to impose necessary restrictions or prohibitions based on potential environmental impacts.

2. That under the said notification environmental clearance for matters falling under Category "A" of the Schedule is to be obtained from the Central

Government in the Ministry of Environment and Forests, while clearance for matters falling under Category “B” is to be obtained at the State level from SEIAA, such decision necessarily resting on the recommendations of a duly constituted SEAC.

3. That SEIAA-UP and SEAC-UP were constituted by notification S.O. 3338(E) dated 16-10-2017 and reconstituted by notification S.O. 2276(E) dated 11-06-2021 issued by the Ministry of Environment, Forest & Climate Change; the Directorate of Environment, Government of Uttar Pradesh, has been designated to function as the Secretariat to both bodies, and all proposals for Prior Environmental Clearance received by SEIAA-UP are dealt with strictly in accordance with the EIA Notification, 2006, as amended.

4. That the original text of the EIA Notification, 2006, did not expressly provide for approval of DSRs by SEIAA; consequently, a clarification was sought from the Ministry vide letter dated 16-11-2023, and by its letter dated 04-12-2023 the Ministry clarified that, pursuant to its notification dated 25-07-2018 and in harmony with the decisions of the Hon’ble Supreme Court in *State of Bihar v. Pawan Kumar* (order dated 10-11-2021) and the Hon’ble NGT in O.A. No. 34/2022 (order dated 29-09-2022), every DSR must be submitted to SEAC for evaluation and to SEIAA for approval, the DSR being prepared in consonance with the *Sustainable Sand Management Guidelines 2016* and the *Enforcement and Monitoring Guidelines for Sand Mining 2020*.

5. That the Hon’ble Tribunal, while perusing the earlier reply affidavit, expressed dissatisfaction because it did not explicitly confirm whether a scientific replenishment study had been completed prior to preparation of the DSRs for

Banda, Basti and Shamli; it is respectfully reiterated that the replenishment study is in fact conducted by the District Magistrate in coordination with DGM, copies whereof have been uploaded on the respective District Mining Portals by the District Administration / Mining Department in compliance with SEIAA conditions, a copies of the replenishment studies is annexed herein as **Annexure 1.**Colly

6. That the District Survey Report ("DSR") for minor-mineral (sand) mining is prepared at the district level under the overall supervision of the District Magistrate in close coordination with the District Mining Officer and the technical personnel of the Directorate of Geology & Mining, Uttar Pradesh; the said authorities conduct ground-truthing, geo-referenced mapping, drone photography, cross-sectional river surveys, public-hearing consultations and compilation of baseline environmental data in strict conformity with para 4.1.1(a) of the *Enforcement and Monitoring Guidelines for Sand Mining, 2020*, which mandates that a DSR be completed before any auction, e-auction, grant or renewal of a mining lease or issuance of a Letter of Intent by the Mining Department.

7. That an integral and mandatory component of the aforesaid exercise is the conduct of a scientific replenishment study in two hydrological seasons, namely the pre-monsoon survey conducted during April–May and the post-monsoon survey conducted during October–November, wherein the joint team measures river-bed levels with differential GPS, records flow velocity, analyses suspended-sediment load and determines volumetric accretion or erosion, the certified findings of both seasonal surveys being appended verbatim to the working papers of the draft DSR and constituting the factual substratum of its

sustainable extraction plan.

8. That upon completion of drafting, together with the authenticated pre- and post-monsoon replenishment reports, GIS shape-files and certification of the District Magistrate, the Director, Directorate of Geology & Mining ("DGM"), forwards the consolidated dossier to the State Environment Impact Assessment Authority, Uttar Pradesh ("SEIAA-UP"), for statutory appraisal in accordance with the *EIA Notification dated 14-09-2006* (as amended).

9. That SEIAA-UP, acting on the recommendations of the State Expert Appraisal Committee ("SEAC-UP"), first verifies that the replenishment study precedes and underpins the extraction calculations in the DSR and that both documents have been uploaded on the District Mining Portal; only upon affirmative satisfaction of these conditions does SEIAA-UP record its approval, otherwise the dossier is remanded for rectification, it being a specific condition of every approval that the replenishment study shall form the basis of the DSR and remain publicly accessible online.

10. That SEIAA-UP and SEAC-UP, in their joint meeting dated 02-02-2024, adopted a written Standard Operating Procedure ("SOP") which prescribes the uniform chapter-wise format of every DSR, mandates enclosure of both seasonal replenishment studies, fixes a ten-day timeline for uploading the replenishment study and the approved DSR on the District Portal, stipulates simultaneous intimation to DGM and the District Administration, and provides that no approval shall be granted unless the replenishment study is first scrutinised for conformity with the *Sustainable Sand Management Guidelines 2016* and the *Enforcement and Monitoring Guidelines for Sand Mining 2020*;

the said SOP is binding on all district authorities and on every appraisal undertaken by SEIAA-UP.

11. That the District Survey Report (DSR), comprising the data of the replenishment study conducted for each district for the period 2023-24, was examined with due diligence by the competent authorities prior to according approval to the respective DSR.

12. That in compliance with the foregoing protocol the DSR of District Banda was considered in the joint meeting of SEAC-1 & SEAC-2 held on 18-07-2024, where the Committee recommended approval; the matter was thereafter placed before the 828th meeting of SEIAA-UP on 01-08-2024, wherein SEIAA-UP concurred with SEAC and approved the DSR, the approval being communicated to the Director, DGM, and the District Magistrate by letter No. 414/Parya./Samanya/2023 dated 07-08-2024. A copy of the Letter dated 07-08-2024 is being filed herewith and marked as **Annexure No. 2.**

13. That the DSR of District Basti was considered in the joint meeting of SEAC-1 & SEAC-2 held on 19-07-2024, likewise recommended for approval, and was approved by SEIAA-UP in its 828th meeting dated 01-08-2024, the approval being conveyed by letter No. 416/Parya./Samanya/2023 dated 07-08-2024. A copy of the Letter dated 07-08-2024 is being filed herewith and marked as **Annexure No. 3.**

14. That the DSR of District Shamli was considered in the joint meeting of SEAC-1

& SEAC-2 held on 19-07-2024, received a favourable recommendation, and was approved by SEIAA-UP in the aforesaid 828th meeting, the approval being communicated by letter No. 415/Parya./Samanya/2023 dated 07-08-2024. A copy of the Letter dated 07-08-2024 is being filed herewith and marked as **Annexure No. 4.**

15. That the specific conditions imposed by SEIAA-UP while granting the above approvals mandated the submission and public uploading of the replenishment study, and the DSRs prepared in compliance with those conditions, as recorded in the minutes of SEIAA meetings, had earlier stood in abeyance but have now been reinstated upon removal of such abeyance.

16. That SEIAA-UP undertakes to hear every project proponent promptly and fairly, to pass reasoned and speaking orders consistent with natural justice, and to ensure that no future lapse occurs in the processing of DSRs or Environmental Clearance applications.

17. That as and when additional districts upload their replenishment studies and forward their DSRs, the appraisal and grant of Environmental Clearance shall be resumed in a phased and coordinated manner strictly in accordance with the Sustainable Sand Mining Guidelines, 2016, the Enforcement and Monitoring Guidelines for Sand Mining, 2020, the clarifications issued by the Ministry, and the binding directions of this Hon’ble Tribunal.

18. That in view of the foregoing facts and circumstances the operative portion of

the order dated 03-02-2025 stands duly complied with, and it is humbly prayed that this Action-Taken Report / Additional Affidavit be taken on record and that the deponent be discharged from further obligations in the present matter.

Through

Date:07.05.2025
Place: New Delhi

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IN THE HON'BLE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH, NEW DELHI

ORIGINAL APPLICATION NO. 1220/2024

IN THE MATTER OF:

YADRAM ...APPLICANTS

VERSUS

SEIAA, UP & ORS. ...RESPONDENTS

AFFIDAVIT

I, **AJAY SHARMA,** aged about 58 years s/o Sh. J.P. Sharma is presently posted as **Member Secretary, SEIAA** having an office at **Directorate of Environment, U.P. Vineet Khand-1, Gomti Nagar, Lucknow.**

1. That I am posted as stated above and well conversant with the facts of the present case and as such competent to swear this before this Tribunal.

2. That the accompanying Reply has been drafted by our counsel upon my instructions.

3. That the contents of the accompanying Reply are true and correct, and the knowledge has been derived from official records and nothing material has been concealed therefrom.

SWORN & VERIFIED
BEFORE ME
Sign.....Dt.....
VIJAY KUMAR DWIVEDI
Advocate & Notary
Regn. 22366 Govt. of India

NOTARY
VIJAY KUMAR DWIVEDI
Regn. No. 22366 Uttar Pradesh
GOVT. OF (INDIA)

DEPONENT

VERIFICATION

Verified on solemn affirmation at ..... on this _____ day of 2025, that the contents of the foregoing affidavit are true and correct to the best of my knowledge and no part of it is false and nothing material has been concealed therefrom.

SWORN & VERIFIED
BEFORE ME
Sign. 8/5/2025
VIJAY KUMAR DWIVEDI
Advocate & Notary
Regn. 22366 Govt. of India

DEPONENT

Identify the deponent/Executant/Surve
who has signed/put T.I. before me.

CONTENT

LIST OF FIGURES, TABLES, ANNEXURES AND PLATES

1.0 **INTRODUCTION**

District Banda is located in geographical extent between 24º 53' to 25º 55' N latitudes and 80º 07’ to 81º 34' E longitudes. The total geographic area of the districts is about 4460 Sq.Km. The district forms part of the northern fringe of the penisular India coming in contact with the Gangetic alluvium. North side of this district is bounded by Fatehpur district, west by Hamirput& Mahoba, east by Chitrakoot and the south is bounded by State of Madhya Pradesh. Banda comprises of 05 tehsils and 8 blocks. As per the 2011 census the district has population of 1,799,410 of which male and female were 965,876 and 833,534 respectively. Literacy rate of the district is 54.2%.

Banda district is drained by Yamuna, and Ken rivers. River Yamuna divides the district Banda from Fatehpur in north and flows from west to east along the entire length of the district. River Ken is the tributary of River Yamuna meeting at Chilla Ghat in district Banda.

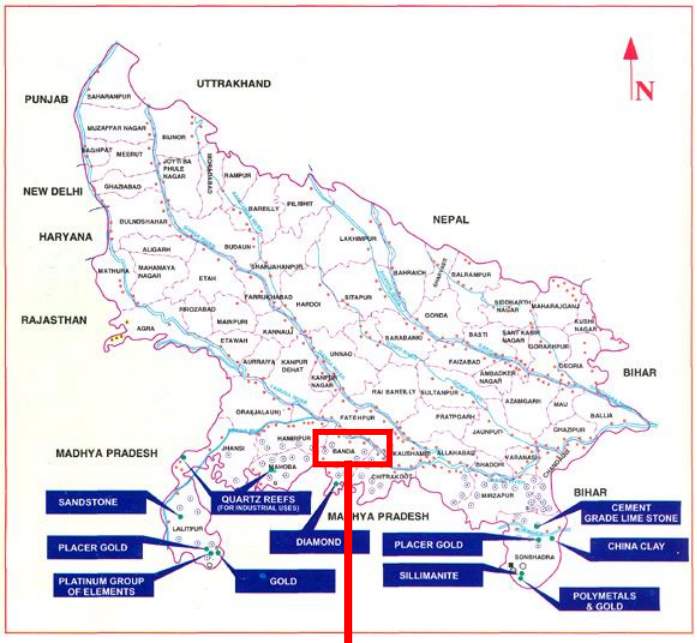
Riverbed material mining in Banda is undertaken on Yamuna, Ken & Baghain Rivers.

It is well understood that mining changes the physical characteristics of the river basin, disturbs the closely linked flora and fauna, and alters the local hydrology, soil structure as well as the socio-economic condition of the basin. In general, it was reported that in-stream mining resulted in channel degradation and erosion, head cutting, increased turbidity, stream bank erosion etc. All these changes adversely affect fish and other aquatic organisms either directed by damage to organisms or through habitat degradation or indirectly through disruption of food web.

In stream habitat is impacted by increase in river gradient, suspended load, sediment transport, sediment deposition. Excessive sediment deposition for replenishment increases turbidity which pavements penetration of light required for photosynthesis and reduces food availability of aquatic fauna.

Large amounts of sediments from the catchment flow into the river channels and are carried by the rivers and deposited along the river banks when the flow reaches the plains during every monsoon cycle. In order to determine the optimum quantity of sand that can be mind from a given area, it is important to estimate the annual rate of deposition/replenishment.

Resource Estimation studies of mineable leases have been conducted on 88 historical leases which have been operated between 2017 & 2022 and 16 leases which were operational in 2023-24. Additionally, resource estimation analysis has been conducted on 09 leases including 01 Patta land, which have been recently identified and have not been operated earlier.



(Source: mineral.up.nic.in)

Fig 1: Location map of Banda District

2.0 GENERAL PROFILE OF THE DISTRICT

Banda is one of the districts of Bundelkhand region of Uttar Pradesh having a rich historical tradition going back to antiquity, is famous for its Shajar stone, used for making jewellery and the historically and architecturally significant sites Khajuraho and Kalinjar. Khajuraho is a World Heritage Site famous for its elaborately carved temples. The fortress of Kalinjar is famed for its war history and its rock sculptures. The district is said to be the birthplace of the great ancient poet Valmiki who has written the immortal epic Ramayana in Sanskrit language. His ashram at Lalapur Bagrehi hills was one of the ancient centers of Vedic Learning.

Every Year Banda-District celebrates week long Kalinjar Mahotasava to promote Kalinjar Fort's Heritage & Tourism. Kalinjar Mahotsava includes many Cultural and Social activities.

In 2006 the Ministry of Panchayati Raj named Banda one of the country's 250 most backward districts out of a total of 640. It is one of the 34 districts in Uttar Pradesh currently receiving funds from the Backward Regions Grant Fund Programme.

a) ADMINISTRATIVE DETAILS

Banda district falls under Chitrakoot Division and Banda town is the divisional & district headquarter. There are 05 Tehsils, 08 blocks, 02 Nagar Palika and 06 Nagar Panchayats. The district has 01 Parliamentary constituency and 04 Assembly seats. Out of the total villages of the district, 660 villages are populated and 34 are uninhabited.

Table 1: Various administrative units in Banda District

S.No.	Particular	Number
1.	Tehsils	05
2.	Sub-Tehsil	08
3.	Nagar Palika	02
4.	Gram Panchayats	437
5.	Revenue villages	660
6.	Assembly Area	04

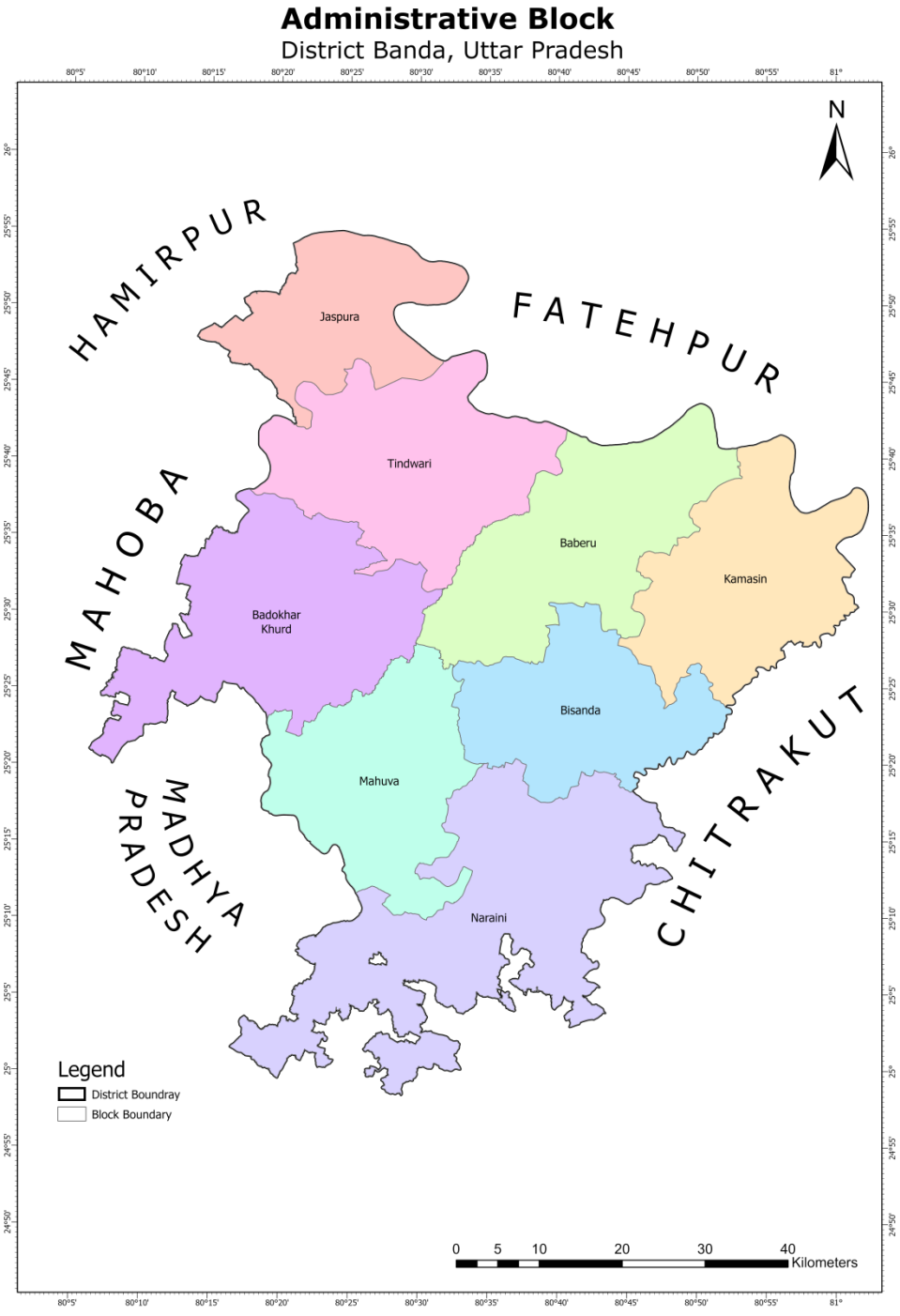


Fig 2: Administrative Boundaries in Banda District

The administrative setup is divided into 5 sub-divisions for the district namely Banda, Atarra, Naraini, Baberu and Pailani. All these divisions are further divided into 8 development blocks – Badokhar Khurd, Mahua, Naraini, Baberu, Bisanda, Kamasin, Jaspura and Tindwari.

Table 2: List of tehsils and blocks of Banda District

S. No.	Tehsil	S. No.	Blocks
1.	Banda	1.	Jaspura
2.	Baberu	2.	Tindwari
3.	Attarra	3.	Baberu
4.	Pailani	4.	Kamasin
5.	Nairani	5.	Badokhar Khurd
		6.	Bisanda
		7.	Mahuva
		8.	Naraini

b) DEMOGRAPHY

In 2011, Banda had population of 1,799,410 of which male and female were 965,876 and 833,534 respectively. Average literacy rate of Banda in 2011 were 66.67 compared to 66.67 of 2001. Male and female literacy were 77.78 and 53.67 respectively. Total literate in Banda District were 1,002,937 of which male and female were 630,626 and 372,311 respectively. With regards to Sex Ratio in Banda, it stood at 863 per 1000 male and child sex ratio is 902 girls per 1000 boys. The initial provisional data released by census India 2011, shows that density of Banda district for 2011 is 408 people per sq. km.

Table 3: River wise classification of socio-economic status of Banda

S.No.	Demographic classification	Yamuna River	Baghain River	Ken river	Ranj river	Total
1.	**No. of House hold**	20292	24236	22583	2871	69982
2.	**Total Population**	120939	140216	126053	15928	403136
3.	**Total Males**	64832	75415	67849	8599	216695
4.	**Total Females**	56107	64801	58204	7329	186441
5.	**Population Scheduled Cast**	13908	27781	19617	2722	64028
6.	**Population Scheduled Tribe**	3	3	4	0	10
7.	**Population Literates**	65161	71314	66373	8147	210995
8.	**Population Illiterates**	55778	68902	59680	7781	192141
9.	**Total Workers Population**	46523	59688	47877	6645	160733
10.	**Main Workers Population**	30841	39980	29930	4348	105099
11.	**Main Cultivaters Population**	13812	21081	13056	2554	50503
12.	**Main Agricultural Labourers Population**	12056	12860	9999	1275	36190
13.	**Main Household industries Population**	677	712	595	76	2060
14.	**Main Other workers Population**	4296	5327	6280	443	16346
15.	**Marginal workers Population**	15682	19708	17947	2297	55634
16.	**Marginal Cultivaters Population**	3325	6463	2397	795	12980
17.	**Marginal Agricultural Labourers Population**	8997	10010	10798	1232	31037
18.	**Marginal Household industries Population**	576	693	490	87	1846
19.	**Marginal Other workers Population**	2784	2542	4262	183	9771
20.	**Non Worker Population**	74416	80528	78176	9283	242403

3.0 **RAINFALL :**

The average annual rainfall is 902.00 mm. The climate is typical subtropicalcharacterized by long and intense summers. About 80% of the annual rainfall is received from south- west monsoon. The relative humidity is highest in August about 85% and lowest in April. There is a meteorological observatory at Jhansi, which may be taken as representative of meteorological condition. The mean wind velocity is 4.5 Km.p.h. The potential evapotranspiration varies from 50 to 205mm. Bundelkhand is known as a drought prone region. It is comprised of 7 districts of Uttar Pradesh and 6 districts of Madhya Pradesh. Monsoon rains are crucial. However for past several years, the region has faced deficit rains leading to water scarcity particularly for agriculture related activities. This basin received 785.4 mm rainfall in 2018 monsoon, 9% below normal rainfall of 863 mm for this sub-basin.

Monthly rainfall in mm in 2021 in Banda District is as given below:

JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**
1.3	2.7	1.5	0.0	30.1	91.1	298.1	244.1	128.0	31.0	0.0	0.0
% Departures of District-wise Monthly Rainfall - Year 2021											
-91	-79	-79	-100	137	-12	17	-19	-30	7	-100	-100

Pre and post monsoon rainfall in mm in 2021 in Banda District is as given below:

Winter	**Pre-Monsoon**	**SW-Monsoon**	**Post-Monsoon**	**Annual**
3.9	31.6	761.3	31.0	827.8
% Departures of District-wise seasonal and annual rainfall – 2021				
-86%	27%	-10%	-30%	-12%

a) ANNUAL RAINFALL OF THE DISTRICT

The climate is sub-humid and it is characterized by a hot dry summer and a bracing cold season. The average normal rainfall is 902.00 mm. About 80% of rainfall takes place between June & September. During monsoon surplus water is available for deep percolation into ground water. There is a meteorological observatory at Banda, January is the coldest month with minimum temperature of the order of 5.8^0 C. May and early June form the hottest period of the year. The mean monthly maximum temperature is 47^0C and mean monthly minimum temperature is 19.7^0C. 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 85% and mean monthly evening relative humidity is 57%. During monsoon season the winds blow predominantly from east or southeast. (Source: Meteorological Department, Government of India, 2021.)

Table 4: Annual Rainfall of Banda district

YEAR	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual Total
2012	32	10.4	1.9	6.2	0.1	13.2	338	218.1	165	0	0.4	0	785.3
2013	0	78.8	2.7	1.2	0	410.8	331.1	306.6	35.9	0	2.9	1.7	1171.7
2104	84.9	33.9	48.2	0.1	0.9	54.4	104.4	157.9	82.5	0	13.2	14.2	594.6
2015	39.8	24.5	100.8	18	0.6	82.8	207.2	117.6	69.3	1.6	1.9	6.2	670.3
2016	11.1	7.9	6.3	0	30.2	71.4	583.5	452.2	56.9	0	0	0	1219.5

Source: Metereological Deptt. GoI

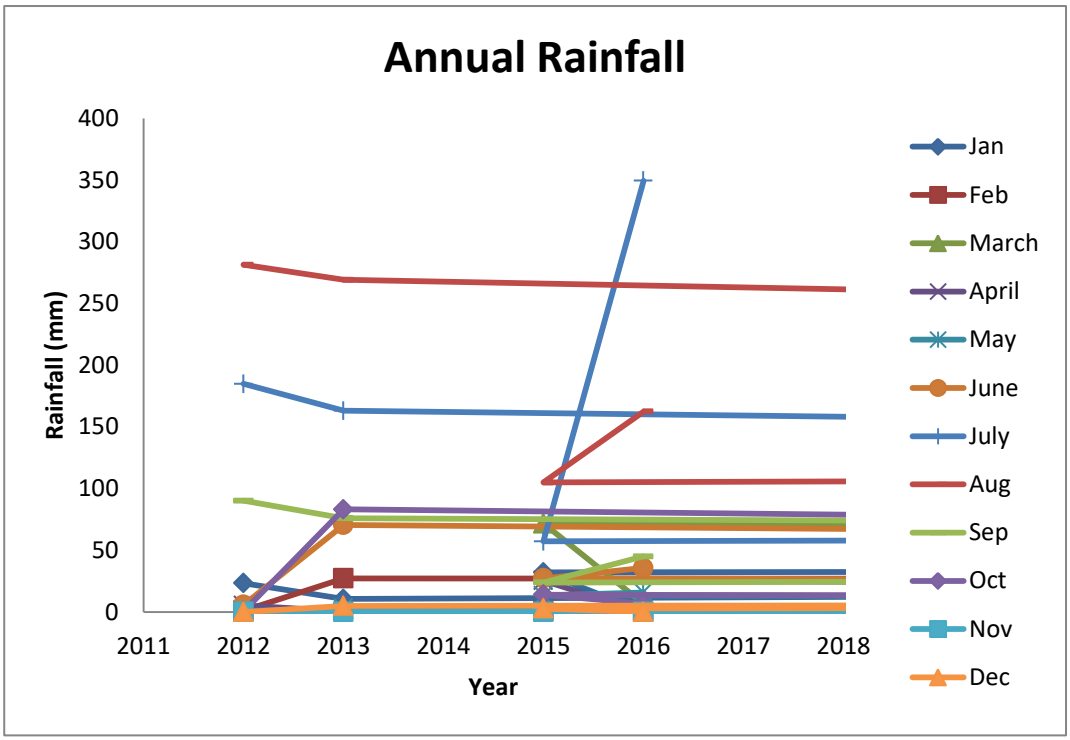


Fig 3: Annual Rainfall Pattern

b) TOPOGRAPHY & TERRAIN

The district largely consists of irregular uplands with outcrops of rocks intermingling mostly with lowlands, frequently under water during rainy season. River Ken borders the western finge of the area. The tract lying to the right of the river is intersected by numerous smaller river and rivulets, but to its left is a flat expanse, most part of which is made up of Mar and Kabar soils, eroded and converted into ravines along the banks of the rivers Ken and the Yamuna.

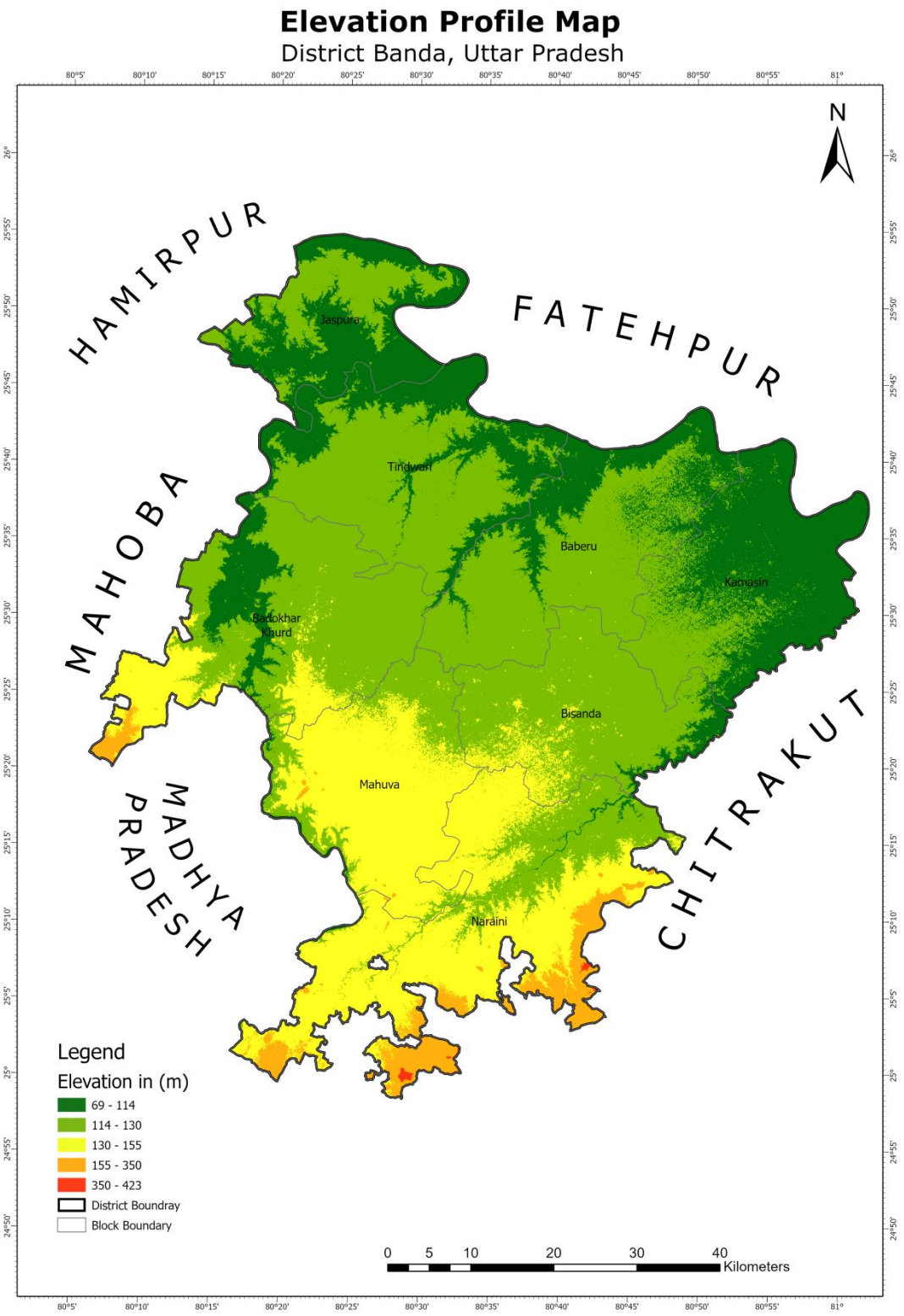


Fig 4: Elevation Profile Map of Banda District

c) WATER COURSE & HYDROLOGY

On the basis of hydrogeological information ground water occurs in unconfined conditions in shallow depths and confined conditions in deeper depth in alluvium. The thickness of alluvium varies from 45.00 to 200.00 mbgl in the district. Granites (Bundelkhand) has also good potential and yield at economical discharge. Ground water occurs in fractures and joints in the hard rock. The potential fractures are encountered from around 28.00 to 96.00 meters in some places.

As per the depth to water level data of 27 permanent ground water monitoring stations in the year 2009, pre monsoon water level ranges from 2.75 mbgl (Khurand) to 26.95 mbgl (Bhitar Kerdera). In the post monsoon period, depth to water level varies from 0.95 mbgl (Girwan) to 22.50 mbgl (Pailani). Water level fluctuation varies from 0.0 in Rolyhdyajue to 8.02 m at Naraini. It is observed that the hilly and rocky area the fluctuation is higher than the plain. Fluctuation is more where less order streams are found. Long term water level trend records in the area from 27 national hydrographic stations (2000-2009) in ten years show that (except Mataudh) all other wells are showing declining trend. The falling trend ranges from 0.0979 m/yr (Girwan) to 1.5087 m/yr at Paprenda.

d) GROUND WATER DEVELOPMENT

The stage of ground water development in the district is 36.71%, leaving net ground water availability for future irrigation 50247.33 ham. The maximum stage of ground water development is in Jagura block 59.91% and minimum in Bilanda block 24.96%. All the 8 blocks are in the safe category.

e) WATER LEVEL FLUCTUATION

On the basis of hydrogeological information ground water occurs inunconfined conditions in shallow depths and confined conditions in deeper depth inalluvium. The thickness of alluvium varies from 45.00 to 200.00 mbgl in the district.Granites (Bundelkhand) has also good potential and yield at economical discharge.Ground

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Depth To Water Level:

As per the depth to water level data of 27 permanent ground water monitoringstations in the year 2009, pre monsoon water level ranges from 2.75 mbgl (Khurand)to 26.95 mbgl (Bhitar Kerdera). In the post monsoon period, depth to water level varies from 0.95 mbgl (Girwan) to 22.50 mbgl (Pailani). Water level fluctuation varies from 0.0 in Rolyhdyajue to 8.02 m at Naraini. It is observed that the hilly androcky area the fluctuation is higher than the plain. Fluctuation is more where lessorder streams are found.

Long Term Water Level Trend:

Long term water level trend records in the area from 27 national hydrographicstations (2000-2009) in ten years show that (except Mataudh) all other wells areshowing declining trend. The falling trend ranges from 0.0979 m/yr (Girwan) to1.5087 m/yr at Paprenda.

4.0 LAND UTILIZATION PATTERN OF THE DISTRICT:FOREST, AGRICULTURE, HORTICULTURE, MINING ETC.

The land use pattern (2005-06) in the district has been indicated in the Table below. The total cultivated area of the district is 11588 ha. And the total cropped area is 405954 ha. The cropping intensity in the district is 122.2 %. The area sown during Rabi is more as compared to area sown in kharif. Land use Pattern in Banda district is given below in Table:

Table 5: Land use pattern of Banda

S.No.	Particulars	Area (Ha)
1.	Cultivated Area	11588
2.	Forest	5421
3.	Non Agri. Use	30622
4.	Net sown area	351472
5.	Follow land	28438
6.	Area Sown more than Once	63519
7.	Total Cropped Area	405954
8.	Cropping Intensity	122.2
Total Area		897136.2

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

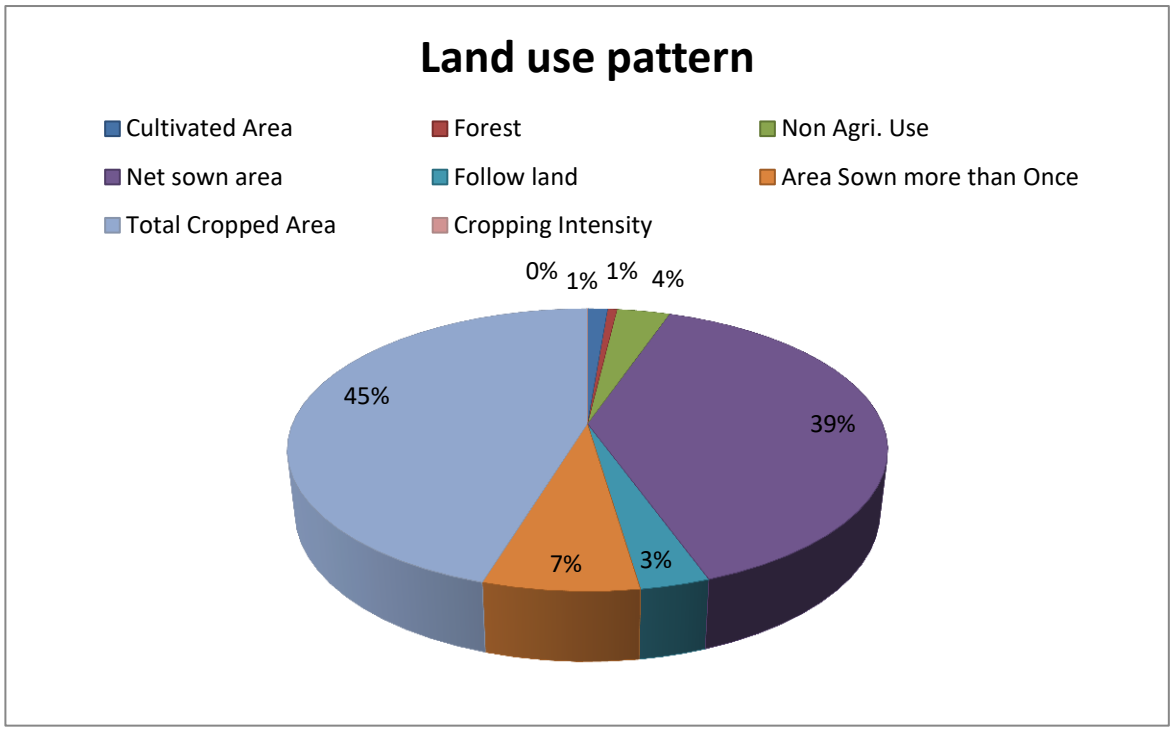


Fig 5: Land use pattern

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 cropping intensity.

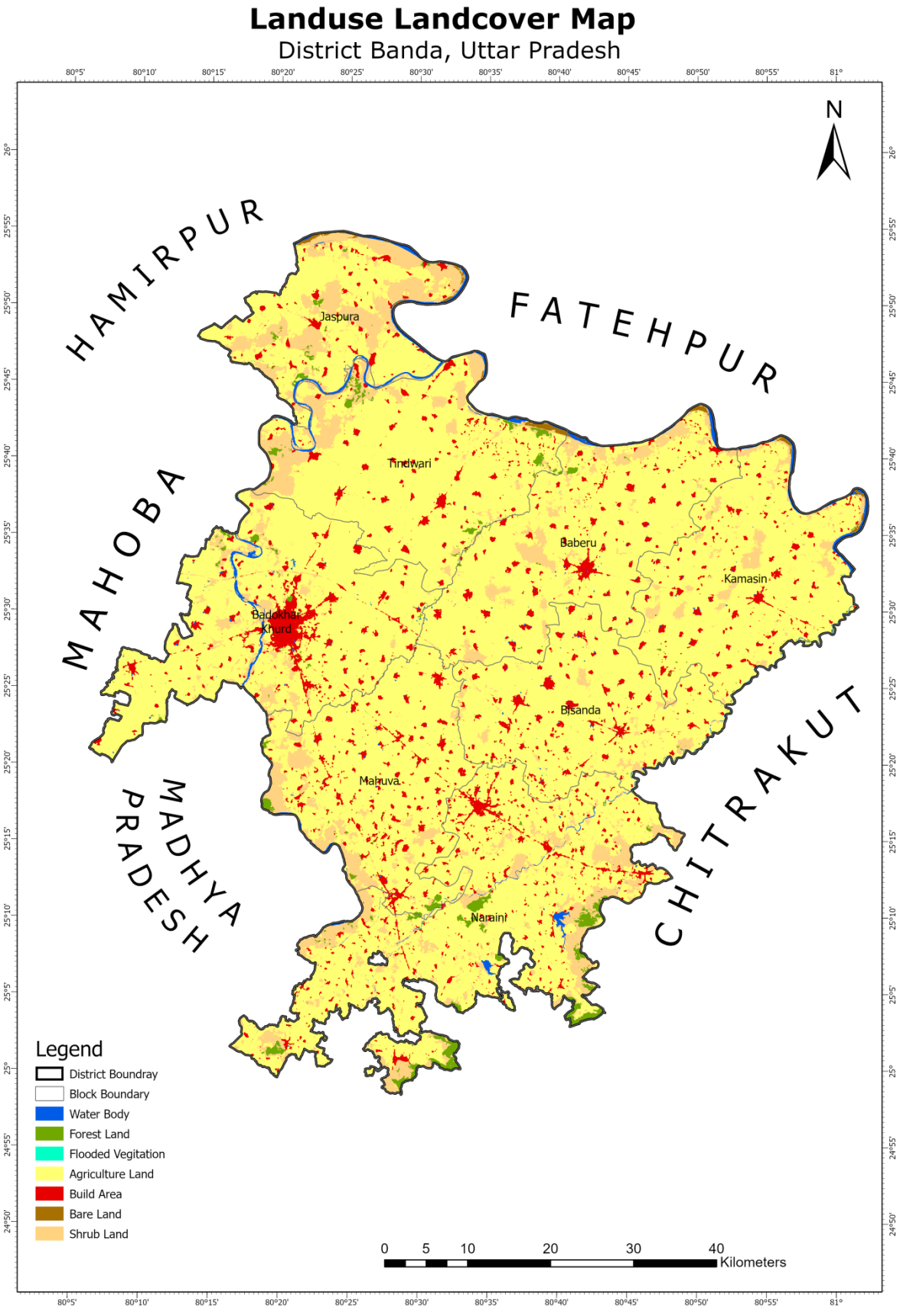


Fig 6: Land Use / Land Cover Map of Banda District

5.0 GEOLOGY AND MINERAL WEALTH

The area comprises Precambrian Bundelkhand granites unconfirmably overlain by Vindhyan are quaternary alluvium. The main and major drainage of the district are Yamuna, and Ken which are part of Yamuna river system.

Physiographically the area can be divided into three physiographic units–

(1) Alluvial Plain
(2) Marginal Alluvial
(3) High Land (Hard rock) area

a) REGIONAL GEOLOGY

The district forms part of the northern fringe of the Peninsular India coming in contact with the Gangetic alluvium. It has an important place in the geology of the country owing to the presence of all Pre Cambrian rocks, probably right from the oldest ones in the Indian sub- continment, in a compact linear east-west stretch.

During the last few years the geological survey of India have carried out regional geological mapping of most of the area, mineral appraisal by detailed mapping, geophysical and geochemical investigations where necessary for pyrophyllite, clays and base metal.

b) LOCAL GEOLOGY

Geologically the district is characterized by Bundelkhand granite/gneiss, Vindhyanformation and younger alluvium near the bank of river Ken and Yamuna.The geological succession of different lithological formations is given below:-

Group	**Formation**	**Lithology**	**Age**	**Thickness (m)**
Quaternary	Alluvium	Clay, silt and sand	Sub- Recent to Recent	130.50

----------Unconformity----------				
Upper Vindhyan	Kaimur	Sand stone and quartzite	Pre-Cambrian	152.50
----------Unconformity----------				
Lower Vindhyan 14	Semari	Tirohan breccia, Tirohan Limestone, Upper gluconitic sandstone, Lower gluconitic sand stone and conglomerate	Pre-Cambrian	
----------Unconformity----------				
Bundelkhand Group	-	Granite, schist, quartzite dyke of basic igneous rock	Archean	

On the basis of above mentioned geological succession three major geological formationshave been noticed in the district. All three units are found in the entire district at differentdepth and of different thickness.

Bundelkhand Granite:

The Bundelkhand granite, which forms the basement complex in the area, is oldest in age. The granite is often traversed by pegmatite veins and well-marked quartz reefs ofdifferent width and length.Quartz reefs form a characteristic feature of landscape at Gorepur and Girwan villagesnear Naraini town. It also occurs north of Kalinger fort in southwest-northeast direction.Granite is also intruded by basic dykes striking west northwest-east south-east directionand forms hillocks at Raksi, Chmitaini and Pangara near Naraini town.

Vindhayan:

The southern hilly tract of the area is characterised by Vindhyan formation. These include rocks of Semari series of lower Vindhyan and upper Kaimur.Quartzite and sandstone are important litho units which form structural hills andplateau.

Alluvium:

The sediments deposited over either Bundelkhand granite or Vindhyan Sandstone/Quartzite is found as alluvium. The thickness of this alluvium is highest innorthern parts of the district and minimum in southern part. Alluvium comprises gravel, sand and clay with sub-ordinate presence of kankar. Main alluvial deposits are found between Baghain and Ken rivers.

Sub-Surface Geology:

The thickness of alluvium varies from place to place. But onthe regional scale the thickness of alluvium is more in north and central part while itdiminishes in south and western part of the district.Thickness of clay is higher in western part than eastern part of the district while it is contrary for kankar. Kankar has less thickness in western part and increases in easternpart of the district. Clay, kankar and sand are observed in descending order in underground behavior.Thickness of sand is higher in west and east than central part of district.Basement has been encountered at different depth (54.27 m to 94.51 m). Bundelkhandgranite and Vindhayan are common basement which are encountered in the entiredistrict. Granites occurring in the area are highly jointed and weathered. It is overlain byQuaternary Alluvium which is in the northern part of the district.

Sandstone of Vindhayan is red to greyish in color medium to fine grained, compact andhighly jointed. The joints areas widely open at surface and have tendency to close downwith depth.

Structures:

Since the district is rocky, rugged topography and a number of structures are observed.

(i) Naraini Depression

(ii) Baghela-Bari Depression

Naraini Depression:

The depression lies between Ken and Baghain rivers south of Naraini town and extends for about 22 Km upto Kartal Village. The depth of bedrock varies from 20 to 105 m.

(i) Baghela-Bari Depression:

The depression is bounded by Banganga and Karelli rivers. Doab is about 15 Km. long North-south and 2-7 Km wide. It has 2 Km. width at Fatehganj in south and Tamar innorth but attains 7 Km. width near Baghela-Bari. Depth of bed rock increases 30 m. atKalayanpur towards Baghela-Bari where it reaches up to 66m.

There are other structural features observed in the district as:

Erosional Hills:

Erosional hills are developed in hard rock area of granite/ Vindhyans.River/streams have eroded soft part and left hardest part as remnants. These type of hills are observed mean Naraini, Kalinger, Kartal and Badauraarea.

Inselbergs:

Isolated granitic hills emerging beneath the alluvial cover at Banda and Naraini forms as Inselbergs. The general trend of Inselbergs is ENE-WSN and they exhibit steepslopes.

Linear Ridges:

Linear ridges are formed from hills emerging beneath the alluvial cover at Banda and Naraini. Granites show differential weathering and are well jointed in nature.

Piedmont Zone:

Isolated occurrence of piedmont zones has been identified around the Inselbergs at various places in the district. Under piedmont zone, plateau, paleo-channel

meanderscars and faults are quite visible. Two major faults (lineaments) trend in northeast andsouth-west direction and third which is less common trends in ENE-WSN direction. The district is characterized by alluvial, hard rock as well as marginal alluvium.The district can be broadly classified into three physiographic units. i.e. (i) The alluvialPlain, (ii) Marginal Alluvial, and (iii) High Land Area.

c) SOIL

In Banda district loose sediments as well as black cotton soil is found. Black cotton soil is prominent in the central part. Four major type of soil a) Rakar, b) Mar, c) Kabar and d) Padua are dominant in the district.

(a) A variety of rakar in Banda district has stones of various sizes.Apart from the red and black soils, some varieties of loamy, alluvial soils are found along river banks. Among these, the **rakar** variety is stony and found on sloping surfaces of ravine land. It is a highly degraded kind of coarse soil. However, where irrigation is available, the soil is suitable for cultivation of jowar, til and bajra.

(b) The second variety of black soil, called **mar**, what is generally called black cotton soil. It has high clay content and is prone to waterlogging. The soil has relatively high organic matter content, and hence can be cropped without use of fertilisers.

(c) The **kabar**, resembles black cotton soils of central India. Its colour varies from dark black to grey black and brownish black. It has high clay content; hence it is highly adhesive, retains moisture, and quickly turns dry and into hard blocks.

(d) A yellowish, light-coloured variety of red soil, called **padua**, is sandy and has some clay content. It is well aerated and easily accepts water. Padua soil is found across UP, Banda and is suited for cultivation of wheat.

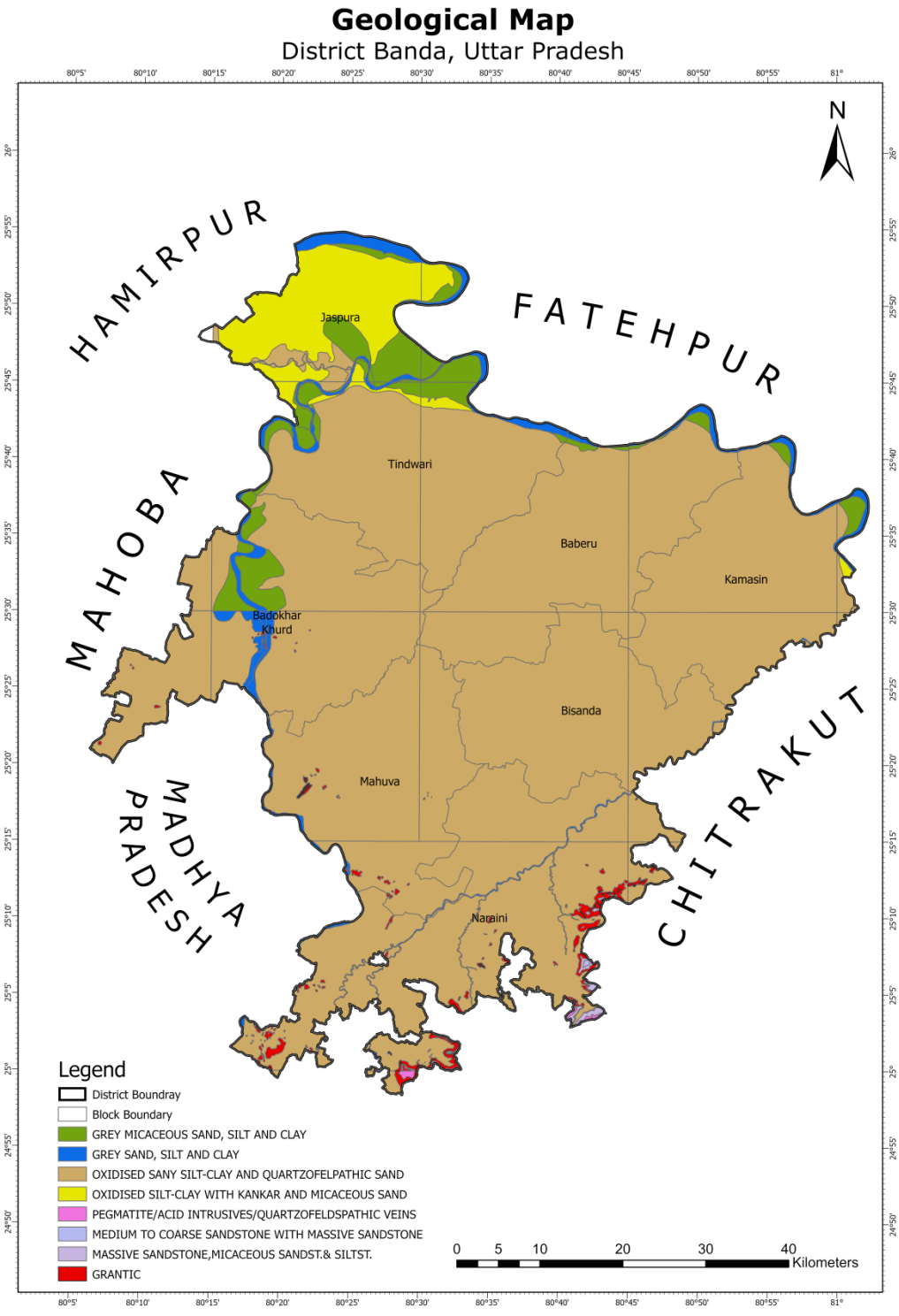


Fig 7: Geological Map of Banda District

6.0 DRAINAGE SYSTEM WITH DESCRIPTION OF MAIN RIVERS

The total geographical area of the district is 4460 km^2. The Yamuna, Ken and several tributaries of river Yamuna are flowing in the Banda district. Average rain in the district approximate 902.00 mm. General climate of the district is healthy and pleasant. The net irrigated area is 153804 Ha and the net area sown is 336000 Ha, which shows that 45.77% area is irrigated by ground water and the surface water while the rest depends on rainfall.

Yamuna River

The Yamuna River is one of the important and sacred rivers of India. It is the largest tributary of the River Ganga. It originates from Yamunotri glacier in the Mussoorie range of the lower Himalayas, and after traversing 1,376 km joins the river Ganga at Allahabad. The drainage area of the Yamuna basin is 366,220 sq km, which comprises part of seven states, viz. Uttarakhand, Himachal Pradesh, Uttar Pradesh, Haryana, Delhi, Rajasthan and Madhya Pradesh. The Yamuna River has four main tributaries in the Himalayan region: Rishi Ganga, Hanuman Ganga, Tons, and Giri. In the plains, the main tributaries are the Hindon, Chambal, Sind, Betwa and Ken. The river water is generally used for irrigation, drinking and industries as well as for mass bathing, laundry, cattle bathing, and secretion of the cremation ash. The construction of diversion structures at regular intervals (Hathinikund, Wazirabad, Okhla, Gokul, etc.) for irrigation, domestic and industrial water supply, has largely modified the flow regime of the river. The inflow of wastewater either treated or partially treated in the river further aggravates the water quality problem of the river. Though the green revolution was important for food security, but lack of regulation in the groundwater abstraction has led to ground water table depletion which causes damage in causal linkage between surface and ground water, resulting change in surface water dynamics during the lean season of the river. This is the main reason of dry river segments observed between Hathinikund and Palla (Delhi).Yamuna Rivers enters in Banda at village

Bhaura Daria and passes through Budhed, Khaptiha Khurd, Amchauli in and out of district boundary. Finally at Joraurpur, river Yamuna exits from District Banda.

Ken River

The Ken River is one of the major rivers of the Bundelkhand region of central India, and flows through two states, Madhya Pradesh and Uttar Pradesh. It is a tributary of the Yamuna.The Ken River originates near village Ahirgawan on the north-west slopes of Barner Range in Jabalpur districtand travels a distance of 427 km, before merging with the Yamuna at Chilla village, district Banda in Uttar Pradesh at 25°46′N 80°31′E.

Ken has an overall drainage basin of 28,058 km^2, out of which 12,620 km^2 belong to Sonar River its largest tributary, whose entire basin lies in Madhya Pradesh; and along its 427 kilometres (265 mi) course it receives water from its own tributaries such as Bawas, Dewar, Kaith and Baink on the left bank, and Kopra and Bearma of the right. Out of its total length of 427 kilometres (265 mi) it flows for 292 kilometres (181 mi) in Madhya Pradesh, 84 kilometres (52 mi) in Uttar Pradesh, and 51 kilometres (32 mi) forms the boundary between the two states.

Other Rivers of Banda

Chan River- This stream rises in the upland below the Patha proper, on which the village of Rukma and Dadri are situated, sometimes called The Dadri-ka-Patha, lying to the south of karwai. It flows in shallow bed, stream with boulders, as far as the village of Semardaha.

Bardaha River- This stream flows from the highlands of Rewah in the south-east corner of tehsil Karwi, and after a short course in this district flows out eastward into district.

Garra River- the last stream of any importance is the Garara, One branch rises near the village of Jamrahi and the other in Adhrauri, Both in Tehsil Naraini. The

united stream flows due north joining the Yamuna at the village of jalalpur in tehsil Baheru.

Baghain River- It is a perennial river, it issues from a hilla near kohari in district and enters at the village of Masauni Bharatpur in tehsil Naraini,flowing north-eastward through Tehsil Naraini.

Ranj River-The Ranj River drains the northeast parts of the Panna distric. The chief tributary of Baghein, the Ranj, joins it at Gurha Kalan (tahsil Naraini) but further east and flows in north direction.

Paisuni River- This stream, one of the tributaries of the Yamuna, rises in the hills of Madhya Pradesh. Near its junction with the Yamuna it forms some remarkable curves amidst lowlying land, cheifly in the village of Bhadedu, which it often floods. Its banks are usually steep and its characteristics are like those of the baghain.

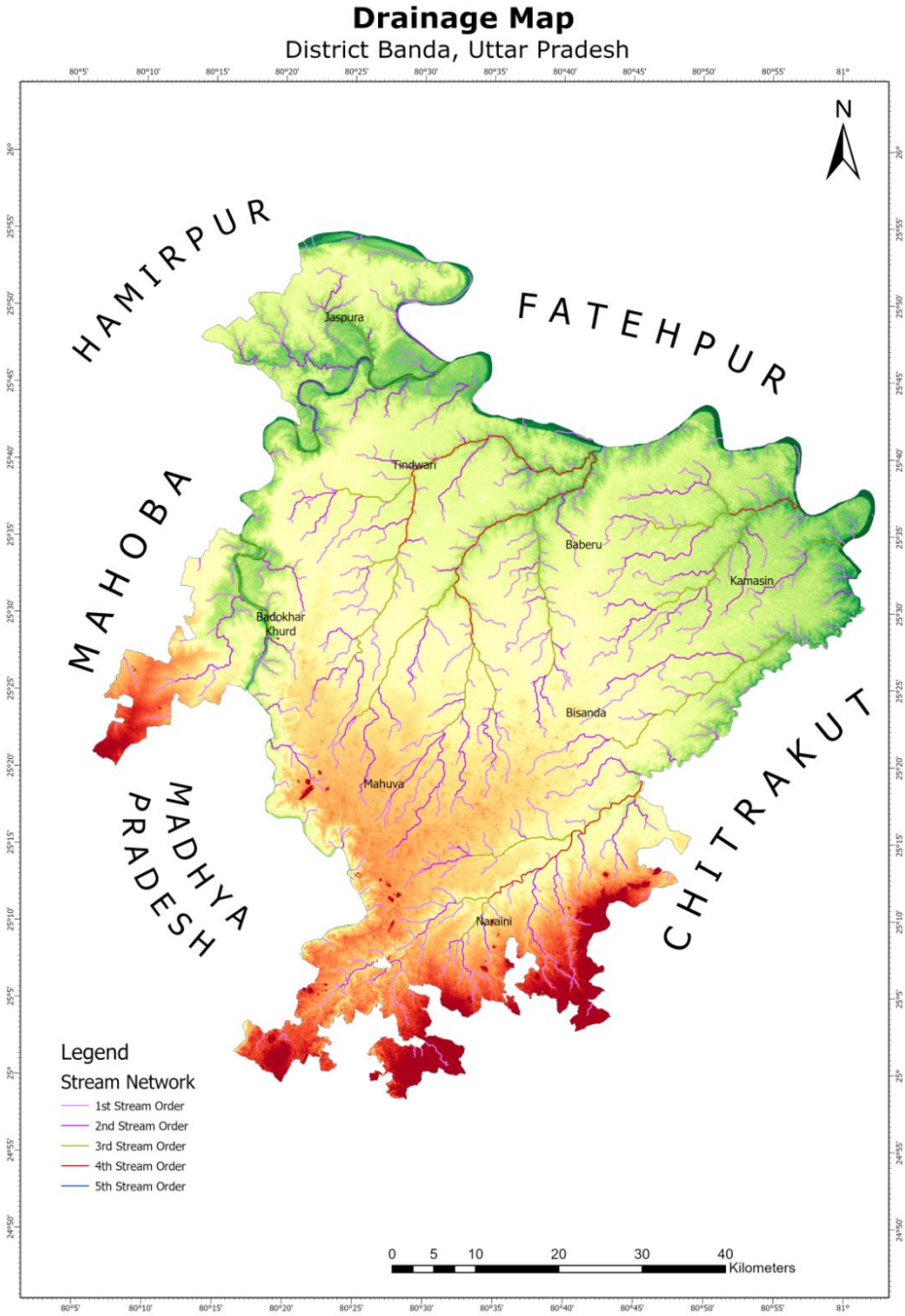


Fig 8: Drainage Map of District Banda

7.0 PROCESS OF DEPOSITION OF SEDIMENTS IN THE RIVERS OF THE DISTRICT (RIVER GEOMETRY)

a) EVOLUTION

Morrum is found in the rivers flowing through Banda. The morrum is derived from the weathering and disintegration of granitic rocks. Another type of morrum called 'Red Morrum' is in fact laterite soils found on the elevated ground comprising old weathering surfaces. It is used for spreading on unpaved roads .The Yamuna River has a highly symmetric drainage pattern in major part of the basin area. Study of the relief aspects shows that the area has high elevation with rugged terrain. It was also found that the bedrock or subsoil is permeable in nature and the drainage texture is coarse implying a young stage of drainage development. At Etawah, it meets it another important tributary, Chambal, followed by a host of tributaries further down, including, Sindh, the Betwa, and Ken.Chambal River carries large quantity of sediment load to transportation. Morrum of Chambal River has Deccan trap Basalt as river bedded rock, Mesozoic age formations through erosional or depositional process. So the morrum in Banda is a mixture of Yamuna sand and Chambal morrum.In the Morrum of Yamuna in Banda mica is the dominant clay mineral in the soils followed by Kaolinite, chlorite, vermiculite and smectite in decreasing order of their abundances. The occurance of fibrous minerals in coarse clay and silt fraction of soil samples of Lavee physiographic unit is the interesting feature of this area. The presence of fibrous minerals indicates that this overlain material designated as natural Levee in this area is not the alluvium brought down by the river Yamuna but is aeolian material flown from adjoining desert of Rajasthan and deposited as stabilized sand dune. The fibrous minerals have been reported earlier in the desert of Rajasthan.

The Ken basin mainly constitutes rocks of the Vindhyan Supergroup, Bijawar Group and granitoids of Granitic Complex. The laminated shale, flagstone, sandstone, limestone and porcellanites of the Kaimur Group of Upper Vindhyan are exposed in the upper reaches of the Ken basin. These rocks are underlain by the

rocks of the Semri and Bijawar Groups. The alternating shale, carbonate, sandstone and volcanic units belong to the Semri Group of Lower Vindhyan Super Group. The Bijawar Group consisting of a succession of quartzite and basal conglomerate is overlain by hornstone breccias, phyllitic shales, limestone, dioritic traps and red jaspers.

Baghain river basin comprises of three major geological units namely: Bundelkhand gnesis complex, Vindhyan supergroup (hard rock terrain named as panna hill) and alluvial deposit (marginal Ganga plain and central Ganga plain).The Lower Vindhyan group (Semi group) consists of carbonates, siliciclastics and volcaniclastics, whereas, the upper Vindhyan Group is dominated by siliciclastic with minor carbonates.

The Ranj River drains the northeast parts of the Panna districtand three-fourths area of the district is covered with alluvium soils forms by the weathering of Vindhyan sediments. The northern part of the district area is covered with yellowish sandy soils derived from weathering of granitic rocks. The thick alluvial soils are found along the river courses. So the sediments in Ranj River is a mixture of all three.

b) 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).

c) MODE OF SEDIMENT TRANSPORT

The sediment load of a river is transported in various ways although these distinctions are to some extent arbitrary. The loose boundary (consisting of movable material) of an alluvial channel deforms under the action of flowing water and the deformed bed with its changing roughness (bed forms) interacts with the flow. The resulting movement of the bed material (sediment) in the direction of flow is called sediment transport and a critical bed shear stress (t) must be exceeded to start the particle movement. Such a critical shear stress is referred to as incipient (threshold) motion condition, below which the particles will be at rest and the flow is similar to that on a rigid boundary.

d) REPLENISHMENT

Ken, Baghain and Ranj are key tributaries of Yamuna River in lower stretch and is also famous for light orange colour sand which is officially and locally known as ‘Morrum’ or *Morang* in Bundelkhand. Morrum is formed by weathering of granitic rocks. It has coarser and thicker grains than grey colour sand. These properties make Morrum of greater adhesive quality and of high value in construction activities. Geologically the presence of ferruingeous breccia of Bijawar group sand stone, silt stone, lime stone and shales belonging to semri group (Vindhyan super group). Pink, fine to medium grained, dense granite is exposed sporadically. Good quality sand mixed with pebbles and kankars and presence of pink, coarse grained massive granite (Bundelkhand Granite) are found. It is characterised by 3 sets of Vertical joints and 1 set of Basal joint with sub-horizontal dip. The joint openings are upto 50 m wide filled with weathered clayey material. Replenishment of River Yamuna is due to the rivers, which originated in Vindhyan region.

e) SEDIMENT DISCHARGE RATE

The soil characteristics of the Yamuna have a large spectrum of particle sizes from 30 μm to 1 mm. A flow velocity of 0.75 m/s can move only silt-sized particles of size up to ~ 60 μm. The total monsoon discharge for a set of average monsoon river stages and the corresponding water flow velocity in the main channel and in the shoulder areas were estimated. The average monsoon river stage of 208.9 m amsl (above mean sea level) corresponds to the flow of 3.9 TMCM (~ 36% of the total mean annual monsoon flow) through the river Yamuna. The velocity in the main river channel at this total discharge was estimated at ~ 1.57 m/s. This velocity of flow can dislodge sediment particles of size ~ 265 μm. An average monsoon flow of 5.5 TMCM (50% of the total mean annual monsoon flow) through river Yamuna corresponds to a river stage of 209.2 m amsl. The velocity in the main river channel at this total discharge was estimated at 1.8 m/s. This velocity of flow can dislodge sediment particles of size ~ 340 μm (medium sand). The main channel can thus be cleared of the larger and heavier sediments more efficiently at this flow velocity. Field-based observations show average monsoon peak flow to be approximately 1.4 m above the average monsoon river stage. Based on this, the peak flow associated with the average monsoon river stage of 209.2 m amsl (corresponding to total flow of 5.5 TMCM) would be 210.6 m amsl. The flow velocity in the main river channel at the river stage of 210.6 m amsl would be 3.4 m/s. This river flow velocity is sufficient to dislodge particles of size ~ 1200 μm (1.2 mm; coarse sand). Hence this river flow velocity will efficiently remove most of the heavy sediments and grit from the main river channel and prevent siltation and shallowing of the river channel. The water flow velocity in areas adjacent to the main river channel corresponding to the monsoon flow of 5.5 TMCM at a river stage of 209.2 m amsl has been estimated at 0.93 m/s). This flow velocity can dislodge sediments particle of size ~ 95 μm (very fine sand). Such well-sorted sediments will have higher permeability leading to enhancement in river bank storage during the monsoon floods. Empirically, it is clear that the river is heavily silted and at present has a depth of only 0.6 m in summer. To remove all

riverbed particles of diameter up to 1–2 mm (coarse sand to very fine gravel) will require a monsoon flow larger than 50% (5.5 MCM), but we also have to balance this with reality (agricultural needs). A 50% (5.5 MCM) monsoon flow can dislodge particles of diameter up to ~ 1.2 mm; however, when such particles are transported and desilting occurs, the main channel will deepen enhancing the flow velocity. Consequently, even particles of larger size will be transported. We conclude that at least 50% (5.5 TMCM) of the monsoon virgin flow of river Yamuna is the flushing flow required in this stretch (Soni *et al*., 2014).

f) SEDIMENTATION YIELD

Sediment, the end product of erosion, has a twofold effect:

1- It depletes the Land front which it is derived

2- It impairs the quality of the water-resources in which it is entrained and deposited.

The importance of the sediment-yield-surveys, as preventive and corrective measures, can be attributed to the erosional-processes. (Kumar, 1992) Naturally, sand is a granular material consisting of rock particles and fine minerals measuring between 0.06 mm to 2 mm. Sand is formed fromdecompotion of rocks due to mechanical strength where decomposed rocks form gravel and then sand. Almost the entire suspended load of Yamuna River is transported during the monsoon period; quartz and illite are the dominant minerals of these suspended sediments. Basin lithology, tributary contributions, and sediment grain size seem to control mineral distribution in the sediments. Trace metal concentrations of Yamuna core sediments reflect their mineralogical composition. Illite is the chief clay mineral of the Himalayan river sediments. The mineralogical characteristics of the Himalayan river sediments differ significantly from the Peninsular Indian Rivers, which chiefly carry montmorillonite. The annual sediment load of Indian rivers is a little more than 1.2 billion tonnes which is roughly 10% of the global sediment flux to the world oceans. Indian rivers show pronounced seasonal and spatial variability in

their sediment discharge. Maximum mass transfer, in the Yamuna River takes place during the monsoon season. The sediment load constitutes 58–86% of the total load carried by the river depending upon the sites. Tributaries carry sediments more actively than the mainstream. The total load of the river seems to be controlled by lithology. At Prayagraj, the Yamuna carries 64×10^6 tonnes sediment load to the Ganges river. The TSM/TDS ratio shows that upstream physical weathering is more dominant than chemical weathering. The negative relation between basin area and total erosion rate and the positive relation between the chemical and sediment erosion in the Yamuna basin agrees with the global trend. The average chemical erosion rate (165 tonnes $km^{-2}yr^{-1}$) of the Yamuna is much higher than that of the Ganges and the Indian average. The total erosion rate (973 t $km^{-2}yr^{-1}$) is 1.7 times greater than that of the Ganges. Upstream, the Yamuna removes 1.04 mm yr^{-1} of the basin surface; the removal rate decreases downstream to 0.19 mm yr^{-1} at Prayagraj, the point of confluence with the Ganges (Jha *et al.,* 1988). The rate of sedimentation at the station Sharanpur (UP) the highest rate of sedimentation (5.99 cm/y) was noticed, most probably due to deforestation and other human influences in the Himalayan regions, while the lowest rate was observed in Hamirpur (UP) (2.48 cm/yr). Yamuna River sediments are mainly composed of very fine sand, silt and clay derived from the Himalayan region. Granulometric analysis shows that the ~20-mm particles are found in the Yamuna River sediments. The total river sediment shows the presence of quartz, feldspar and illite minerals in bulk mineralogical composition. Metal ratios for the river sediments show various degrees of enrichment. A river has two sources of heavy metals: lithogenic sources from weathering of rocks and anthropogenic. The values are greater than one except for *Manganese, Iron* and to some extent for Cobalt. High ratios of Chromium, Nickle, Copper, Zinc, Lead and an exceptionally high ratio of Cadmium for some sediment samples have been found.

8.0 GUIDELINES FOR SUSTAINABLE SAND MINING

Ministry of Environment, Forests & Climate Change (MoEF&CC), Government of India, in the *Sustainable Sand Mining Management Guidelines, 2016* has identified the following impacts on account of sand and gravel mining:

I. Extraction of bed material in excess of replenishment by transport from upstream causes the bed to lower (degrade) upstream and downstream of the site of removal.

II. In-stream habitat is impacted by increase in river gradient, suspended load, sediment transport, sediment deposition. Excessive sediment deposition for replenishment increases turbidity which prevents penetration of light required for photosynthesis and reduces food availability of aquatic fauna.

III. Riparian habitat including vegetative cover on and adjacent to the river banks controls erosion, provide nutrient inputs into the stream and prevents intrusion of pollutants in the stream through runoff. Bank erosion and change of morphology of the river can destroy the riparian vegetative cover.

IV. Bed degradation are responsible for channel shifting. causing loss of properties and degradation of landscape, it can also undermine bridge supports, pipe lines or other structures.

V. Degradation may change the morphology of the river bed, which constitutes one aspect of the aquatic habitat.

VI. Degradation can deplete the entire depth of gravelly bed material, exposing other substrates that may underlie the gravel, which could in turn affect the quality of Aquatic habitat. Lowering of ground water table in the flood plain because of lowering of riverbed level as well as river water level takes place because of extraction and draining out of excessive ground water from the adjacent areas. So, if a floodplain aquifer drains to the stream, groundwater levels can be lowered as a result of bed degradation.

VII. Lowering of the water table can destroy riparian vegetation.

VIII. Excessive pumping of ground water in the process of mining in abandoned channels depletes ground water causing scarcity of irrigation and drinking water. In extreme cases it may create ground fissures and subsidence in adjacent areas.

IX. Flooding is reduced as bed elevations and food heights decrease, reducing hazard for human occupancy of floodplains and the possibility of damage to engineering works.

X. The supply of overbank sediments to floodplains is reduced as flood heights decrease.

XI. Rapid bed degradation may induce bank collapse and erosion by increasing the heights of banks.

XII. Polluting ground water by reducing the thickness of the filter material especially if mining is taking place at top of recharge fissures.

XIII. Choking of filter materials for ingress of ground water from river by dumping of finer material, compaction of filter zone due to movement of heavy vehicles. It also reduces the permeability and porosity of the filter material.

XIV. Removal of gravel from bars may cause downstream bars to erode if they subsequently receive less bed material than is carried downstream from them by fluvial transport.

XV. Ecological effects on bird nesting, fish migration, angling, etc.

XVI. Direct destruction from heavy equipment operation; discharges from equipment and refueling.

XVII. Bio-security and pestrisks.

XVIII. Impacts on coastal processes.

The other deleterious impacts of indiscrete mining include-

Loss of riparian habitat resulting from direct removal of vegetation along the steam bank to facilitate the use of a dragline or through the process of lowering the water table, bank undercutting, and channel incision.

The physical composition and stability of substrates are altered as a result of in-stream mining and most of these physical effects may exacerbate sediment entrainment in the channel.

Sustainable Sand Mining Guidelines -MoEF&CC

Sand is naturally occurring granular material composed of finely divided rock and mineral particles between 150 micron to 4.75 mm in diameter. Sand is formed due to weathering of

rocks due to mechanical forces. In the process the weathered rocks forms gravel and then to sand.

Sand and gravel known as aggregate, represent the highest volume of raw material used on earth. The mining of aggregate has been continuing for many years. Now the mining of aggregates has reached a level threatening the environment and ecosystem besides also reaching a level of scarcity that would threaten the economy. It is recommended that sand & aggregate mining, and quarrying should be done only after sound scientific assessment and adopting best practices to limit the impact on the environment.

It is also felt that the greater use of substitute material (manufactured sand) & construction technology, and sustainable use of the resource could drastically reduce adverse impact of mining on the environment.

The Guidelines has been based on the following principles:

- Uncontrolled sand mining is not sustainable.
- Compliance with present and future legislation and regulations on the subject is mandatory and not voluntary.
- Each lease holder should be given the opportunity to self-regulate to the extent that it can demonstrate compliance with legislation and regulations.
- Where self- regulation fails to deliver compliance with legislation and regulations, increased formal enforcement and monitoring should be implemented with punitive measures applied in line with the legal framework.
- There is a need to protect the environment and the right of the population to live in clean and safe surroundings, with the need to use natural resources in a way that will make a positive and sustainable contribution to the economy.

Approaches to Sustainable Sand and Gravel Mining:

Following considerations should be kept in mind for sand / gravel mining:

- Parts of the river reach that experience deposition or aggradations shall be identified first. The Lease holder/ Environmental Clearance holder may be allowed 1to extract the sand and gravel deposit in these locations to manage aggradations problem. .

- 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.
- Sand and gravel may be extracted across the entire active channel during the dry season.
- Abandoned stream channels on terrace and inactive floodplains be preferred rather than active channels and their deltas and food plains. Stream should not be diverted to form inactive channel.
- 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.
- Sand and gravel shall not be allowed to be extracted where erosion may occur, such as at the concave bank.
- 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.
- Sand and gravel shall net 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.
- 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.
- 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.

- Alternatively, off-channel or floodplain extraction is recommended to allow rivers to replenish the quantity taken out during mining.
- 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.
- 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.
- 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 entre to centre should be left the borrow pits.
- Demarcation of mining area with pillars and geo-referencing should be done prior to strat of mining.

9.0 **VOLUME ESTIMATION**

CMPDI in its study had used the following methodology to compute volume of sand through DGPS survey:

1. Co-ordinates along with RL were taken at 9 points by DGPS survey in each patch.
2. The Lowest RL of a patch was taken as the base RL and Average of all RLs in a patch was taken as the Final RL for volume calculation of sand in a particular patch. Average Height difference was computed by subtracting lowest RL from Final RL.
3. Area of the boundary as per geo-coordinates were considered while computation.
4. Volume is computed through multiplication of area and average height difference.

Three approaches to resource estimation have been used in estimating the available volume in the leases operational in 2023-24.

A. The dual synchronic level estimation through elevation survey method taking pre and post monsoon levels and estimating the available volume between level differences using DGPS survey.
B. The post monsoon trench & trial pit method to assess the volume available between top soil and phreatic water table.
C. Satellite imagery based Digital Terrain Modeling to assess zone wise excavable volume.

An amalgamation of the three methods has been found to provide relatively substantive results.

In the amalgamated method, the lease is organized into a grid of 1 ha plots. The surface levels in each unit of the grid are recorded. Representative samples of phreatic water table are also taken.

The same methodology is repeated in the post monsoon season. The following conditions are adhered:

1. The lease area is demarcated on contour lines & zones demarcated based on intra-zone HRLs & MRLs.
2. Water table pits are taken up to the depth of 3 m.
3. The difference between pre and post monsoon phreatic water level be recorded scrupulously.

The mineable reserve estimation takes pre monsoon phreatic water table as a base and mining is restricted to 1 m above the water table.

At any rate the mineable volume must not be more than 60% of geological reserve and more than the material replenished.

It is suggested that the same technique is followed during the preparation of mine plan. Pit profile samples should be retained for sieve analysis. A more comprehensive and detailed estimation is expected when the Mine Plan for the lease is being prepared as it is at that stage that safety margins, terracing and other mining precautions would also be considered.

10.0 **REPLENISHMENT IN THE LEASES IN BANDA**

Detrital input reaching river Yamuna is generated from various sources i.e. exposed fresh and weathered rocks recycled marine material and fluvial sediment and soils. The catchments outcrops are exposed to variable rates and intensity of weathering and the weathering products may vary mineralogical characteristics because of mixing mineral component during erosion and transport prior to final deposition.

CMPDI had taken up the replenishment study in 2022 by measuring the river bed at strategic locations in pre and post monsoon season by using DGPS survey and drone survey. The result obtained in this study is tabulated below:

Table 6: Details of replenishment study done by CMPDI in 2022

Sl. No.	Lease Details	Area (in ha)	Mineral to be mined 2023-24	CMPDI Volume (cum) 2021-22
1.	Village-Itwan, Tehsil- Baberu, District- Banda Gata No.- 3257, 3276mi, 3278	8.15	2,39,328 cum	440372.0 cum
2.	Village-Marka Khadar, Tehsil- Baberu, District- Banda Gata No.- part of 96/2 (Khand No. 04)	20.0	6,00,000 cum	600780.0 cum
3.	Village-Marka Khadar, Tehsil- Baberu, District- Banda Gata No.- part of 96/2 (Khand No. 03)	20.0	6,00,000 cum	600780.0 cum
4.	Village-Marka Khadar, Tehsil- Baberu, District- Banda Gata No.- part of 96/2 (Khand No. 01)	20.0	6,00,000 Cum	600780.0 cum
5.	Village-Marka Khadar, Tehsil- Baberu, District- Banda Gata No.- part of 96/2 (Khand No. 02)	20.0	6,00,000 Cum	600780.0 cum
6.	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 02)	11.0	3,30,000 cum	330429.0 cum
7.	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 03)	11.0	3,30,000 cum	330429.0 cum
8.	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 01)	12.50	3,75,000 cum	375488.0 cum
9.	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 04)	11.0	3,30,000 cum	330429.0 cum

10.	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 05)	11.0	3,30,000 cum	330429.0 cum
11.	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 06)	11.0	3,30,000 cum	330429.0 cum
12.	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 07)	11.0	3,30,000 cum	330429.0 cum
13.	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 08)	11.0	3,30,000 cum	330429.0 cum
14.	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 09)	11.0	3,30,000 cum	330429.0 cum
15.	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 10)	11.0	3,30,000 cum	330429.0 cum
16.	Village –Bendakhadar, Tehsil- Banda, District- Banda, Gata No.- 2/4, 2/23, 2/24, 2/28 (Khand No. 01)	21.0	6,30,000 cum	662361.0 cum
17.	Village –Bendakhadar, Tehsil- Banda, District- Banda, Gata No.- 2/4, 2/23, 2/24, 2/28 (Khand No. 02)	21.0	6,30,000 cum	662361.0 cum
18.	Village –Bendakhadar, Tehsil- Banda, District- Banda, Gata No.- 2/4, 2/23, 2/24, 2/28 (Khand No. 04)	21.0	4,20,000 cum	662361.0 cum
19.	Village –Marauli Khadar, Tehsil- Banda, District- Banda, Gata No.- 332/17, Part of 333/7, 431/333/1 (Khand No. 06)	23.0	2,61,972 cum	261972.0 cum
20.	Village –Marauli Khadar, Tehsil- Banda, District- Banda, Gata No.- Part of 333/7 (Khand No. 02)	22.0	4,40,000 cum	250582.0 cum
21.	Village –Marauli Khadar, Tehsil- Banda, District- Banda, Gata No.- Part of 333/7, 418, 421 mi, 426/30 (Khand No. 03)	23.0	4,60,000 cum	261972.0 cum
22.	Village –Marauli Khadar, Tehsil- Banda, District- Banda, Gata No.- Part of 333/7 (Khand No. 01)	17.2802	3,45,604 cum	196823.0 cum
23.	Village –Marauli Khadar, Tehsil- Banda, District- Banda,	23.0	2,61,972 cum	261972.0 cum

	Gata No.- Part of 333/7, 412, 413, 414 (Khand No. 04)			
24.	Village –Hateti Purwa, Tehsil- Banda, District- Banda, Gata No.- 3061mi (Khand No. 01)	4.048	58,282 cum	143977.0 cum
25.	Village –Hateti Purwa, Tehsil- Banda, District- Banda, Gata No.- 3061mi (Khand No. 02)	3.644	52,465 cum	129579.0 cum
26.	Village – Bhawani Purwa, Tehsil- Banda, District- Banda, Gata No.- 5137, 5138, 5139, 5140, 5141	4.0	80,000 cum	55024.0 cum
27.	Village – Bhuredi, Tehsil- Banda, District- Banda, Gata No.- Part of 1141, 1137, 1136, 1123/2, 1125, 1127, 1131, 1132	37.0	2,24,932 cum	224932.0 cum
28.	Village – Pathri, Tehsil- Banda, District- Banda, Gata No.- Part of 72/47, part of 74/1 (Khand No. 03)	19.0	2,16,412 cum	216412.0 cum
29.	Village – Pathri, Tehsil- Banda, District- Banda, Gata No.- part of 72/47, part of 74/1, 75 mi (Khand No. 01)	20.0	2,87,954 cum	287954.0 cum
30.	Village – Duredi, Tehsil- Banda, District- Banda, Gata No.- 5029, 5030KA, 5093KA, 5094KA, 5097	20.0	2,75,118 cum	371409.0 cum
31.	Village – Duredi, Tehsil- Banda, District- Banda, Gata No.- 678, 680Kha, 681Kha, 682, 677ka, 683Kha, 676	24.0	3,30,141 cum	330141.0 cum
32.	Village – Duredi, Tehsil- Banda, District- Banda, Gata No.- 4881, 4880, 4834, 4824 Kha	27.0	3,71,410 cum	371409.0 cum
33.	Village – Duredi, Tehsil- Banda, District- Banda, Gata No.- 4943, 4942, 4941, 4939GA, 4938, 4937, 4922KA, 4923KA, 4925KA, 4931, 4959 GA, 4958, 4957, 4955, 4883	40.0	8,00,000 cum	575908.0 cum
34.	Village – Jauharpur, Tehsil- Banda, District- Banda, Khand No. 06	15.0	3,00,000 cum	428040.0 cum
35.	Village – Jauharpur, Tehsil- Banda, District- Banda, Khand No. 01	15.0	3,00,000 cum	428040.0 cum

36.	Village – Jauharpur, Tehsil- Banda, District- Banda, Khand No. 05	15.0	3,00,000 cum	428040.0 cum
37.	Village – Jauharpur, Tehsil- Banda, District- Banda, Khand No. 02	15.0	3,00,000 cum	428040.0 cum
38.	Village – Jauharpur, Tehsil- Banda, District- Banda, Khand No. 03	15.0	3,00,000 cum	428040.0 cum
39.	Village – Jauharpur, Tehsil- Banda, District- Banda, Khand No. 04	15.0	3,00,000 cum	428040.0 cum
40.	Village – Achhraud, Tehsil- Banda, District- Banda, Gata No. Part of 1130, (Khand No. 02)	28.0	6,13,529 cum	613529.0 cum
41.	Village – Achhraud, Tehsil- Banda, District- Banda, Gata No. Part of 1130, (Khand No. 01)	10.7	2,14,000 cum	613529.0 cum
42.	Village – Ganchha, Tehsil- Banda, District- Banda, Gata no. 1971/1	10.0	1,37,559 cum	137559.0 cum
43.	Village-Ladakapurwa, Tehsil- Banda, District- Banda, Gata no. 5065, 5114/1, 5115 to 5126, 5128 to 5132, 5134, 5135, 5136, 5152	20.0	4,00,000 cum	198341.0 cum
44.	Village-Sadimadanpur, Tehsil- Pailani, District- Banda, Gata no. Part of 56, 57, 92/6, 93/1, 94, 95/2, part of 60/1/3	18.5	5,55,722 cum	555722.0 cum
45.	Village-Khaptiha Kala, Tehsil- Pailani, District- Banda, Gata no. Part of 356 (Khand No.02)	16.0	2,39,932 cum	239932.0 cum
46.	Village-Khaptiha Kala, Tehsil- Pailani, District- Banda, Gata no. 62, 63/1	17.0	2,54,928 cum	254928.0 cum
47.	Village-Khaptiha Kala, Tehsil- Pailani, District- Banda, Gata no. 426/7	8.724	1,24,812 cum	271828.0 cum
48.	Village-Khaptiha Kala, Tehsil- Pailani, District- Banda, Gata no. Part of 100 (Khand no. 01)	16.0	3,20,000 cum	239932.0 cum
49.	Village-Khaptiha Kala, Tehsil- Pailani, District- Banda, Gata no. 455	23.0	4,60,000 cum	344903.0 cum
50.	Village-Khaptiha Kala, Tehsil- Pailani, District- Banda,	20.0	4,00,000 cum	299916.0 cum

	Gata no. 61/3			
51.	Village- Barehata Khadar, Tehsil- Pailani, District- Banda, Gata no. 122/7 & 111/2 (Khand no.-02)	13.00	1,95,000 cum	Not given
52.	Village-Madaulikhurd Khadar, Tehsil- Pailani, District- Banda, Gata no. 58, 107, 108, 109, 110, 111, 114	7.053	1,01,504 cum	101504.0 cum
53.	Village-Sindhankala, Tehsil- Pailani, District- Banda, Gata no. 99/3, 99/22, 100/7, 101/5, 103/10, 104/2, 104/5	18.21	2,62,182 cum	262182.0 cum
54.	Village-Sindhankala, Tehsil- Pailani, District- Banda, Gata no. 683/43, 684/6, 693/48, 684/7, 692/1, 699/3	19.0	2,73,556 cum	273556.0 cum
55.	Village-Padoharakhadar, Tehsil- Pailani, District- Banda, Gata no. 165, 166, 174	14.0	2,01,568 cum	201568.0 cum
56.	Village-Pailani, Tehsil- Pailani, District- Banda, Gata no. 21/91, 47/9, 58/27, 54/2, 53/2, 52/2	18.0	3,60,000 cum	259158.0 cum
57.	Village-Sabadakhadar, Tehsil- Pailani, District- Banda, Gata no. part of 168	10.0	1,00,000 cum	300390.0 cum
58.	Village-Sadikhadar, Tehsil- Pailani, District- Banda, Gata no. 73/1, 73/2, 77/1, 77/7, 89, 101/1, 102/1	26.62	3,83,267 cum	383267.0 cum
59.	Village-Sadimadanpur, Tehsil- Pailani, District- Banda, Gata no. Part of 50/2, 52/1, 53, 55, Part of 56, 58, 59 & Part of 60/1/3	17.50	5,25,000 cum	525683.0 cum
60.	Village-Sadimadanpur, Tehsil- Pailani, District- Banda, Gata no. 92/6, 92/7, 94	7.46	2,23,800 cum	555752.0 cum
61.	Village-Sadimadanpur, Tehsil- Pailani, District- Banda, Gata no. 50/2, 50/2kha, 51	18.49	5,54,700 cum	1276357.0 cum
62.	Village-Amlorkhadar, Tehsil- Paialani, District- Banda, Gata No. 176mi, 172ga, 182, 187	25.29	2,91,518 cum	291518.0 cum
63.	Village-Amlorkhadar, Tehsil- Paialani, District- Banda, Gata No. 7, 17, 18, 21, 23, 25, 27, 28, 29, 30, 35, 37, 38, 40, 177, 176mi	25.29	2,91,518 cum	291518.0 cum

64.	Village-Khalari, Tehsil- Naraini, District- Banda, Gata No. 585/1, 857, 859/1, 914, 954, 1248/2	6.648	94,652 cum	128139.0 cum
65.	Village-Shahpatan, Tehsil- Naraini, District- Banda, Gata No. 420, 530/2, 532, 709, 716	6.93	1,01,227 cum	160678.0 cum
66.	Village-Bahadurpur Syodha, Tehsil- Naraini, District- Banda, Gata No. 300mi, 316mi	7.30	94,949 cum	94949.0 cum
67.	Village-Barkola Kala, Tehsil- Naraini, District- Banda, Gata No. 659, 724, 805	10.00	1,43,177 cum	257719.0 cum
68.	Village- Barsandamanpur, Tehsil- Naraini, District- Banda, Gata No. Part of 3/1/1 (Khand No. 01)	21.0	3,02,351 cum	302351.0 cum
69.	Village- Barsandamanpur, Tehsil- Naraini, District- Banda, Gata No. Part of 3/1/1 (Khand No. 02)	21.0	3,02,351 cum	302351.0 cum
70.	Village- Kolawalraipur, Tehsil- Naraini, District- Banda, Gata No. 721, 722, 723	20.0	2,60,206 cum	260206.0 cum
71.	Village- Bilharka, Tehsil- Naraini, District- Banda, Gata No. Part of 5, Part of 9	12.86	1,38,552 cum	269345.0 cum
72.	Village- Bilharka, Tehsil- Naraini, District- Banda, Gata No. Part of 5, Part of 9	15.165	3,03,300 cum	269345.0 cum
73.	Village- Risaura, Tehsil- Naraini, District- Banda, Gata No. 116Ga	18.0	2,34,185 cum	234185.0 cum
74.	Village- Singhauti, Tehsil- Naraini, District- Banda, Gata No. 13/1, 13/3, 30/2, 400/2	3.55	57,118 cum	64,358.0 cum
75.	Village- Nihalpur, Tehsil- Naraini, District- Banda, Gata No. 492/13	24.0	3,12,247 cum	312247.0 cum
76.	Village- Chandpura, Tehsil- Naraini, District- Banda, Gata No. 269, 287, 313	1.445	20,527 cum	42617.0 cum
77.	Village- Jarar, Tehsil- Naraini, District- Banda, Gata No. 851, 866, 867, 869, 872, 876	8.0	1,60,000 cum	104082.0 cum
78.	Village- Barehata Khadar, Tehsil- Pailani, District- Banda, Gata no. 133 & 134 (Khand no.-01)	15.654	2,34,810 cum	Not given
79.	Village- Gopra, Tehsil- Naraini, District- Banda,	4.21	58,882 cum	97904.0 cum

	Gata No. 2/1, 473mi, 474, 659			
80.	Village- Lahureta, Tehsil- Naraini, District- Banda, Gata No. Part of 195/1, 191, 3	33.0	3,55,535 cum	355535.0 cum
81.	Village- Lahureta, Tehsil- Naraini, District- Banda, Gata No. Part of 195/1	33.0	6,60,000 cum	355535.0 cum
82.	Village- Badausa, Tehsil- Atarra, District- Banda, Gata No. 6261, 6262, 6478, 6497, 6595, 6597, 6598	10.0	1,00,000 cum	295677.0 cum
83.	Village- Bhadawal, Tehsil- Atarra, District- Banda, Gata No. 1169, 1858/3, 1133/4, 1161/3, 1949	22.94	2,81,328 cum	281328.0 cum
84.	Village- Chandaur, Tehsil- Atarra, District- Banda, Gata No. 2494	7.80	95,657 cum	Not given
85.	Village- Tera Ba, Tehsil- Atrra, District- Banda, Gata No. 1749kha, 1766, 2421	9.34	1,14,543 cum	114543.0 cum
86.	Village-Sadikhadar, Tehsil- Pailani, District- Banda, Gata no. 4/1, 4/21, 4/22, 4/24, 4/25, 4/26, 4/29, 4/32, 4/33, 4/34, 4/35, 4/36	13.0	2,60,000 cum	187170.0 cum
87.	Village –Kanwara, Tehsil- Banda, District- Banda, Gata No.- 337/1, 337/4, 337/5, 337/6 (Khand No. 03)	24.0	4,80,000 cum	273362.0
88.	Village –Kanwara, Tehsil- Banda, District- Banda, Gata No.- 28/1, 28/5, 28/6, 28/7, 29 (Khand No. 01)	27.0	5,40,000 cum	307532.0

Rivers at the time of more rainfall, exhibit higher discharge as there is more water entering the channel. Transportation also increases with discharge. As energy increases so do the capacity of rivers to transport material. Heavy rainfall causes the ground to be saturated. This can lead to mass movement on river sides such as slumping and sliding which can result in material entering the river channel. When the volume of water in a river high and the river channel is deep and wide, and the land around the river is flat, energy in the river is at its lowest, and deposition occurs. During the monsoon season (when rainfall is normal), water containing large quantities of alluvium (river silt) pours over the flat valley floor. The water slowly recedes, leaving behind the

deposited sediment. The suspended load bounces in line with the rise and fall in the velocity of the river; Whereas low rainfall intensity reduces the flow of water in a river. This leads to less transportation and erosion. Mass movement is also less likely to occur.

The data collected during site visit of the sites in Banda is represented in table below:

Table 7: Status of Sand Replenishment vis-à-vis annual planned production

S.No.	Name of Lease	Lease Area (ha)	Minable Area Less safety margin of 7.5 m offset from 3 sides	Total Volume (cum)	Volume As per LOI (cum)	Volume As per CMPDI study (cum) 2021-22
1	Village – Khaptiha, Tehsil - Pailani Gata No. part of 100 , (khand no. 03)	16.00 ha	1,50,979.24 sqm	2,56,106	2,39,932	2,39,932
2	Village – Marauli khadar, Tehsil - Banda , Gata No. part of 333/7, (khand no. 05)	23.00ha	2,17,350.86 sqm	4,74,944	4,60,000	2,61,972
3	Village – Kanwara, Tehsil - Banda Gata No. part of 431, (khand no. 05)	23.00 ha	2,15,235.08 sqm	4,79,728	4,60,000	3,31,147
4	Village – Benda khadar, Tehsil - Banda Gata No. 2/4, 2/23,2/24, 2/28 (khand no. 03)	21.00 ha	1,99,995.83 sqm	4,30,164	4,20,000	6,62,361
5	Village – Dadau khadar, Tehsil – Baberu, Gata No. 38, 40, 41, 42, (khand no. 07)	12.00 ha	1,10,557.24 sqm	1,35,395	1,20,000	3,60,468
6	Village – Bahadurpur syoda, Tehsil – Naraini, Gata No. 195/1	14.39 ha	1,33,471.18 sqm	2,22,531	2,15,775	1,87,153
7	Village – Khairai, Tehsil - Pailani, Gata No. 2/1, 2/2, 2/4	5.80 ha	50,300.04 sqm	1,16,320	1,16,000	86,976
8	Village – Bariyari, Tehsil - Naraini Gata No. 429, 430	13.36 ha	1,23,513.25 sqm	2,68,942	2,67,240	1,73,843

9	Village – Tarsuma, Tehsil – Atarra Gata No. 2/2, 3	3.11 ha	23,489.43 sqm	41,213	38,140	38,140
10	Village –Mahuta, Tehsil – Atarra, Gata No. 876kha, 886ka,etc	20.61 ha	1,76,519.82 sqm	2,23,656	2,10,000	2,57,537
	Block-1		4,258.33 sqm	8,750		
	Block-2		15,320.95 sqm	8,479		
	Block-3		1,854.37 sqm	927		
	Block-4		63,204.74 sqm	93,198		
	Block-5		28,416.64 sqm	44,065		
	Block-6		27,842.71 sqm	29,708		
	Block-7		8,851.84 sqm	7,403		
	Block-8		6,814.72 sqm	4,396		
	Block-9		19,955.52 sqm	26,728		
11	Village – Sadikhadar, Tehsil – pailani Gata No. 60	18.00 ha	1,69,116.63 sqm	2,67,166	2,59,158	2,59,158
12	Village – Pathri, Tehsil – Banda, Gata No. part of 72/47, part of 74/1 (khand no. 02)	19.00 ha	1,80,243.68 sqm	2,24,717	2,16,412	2,16,412
13	Village – Sadikhadar, Tehsil – pailani Gata No. 04	13.00 ha	1,18,562.22 sqm	2,69,907	2,60,000	1,87,170
14	Village - Khaptiha Kalan, Tehsil - Pailani Gata No. part of 100 (khand no. 02)	16.00 ha	1,52,246.46 sqm	2,52,364	2,39,932	2,39,932
15	Village - Khaptiha, Tehsil - Pailani Gata No. part of 356 (khand no. 01)	16.00 ha	1,52,389.10 sqm	2,46,362	2,39,932	2,39,932
16	Village –Kolawalraypur, Tehsil – Naraini, Gata No. 04	10.00 ha	93,148.15 sqm	1,44,655	1,30,104	2,60,206

Rainfall intensity is directly associated with sediment transport and replenishment is directly proportionate.

Table 8: Replenished Volume in pre & post monsoon 2024

Sl. No.	River Details	Lease Details	Area (in Ha)	Volume as per LoI / Mineable Reserve (Cum / Annum)	Total Resource available in post monsoon 2024 (Cum)	Resource available in pre-monsoon 2024 (Cum)	Replenished Volume during pre & post monsoon 2024 (Cum)
1.	Baghain River	Village-Itwan, Tehsil- Baberu, District- Banda Gata No.- 3257, 3276mi, 3278	8.15	2,39,328	3,98,880	1,57,421	2,41,459
2.	Yamuna River	Village-Marka Khadar, Tehsil- Baberu, District- Banda Gata No.- part of 96/2 (Khand No. 04)	20.0	6,00,000	10,00,000	3,49,597	6,50,403
3.	Yamuna River	Village-Marka Khadar, Tehsil- Baberu, District- Banda Gata No.- part of 96/2 (Khand No. 03)	20.0	6,00,000	10,00,000	3,85,769	6,14,231
4.	Yamuna River	Village-Marka Khadar, Tehsil- Baberu, District- Banda Gata No.- part of 96/2 (Khand No. 01)	20.0	6,00,000	10,00,000	3,72,795	6,27,205
5.	Yamuna River	Village-Marka Khadar, Tehsil- Baberu, District- Banda Gata No.- part of 96/2 (Khand No. 02)	20.0	6,00,000	10,00,000	3,60,663	6,39,337
6.	Yamuna River	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 02)	11.0	3,30,000	5,50,000	2,14,943	3,35,057
7.	Yamuna River	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 03)	11.0	3,30,000	5,50,000	2,09,212	3,40,788

8.	Yamuna River	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 01)	12.50	3,75,000	6,25,000	2,37,512	3,87,488
9.	Yamuna River	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 04)	11.0	3,30,000	5,50,000	1,90,097	3,59,903
10.	Yamuna River	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 05)	11.0	3,30,000	5,50,000	1,55,793	3,94,207
11.	Yamuna River	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 06)	11.0	3,30,000	5,50,000	2,00,033	3,49,967
12.	Yamuna River	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 07)	11.0	3,30,000	5,50,000	2,12,239	3,37,761
13.	Yamuna River	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 08)	11.0	3,30,000	5,50,000	1,60,658	3,89,342
14.	Yamuna River	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 09)	11.0	3,30,000	5,50,000	1,87,343	3,62,657
15.	Yamuna River	Village – Charka Khadar, Tehsil- Baberu, District- Banda, Gata No.- 21 (Khand no. 10)	11.0	3,30,000	5,50,000	1,93,018	3,56,982
16.	Yamuna River	Village –Bendakhadar, Tehsil- Banda, District- Banda, Gata No.- 2/4, 2/23, 2/24, 2/28 (Khand No. 01)	21.0	6,30,000	10,50,000	4,02,268	6,47,732

17.	Yamuna River	Village –Bendakhadar, Tehsil- Banda, District- Banda, Gata No.- 2/4, 2/23, 2/24, 2/28 (Khand No. 02)	21.0	6,30,000	10,50,000	4,07,559	6,42,441
18.	Yamuna River	Village –Bendakhadar, Tehsil- Banda, District- Banda, Gata No.- 2/4, 2/23, 2/24, 2/28 (Khand No. 04)	21.0	4,20,000	7,00,000	2,68,391	4,31,609
19.	Yamuna River	Village –Bendakhadar, Tehsil- Banda, District- Banda, Gata No.- 2/4, 2/23, 2/24, 2/28 (Khand No. 03)	21.0	4,20,000	7,00,000	2,69,836	4,30,164
20.	Ken River	Village –Marauli Khadar, Tehsil- Banda, District- Banda, Gata No.- Part of 333/7 (Khand No. 05)	23.0	4,60,000	7,66,666	2,91,722	4,74,944
21.	Ken River	Village –Marauli Khadar, Tehsil- Banda, District- Banda, Gata No.- 332/17, Part of 333/7, 431/333/1 (Khand No. 06)	23.0	2,61,972	3,66,760	88,900	2,77,860
22.	Ken River	Village –Marauli Khadar, Tehsil- Banda, District- Banda, Gata No.- Part of 333/7 (Khand No. 02)	22.0	4,40,000	7,33,333	2,82,007	4,51,326
23.	Ken River	Village –Marauli Khadar, Tehsil- Banda, District- Banda, Gata No.- Part of 333/7, 418, 421 mi, 426/30 (Khand No. 03)	23.0	4,60,000	7,66,666	2,89,690	4,76,976
24.	Ken River	Village –Marauli Khadar, Tehsil- Banda, District- Banda, Gata No.- Part of 333/7 (Khand No. 01)	17.2802	3,45,604	5,76,006	2,23,700	3,52,306
25.	Ken River	Village –Marauli Khadar, Tehsil- Banda, District- Banda, Gata No.- Part of 333/7, 412, 413, 414	23.0	2,61,972	3,36,760	63,761	2,72,999

		(Khand No. 04)					
26.	Ken River	Village –Hateti Purwa, Tehsil- Banda, District- Banda, Gata No.- 3061mi (Khand No. 01)	4.048	58,282	97,136	37,456	59,680
27.	Ken River	Village –Hateti Purwa, Tehsil- Banda, District- Banda, Gata No.- 3061mi (Khand No. 02)	3.644	52,465	87,441	21,665	56,776
28.	Ken River	Village – Bhawani Purwa, Tehsil- Banda, District- Banda, Gata No.- 5137, 5138, 5139, 5140, 5141	4.0	80,000	1,33,333	39,782	93,551
29.	Ken River	Village – Bhuredi, Tehsil- Banda, District- Banda, Gata No.- Part of 1141, 1137, 1136, 1123/2, 1125, 1127, 1131, 1132	37.0	2,24,932	3,74,886	1,39,536	2,35,350
30.	Ken River	Village – Pathri, Tehsil- Banda, District- Banda, Gata No.- Part of 72/47, part of 74/1 (Khand No. 03)	19.0	2,16,412	3,60,686	1,39,122	2,21,564
31.	Ken River	Village – Pathri, Tehsil- Banda, District- Banda, Gata No.- Part of 72/47, part of 74/1 (Khand No. 02)	19.0	2,16,412	3,60,686	1,35,969	2,24717
32.	Ken River	Village – Pathri, Tehsil- Banda, District- Banda, Gata No.- part of 72/47, part of 74/1, 75 mi (Khand No. 01)	20.0	2,87,954	4,79,923	1,87,400	2,92,523

33.	Ken River	Village – Duredi, Tehsil- Banda, District- Banda, Gata No.- 5029, 5030KA, 5093KA, 5094KA, 5097	20.0	Submerged at the time of Survey			
34.	Ken River	Village – Duredi, Tehsil- Banda, District- Banda, Gata No.- 678, 680Kha, 681Kha, 682, 677ka, 683Kha, 676	24.0	3,30,141	5,50,235	2,05,887	3,44,348
35.	Ken River	Village – Duredi, Tehsil- Banda, District- Banda, Gata No.- 4881, 4880, 4834, 4824 Kha	27.0	3,71,410	6,19,016	2,31,841	3,87,175
36.	Ken River	Village – Duredi, Tehsil- Banda, District- Banda, Gata No.- 4943, 4942, 4941, 4939GA, 4938, 4937, 4922KA, 4923KA, 4925KA, 4931, 4959 GA, 4958, 4957, 4955, 4883	40.0	8,00,000	13,33,333	5,16,254	8,17,079
37.	Yamuna River	Village – Jauharpur, Tehsil- Banda, District- Banda, Khand No. 06	15.0	3,00,000	5,00,000	1,88,796	3,11,204
38.	Yamuna River	Village – Jauharpur, Tehsil- Banda, District- Banda, Khand No. 01	15.0	3,00,000	5,00,000	1,90,068	3,09,932
39.	Yamuna River	Village – Jauharpur, Tehsil- Banda, District- Banda, Khand No. 05	15.0	3,00,000	5,00,000	1,86,564	3,13,436
40.	Yamuna River	Village – Jauharpur, Tehsil- Banda, District- Banda, Khand No. 02	15.0	3,00,000	5,00,000	1,91,926	3,08,074
41.	Yamuna River	Village – Jauharpur, Tehsil- Banda, District- Banda, Khand No. 03	15.0	3,00,000	5,00,000	1,89,784	3,10,216

42.	Yamuna River	Village – Jauharpur, Tehsil- Banda, District- Banda, Khand No. 04	15.0	3,00,000	5,00,000	1,96,218	3,03,782
43.	Ken River	Village – Achhraud, Tehsil- Banda, District- Banda, Gata No. Part of 1130, (Khand No. 02)	28.0	6,13,529	10,22,548	4,07,567	6,14,981
44.	Ken River	Village – Achhraud, Tehsil- Banda, District- Banda, Gata No. Part of 1130, (Khand No. 01)	10.7	2,14,000	3,56,667	1,37,851	2,18,816
45.	Ken River	Village – Ganchha, Tehsil- Banda, District- Banda, Gata no. 1971/1	10.0	1,37,559	2,29,265	86,915	1,42,350
46.	Ken River	Village-Ladakapurwa, Tehsil- Banda, District- Banda, Gata no. 5065, 5114/1, 5115 to 5126, 5128 to 5132, 5134, 5135, 5136, 5152	20.0	4,00,000	6,66,666	2,61,071	4,05,595
47.	Yamuna River	Village-Sadimadanpur, Tehsil- Pailani, District- Banda, Gata no. Part of 56, 57, 92/6, 93/1, 94, 95/2, part of 60/1/3	18.5	5,55,722	9,26,203	3,58,601	5,67,602
48.	Ken River	Village-Khaptiha Kala, Tehsil- Pailani, District- Banda, Gata no. Part of 356 (Khand No.01)	16.0	2,39,932	3,99,886	1,56,220	2,43,666
49.	Ken River	Village-Khaptiha Kala, Tehsil- Pailani, District- Banda, Gata no. Part of 356 (Khand No.02)	16.0	2,39,932	3,99,886	1,55,676	2,44,210
50.	Ken River	Village-Khaptiha Kala, Tehsil- Pailani, District- Banda, Gata no.Part of 100 (Khand No.02)	16.0	2,39,932	3,99,886	1,47,522	2,52,364

51.	Ken River	Village-Khaptiha Kala, Tehsil- Pailani, District- Banda, Gata no. 62, 63/1	17.0	2,54,928	4,24,880	1,65,223	2,59,657
52.	Ken River	Village-Khaptiha Kala, Tehsil- Pailani, District- Banda, Gata no. 426/7	8.724	1,24,812	2,08,020	75,880	1,32,140
53.	Ken River	Village-Khaptiha Kala, Tehsil- Pailani, District- Banda, Gata no. Part of 100 (Khand no. 03)	16.0	2,39,932	3,99,886	1,43,780	2,56,106
54.	Ken River	Village-Khaptiha Kala, Tehsil- Pailani, District- Banda, Gata no. Part of 100 (Khand no. 01)	16.0	3,20,000	5,33,333	2,86,971	2,46,362
55.	Ken River	Village-Khaptiha Kala, Tehsil- Pailani, District- Banda, Gata no. 455	23.0	4,60,000	7,66,666	2,99,406	4,67,260
56.	Ken River	Village-Khaptiha Kala, Tehsil- Pailani, District- Banda, Gata no. 61/3	20.0	4,00,000	6,66,666	2,49,692	4,16,974
57.	Ken River	Village-Khairai, Tehsil- Pailani, District- Banda, Gata no. 2/1, 2/2, 2/4	5.80	1,16,000	1,93,333	77,013	1,16,320
58.	Ken River	Village- Barehata Khadar, Tehsil- Pailani, District- Banda, Gata no. 122/7 & 111/2 (Khand no.-02)	13.00	1,95,000	3,25,000	1,17,428	2,07,572
59.	Ken River	Village-Kolawalraipur, Tehsil- Naraini, District- Banda, Gata no. 4	10.0	1,30,104	2,16,840	72,185	1,44,655

60.	Ken River	Village-Madaulikhurd Khadar, Tehsil- Pailani, District- Banda, Gata no. 58, 107, 108, 109, 110, 111, 114	7.053	1,01,504	1,69,173	52,093	1,17,080
61.	Ken River	Village-Sindhankala, Tehsil- Pailani, District- Banda, Gata no. 99/3, 99/22, 100/7, 101/5, 103/10, 104/2, 104/5	18.21	2,62,182	4,36,970	1,66,839	2,70,131
62.	Ken River	Village-Sindhankala, Tehsil- Pailani, District- Banda, Gata no. 683/43, 684/6, 693/48, 684/7, 692/1, 699/3	19.0	2,73,556	4,55,926	1,73,700	2,82,226
63.	Ken River	Village-Padoharakhadar, Tehsil- Pailani, District- Banda, Gata no. 165, 166, 174	14.0	2,01,568	3,35,946	1,22,164	2,13,782
64.	Ken River	Village-Pailani, Tehsil- Pailani, District- Banda, Gata no. 21/91, 47/9, 58/27, 54/2, 53/2, 52/2	18.0	3,60,000	6,00,000	2,27,588	3,72,412
65.	Yamuna River	Village-Sabadakhadar, Tehsil- Pailani, District- Banda, Gata no. part of 168	10.0	1,00,000	1,66,666	62,980	1,03,686
66.	Ken River	Village-Sadikhadar, Tehsil- Pailani, District- Banda, Gata no. 73/1, 73/2, 77/1, 77/7, 89, 101/1, 102/1	26.62	3,83,267	6,38,778	2,49,554	3,89,224
67.	Ken River	Village-Sadikhadar, Tehsil- Pailani, District- Banda, Gata no. part of 176, 179, 180, 177, part of 147, part of 144, part of 141, 143, 145, 142, 122, 121, part of 114, part of 117	46.0	6,62,294	11,03,823	4,36,441	6,67,382
68.	Ken River	Village-Sadikhadar, Tehsil- Pailani, District- Banda, Gata no. 60	18.0	2,59,158	4,31,930	1,64,764	2,67,166

69.	Yamuna River	Village-Sadimadanpur, Tehsil- Pailani, District- Banda, Gata no. Part of 50/2, 52/1, 53, 55, Part of 56, 58, 59 & Part of 60/1/3	17.50	5,25,000	8,75,000	3,43,921	5,31,079
70.	Yamuna River	Village-Sadimadanpur, Tehsil- Pailani, District- Banda, Gata no. 92/6, 92/7, 94	7.46	2,23,800	3,73,000	1,35,109	2,37,891
71.	Yamuna River	Village-Sadimadanpur, Tehsil- Pailani, District- Banda, Gata no. 50/2, 50/2kha, 51	18.49	5,54,700	9,24,500	3,68,121	5,56,379
72.	Ken River	Village-Amlorkhadar, Tehsil- Paialani, District- Banda, Gata No. 176mi, 172ga, 182, 187	25.29	2,91,518	4,85,863	1,92,533	2,93,330
73.	Ken River	Village-Amlorkhadar, Tehsil- Paialani, District- Banda, Gata No. 7, 17, 18, 21, 23, 25, 27, 28, 29, 30, 35, 37, 38, 40, 177, 176mi	25.29	2,91,518	4,85,863	1,89,722	2,96,141
74.	Ranj River	Village-Khalari, Tehsil- Naraini, District- Banda, Gata No. 585/1, 857, 859/1, 914, 954, 1248/2	6.648	94,652	1,57,753	55,264	1,02,489
75.	Ranj River	Village-Shahpatan, Tehsil- Naraini, District- Banda, Gata No. 420, 530/2, 532, 709, 716	6.93	1,01,227	1,68,711	59,189	1,09,522
76.	Ken River	Village-Bariyari, Tehsil- Naraini, District- Banda, Gata No. 429, 430	13.3620	2,67,240	4,45,400	1,76,458	2,68,942
77.	Ken River	Village-Bahadurpur Syodha, Tehsil- Naraini, District- Banda, Gata No. 195/1	14.3850	2,15,775	3,59,625	1,37,094	2,22,531
78.	Ken River	Village-Bahadurpur Syodha, Tehsil- Naraini,	7.30	94,949	1,58,248	57,570	1,00,678

		District- Banda, Gata No. 300mi, 316mi					
79.	Ranj River	Village-Barkola Kala, Tehsil- Naraini, District- Banda, Gata No. 659, 724, 805	10.00	1,43,177	2,38,628	90,649	1,47,979
80.	Ken River	Village- Barsandamanpur, Tehsil- Naraini, District- Banda, Gata No. Part of 3/1/1 (Khand No. 01)	21.0	3,02,351	5,03,918	1,91,798	3,12,120
81.	Ken River	Village- Barsandamanpur, Tehsil- Naraini, District- Banda, Gata No. Part of 3/1/1 (Khand No. 02)	21.0	3,02,351	5,03,918	1,94,426	3,09,492
82.	Ken River	Village- Kolawalraipur, Tehsil- Naraini, District- Banda, Gata No. 721, 722, 723	20.0	2,60,206	4,33,676	1,65,785	2,67,891
83.	Ken River	Village- Bilharka, Tehsil- Naraini, District- Banda, Gata No. Part of 5, Part of 9	12.86	1,38,552	2,30,920	88,914	1,42,006
84.	Ken River	Village- Bilharka, Tehsil- Naraini, District- Banda, Gata No. Part of 5, Part of 9	15.165	3,03,300	5,05,500	1,96,136	3,09,364
85.	Ken River	Village- Risaura, Tehsil- Naraini, District- Banda, Gata No. 116Ga	18.0	2,34,185	3,90,308	1,53,078	2,37,230
86.	Baghain River	Village- Singhauti, Tehsil- Naraini, District- Banda, Gata No. 13/1, 13/3, 30/2, 400/2	3.55	57,118	95,196	7,792	87,404
87.	Ken River	Village- Nihalpur, Tehsil- Naraini, District- Banda, Gata No. 492/13	24.0	3,12,247	5,20,411	2,05,293	3,15,118

88.	Ranj River	Village- Chandpura, Tehsil- Naraini, District- Banda, Gata No. 269, 287, 313	1.445	20,527	34,211	9,342	24,869
89.	Ken River	Village- Jarar, Tehsil- Naraini, District- Banda, Gata No. 851, 866, 867, 869, 872, 876	8.0	1,60,000	2,66,666	1,03,536	1,63,130
90.	Ken River	Village- Barehata Khadar, Tehsil- Pailani, District- Banda, Gata no. 133 & 134 (Khand no.-01)	15.654	2,34,810	3,91,350	1,51,719	2,39,631
91.	Baghain River	Village- Gopra, Tehsil- Naraini, District- Banda, Gata No. 2/1, 473mi, 474, 659	4.21	58,882	98,136	35,776	62,360
92.	Ken River	Village- Lahureta, Tehsil- Naraini, District- Banda, Gata No. Part of 195/1, 191, 3	33.0	3,55,535	5,92,558	2,35,367	3,57,191
93.	Ken River	Village- Lahureta, Tehsil- Naraini, District- Banda, Gata No. Part of 195/1	33.0	6,60,000	11,00,000	4,28,535	6,71,465
94.	Baghain River	Village- Badausa, Tehsil- Atrra, District- Banda, Gata No. 6261, 6262, 6478, 6497, 6595, 6597, 6598	10.0	1,00,000	1,66,667	63,315	1,03,352
95.	Baghain River	Village- Mahuta, Tehsil- Atrra, District- Banda, Gata No. 876kha, 886ka, 1481, 1482, 1505, 2031, 2039, 2047, 2247, 2270, 2521, 2522, 2538, 2541kha, 2577, 2599, 2676	21.00	2,10,000	3,50,000	1,26,344	2,23,656
96.	Baghain River	Village- Bhadawal, Tehsil- Atrra, District- Banda, Gata No. 1169, 1858/3, 1133/4, 1161/3, 1949	22.94	2,81,328	4,68,880	1,83,654	2,85,226

97.	Baghain River	Village- Chandaur, Tehsil- Atrra, District- Banda, Gata No. 2494	7.80	95,657	1,59,428	61,779	97,649
98.	Baghain River	Village- Tarsuma, Tehsil- Atrra, District- Banda, Gata No. 2/2, 3	3.11	38,140	63,566	22,353	41,213
99.	Baghain River	Village- Tera Ba, Tehsil- Atrra, District- Banda, Gata No. 1749kha, 1766, 2421	9.34	1,14,543	1,90,905	75,123	1,15,782
100.	Yamuna River	Village-Dadau Khadar, Tehsil- Baberu, District- Banda, Gata No.- 38/1, 40, 41, 42Mi (Khand no. 07)	12.0	1,20,000	2,00,000	64,605	1,35,395
101.	Ken River	Village-Sadikhadar, Tehsil- Pailani, District- Banda, Gata no. 4/1, 4/21, 4/22, 4/24, 4/25, 4/26, 4/29, 4/32, 4/33, 4/34, 4/35, 4/36	13.0	2,60,000	4,33,333	1,63,426	2,69,907
102.	Ken River	Village –Kanwara, Tehsil- Banda, District- Banda, Gata No.- 431/1 (Khand No. 05)	23.0	4,60,000	7,66,666	3,02,942	4,79,728
103.	Ken River	Village –Kanwara, Tehsil- Banda, District- Banda, Gata No.- 337/1, 337/4, 337/5, 337/6 (Khand No. 03)	24.0	4,80,000	8,00,000	3,12,491	4,87,509
104.	Ken River	Village –Kanwara, Tehsil- Banda, District- Banda, Gata No.- 28/1, 28/5, 28/6, 28/7, 29 (Khand No. 01)	27.0	5,40,000	9,00,000	3,54,511	5,45,489
105.	Yamuna River	Village-Amlikaur Khadar, Tehsil- Banda, District- Banda, Gata no. Part of 6/2 (Khand No.-01)	17.50	3,50,000	5,83,333	2,29,470	3,53,863

106.	Yamuna River	Village-AmlikaurKhadar, Tehsil- Banda, District- Banda, Gata no. Part of 6/2 (Khand No.-02)	17.50	3,50,000	5,83,333	2,26,832	3,56,501
107.	Yamuna River	Village-AmlikaurKhadar, Tehsil- Banda, District- Banda, Gata no. Part of 6/2 (Khand No.-03)	17.50	3,50,000	5,83,333	2,30,554	3,52,779
108.	Yamuna River	Village-AmlikaurKhadar, Tehsil- Banda, District- Banda, Gata no. Part of 6/2 (Khand No.-04)	17.50	3,50,000	5,83,333	2,23,518	3,59,815
109.	Yamuna River	Village-Amedhi Khadar, Tehsil- Baberu, District- Banda, Gata No. 69/94, 69/95, Part of 69/96 (Khand No.-01)	16.80	3,36,000	5,60,000	2,18,363	3,41,637
110.	Yamuna River	Village-Amedhi Khadar, Tehsil- Baberu, District- Banda, Gata No. 69/94, 69/95, Part of 69/96 (Khand No.-02)	17.50	3,50,000	5,83,333	2,21,398	3,61,935
111.	Yamuna River	Village-Gaura Khadar, Tehsil- Baberu, District- Banda, Gata No. Part of 2/1 (Khand No.-01)	9.00	1,80,000	3,00,000	1,14,142	1,85,858
112.	Yamuna River	Village-Gazipur Khadar, Tehsil- Pailani, District- Banda, Gata No. Part of 138/1	20.00	4,00,000	6,66,666	2,57,564	4,09,102
113.	Yamuna River	Village- Sadimadanpur Tehsil- Pailani, District- Banda, Gata No. 836, 840, 841, 842, 843 & 844	1.068	26,775	44,625	15,258	29,367

Table 9: Details of replenishment study of functional leases in post-monsoon season (2024)

S. No.	Name of Lease	Minable Area after safety Margin (sqm)	Depth up to which sand is available (m)	Replenished Volume of Sand / Morrum (cum)
1	Village – Khaptiha, Tehsil - Pailani Gata No. part of 100 , (khand no. 03)	15187.93	0.25	3,797
		87169.63	1.50	1,30,754
		48621.68	2.50	1,21,554
		1,50,979.24		**2,56,106**
2	Village – Marauli khadar, Tehsil - Banda , Gata No. part of 333/7, (khand no. 05)	177108.09	2.00	354216.18
		40242.77	3.00	120728.31
		2,17,350.86		**4,74,944**
3	Village – Kanwara, Tehsil - Banda Gata No. part of 431, (khand no. 05)	39738.66	1.00	39,739
		103936.01	2.50	2,59,840
		69064.48	2.50	1,72,661
		2495.93	3.00	7,488
		2,15,235.08		**4,79,728**
4	Village – Benda khadar, Tehsil - Banda Gata No. 2/4, 2/23,2/24, 2/28 (khand no. 03)	45462.23	0.75	34,097
		135067.81	2.50	3,37,670
		19465.79	3.00	58,397
		1,99,995.83		**4,30,164**
5	Village – Dandau khadar, Tehsil – Baberu, Gata No. 38, 40, 41, 42, (khand no. 07)	51116.13	0.80	40,893
		55880.70	1.50	83,821
		3560.41	3.00	10,681
		1,10,557.24		**1,35,395**
6	Village – Bahadurpur syoda, Tehsil – Naraini, Gata No. 195/1	127058.68	1.60	2,03,294
		6412.5	3.00	19,238
		1,33,471.18		**2,22,531**
7	Village – Khairai, Tehsil - Pailani Gata No. 2/1, 2/2, 2/4	14408.52	0.60	8,645
		25703.07	3.00	77,109
		9497.90	3.00	28,494
		690.55	3.00	2,072
		50,300.04		**1,16,320**

8	Village – Bariyari, Tehsil - Naraini Gata No. 429, 430	56443.17	1.20	67,732
		62474.01	3.00	1,87,422
		4596.07	3.00	13,788
		1,23,513.25		**2,68,942**
9	Village – Tarsuma, Tehsil – Atarra Gata No. 2/2, 3	3449.14	0.50	1724.57
		10612.11	1.50	15918.165
		9428.18	2.50	23570.45
		23,489.43		**41,213**
10	Village –Mahuta, Tehsil – Atarra Gata No. 876kha, 886ka,etc	176519.820	-	2,23,656
	Block-1	627.520	0.50	314
		1637.240	1.50	2,456
		1993.570	3.00	5,981
		4,258.33		**8,750**
	Block-2	14501.950	0.50	7250.975
		819.000	1.50	1228.5
		15,320.95		**8,479**
	Block-3	1854.370	0.50	927
	Block-4	12421.800	0.50	6,211
		29158.180	1.50	43,737
		21624.760	2.00	43,250
		63,204.74		**93,198**
	Block-5	3896.240	0.50	1,948
		13847.330	1.50	20,771
		10673.070	2.00	21,346
		28,416.64		**44,065**
	Block-6	14541.500	0.50	7,271
		8330.410	1.50	12,496
		4970.800	2.00	9,942
		27,842.71		**29,708**
	Block-7	5874.530	0.50	2,937
		2977.310	1.50	4,466

		8,851.84		**7,403**
	Block-8	5825.770	0.50	2,913
		988.950	1.50	1,483
		6,814.72		**4,396**
	Block-9	4354.580	0.50	2,177
		5583.820	0.50	2,792
		4289.070	1.50	6,434
		3717.570	2.50	9,294
		2010.480	3.00	6,031
		19,955.52		**26,728**
11	Village – Sadikhadar, Tehsil – pailani Gata No. 60	46882.05	1.00	46,882
		87730.02	1.50	1,31,595
		29650.19	2.50	74,125
		4854.37	3.00	14563.11
		1,69,116.63		**2,67,166**
12	Village – Pathri, Tehsil – Banda, Gata No. part of 72/47, part of 74/1 (khand no. 02)	9525.99	0.00	0
		19638.02	0.50	9,819
		27675.7	1.00	27,676
		79913.78	1.50	1,19,871
		42079.18	1.50	63,119
		1411.01	3.00	4,233
		1,80,243.68		**2,24,717**
13	Village – Sadikhadar, Tehsil – pailani Gata No. 04	18241.72	0.50	9,121
		26783.59	1.50	40,175
		39983.65	3.00	1,19,951
		30119.91	3.00	90,360
		3433.35	3.00	10,300
		1,18,562.22		**2,69,907**
14	Village - Khaptiha Kalan, Tehsil - Pailani Gata No. part of 100 (khand no. 02)	39374.36	0.50	19,687
		54263.58	1.50	81,395
		49088.88	2.50	1,22,722
		9519.64	3.00	28,559

		1,52,246.46		**2,52,364**
15	Village - Khaptiha, Tehsil - Pailani Gata No. part of 356 (khand no. 01)	67010.86	0.50	33,505
		28851.80	1.50	43,278
		27450.04	3.00	82,350
		29076.40	3.00	87,229
		1,52,389.10		**2,46,362**
16	Village –Kolawalraypur, Tehsil – Naraini, Gata No. 04	45527.06	1.00	45,527
		43735.12	2.00	87,470
		3885.97	3.00	11,658
		93,148.15		**1,44,655**

11.0 LEASE WISE DESCRIPTION OF RESOURCE ESTIMATION STUDY FOR LEASES OPERATIONAL IN YEAR 2023-24:

Lease-01

The mining site is situated on the river bank of Ken at Gata No. Part of 100 (Khand no. 03), is having an area of 16.0 Ha Village- Khaptiha Kala, Tehsil-Pailani, District- Banda, U.P, The co-ordinates of Mining lease area are:

Pillar No.	Latitude	Longitude
A	25° 40' 32.640" N	80° 21' 40.400" E
A’	25° 40' 33.840" N	80° 21' 54.730" E
B	25° 40' 36.120" N	80° 22' 6.060" E
C	25° 40' 28.470" N	80° 22' 9.080" E
D	25° 40' 27.830" N	80° 21' 39.120" E

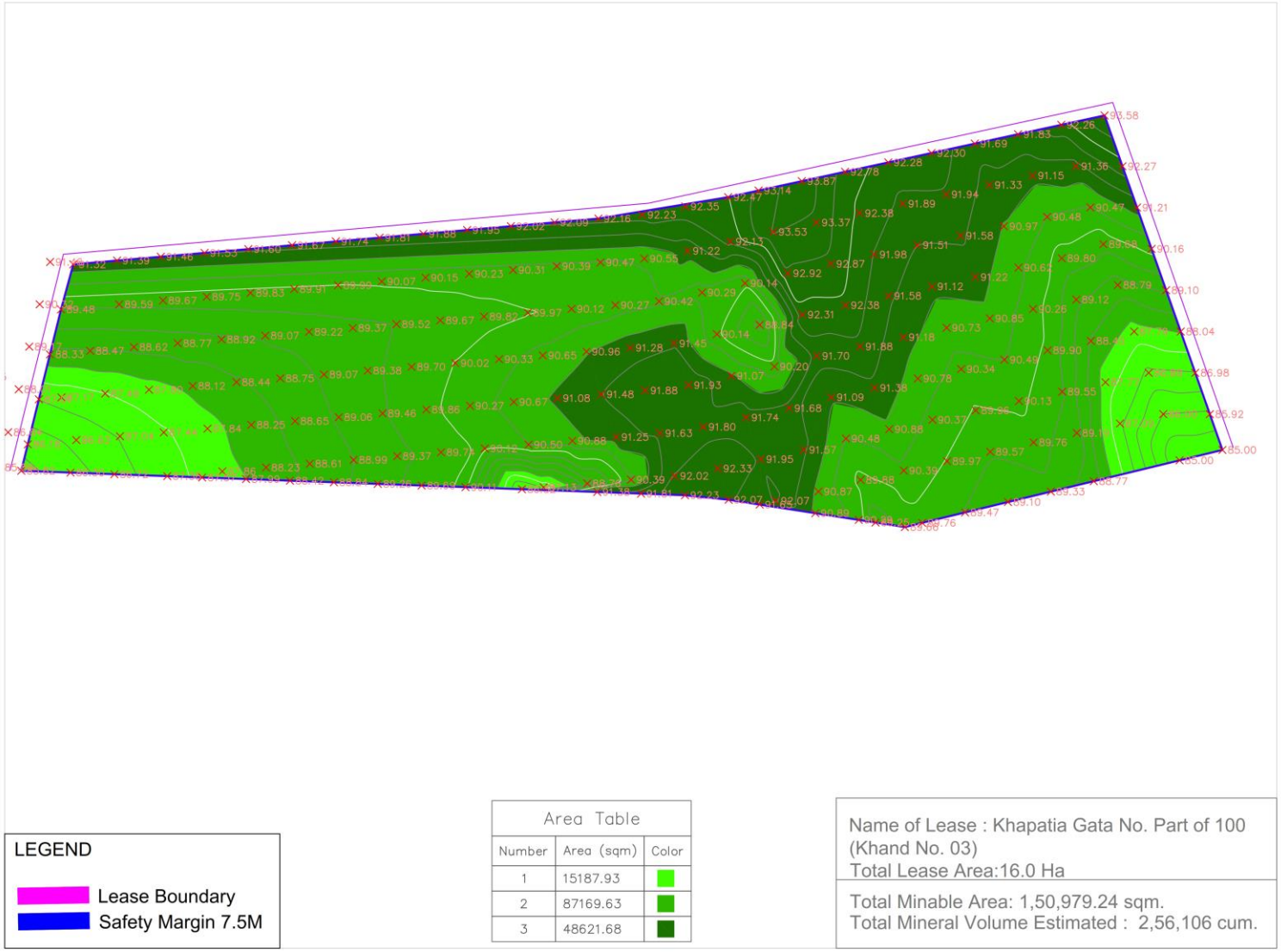
Physiography & Drainage

Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology. The lease area is in the river bed and government barren land. The river bed is mostly dried, undefined stream track with break in sand bed. The area surrounding the lease is mostly agricultural land.

Estimation of Replenishment sand

The lease area has an area of 16.0 ha (1,60,000 sqm) and the minable area less safety margin of 7.5 m offset from 3 sides is 1,50,979.24 sqm. 3797 cum Sand was deposited up to a depth of 0.25 m in 15,187.93 sqm area,while 1,30,754 cum sand was replenished up to 0.50 m in 87,169.63 sqm. 1,21,554 cum sand was accumulated up to a depth of 2.50 m in 48621.68 sqm area.The volume of total sand replenished in the lease are in pre-monsoon season (2024) was 2,56,106 cum.

Area (sqm)	Depth (m)	Volume of sand replenished in cum
15187.93	0.25	3,797
87169.63	1.50	1,30,754
48621.68	2.50	1,21,554
1,50,979.24		**2,56,106**


LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number | Area (sqm) | Color
1 | 15187.93
2 | 87169.63
3 | 48621.68
Name of Lease : Khapatia Gata No. Part of 100 (Khand No. 03)
Total Lease Area:16.0 Ha
Total Minable Area: 1,50,979.24 sqm.
Total Mineral Volume Estimated : 2,56,106 cum.

Lease-02

The mining site is situated on the river bank of Ken at Gata part of 333/7 (Khand No. 05) is having an area of 23.0 Ha Village- Marauli Khadar, Tehsil- Banda, District- Banda, U.P, The co-ordinates of Mining lease area are:

Pillar No.	Latitude	Longitude
A	25° 33' 58.580" N	80° 17' 56.230" E
B	25° 34' 9.450" N	80° 17' 58.680" E
C	25° 34' 1.800" N	80° 18' 21.400" E
D	25° 33' 50.170" N	80° 18' 18.280" E

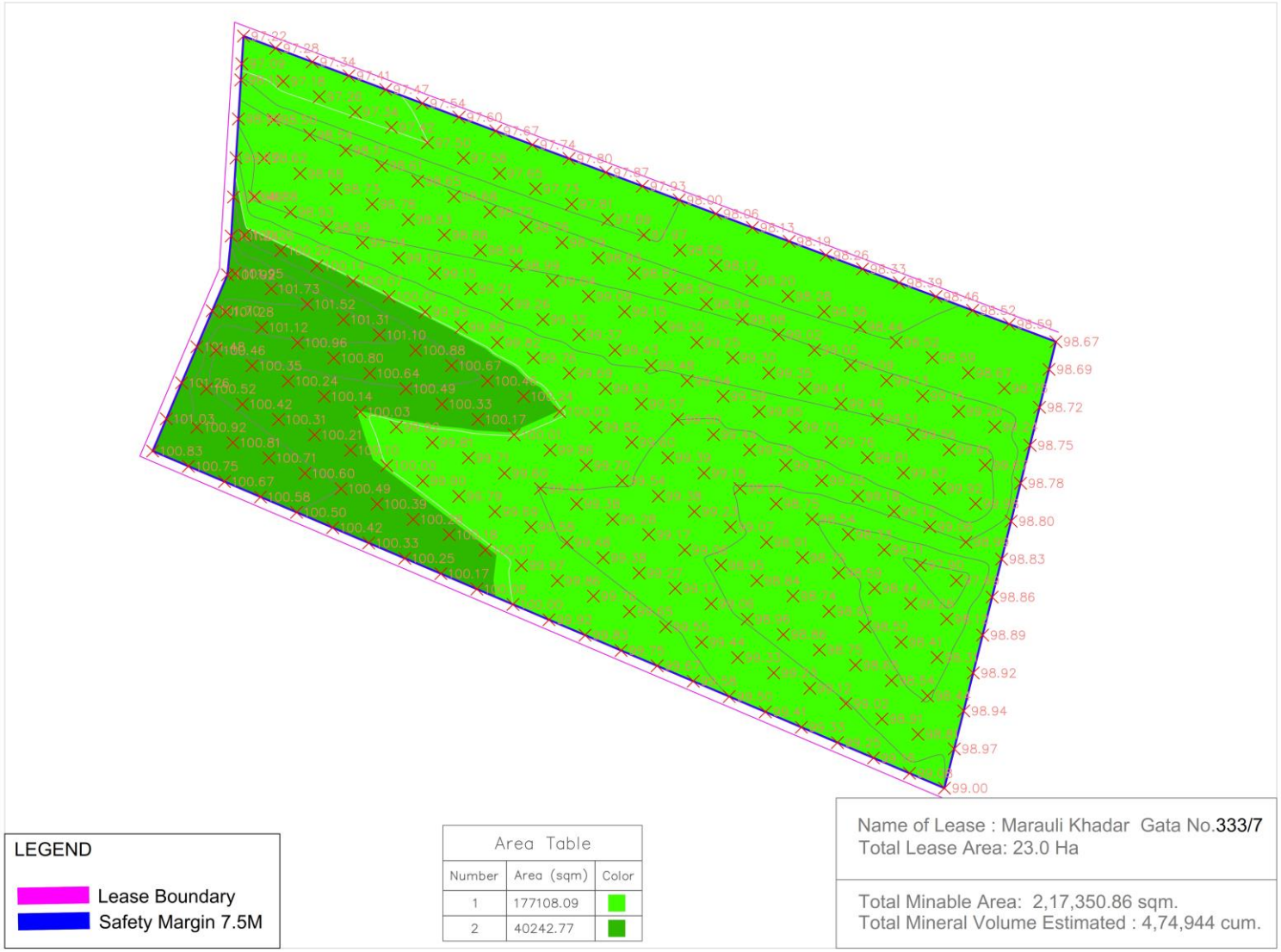
Physiography & Drainage

The lease area is in the river bed and government barren land. Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology.The river bed is eroded and converted into ravines. The area surrounding the lease is mostly agricultural land.

Estimation of Replenishment sand

The lease area has an area of 23.0 ha (2,30,000 sqm) and the minable area less safety margin of 7.5 m offset from 3 sides is 2,17,350.86 sqm. 354216.18 cum Sand was deposited up to a depth of 2.0 m in 177108.09 sqm area, while 120728.31 cum sand was accumulated up to a depth of 3.0 m in 40242.77 sqm area.The volume of total sand replenished in the lease are in pre-monsoon season (2024) was 4,74,944 cum.

Area (sqm)	Depth (m)	Volume of sand replenished in cum
177108.09	2.00	354216.18
40242.77	3.00	120728.31
2,17,350.86		4,74,944


LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number | Area (sqm) | Color
1 | 177108.09
2 | 40242.77
Name of Lease : Marauli Khadar Gata No.333/7
Total Lease Area: 23.0 Ha
Total Minable Area: 2,17,350.86 sqm.
Total Mineral Volume Estimated : 4,74,944 cum.

Lease-03

The mining site is situated on the river bank of Ken at Gata 431/1, (Khand No. 05) is having an area of 23.0 Ha, Village- Kanwara, Tehsil-Banda, District- Banda, U.P, The co-ordinates of Mining lease area are:

Pillar No.	Latitude	Longitude
A	25° 30' 51.500" N	80° 17' 26.850" E
B	25° 30' 43.020" N	80° 17' 16.250" E
C	25° 30' 35.340" N	80° 17' 30.180" E
D	25° 30' 38.100" N	80° 17' 34.980" E
E	25° 30' 33.960" N	80° 17' 51.680" E
F	25° 30' 35.700" N	80° 17' 50.280" E
G	25° 30' 37.670" N	80° 17' 48.450" E

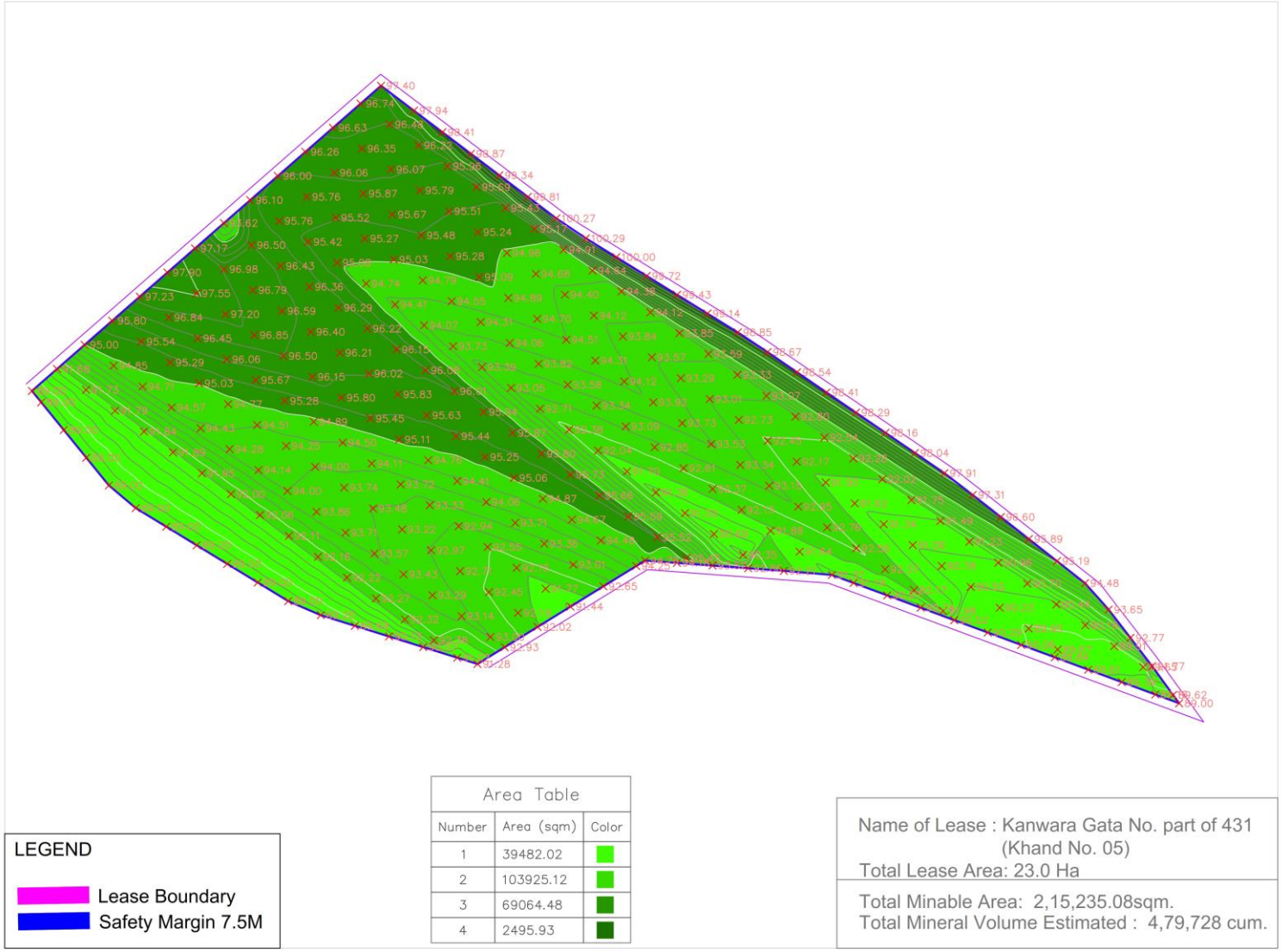
Physiography & Drainage

The river bed is mostly dried, undefined stream track with break and alluvium overlies in varying degree of thickness. The area surrounding the lease is mostly agricultural land.The lease area is in the river bed and government barren land. Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology.

Estimation of Replenishment sand

The lease area has an area of 23.0 ha (2,30,000 sqm) and the minable area less safety margin of 7.5 m offset from 3 sides is 2,15,235.08 sqm. 39,739 cum Sand was deposited up to a depth of 1.0 m in 39738.66 sqm area, while 173000.49 cum sand was accumulated up to a depth of 2.5 m in 432,501 sqm area. 7,488 cum sand was collected in pre monsoon season upto a depth of 3.0 m in 2495.93 sqm.The volume of total sand replenished in the lease are in pre-monsoon season (2024) was 4,79,728cum.

Area (sqm)	Depth (m)	Volume of sand replenished in cum
39738.66	1.00	39,739
103936.01	2.50	2,59,840
69064.48	2.50	1,72,661
2495.93	3.00	7,488
2,15,235.08		4,79,728


LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number | Area (sqm) | Color
1 | 39482.02
2 | 103925.12
3 | 69064.48
4 | 2495.93
Name of Lease : Kanwara Gata No. part of 431 (Khand No. 05)
Total Lease Area: 23.0 Ha
Total Minable Area: 2,15,235.08sqm.
Total Mineral Volume Estimated : 4,79,728 cum.

Lease-04

The mining site is situated on the river bank of Yamuna at Gata 2/4, 2/23, 2/24, 2/28 (Khand No. 03). is having an area of 21.00 Ha Village- Bendakhadar, Tehsil-Banda, District- Banda, U.P, The co-ordinates of Mining lease area are:

Pillar No.	Latitude	Longitude
A	25° 42' 14.340" N	80° 37' 27.180" E
B	25° 42' 10.540" N	80° 37' 47.890" E
C	25° 42' 23.040" N	80° 37' 50.750" E
D	25° 42' 23.040" N	80° 37' 29.520" E

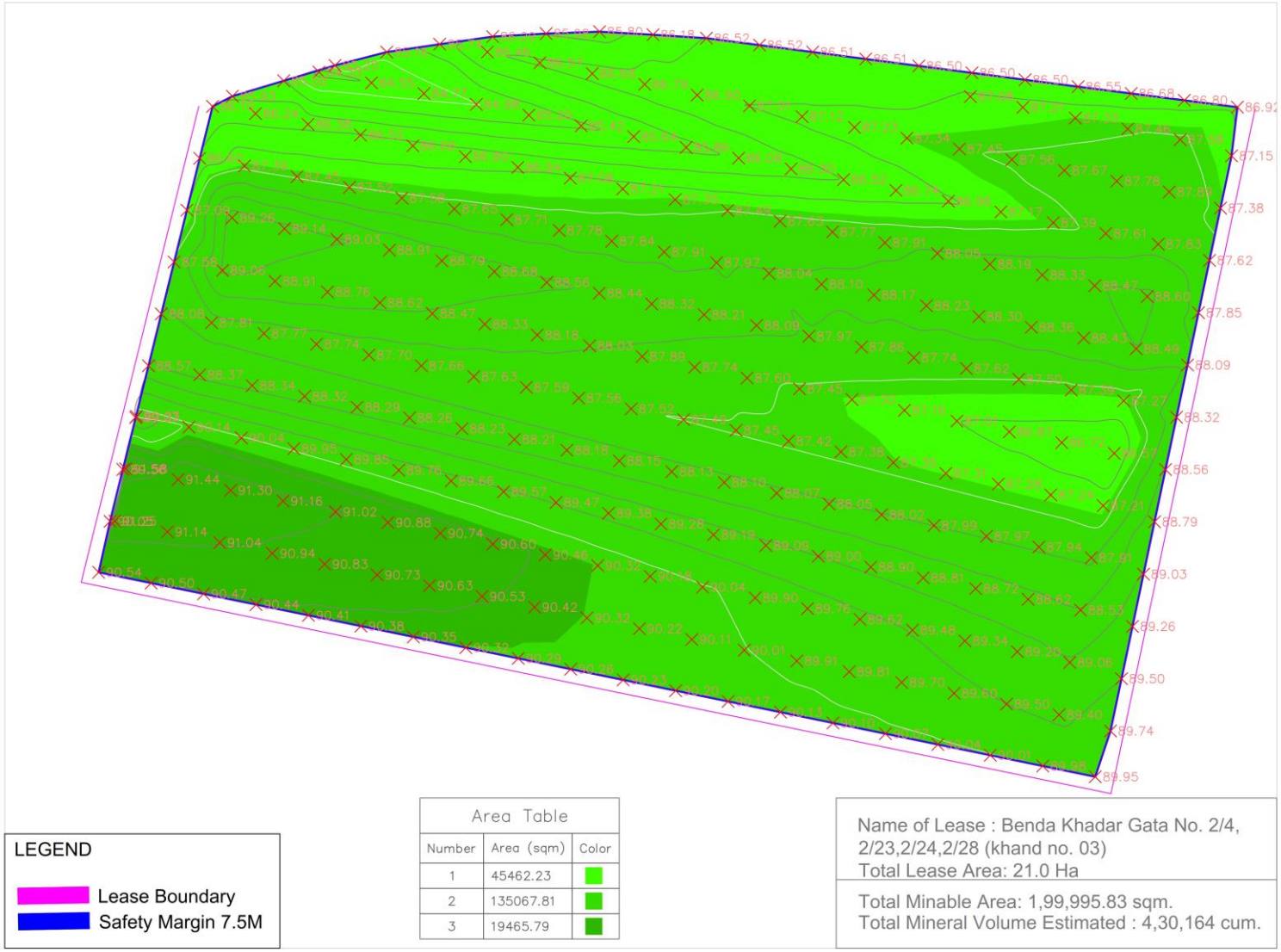
Physiography & Drainage

Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology, the alluvium thickness is more in river bed. The river bed is flanked with unsightly ravines due to corrosive action. The area surrounding the lease is mostly agricultural land.The lease area is in the river bed and government barren land.

Estimation of Replenishment sand

The lease area has an area of 21.0 ha (210,000 sqm) and the minable area less safety margin of 7.5 m offset from 3 sides is 1,99,995.83 sqm. 45,462.23 cum Sand was deposited up to a depth of 0.75 m in 34,097 sqm area, while 1,35,067.81 cum sand was accumulated up to a depth of 2.5 m in 3,37,670 sqm area. 19465.79 cum sand was collected in pre monsoon season upto a depth of 3.0 m in 58,397 sqm.The volume of total sand replenished in the lease are in pre-monsoon season (2024) was 4,30,164 cum.

Area (sqm)	Depth (m)	Volume of sand replenished in cum
45462.23	0.75	34,097
135067.81	2.50	3,37,670
19465.79	3.00	58,397
1,99,995.83		4,30,164


LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number | Area (sqm) | Color
1 | 45462.23
2 | 135067.81
3 | 19465.79
Name of Lease : Benda Khadar Gata No. 2/4, 2/23,2/24,2/28 (khand no. 03)
Total Lease Area: 21.0 Ha
Total Minable Area: 1,99,995.83 sqm.
Total Mineral Volume Estimated : 4,30,164 cum.

Lease-05

The mining site is situated on the river bank of Yamuna at Gata No. 38, 40, 41, 42, (khand no. 07). is having an area of 12.00 Ha Village- Dandau khadar, Tehsil-Baberu, District-Banda, U.P, The co-ordinates of Mining lease area are:

Pillar No.	Latitude	Longitude
A	25° 37' 39.200" N	81° 1' 16.700" E
B	25° 37' 56.050" N	81° 1' 17.100" E
C	25° 37' 56.820" N	81° 1' 28.160" E
D	25° 37' 37.760" N	81° 1' 20.940" E
E	25° 37' 38.030" N	81° 1' 19.510" E
F	25° 37' 38.590" N	81° 1' 19.620" E

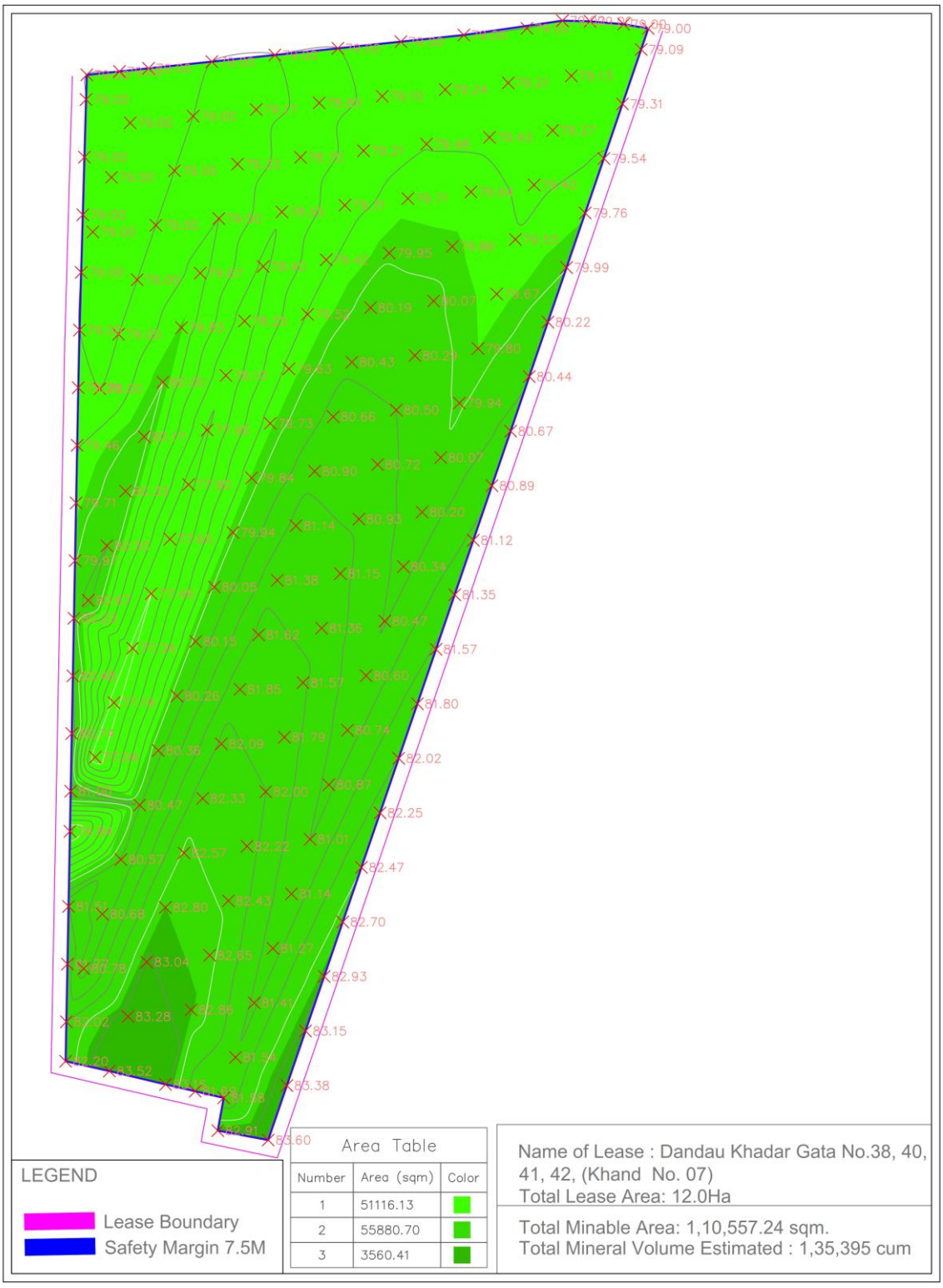
Physiography & Drainage

Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology. There is fair alluvial soil and river turns in a concave down shape and is accumulating sand. The alluvium thickness is more in river bed. The river bed is flanked with unsightly ravines due to corrosive action. The area surrounding the lease is mostly agricultural land.The lease area is in the river bed and government barren land

Estimation of Replenishment sand

The lease area has an area of 12. 0 ha (120,000 sqm) and the minable area less safety margin of 7.5 m offset from 3 sides is 1,10,557.24 sqm. 40,893 cum Sand was deposited up to a depth of 0.80 m in 51116.13 sqm area, while 83,821 cum sand was accumulated up to a depth of 1.5 m in 55880.70 sqm area. 10,681 cum sand was collected in pre monsoon season upto a depth of 3.0 m in 3560.41 sqm.The volume of total sand replenished in the lease are in pre-monsoon season (2024) was 1,35.395 cum.

Area (sqm)	Depth (m)	Volume of sand replenished in cum
51116.13	0.80	40,893
55880.70	1.50	83,821
3560.41	3.00	10,681
1,10,557.24		1,35.395


LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number | Area (sqm) | Color
1 | 51116.13
2 | 55880.70
3 | 3560.41
Name of Lease : Dandau Khadar Gata No.38, 40, 41, 42, (Khand No. 07)
Total Lease Area: 12.0Ha
Total Minable Area: 1,10,557.24 sqm.
Total Mineral Volume Estimated : 1,35,395 cum

Lease-06

The mining site is situated on the river bank of Ken at Gata No. 195/1, Village- Bahadurpur Syodha, Tehsil-Naraini, District- Banda, U.P.is having an area of 14.3850 Ha, The co-ordinates of Mining lease area are:

Pillar No.	Latitude	Longitude
A	25° 18' 24.500" N	80° 19' 14.600" E
B	25° 18' 24.770" N	80° 19' 15.160" E
C	25° 18' 16.870" N	80° 19' 10.690" E
D	25° 18' 15.000" N	80° 19' 8.800" E
E	25° 18' 1.500" N	80° 18' 54.400" E
F	25° 17' 58.600" N	80° 18' 53.300" E
G	25° 17' 53.600" N	80° 18' 49.700" E
H	25° 17' 55.400" N	80° 18' 45.800" E
I	25° 18' 9.800" N	80° 18' 57.000" E

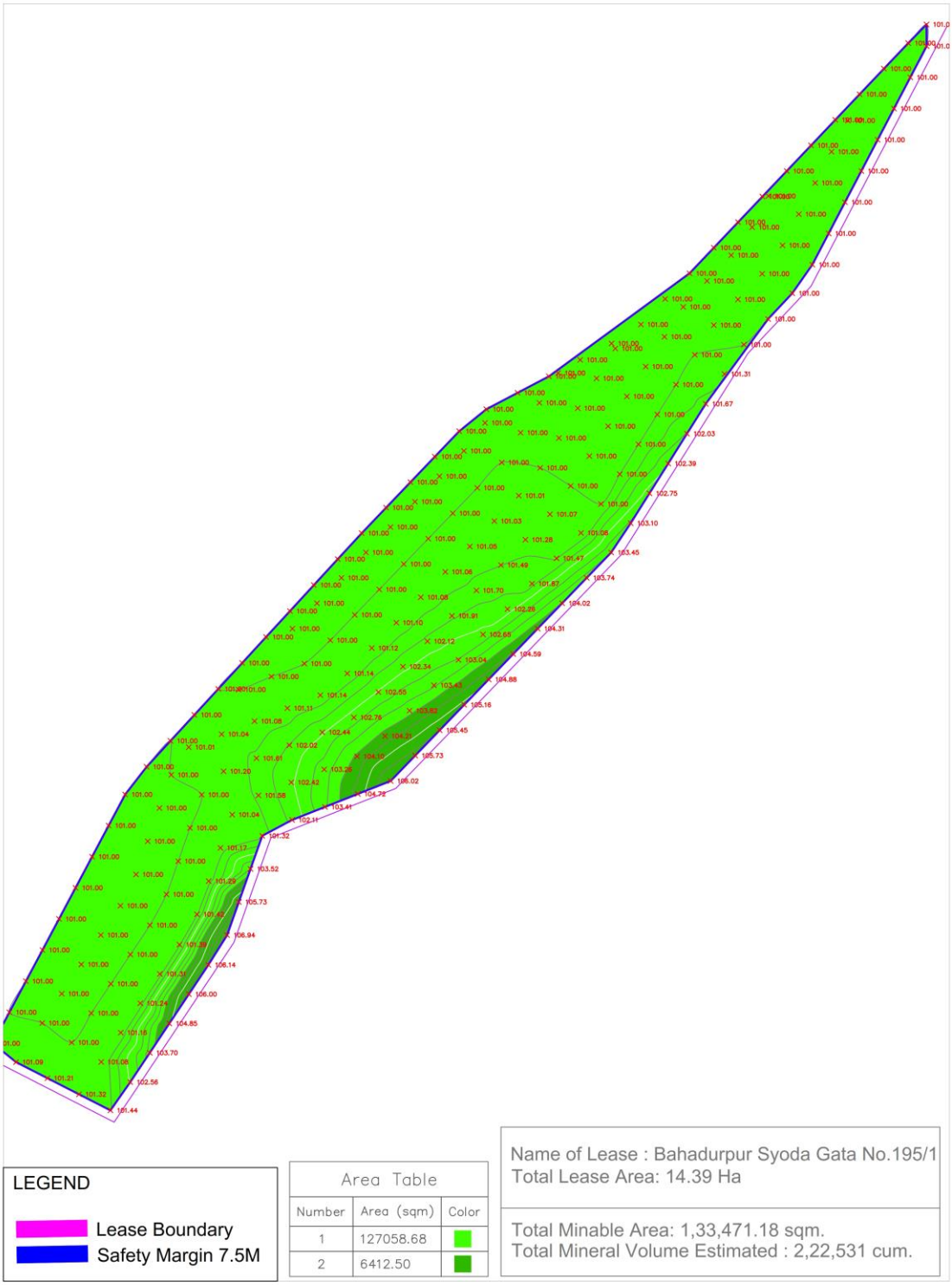
Physiography & Drainage

Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology, the alluvium thickness is more in river bed. The river bed is generally undulating and cut up by streams which flow into Ken. The area surrounding the lease is mostly agricultural land.The lease area is in the river bed and government barren land.

Estimation of Replenishment sand

The lease area has an area of 14.3850 ha (143850 sqm) and the minable area less safety margin of 7.5 m offset from 3 sides is 1,33,471.18 sqm. 2,03,294 cum Sand was deposited up to a depth of 1.60 m in 127058.68 sqm area, while 19,238 cum sand was accumulated up to a depth of 3.0 m in 6412.5 sqm area. .The volume of total sand replenished in the lease are in pre-monsoon season (2024) was 1,35.395 cum.

Area (sqm)	Depth (m)	Volume of sand replenished in cum
127058.68	1.60	2,03,294
6412.5	3.00	19,238
1,33,471.18		1,35.395


LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number
Area (sqm)
Color
1
127058.68
2
6412.50
Name of Lease : Bahadurpur Syoda Gata No.195/1
Total Lease Area: 14.39 Ha
Total Minable Area: 1,33,471.18 sqm.
Total Mineral Volume Estimated : 2,22,531 cum.

Lease-07

The mining site is situated on the river bank of Ken at Gata No. 2/1, 2/2, 2/4 is having an area of 5.80 Ha Village- Khairai, Tehsil-Pailani, District- Banda, U.P, The co-ordinates of Mining lease area are:

Co-ordinates of Mining lease at Village – Khairai

Pillar No.	Latitude	Longitude
A	25° 42' 5.030" N	80° 20' 38.150" E
B	25° 41' 35.870" N	80° 20' 43.790" E
C	25° 41' 40.500" N	80° 20' 43.990" E
D	25° 42' 3.560" N	80° 20' 42.080" E
E	25° 42' 6.040" N	80° 20' 42.990" E
F	25° 42' 6.480" N	80° 20' 41.970" E

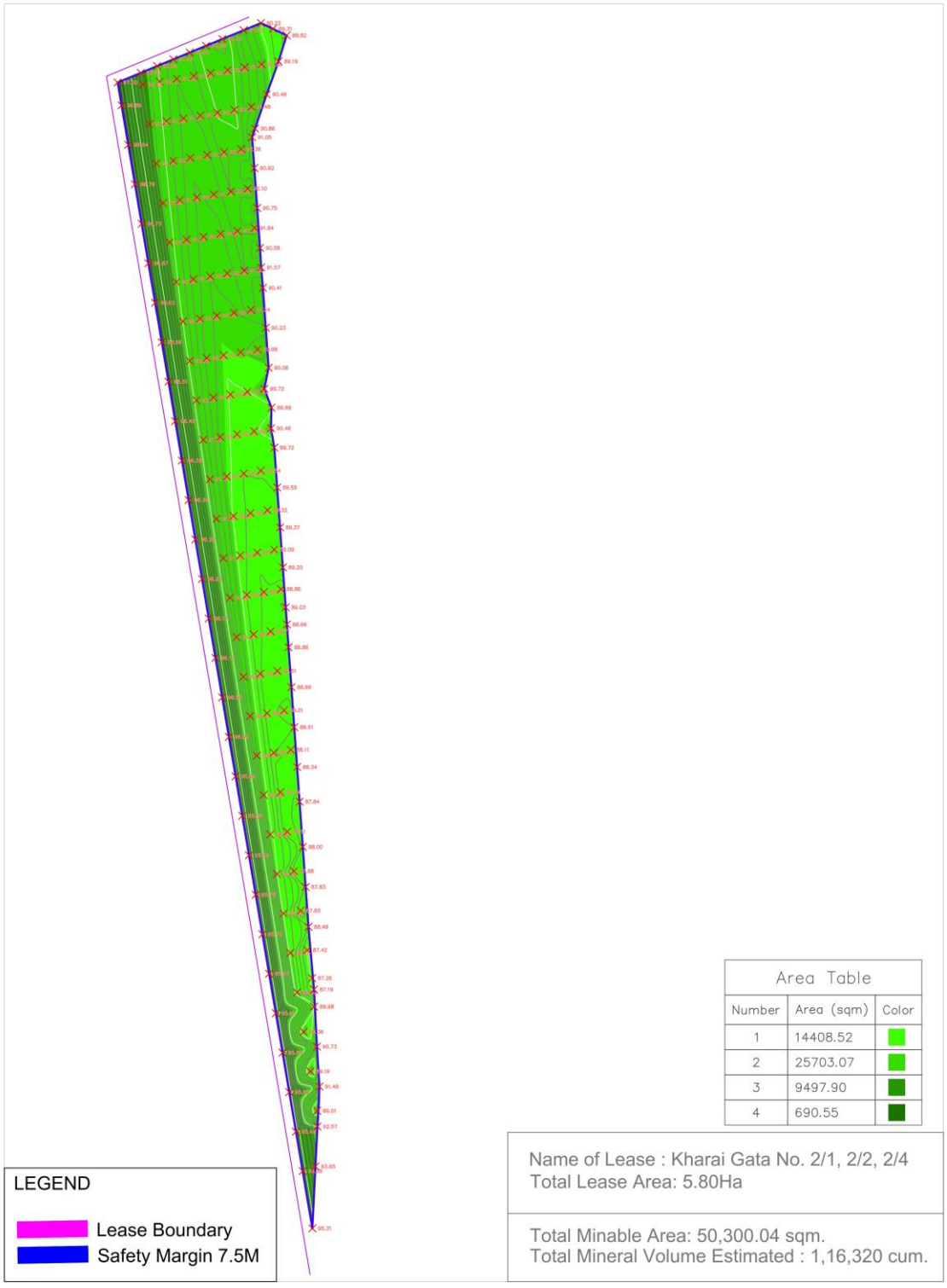
Physiography & Drainage

Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology, the alluvium thickness is more in river bed. The river bed is flanked with unsightly ravines due to corrosive action. The area surrounding the lease is mostly agricultural land.The lease area is in the river bed and government barren land.

Estimation of Replenishment sand

The lease area has an area of 5.80ha (58,000 sqm) and the minable area less safety margin of 7.5 m offset from 3 sides is 50,300.04 sqm. 8,645 cum Sand was deposited up to a depth of 0.60 m in 14408.52 sqm area, while 107675 cum sand was collected in pre monsoon season upto a depth of 3.0 m in 35,891.52 sqm.The volume of total sand replenished in the lease are in pre-monsoon season (2024) was 1,16,320 cum.

Area (sqm)	Depth (m)	Volume of sand replenished in cum
14408.52	0.60	8,645
25703.07	3.00	77,109
9497.90	3.00	28,494
690.55	3.00	2,072
50,300.04		1,16,320


LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number | Area (sqm) | Color
1 | 14408.52
2 | 25703.07
3 | 9497.90
4 | 690.55
Name of Lease : Kharai Gata No. 2/1, 2/2, 2/4
Total Lease Area: 5.80Ha
Total Minable Area: 50,300.04 sqm.
Total Mineral Volume Estimated : 1,16,320 cum.

Lease-08

The mining site is situated on the river bank of Ken at Gata No. 429, 430, Village-Bariyari, Tehsil-Naraini, District- Banda, U.P.is having an area of 13.3620 Ha, The co-ordinates of Mining lease area are:

Co-ordinates of Mining lease at Village – Bariyari

Pillar No.	Latitude	Longitude
A	25° 14' 40.080" N	80° 22' 40.320" E
B	25° 14' 20.490" N	80° 23' 1.320" E
C	25° 14' 18.330" N	80° 23' 9.540" E
D	25° 14' 16.950" N	80° 23' 13.310" E
E	25° 14' 19.500" N	80° 23' 16.550" E
F	25° 14' 21.150" N	80° 23' 17.970" E
G	25° 14' 32.900" N	80° 23' 25.900" E
H	25° 14' 30.930" N	80° 23' 25.560" E
I	25° 14' 21.550" N	80° 23' 20.690" E
J	25° 14' 21.420" N	80° 23' 19.540" E
K	25° 14' 19.810" N	80° 23' 19.410" E
L	25° 14' 18.960" N	80° 23' 16.340" E
M	25° 14' 16.070" N	80° 23' 7.100" E
N	25° 14' 35.340" N	80° 22' 35.400" E

Physiography & Drainage

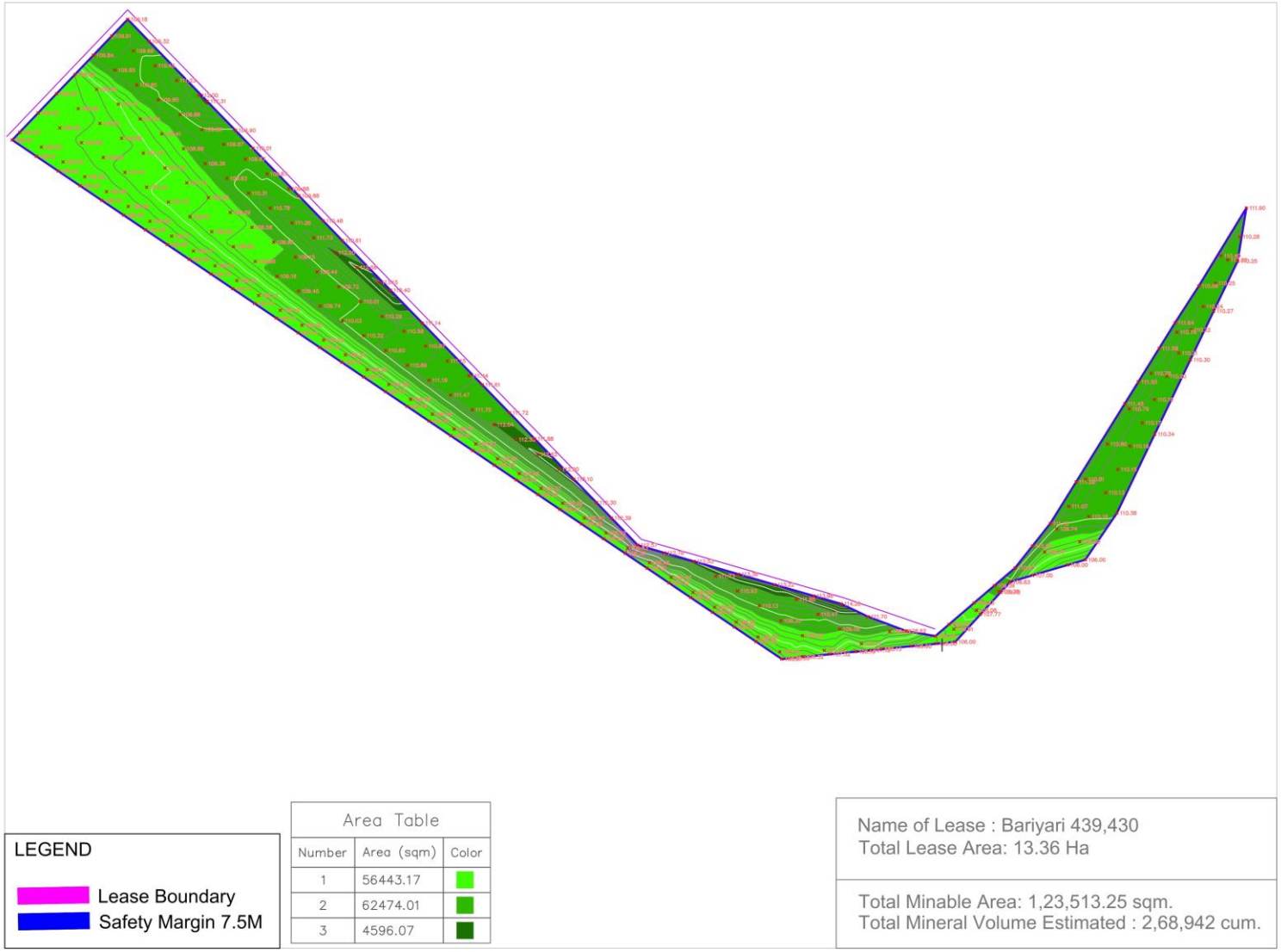
Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology, the alluvium thickness is more in river bed. The river bed is flanked with unsightly ravines due to corrosive action. The area surrounding the lease is mostly agricultural land.The lease area is in the river bed and government barren land.

Estimation of Replenishment sand

The lease area has an area of 13.3620 ha (133,620 sqm) and the minable area less safety margin of 7.5 m offset from 3 sides is **1,23,513.25** sqm. 67,732 cum Sand was deposited up to a depth of 1.20 m in 56443.17 sqm area, while 13,778 cum sand was accumulated up to a depth of 3.0 m in pre monsoon season. The volume of total sand replenished in the lease are in pre-monsoon season (2024) was **2,68,942** cum.

Area	Depth	Volume of sand

(sqm)	(m)	replenished in cum
56443.17	1.20	67,732
62474.01	3.00	1,87,422
4596.07	3.00	13,788
1,23,513.25		**2,68,942**


LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number | Area (sqm) | Color
1 | 56443.17
2 | 62474.01
3 | 4596.07
Name of Lease : Bariyari 439,430
Total Lease Area: 13.36 Ha
Total Minable Area: 1,23,513.25 sqm.
Total Mineral Volume Estimated : 2,68,942 cum.

Lease-09

The mining site is situated on the river bank of Baghain at Gata No. 2/2, 3, Village-Tarsuma, Tehsil-Atarra, District- Banda, U.P.is having an area of 3.11Ha, The co-ordinates of Mining lease area are:

Pillar No.	Latitude	Longitude
A	25° 13' 25.350" N	80° 38' 17.160" E
B	25° 13' 25.220" N	80° 38' 8.470" E
C	25° 13' 22.080" N	80° 38' 1.410" E
D	25° 13' 14.220" N	80° 37' 52.550" E
E	25° 13' 12.460" N	80° 37' 50.190" E
F	25° 13' 10.480" N	80° 37' 43.610" E
G	25° 13' 10.930" N	80° 37' 43.670" E
H	25° 13' 11.750" N	80° 37' 46.630" E
H1	25° 13' 15.480" N	80° 37' 52.690" E
I	25° 13' 17.420" N	80° 37' 54.480" E
J	25° 13' 18.330" N	80° 37' 56.370" E
K	25° 13' 23.500" N	80° 38' 1.000" E
L	25° 13' 26.270" N	80° 38' 6.010" E
M	25° 13' 27.410" N	80° 38' 12.620" E

Physiography & Drainage

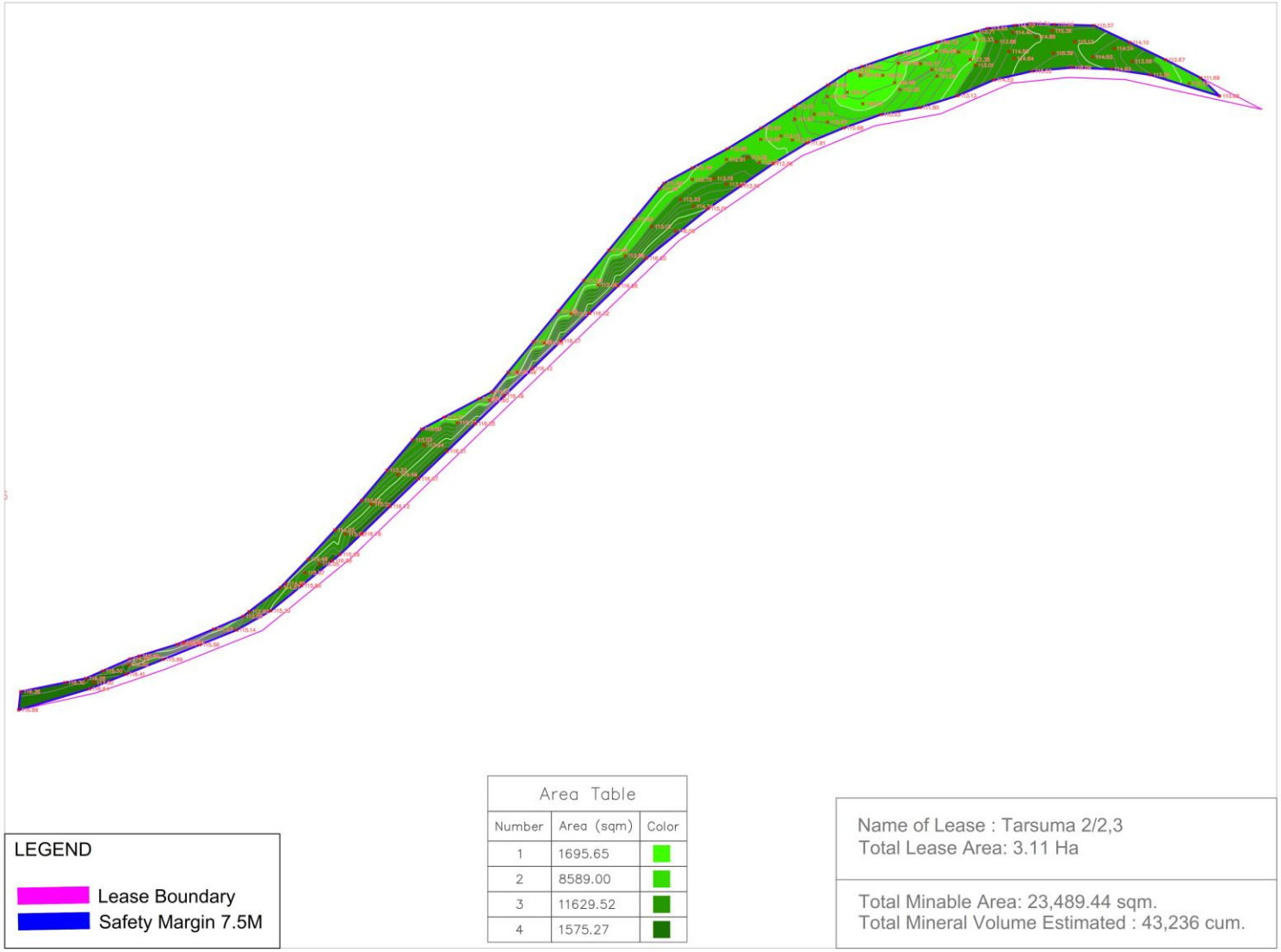
Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology, the alluvium thickness is more in river bed. The river bed is flanked with unsightly ravines due to corrosive action. The area surrounding the lease is mostly agricultural land.The lease area is in the river bed and government barren land.

Estimation of Replenishment sand

The lease area has an area of 3.11 ha (31,100 sqm) and the minable area less safety margin of 7.5 m offset from 3 sides is **23,489.43** sqm. 1724.57 cum Sand was deposited up to a depth of 0.50 m in 3449.14 sqm area, while 15918.165 cum sand was accumulated up to a depth of 1.5 m in 15918.165 sqm area. 23570.45 cum sand was collected in pre monsoon

season upto a depth of 2.50 m in 9428.18 sqm.The volume of total sand replenished in the lease are in pre-monsoon season (2024) was **41,213** cum.

Area (sqm)	Depth (m)	Volume of sand replenished in cum
3449.14	0.50	1724.57
10612.11	1.50	15918.165
9428.18	2.50	23570.45
23,489.43		**41,213**


LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number | Area (sqm) | Color
1 | 1695.65
2 | 8589.00
3 | 11629.52
4 | 1575.27
Name of Lease : Tarsuma 2/2,3
Total Lease Area: 3.11 Ha
Total Minable Area: 23,489.44 sqm.
Total Mineral Volume Estimated : 43,236 cum.

Lease-10

The mining site is situated on the river bank of Baghain at Gata No. 876kha, 886ka, Village- Mahuta, Tehsil-Atrra, District- Banda, U.P is s having an area of 21.00 Ha (Block 1, Block 2, Block 3, Block 4, Block 5, Block 6, Block 7, Block 8, Block 9), The co-ordinates of Mining lease area are:

Block-1

Pillar No.	Latitude	Longitude
A	25° 13' 16.610" N	80° 37' 42.510" E
B	25° 13' 13.530" N	80° 37' 45.410" E
C	25° 13' 14.360" N	80° 37' 40.270" E

Block-2

Pillar No.	Latitude	Longitude
D	25° 13' 12.290" N	80° 37' 43.480" E
E	25° 13' 11.710" N	80° 37' 42.960" E
F	25° 13' 14.850" N	80° 37' 29.740" E
G	25° 13' 9.750" N	80° 37' 26.940" E
H	25° 13' 10.290" N	80° 37' 25.630" E
I	25° 13' 16.350" N	80° 37' 29.090" E

Block-3

Pillar No.	Latitude	Longitude
J	25° 13' 12.400" N	80° 37' 25.080" E
K	25° 13' 8.530" N	80° 37' 25.340" E
L	25° 13' 10.130" N	80° 37' 24.240" E

Block-4

Pillar No.	Latitude	Longitude
M	25° 13' 3.120" N	80° 37' 8.890" E
N	25° 13' 2.200" N	80° 37' 8.670" E
O	25° 12' 59.150" N	80° 37' 0.740" E
P	25° 12' 35.600" N	80° 37' 10.350" E
Q	25° 12' 32.000" N	80° 37' 8.270" E
R	25° 12' 32.400" N	80° 37' 7.690" E
S	25° 12' 46.260" N	80° 37' 4.120" E
T	25° 12' 56.820" N	80° 36' 56.410" E

Block-5

Pillar No.	Latitude	Longitude
U	25° 12' 41.350" N	80° 37' 5.170" E
V	25° 12' 41.660" N	80° 37' 5.950" E
W	25° 12' 32.990" N	80° 37' 7.120" E
X	25° 12' 33.390" N	80° 36' 59.340" E

Block-6

Pillar No.	Latitude	Longitude
Y	25° 12' 35.390" N	80° 36' 46.260" E
Z	25° 12' 38.570" N	80° 36' 33.570" E
AA	25° 12' 33.360" N	80° 36' 21.220" E
AB	25° 12' 41.350" N	80° 36' 30.070" E

Block-7

Pillar No.	Latitude	Longitude
AC	25° 12' 33.270" N	80° 36' 18.530" E
AD	25° 12' 29.850" N	80° 36' 18.950" E
AE	25° 12' 28.010" N	80° 36' 11.950" E

Block-8

Pillar No.	Latitude	Longitude
AF	25° 12' 26.190" N	80° 36' 13.010" E
AG	25° 12' 21.640" N	80° 35' 58.340" E
AH	25° 12' 23.700" N	80° 36' 0.360" E

Block-9

Pillar No.	Latitude	Longitude
AI	25° 12' 32.510" N	80° 36' 2.770" E
AJ	25° 12' 29.340" N	80° 36' 4.320" E
AK	25° 12' 26.820" N	80° 36' 4.330" E
AL	25° 12' 24.530" N	80° 35' 59.510" E
AM	25° 12' 25.030" N	80° 35' 57.760" E
AN	25° 12' 28.150" N	80° 35' 59.560" E
AO	25° 12' 30.410" N	80° 36' 0.090" E
AP	25° 12' 30.080" N	80° 36' 1.100" E

AQ	25° 12' 31.710" N	80° 36' 2.190" E
AR	25° 12' 32.060" N	80° 36' 1.660" E

Physiography & Drainage

Lease and adjoining area is intersected by numerous rivers and nalas. The river bed is flanked with unsightly ravines due to corrosive action. The area surrounding the lease is mostly agricultural land.The lease area is in the river bed and government barren land. The alluvium is disintegrated sandstone overlying a substratum of rock and not very deep.

Estimation of Replenishment sand

The lease area has an area of 21.0 ha (210,000 sqm) and the minable area less safety margin of 7.5 m offset from 3 sides is **1,76,519.82** sqm.

In Block-1, area of mining is **4,258.33** sqm and **8,750** cum sand is available for mining. 314 cum sand was deposited in 627.52 sqm upto the depth of 0.5 m while 2,456 cum Sand was accumulated up to a depth of 1.50 m in 16,37.24 sqm area. 5,981 cum sand was collected in pre-monsoon season upto a depth of 3.0 m in 1993.57 sqm.

In Block-2, area of mining is **15,320.95** sqm and **8,479** cum sand is available for mining. 14,501.95 cum sand was deposited in 7,250.975 sqm upto the depth of 0.5 m while 1,228.5 cum Sand was accumulated up to a depth of 1.50 m in 819 sqm area.

In Block-3, area of mining is **1854.370** sqm and **927** cum sand is available for mining up to the depth of 0.5 m.

In Block-4, area of mining is **63,204.74** sqm and **93,198** cum sand is available for mining. 6,211 cum sand was deposited in 12,421.8 sqm upto the depth of 0.5 m while 43,737 cum sand was accumulated up to a depth of 1.50 m in 29,158.18 sqm area. 43,250 cum sand was collected in pre-monsoon season upto a depth of 2.0 m in 21,624.76sqm.

In Block-5, area of mining is **28,416.64** sqm and **44,065** cum sand is available for mining. 1,948 cum sand was deposited in 3,896.24 sqm upto the depth of 0.5 m while 20,771 cum sand was accumulated up to a depth of 1.50 m in 13,847.33 sqm area. 21,346 cum sand was collected in pre-monsoon season upto a depth of 2.0 m in 10,673.07 sqm.

In Block-6, area of mining is **27,842.71** sqm and **29,708** cum sand is available for mining. 7,271 cum sand was deposited in 14,541.5 sqm upto the depth of 0.5 m while 12,496 cum sand was accumulated up to a depth of 1.50 m in 8,330.41 sqm area. 4,970.8 cum sand was collected in pre-monsoon season upto a depth of 2.0 m in 9,942 sqm.

In Block-7, area of mining is **8,851.84** sqm and **7,403** cum sand is available for mining. 2,937 cum sand was deposited in 5,874.53 sqm upto the depth of 0.5 m while 4,466 cum Sand was accumulated up to a depth of 1.50 m in 2,977.31 sqm area.

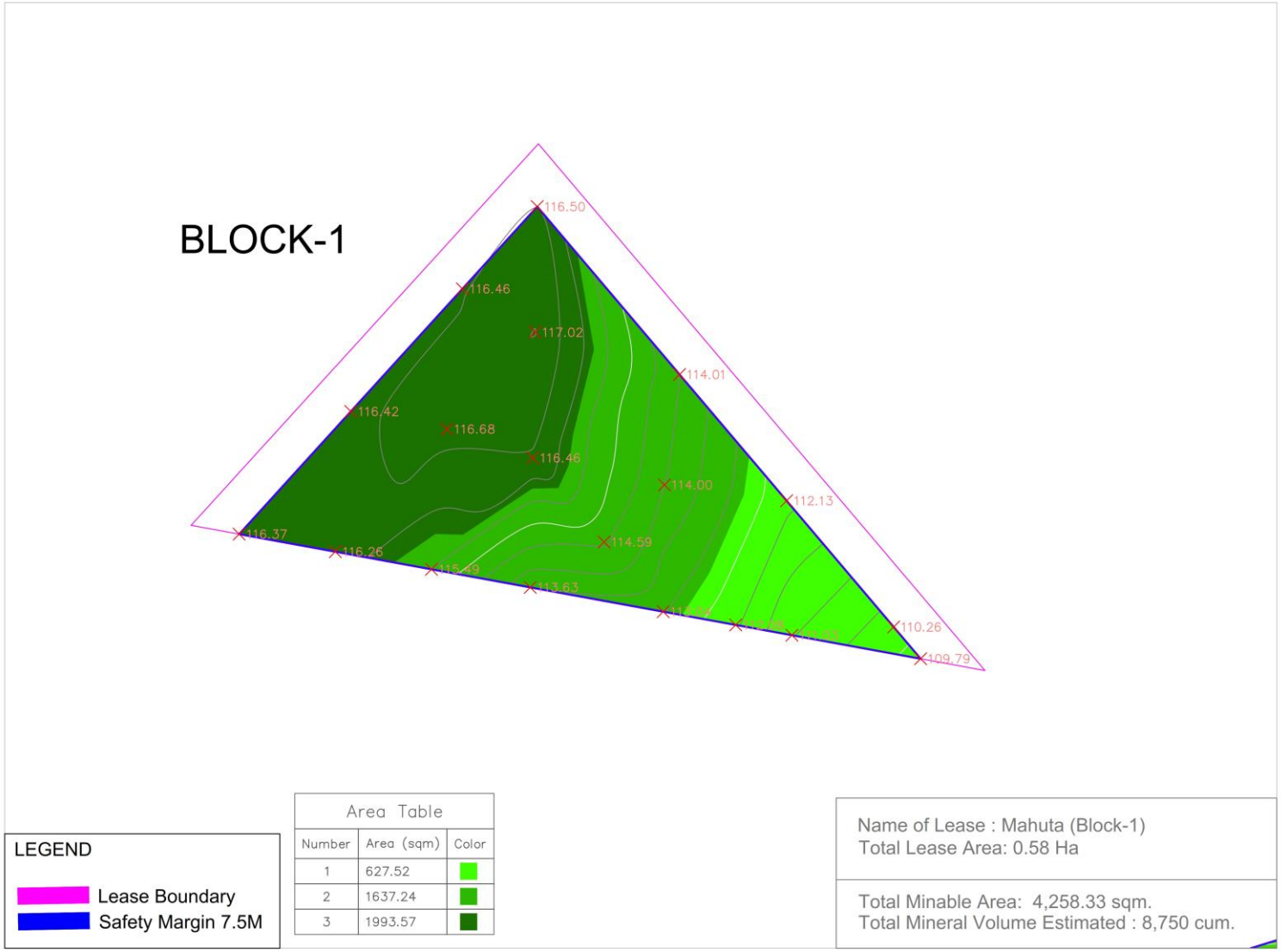
In Block-8, area of mining is **6,814.72** sqm and **4,396** cum sand is available for mining. 2,913 cum sand was deposited in 5825.77 sqm upto the depth of 0.5 m while 1,483 cum Sand was accumulated up to a depth of 1.50 m in 988.95 sqm area.

In Block-9, area of mining is **19,955.52** sqm and **26,728** cum sand is available for mining. 4,969 cum sand was deposited in 9,938.4 sqm upto the depth of 0.5 m while 6,434 cum Sand was accumulated up to a depth of 1.50 m in 14,289.07 sqm area. 9,294 cum sand was collected in pre-monsoon season upto a depth of 2.5 m in 3,717.57 sqm. 6,031 cum sand is accumulated in 2010.48 sqm upto 3 m depth.

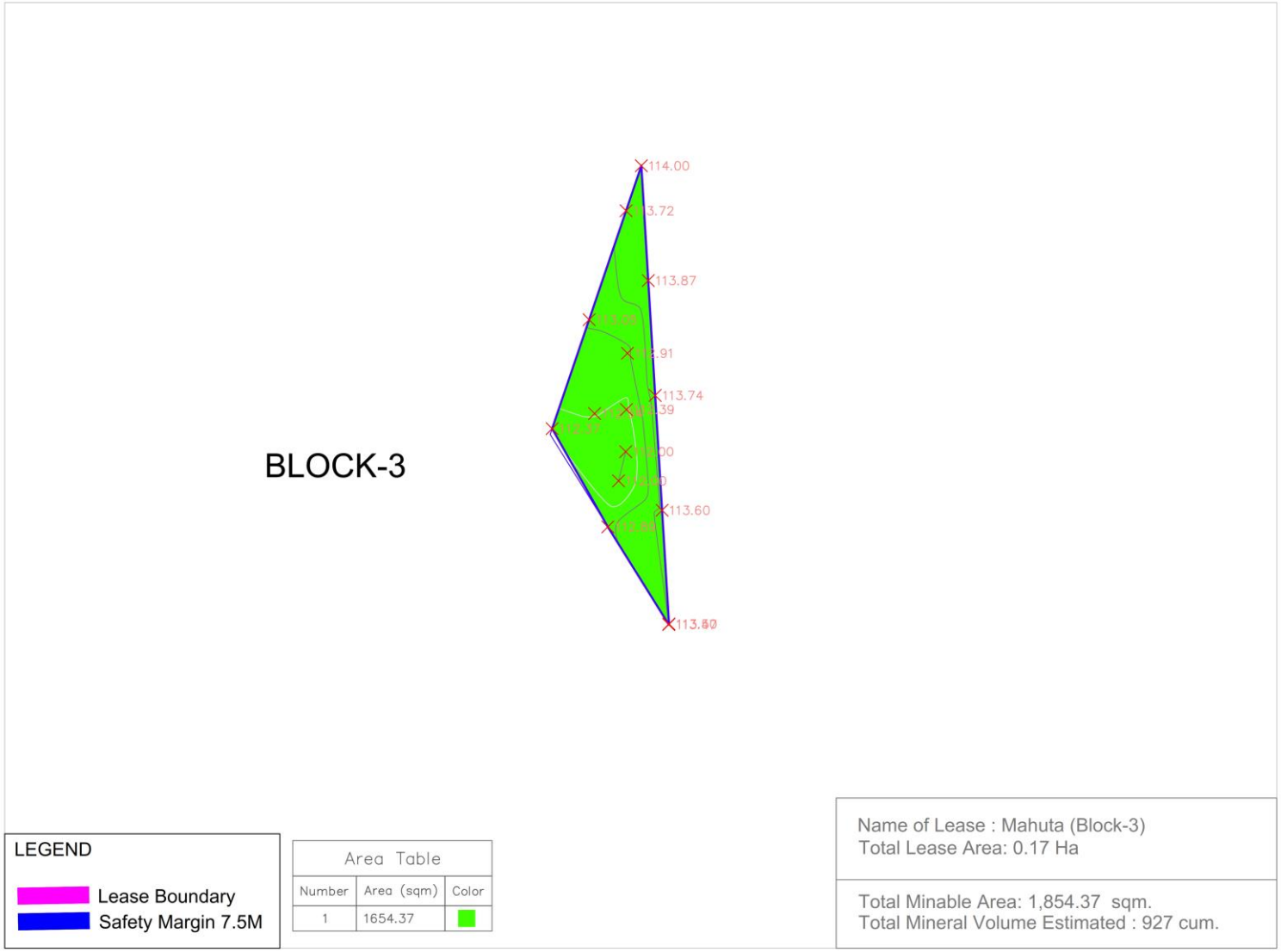
The volume of total sand replenished in the lease are in pre-monsoon season (2024) was **2,23,656** cum.

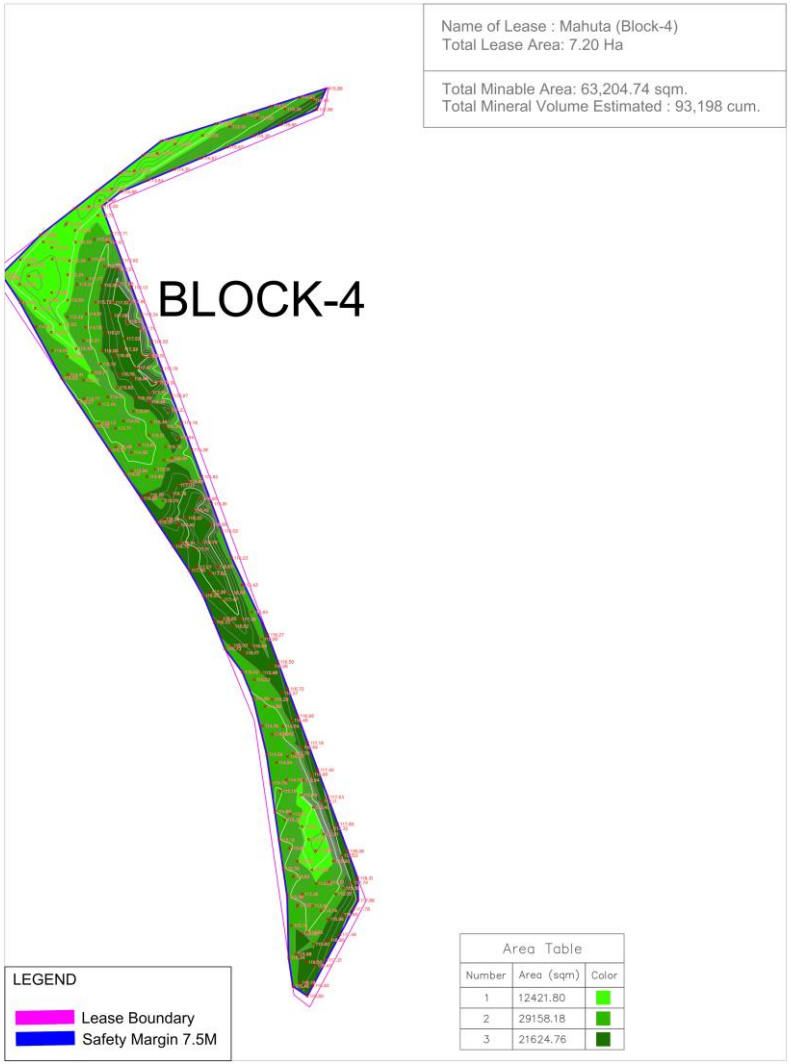
Block	Area (sqm)	Depth (m)	Volume of sand replenished in cum
Block-1	627.520	0.50	314
	1637.240	1.50	2,456
	1993.570	3.00	5,981
	4,258.33		**8,750**
Block-2	14501.950	0.50	7250.975
	819.000	1.50	1228.5
	15,320.95		**8,479**
Block-3	**1854.370**	0.50	**927**
Block-4	12421.800	0.50	6,211
	29158.180	1.50	43,737
	21624.760	2.00	43,250
	63,204.74		**93,198**
Block-5	3896.240	0.50	1,948
	13847.330	1.50	20,771
	10673.070	2.00	21,346
	28,416.64		**44,065**
Block-6	14541.500	0.50	7,271
	8330.410	1.50	12,496
	4970.800	2.00	9,942

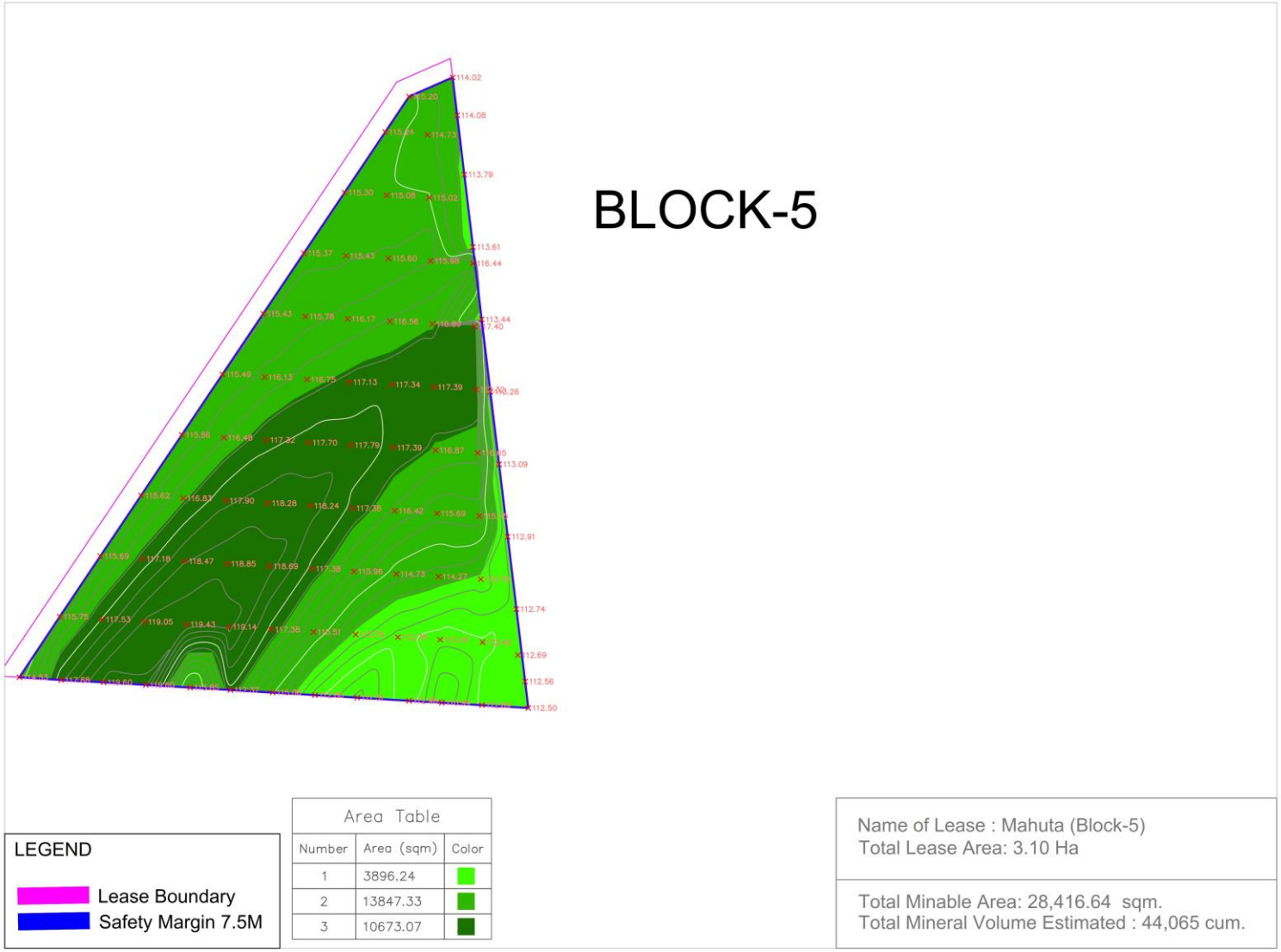
	27,842.71		**29,708**
Block-7	5874.530	0.50	2,937
	2977.310	1.50	4,466
	8,851.84		**7,403**
Block-8	5825.770	0.50	2,913
	988.950	1.50	1,483
	6,814.72		**4,396**
Block-9	4354.580	0.50	2,177
	5583.820	0.50	2,792
	4289.070	1.50	6,434
	3717.570	2.50	9,294
	2010.480	3.00	6,031
	19,955.52		**26,728**
	1,76,519.82		**2,23,656**

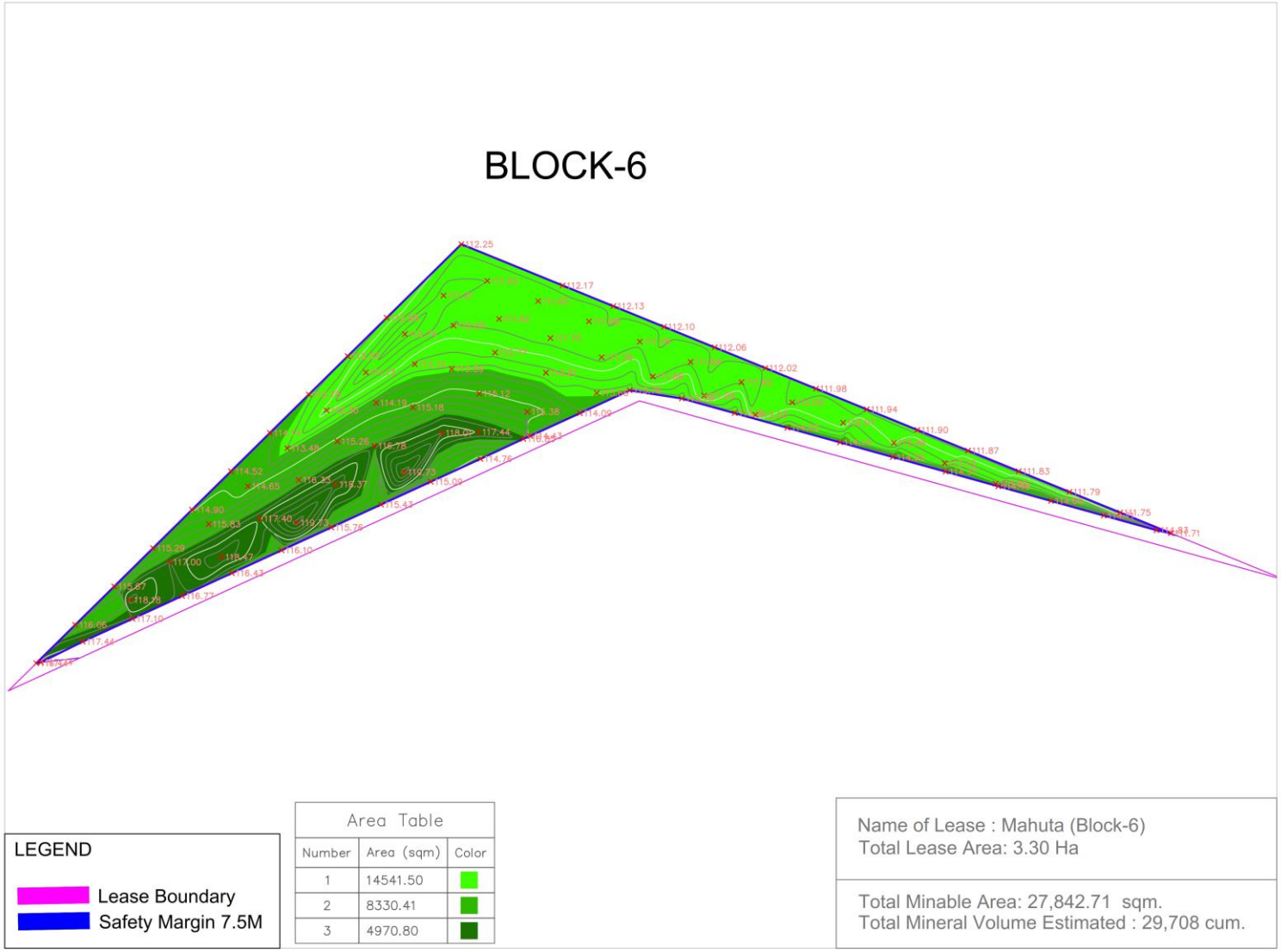

BLOCK-1
116.50
116.46
117.02
114.01
116.42
116.68
116.46
114.00
112.13
116.37
116.26
114.59
110.26
109.79
LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number
Area (sqm)
Color
1
627.52
2
1637.24
3
1993.57
Name of Lease : Mahuta (Block-1)
Total Lease Area: 0.58 Ha
Total Minable Area: 4,258.33 sqm.
Total Mineral Volume Estimated : 8,750 cum.

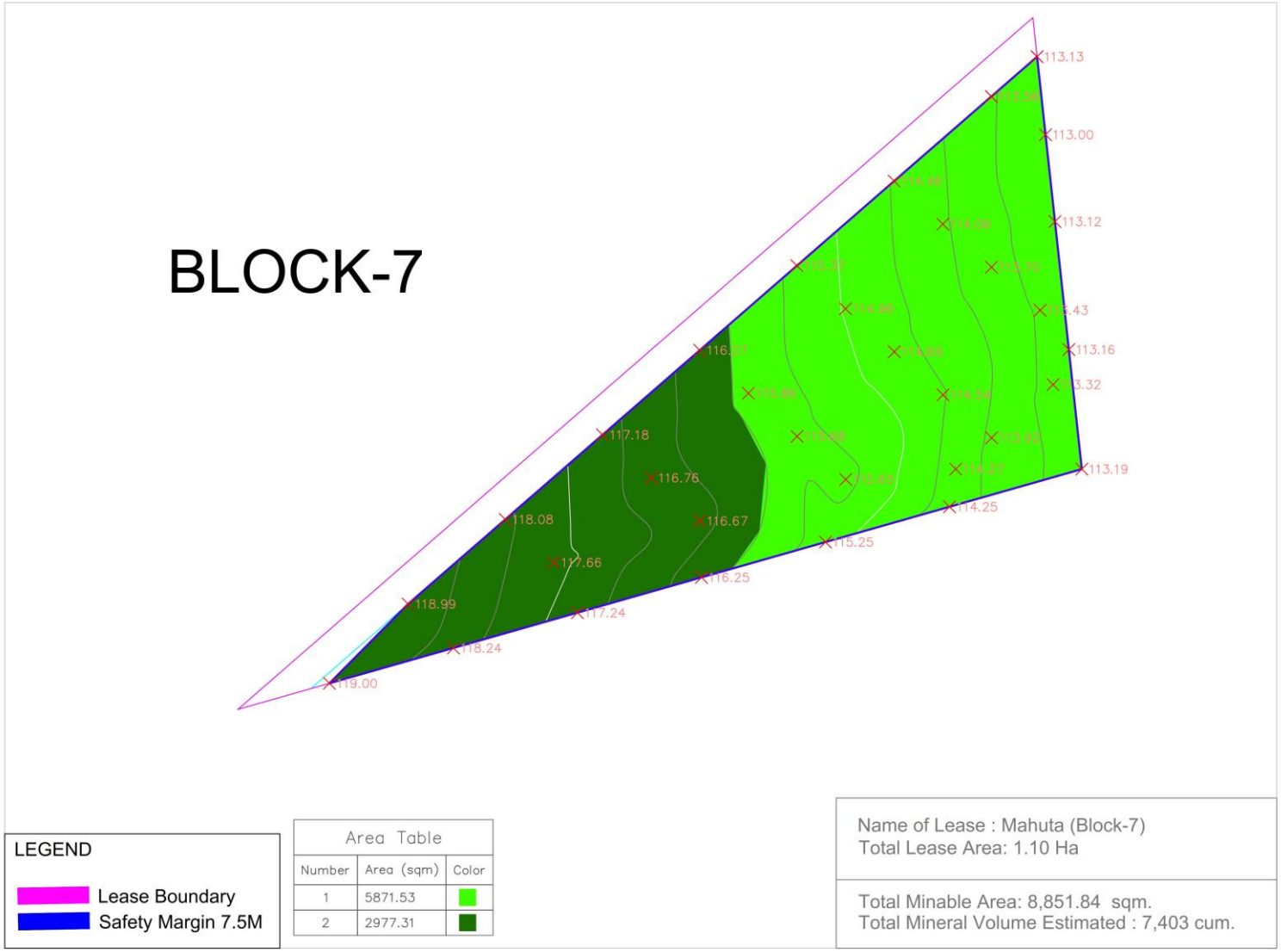

BLOCK-2
LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number | Area (sqm) | Color
1 | 14501.95
2 | 819.06
Name of Lease : Mahuta (Block-2)
Total Lease Area: 1.96 Ha
Total Minable Area: 15,320.95 sqm.
Total Mineral Volume Estimated :8,479 cum.

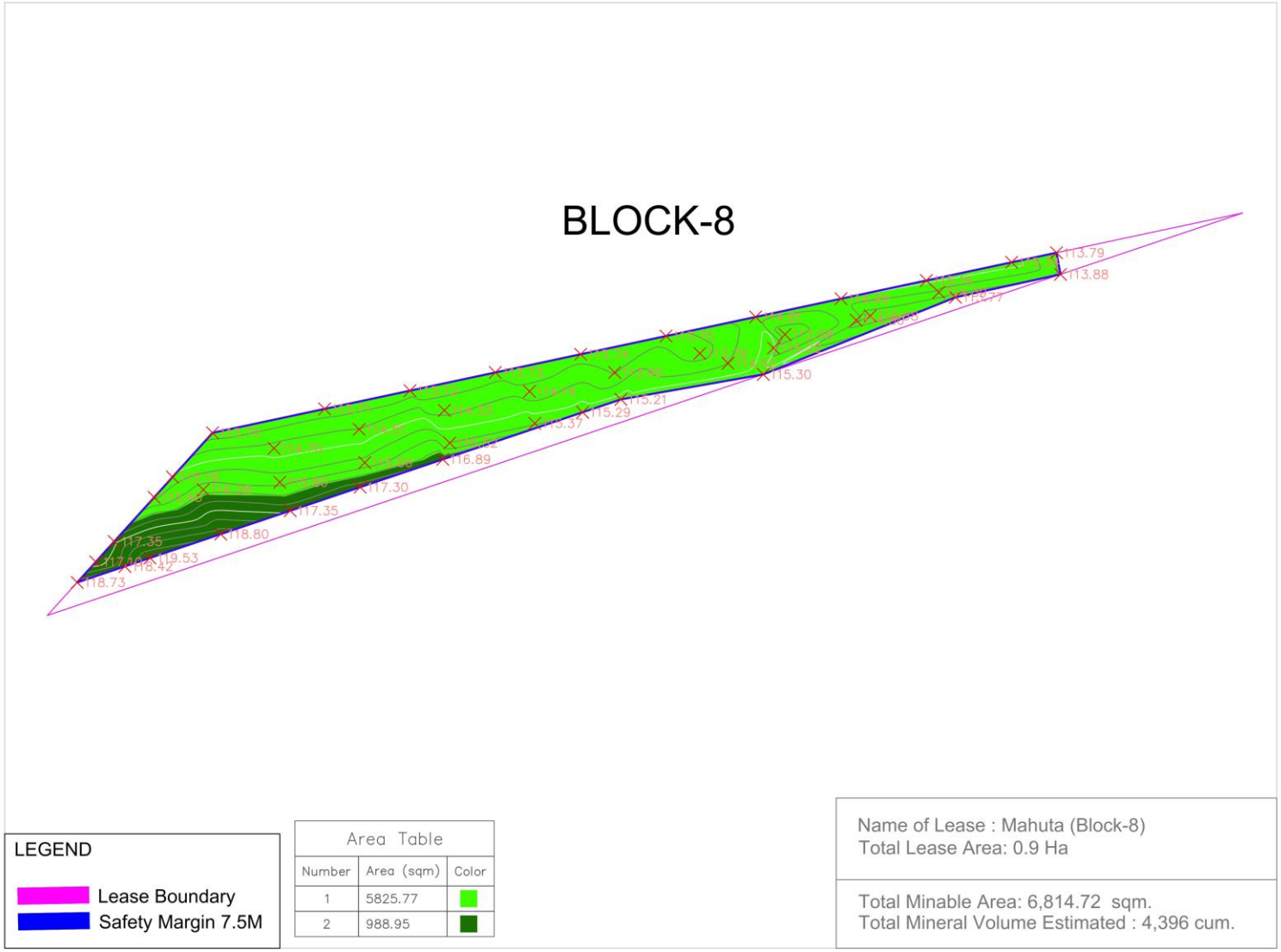

BLOCK-3
114.00
113.87
113.74
113.60
LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number
Area (sqm)
Color
1
1654.37
Name of Lease : Mahuta (Block-3)
Total Lease Area: 0.17 Ha
Total Minable Area: 1,854.37 sqm.
Total Mineral Volume Estimated : 927 cum.

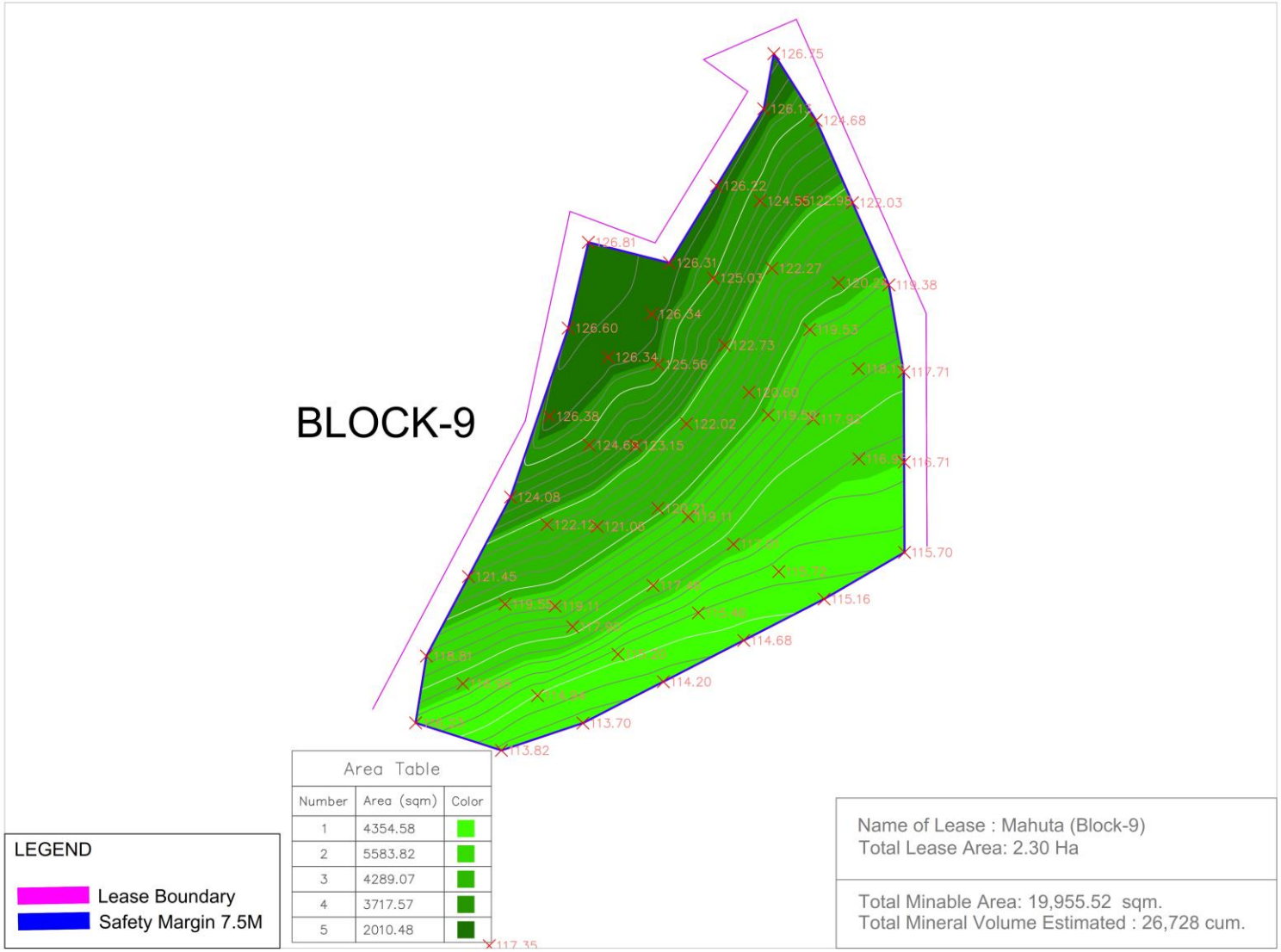

Name of Lease : Mahuta (Block-4)
Total Lease Area: 7.20 Ha
Total Minable Area: 63,204.74 sqm.
Total Mineral Volume Estimated : 93,198 cum.
BLOCK-4
LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number
Area (sqm)
Color
1
12421.80
2
29158.18
3
21624.76


BLOCK-5
LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number | Area (sqm) | Color
1 | 3896.24
2 | 13847.33
3 | 10673.07
Name of Lease : Mahuta (Block-5)
Total Lease Area: 3.10 Ha
Total Minable Area: 28,416.64 sqm.
Total Mineral Volume Estimated : 44,065 cum.


BLOCK-6
LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number | Area (sqm) | Color
1 | 14541.50
2 | 8330.41
3 | 4970.80
Name of Lease : Mahuta (Block-6)
Total Lease Area: 3.30 Ha
Total Minable Area: 27,842.71 sqm.
Total Mineral Volume Estimated : 29,708 cum.


BLOCK-7
113.13
113.00
113.12
113.16
113.19
117.18
116.76
116.67
118.08
117.66
116.25
118.99
117.24
118.24
119.00
115.25
114.25
LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number
Area (sqm)
Color
1
5871.53
2
2977.31
Name of Lease : Mahuta (Block-7)
Total Lease Area: 1.10 Ha
Total Minable Area: 8,851.84 sqm.
Total Mineral Volume Estimated : 7,403 cum.


BLOCK-8
LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number
Area (sqm)
Color
1
5825.77
2
988.95
Name of Lease : Mahuta (Block-8)
Total Lease Area: 0.9 Ha
Total Minable Area: 6,814.72 sqm.
Total Mineral Volume Estimated : 4,396 cum.


BLOCK-9
126.75
126.81
126.31
126.60
126.34
126.38
124.08
121.45
118.81
114.68
114.20
113.70
113.82
LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number | Area (sqm) | Color
1 | 4354.58
2 | 5583.82
3 | 4289.07
4 | 3717.57
5 | 2010.48
Name of Lease : Mahuta (Block-9)
Total Lease Area: 2.30 Ha
Total Minable Area: 19,955.52 sqm.
Total Mineral Volume Estimated : 26,728 cum.

Lease-11

The mining site is situated on the river bank of Ken at Gata No. 60, Village- Sadikhadar, Tehsil- Pailani, District- Banda, U.P.is having an area of 18.00 Ha, The co-ordinates of Mining lease area are:

Co-ordinates of Mining lease at Village – Sadikhadar

Pillar No.	Latitude	Longitude
A	25° 42' 32.100" N	80° 19' 28.500" E
B	25° 42' 29.280" N	80° 20' 4.980" E
C	25° 42' 34.740" N	80° 20' 4.560" E
D	25° 42' 41.340" N	80° 19' 27.780" E

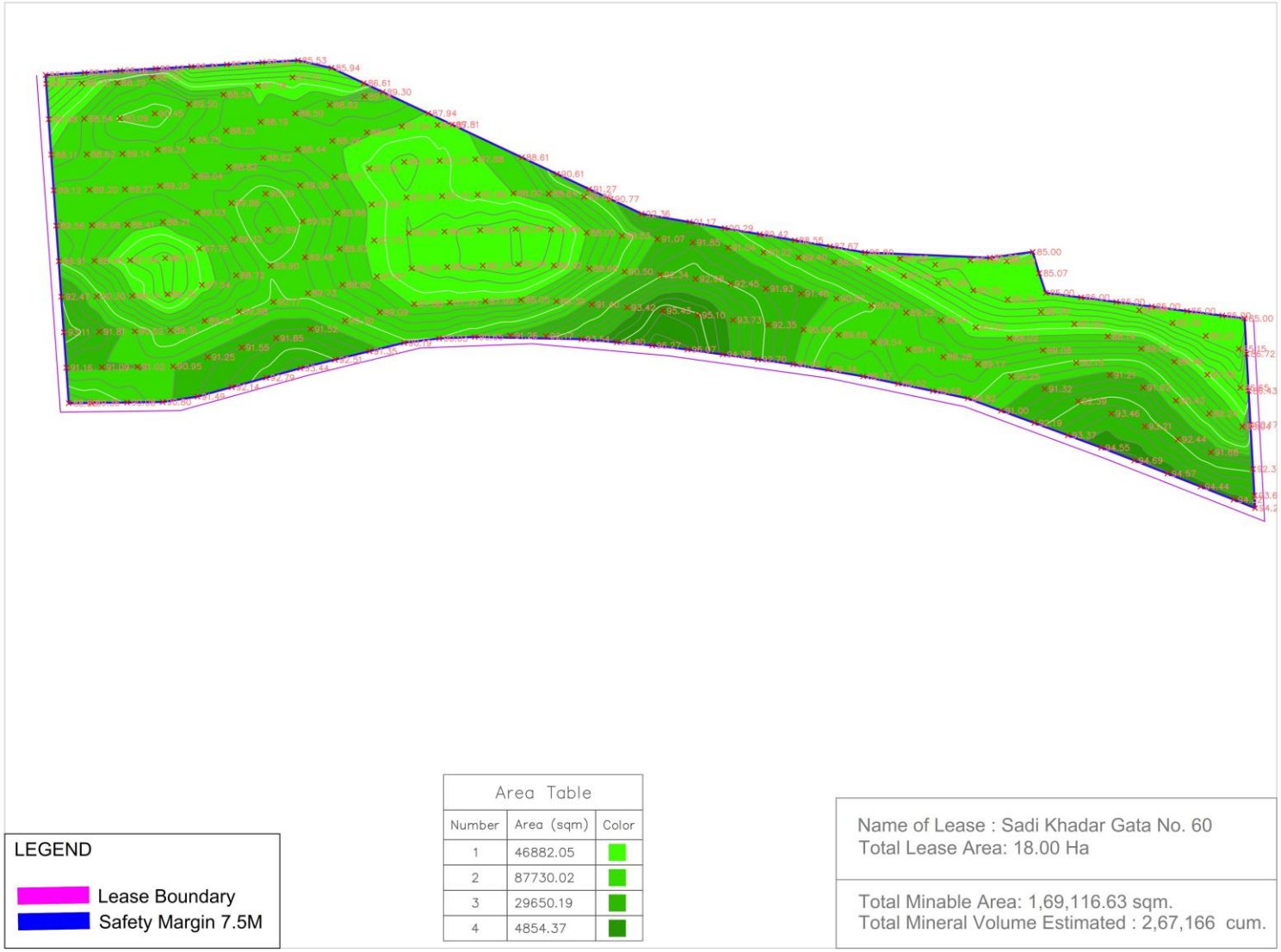
Physiography & Drainage

Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology, the alluvium thickness is more in river bed. The river bed is flanked with unsightly ravines due to corrosive action. The area surrounding the lease is mostly agricultural land.The lease area is in the river bed and government barren land.

Estimation of Replenishment sand

The lease area has an area of 18.0 ha (180,000 sqm) and the minable area less safety margin of 7.5 m offset from 3 sides is **23,489.43** sqm. 46,882 cum sand was deposited in 46882.05 sqm upto the depth of 1.0 m. 87730.02 cum Sand was deposited up to a depth of 1.50 m in 1,31,595sqm area, while 29650.19 cum sand was accumulated up to a depth of 2.5 m in 74,125 sqm area. 4854.37 cum sand was collected in pre monsoon season upto a depth of 3.0 m in 14563.11 sqm. The volume of total sand replenished in the lease are in pre-monsoon season (2024) was **41,213** cum.

Area (sqm)	Depth (m)	Volume of sand replenished in cum
46882.05	1.00	46,882
87730.02	1.50	1,31,595
29650.19	2.50	74,125
4854.37	3.00	14563.11
23,489.43		**41,213**


LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number | Area (sqm) | Color
1 | 46882.05
2 | 87730.02
3 | 29650.19
4 | 4854.37
Name of Lease : Sadi Khadar Gata No. 60
Total Lease Area: 18.00 Ha
Total Minable Area: 1,69,116.63 sqm.
Total Mineral Volume Estimated : 2,67,166 cum.

Lease-12

The mining site is situated on the river bank of Ken at Gata No. part of 72/47, part of 74/1 (khand no. 02), is having an area of 19.0 Ha Village- Pathri, Tehsil & District- Banda, U.P, The co-ordinates of Mining lease area are:

Pillar No.	Latitude	Longitude
A	25° 37' 23.280" N	80° 16' 58.180" E
B	25° 37' 15.620" N	80° 16' 51.930" E
C	25° 37' 20.560" N	80° 16' 37.640" E
D	25° 37' 34.950" N	80° 16' 43.360" E

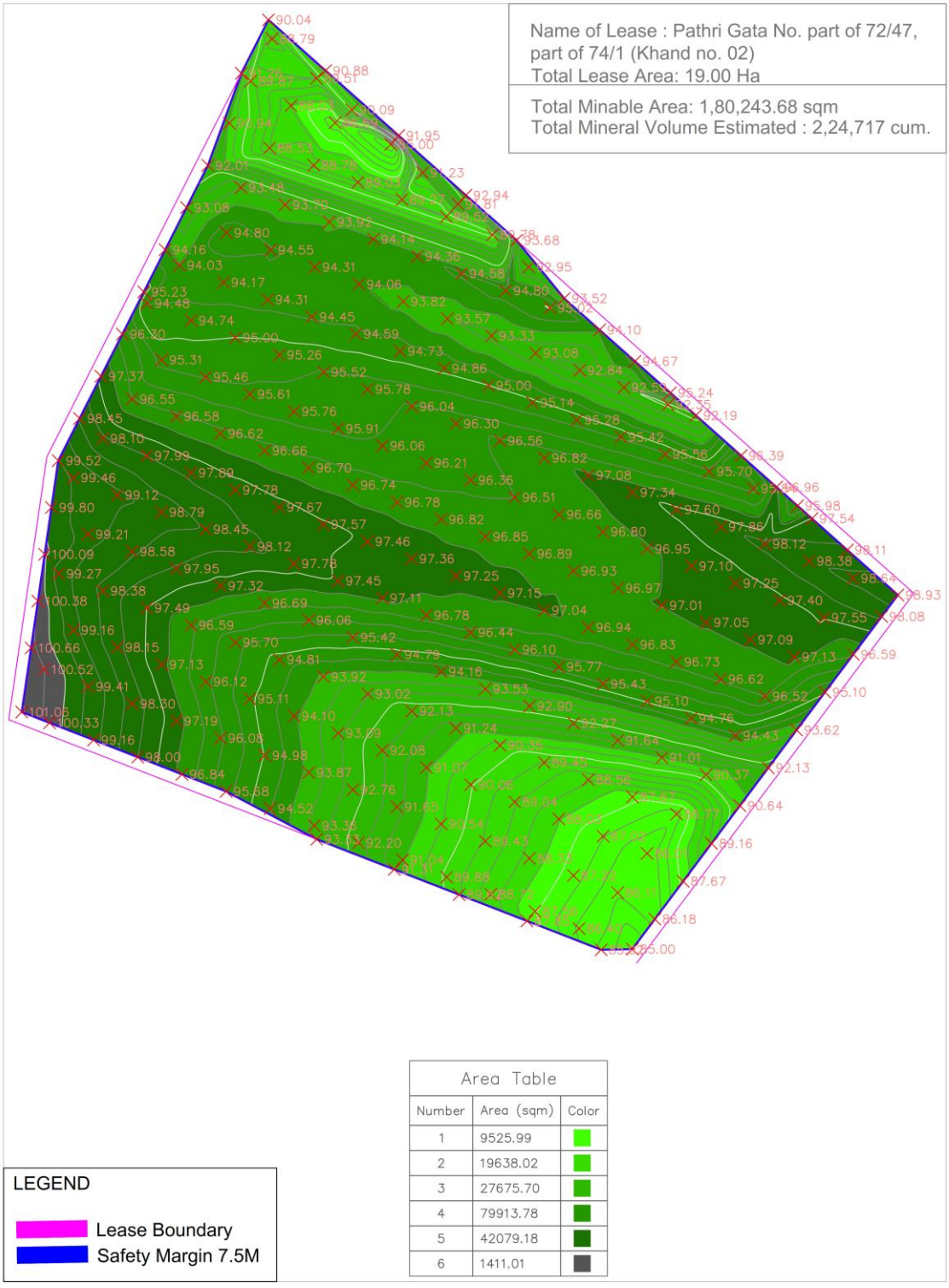
Physiography & Drainage

Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology, the alluvium thickness is more in river bed. The river bed is flanked with unsightly ravines due to corrosive action. The area surrounding the lease is mostly agricultural land.The lease area is in the river bed and government barren land.

Estimation of Replenishment sand

The lease area has an area of 19.0 ha (190,000 sqm) and the minable area less safety margin of 7.5 m offset from 3 sides is **1,80,243.68** sqm. 9525.99 area is not fit for mining as there is no sand deposition at the time of survey. 9,819 cum Sand was deposited up to a depth of 0.50 m in 19638.02 sqm area, while 27,676 cum sand was accumulated up to a depth of 1.0 m in 19638.02 sqm area. 1,82,990 cum sand was deposited in 121992.96 sqm upto the depth of 1.5 m. 4,233 cum sand was collected in pre monsoon season upto a depth of 3.0 m in 1411.01 sqm.The volume of total sand replenished in the lease are in pre-monsoon season (2024) was **2,24,717** cum.

Area (sqm)	Depth (m)	Volume of sand replenished in cum
9525.99	0.00	0
19638.02	0.50	9,819
27675.7	1.00	27,676
79913.78	1.50	1,19,871
42079.18	1.50	63,119
1411.01	3.00	4,233
1,80,243.68		**2,24,717**



Area Table

Number	Area (sqm)	Color
1	9525.99	
2	19638.02	
3	27675.70	
4	79913.78	
5	42079.18	
6	1411.01	

Lease-13

The mining site is situated on the river bank of Ken at Gata No. 04, is having an area of 13.0 Ha Village- SadiKhadar, Tehsil-Pailani, District- Banda, U.P, The co-ordinates of Mining lease area are:

Pillar No.	Latitude	Longitude
A	25° 42' 27.200" N	80° 20' 6.580" E
B	25° 42' 32.380" N	80° 20' 7.490" E
C	25° 42' 7.150" N	80° 20' 45.360" E
D	25° 42' 5.860" N	80° 20' 37.160" E

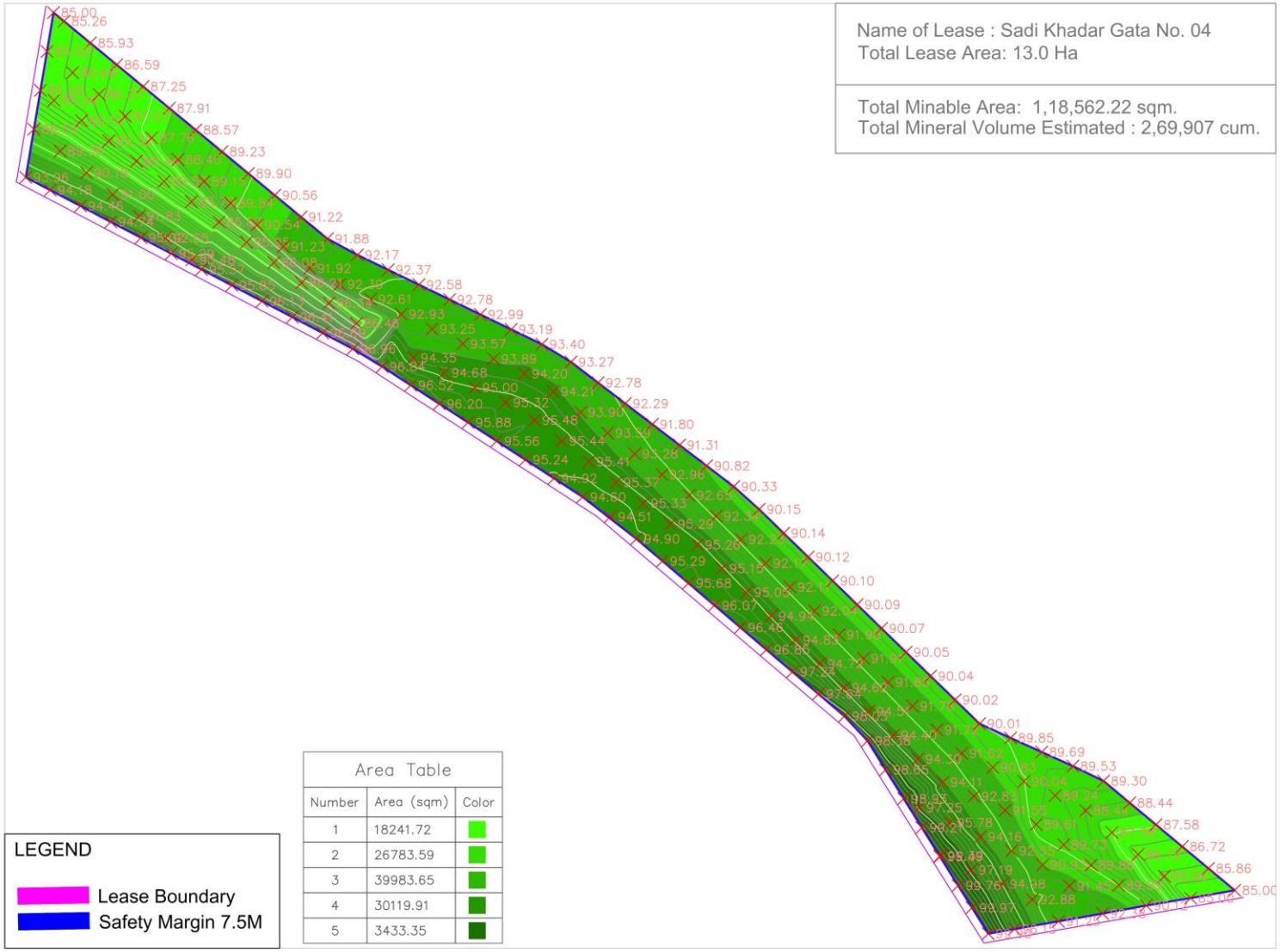
Physiography & Drainage

Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology. The river bed is flanked with unsightly ravines due to corrosive action. The area surrounding the lease is mostly agricultural land.The lease area is in the river bed and government barren land.

Estimation of Replenishment sand

The lease area has an area of 13.0 ha (130,000 sqm) and the minable area less safety margin of 7.5 m offset from 3 sides is **1,18,562.22** sqm. 9,121 cum Sand was deposited up to a depth of 0.50 m in 18241.72 sqm area, while 40,175 cum sand was accumulated up to a depth of 1.5 m in 26783.59 sqm area. 100660 cum sand was collected in pre monsoon season upto a depth of 3.0 m in 73536.91 sqm. The volume of total sand replenished in the lease are in pre-monsoon season (2024) was **2,69,907** cum.

Area (sqm)	Depth (m)	Volume of sand replenished in cum
18241.72	0.50	9,121
26783.59	1.50	40,175
39983.65	3.00	1,19,951
30119.91	3.00	90,360
3433.35	3.00	10,300
1,18,562.22		**2,69,907**


Name of Lease : Sadi Khadar Gata No. 04
Total Lease Area: 13.0 Ha
Total Minable Area: 1,18,562.22 sqm.
Total Mineral Volume Estimated : 2,69,907 cum.
LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number | Area (sqm) | Color
1 | 18241.72
2 | 26783.59
3 | 39983.65
4 | 30119.91
5 | 3433.35

Lease-14

The mining site is situated on the river bank of Ken at Gata No. Part of 100 (Khand No.02), is having an area of 16.0 Ha Village- Khaptiha Kala, Tehsil-Pailani, District- Banda, U.P, The co-ordinates of Mining lease area are:

Pillar No.	Latitude	Longitude
A	25° 40' 40.300" N	80° 21' 15.700" E
B	25° 40' 38.510" N	80° 21' 19.670" E
C	25° 40' 32.640" N	80° 21' 40.400" E
D	25° 40' 27.830" N	80° 21' 39.120" E
E	25° 40' 29.340" N	80° 21' 33.170" E
F	25° 40' 29.810" N	80° 21' 27.280" E
G	25° 40' 30.810" N	80° 21' 20.050" E
H	25° 40' 30.680" N	80° 21' 13.310" E
I	25° 40' 33.600" N	80° 21' 11.000" E
J	25° 40' 34.360" N	80° 21' 9.440" E

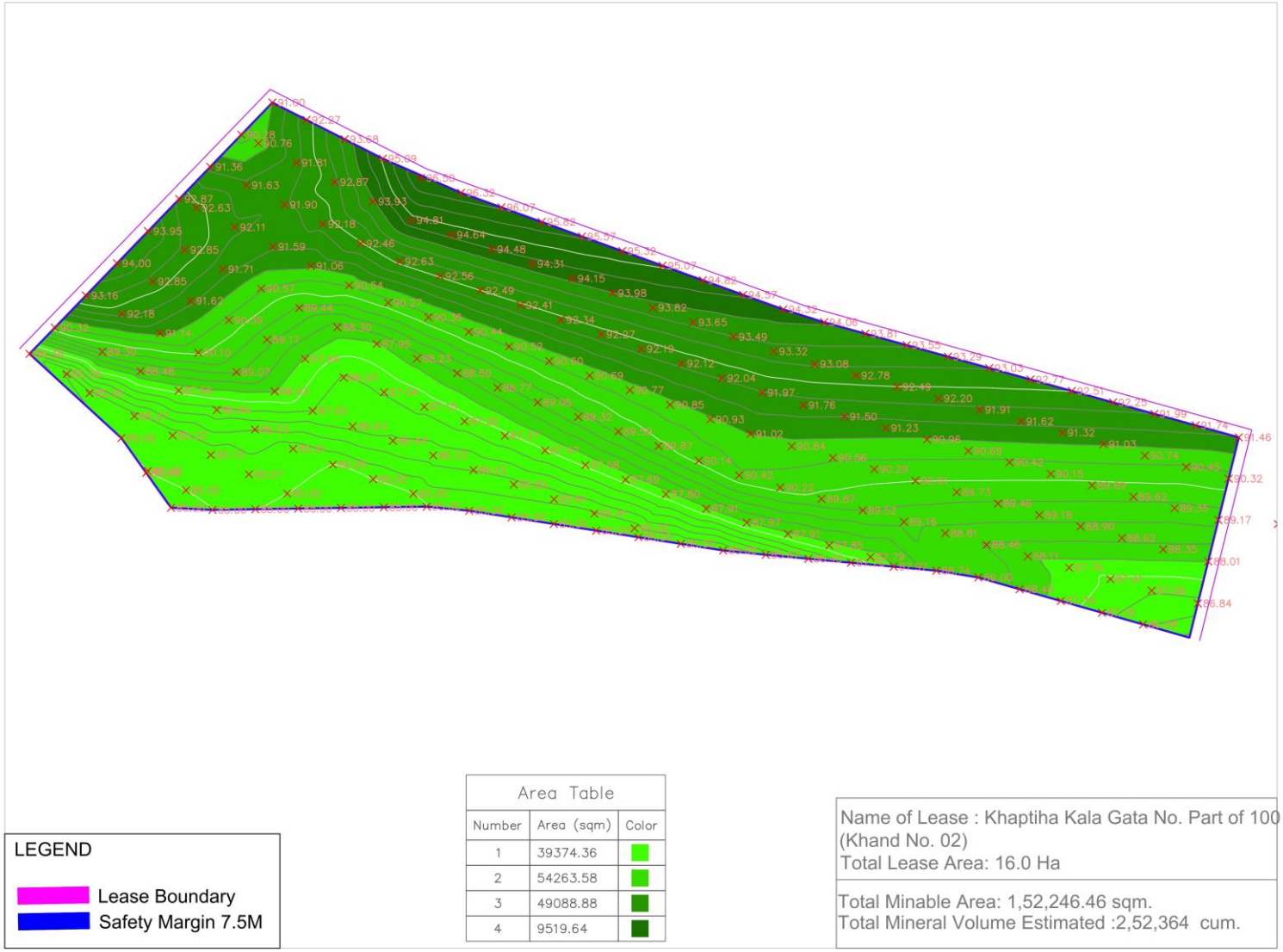
Physiography & Drainage

The general feature of the lease and adjoining area is a succession of narrow land area formed by numerous streams. The alluvium thickness is more in river bed. The river bed is flanked with unsightly ravines due to corrosive action. The area surrounding the lease is mostly agricultural land.The lease area is in the river bed and government barren land.

Estimation of Replenishment sand

The lease area has an area of 16.0 ha (160,000 sqm) and the minable area less safety margin of 7.5 m offset from 3 sides is **1,52.246.46** sqm. 19,687 cum Sand was deposited up to a depth of 0.50 m in 54263.58 sqm area, while 81,395 cum sand was accumulated up to a depth of 1.5 m in 3,37,670 sqm area. 1,22,722 cum sand was collected in pre monsoon season upto a depth of 2.5 m in 49088.88 sqm. 28,559 cum Sand was deposited up to a depth of 3.0 m in 9519.64 sqm area. The volume of total sand replenished in the lease are in pre-monsoon season (2024) was **2,52,364** cum.

Area (sqm)	Depth (m)	Volume of sand replenished in cum
49088.88	2.50	1,22,722
9519.64	3.00	28,559
1,52.246.46		**2,52,364**



Area Table

Number	Area (sqm)	Color
1	39374.36	
2	54263.58	
3	49088.88	
4	9519.64	

Name of Lease : Khaptiha Kala Gata No. Part of 100 (Khand No. 02)
Total Lease Area: 16.0 Ha

Total Minable Area: 1,52,246.46 sqm.
Total Mineral Volume Estimated :2,52,364 cum.

Lease-15

The mining site is situated on the river bank of Ken at Gata No. Part of 356 (Khand No.01), is having an area of 16.0 Ha in Village- Khaptiha Kala, Tehsil-Pailani, District- Banda, U.P, The co-ordinates of Mining lease area are:

Pillar No.	Latitude	Longitude
A	25° 40' 37.900" N	80° 22' 5.400" E
B	25° 40' 46.000" N	80° 22' 15.300" E
C	25° 40' 40.500" N	80° 22' 26.160" E
D	25° 40' 28.500" N	80° 22' 9.060" E

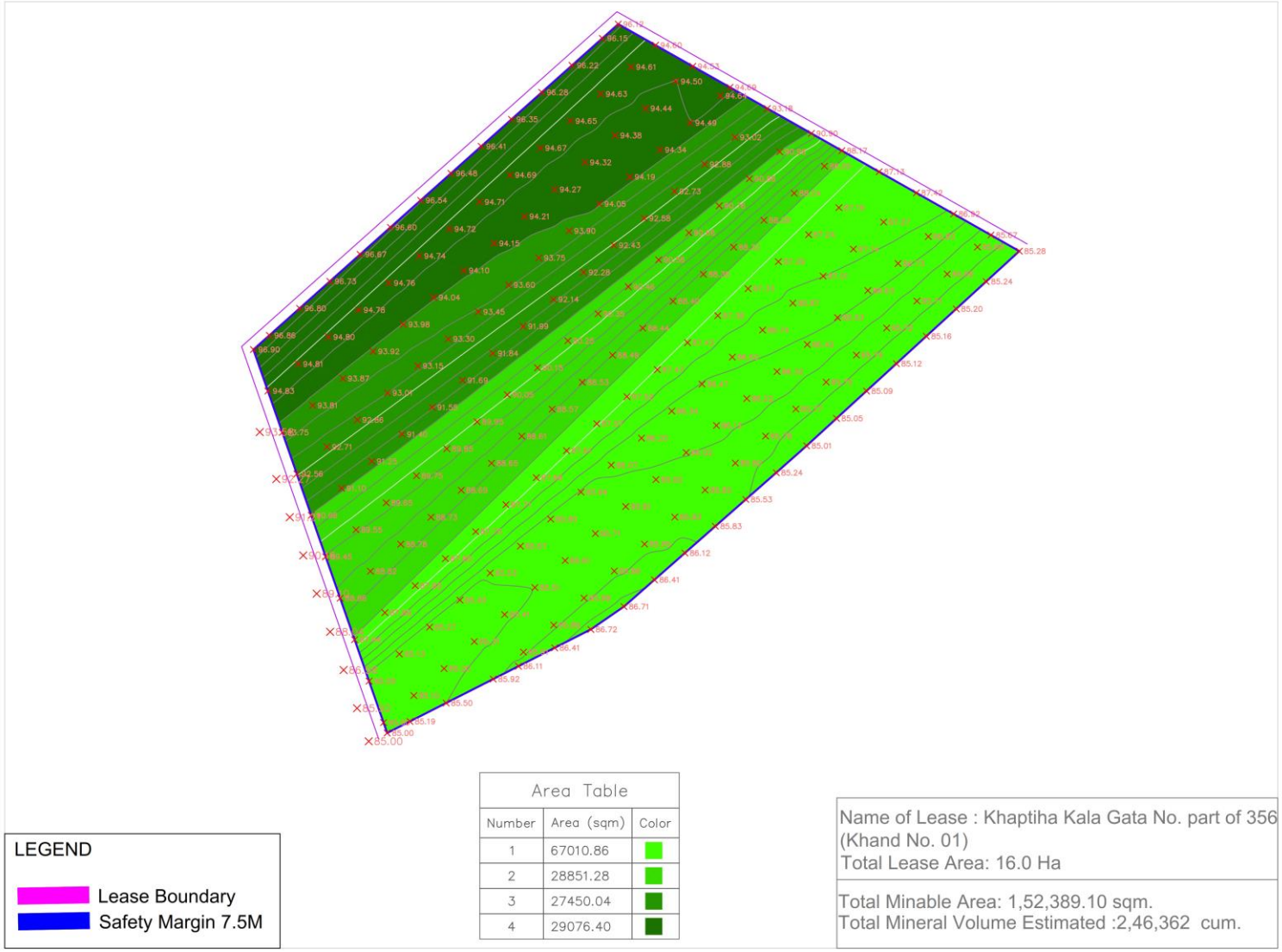
Physiography & Drainage

Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology. The river bed is flanked with unsightly ravines due to corrosive action. The alluvium thickness is more in river bed . The area surrounding the lease is mostly agricultural land.The lease area is in the river bed and government barren land.

Estimation of Replenishment sand

The lease area has an area of 16.0 ha (160,000 sqm) and the minable area less safety margin of 7.5 m offset from 3 sides is **1,52,389.10** sqm. 33,505 cum Sand was deposited up to a depth of 0.50 m in 67010.86 sqm area, while 43,278 cum sand was accumulated up to a depth of 1.5 m in 28851.80 sqm area. 169579 cum sand was collected in pre monsoon season upto a depth of 3.0 m in 56526.44 sqm.The volume of total sand replenished in the lease are in pre-monsoon season (2024) was **2,46,362** cum.

Area (sqm)	**Depth (m)**	**Volume of sand replenished in cum**
67010.86	0.50	33,505
28851.80	1.50	43,278
27450.04	3.00	82,350
29076.40	3.00	87,229
1,52,389.10		**2,46,362**



Area Table

Number	Area (sqm)	Color
1	67010.86	
2	28851.28	
3	27450.04	
4	29076.40	

Name of Lease : Khaptiha Kala Gata No. part of 356 (Khand No. 01)
Total Lease Area: 16.0 Ha

Total Minable Area: 1,52,389.10 sqm.
Total Mineral Volume Estimated :2,46,362 cum.

Lease-16

The mining site is situated on the river bank of Ken at Gata No. 4 is having an area of 10.0 Ha Village- Kolawalraipur, Tehsil-Naraini, District- Banda, U.P, The co-ordinates of Mining lease area are:

Pillar No.	Latitude	Longitude
A	25°15'57.04"N	80°21'37.27"E
B	25°15'43.88"N	80°21'37.12"E
C	25°15'35.59"N	80°21'38.77"E
D	25°15'33.52"N	80°21'35.99"E
F	25°15'54.37"N	80°21'28.81"E

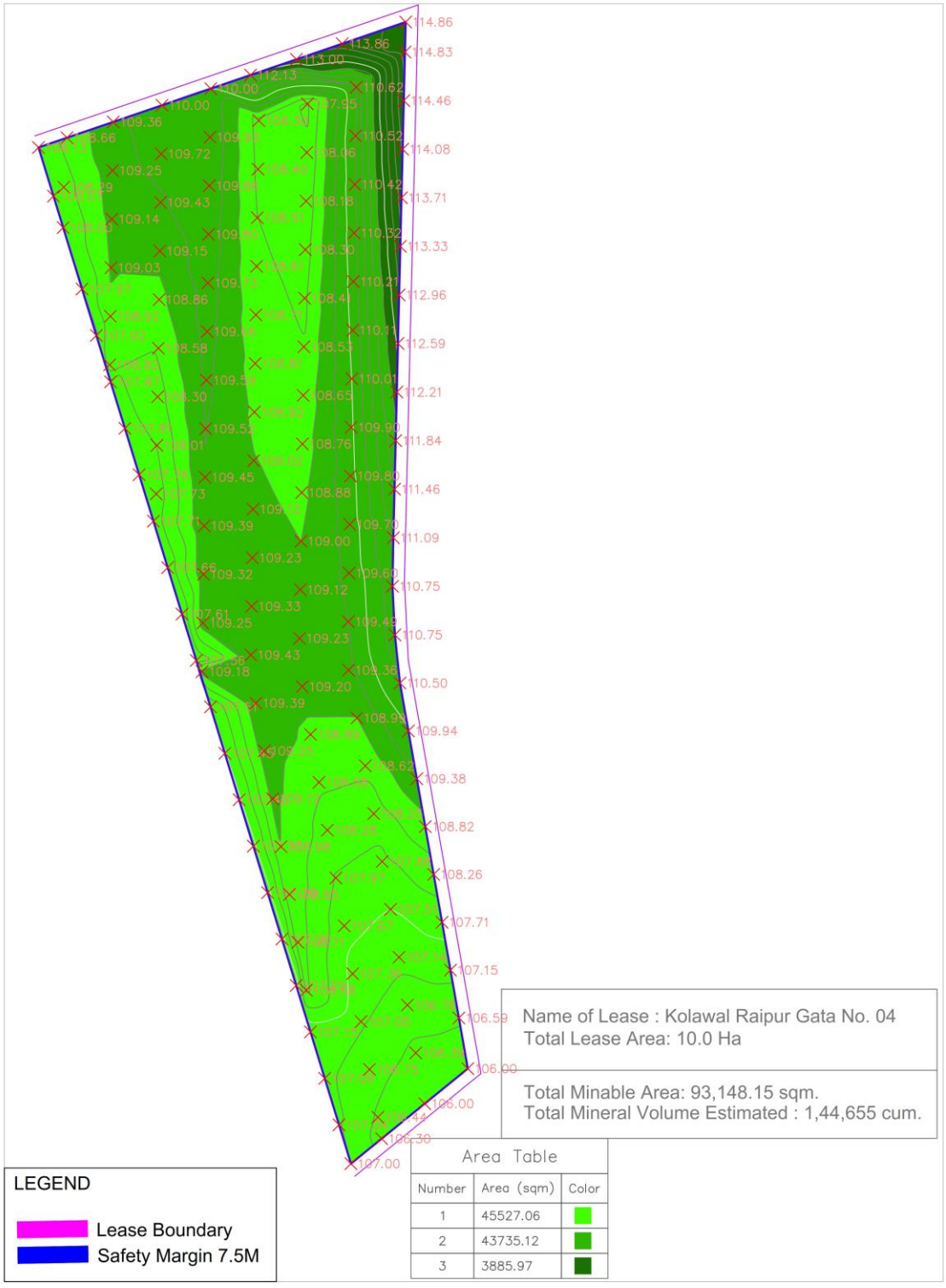
Physiography & Drainage

Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology, The alluvium thickness is more in river bed . The river bed is flanked with unsightly ravines due to corrosive action. The area surrounding the lease is mostly agricultural land.The lease area is in the river bed and government barren land.

Estimation of Replenishment sand

The lease area has an area of 10 ha (100,000 sqm) and the minable area less safety margin of 7.5 m offset from 3 sides is **93,148.15** sqm. 45,527 cum Sand was deposited up to a depth of 1.0 m in 45527.06 sqm area, while 87,470 cum sand was accumulated up to a depth of 2.0 m in 43735.12 sqm area. 11,658 cum sand was collected in pre monsoon season upto a depth of 3.0 m in 3885.97 sqm.The volume of total sand replenished in the lease are in pre-monsoon season (2024) was **1,44,655** cum.

Area (sqm)	**Depth (m)**	**Volume of sand replenished in cum**
43735.12	2.00	87,470
3885.97	3.00	11,658
93,148.15		**1,44,655**


Name of Lease : Kolawal Raipur Gata No. 04
Total Lease Area: 10.0 Ha
Total Minable Area: 93,148.15 sqm.
Total Mineral Volume Estimated : 1,44,655 cum.
Area Table
Number | Area (sqm) | Color
1 | 45527.06
2 | 43735.12
3 | 3885.97
LEGEND
Lease Boundary
Safety Margin 7.5M

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प्रेषक,

जिलाधिकारी,
बस्ती।

सेवा में,

सदस्य–सचिव,
राज्य स्तरीय पर्यावरण प्रभाव आकंलन प्राधिकरण (SEIAA),
पर्यावरण निदेशालय, उ0प्र0 लखनऊ।

पत्रांकः 865 / खनन सहायक / डी0एस0आर0 / 2024–25 दिनांक, 11-03-2025

विषयः– जनपद बस्ती के अनुमोदित DSR एवं Replenishment study को अपलोड किये जाने के सम्बन्ध में।

महोदय,

कृपया अपने कार्यालय के पत्र संख्या–416 / पर्या0 / सा0 / 2023 दिनांक 07.08.2024 का सन्दर्भ ग्रहण करने का कष्ट करें, जिसके द्वारा अवगत कराया गया है कि जनपद बस्ती के ड्राफ्ट डी0एस0आर0 की राज्य स्तरीय विशेषज्ञ मूल्याकंन समिति की बैठक दिनांक 19.07.2024 तथा राज्य स्तरीय पर्यावरण प्रभाव निर्धारण प्राधिकरण, उ0प्र0 की बैठक दिनांक 01.08.2024 द्वारा अनुमोदन प्रदान किया गया है। उक्त पत्र के शर्त / बिन्दु संख्या 08 में उल्लिखित है कि–

3- Replenishment study on the basis of which the mineral availability is assessed should be uploaded on websites of District and Mining Department and submitted to SEIAA along with methodology adopted for study and details like geo-coordinates etc. of study points.

अतः उक्त निर्देश के क्रम में DSR एवं Replenishment study की प्रति अवलोकनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित की जा रही है।

संलग्नक– यथोपरि।

भवदीय

अपर जिलाधिकारी (वि0 / रा0) /
प्रभारी अधिकारी खनिज, बस्ती।

पत्रांक व दिनांक तदैव।

प्रतिलिपि : निम्नलिखित को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित।

1. निदेशक, भूतत्व एवं खनिकर्म निदेशालय, उ0प्र0, लखनऊ।
2. जिला सूचना विज्ञान अधिकारी, बस्ती को इस निर्देश के साथ प्रेषित कि Replenishment study कर एक प्रति को जनपद बस्ती के NIC वेबसाइट / पोर्टल पर अपलोड करना सुनिश्चित करें।
3. खान अधिकारी, बस्ती।

अपर जिलाधिकारी (वि0 / रा0) /
प्रभारी अधिकारी खनिज, बस्ती।

Developmental Assistance Systems (INDIA) Pvt. Ltd.

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Ph: +91 522 4007470, 4107624 TeleFax: 0522 4021236
Email: admin@dasindia.orgWebsite: www.dasindia.org
CIN: U85320UP1997PTC022705

Our Ref: 7597/2023-18/DSR/Basti/Corr/1
Date: 01.02.2024

To,
District Mining Officer, Basti,
Mining Section, DM Camp Office,
Katra, Basti, Nauachh,
Basti – 272001, Uttar Pradesh

Subject: Regarding submission of Replenishment Study Report for Sand / Morrum leases of District- Basti.

Dear Sir,

We are pleased to submit the Replenishment Study Report for District Basti effective from December 2024 based on data made available from the CMPDI study of 2022-23 and primary data analysis of the leases active in 2023-24.

Thanking you,

Yours faithfully,

Richa Singh

(Richa Singh)
Management Representative

Encl: As above

DISTRICT-BASTI

(UTTAR PRADESH)

SAND REPLENISHMENT STUDY

Supplementary to DSR

(RESOURCE ESTIMATION)

DECEMBER, 2024

Client:

District Magistrate, Basti
Mining Section, DM Camp Office, Katra, Basti,
Nauachh, 272001 Uttar Pradesh

Consultant:

ENV Developmental Assistance Systems (I) Pvt. Ltd.
C-363, Indira Nagar, Lucknow-226016
Ph: +91 522 4007470, 4107624,
Email: admin@dasindia.org

CONTENT

Richa Singh

For ENV Developmental Assistance Systems (I) Pvt. Ltd.

LIST OF FIGURES, TABLES AND PLATES

Richa Singh

1.0 INTRODUCTION

Basti was originally known as Vaishishthi. The origin of the name Vaishishthi is attributed to the fact that this area was the ashram of Rishi (sage) Vashistha in ancient period. Rama with his younger brother Lakshmana had resided here for some time with Rishi Vashistha. The tract comprising the present district was remote and much of it was covered with forest. But gradually the area became habitable, for want of recorded and reliable history it cannot, with any degree of certainty, be said how the district came to be known by its present name. In 1801, the town Basti became a *tehsil* headquarter, and in 1865, it was chosen as the headquarters of the newly established Basti district of Gorakhpur Division, on 6 May 1865. At first, the plan was to use the Rapti and Jamuwar rivers as the boundary between Basti and Gorakhpur districts, but this plan was abandoned. Instead, the boundary cut across existing parganas, with a few areas east of the Jamuwar becoming part of Basti district, while the eastern parts of Maghar and Binayakpur parganas remained in Gorakhpur district. New tehsils were established, and most of the original 8 parganas were split into two, for a new total of 13 parganas. Subordinate to the parganas were 131 tappas, which were of significant administrative significance. Amorha Khas is a historical place situated at a distance of 41 km from the district headquarter. Its old name is Ambodha, and it was once a province (state) of Raja Zalim Singh. Raja Zalim Singh's Mahal is here, old wall of mahal is still visible with the marks of bullets used by the English. The famous Ramrekha Temple is one of the most ancient Hindu Mandir of Lord Ram and Goddess Sita. Lord Shri Ram stayed here for one day during his journey of Janakpur-Ayodhya. Lord Shri Rama and Sita with Lakshmana journeyed towards Ayodhya by the road called Ram Janki Marg (present-day State Highway 72) near Chhawani. In the Great Revolt of 1857, about 250 martyrs of Amorha State were hanged by the British Government from peepal trees located at Chhawani.

2.0 GENERAL PROFILE OF THE DISTRICT

The district is situated in the north – eastern part of Uttar Pradesh. It forms part of the stretch of country lying beyond the river Ghaghra in northeast corner of Uttar Pradesh. The district lies between the parallels of 26 o 23' and 27 o 30' North latitude and 82 o 17' and 82 o 59' East longitude. It comprises of a tract of somewhat irregular shape. The

Richa Singh

district is surrounded by Sant Kabir Nagar on the east and Gonda on west, on the south, Ghaghara River separate it from Ayodhya and Ambedker Nagar while on the north the boundary matches with Siddharth Nagar district.

(Source: mineral.up.nic.in)

Fig 1: Location Map of Basti District

The seat of district administration is at Basti. To provide efficient administration the district is administratively divided into 04 Tehsils namely, Harraiya, Bhanpur, Basti and Rudhauli (newly created after 2001 Census). For implementation and monitoring of development scheme the district is divided into 14 Development Blocks namely, Ramnagar, Saltaua Gopal Pur, Paras Rampur, Gaur, Harraiya, Vikram Jot, Kaptanganj,

Rudhauli, Sau Ghat, Basti, Bankati, Bahadurpur, Kudaraha and Dubaulia (newly created in year 2002). Total area of the district is 2688.0 Sq. Km. The rural area covers 2662.0 Sq. Km. and urban recorded 26.0 Sq. Km. There are 1047 Gram Panchayats and 3348 Revenue villages with 3160 inhabited villages and 188 uninhabited villages in the district. In urban area there are 03 statutory Towns. Statutory Towns comprises of 01 Nagar Palika Parishad and 02 Nagar Panchayats.

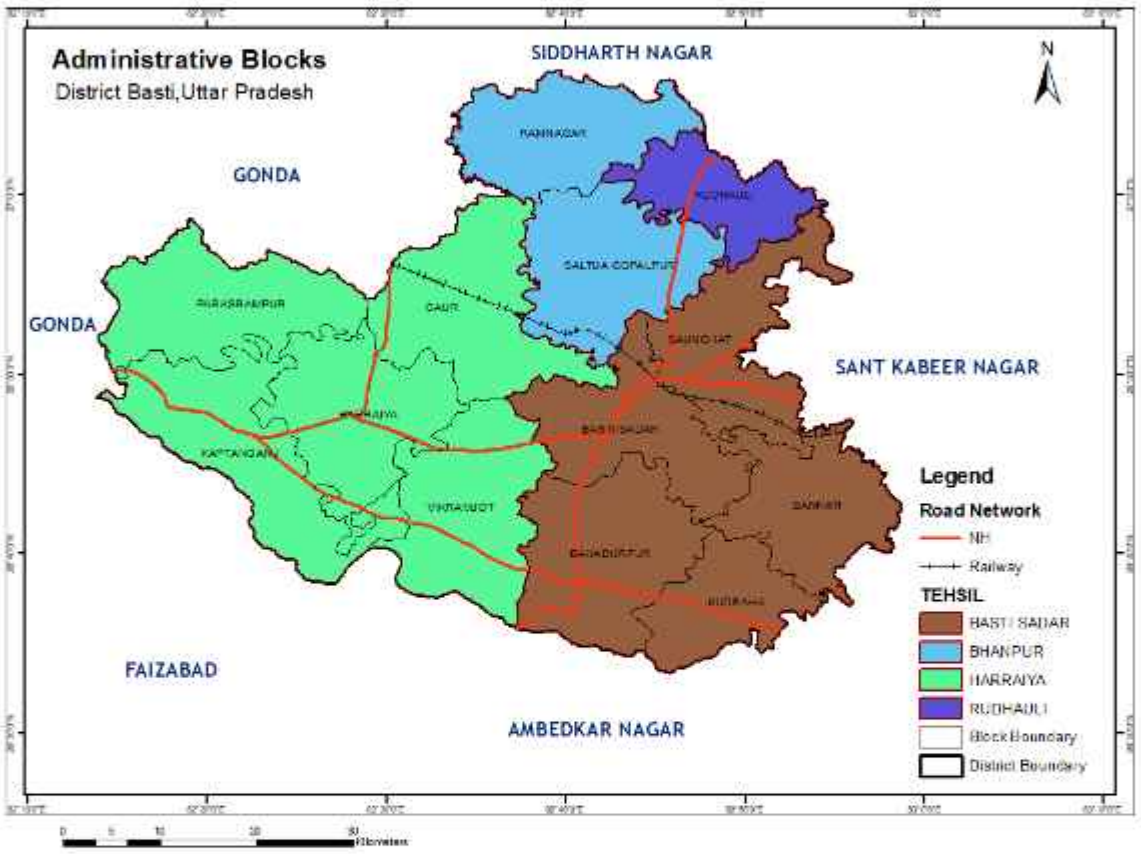

Fig 2: Administrative Map of Basti District

2.1 ADMINISTRATIVE DETAILS

The seat of district administration is at Basti. To provide efficient administration the district is administratively divided into 04 Tehsils namely, Harraiya, Bhanpur, Basti and Rudhauli (newly created after 2001 Census). For implementation and monitoring of development schemes the district is divided into 14 Development Blocks namely, Ramnagar, Saltaua Gopal Pur, Paras Rampur, Gaur, Harraiya, Vikram Jot, Kaptanganj, Rudhauli, Sau Ghat, Basti, Bankati, Bahadurpur, Kudaraha and Dubaulia (newly created in year 2002). Total area of the district is 2688.0 Sq. Km. The rural area covers 2662.0 Sq. Km. and urban recorded as 26.0 Sq. Km. There are 1047 Gram Panchayats and 3348

Revenue villages with 3160 inhabited villages and 188 uninhabited villages in the district. In urban area there are 03 statutory Towns. Statutory Towns comprises of 01 Nagar Palika Parishad and 02 Nagar Panchayats.

Table 1: List of Blocks of Basti District

S. No.	Name of Tehsil	S. No.	Name of Block
1.	Basti sadar	1.	Basti
2.	Rudhauli,	2.	Bankati
3.	Bhanpur	3.	Dubauliya
4.	Harraiya	4.	Gaur
		5.	Harraiya
		6.	Kaptanganj
		7.	Kudaraha
		8.	Paras Rampur
		9.	Ramnagar
		10.	Rudhauli (Tehsil)
		11.	Saltaua Gopal Pur
		12.	Sau Ghat
		13.	Vikram Jot
		14.	Bahadurpur

Basti district, a part of Basti division, is formed of four tehsils: Basti Sadar, Harraiya, Bhanpur and Rudhauli and 14 development blocks, 139 Nyay Panchayats, two Parganas named Amorha and Nagar as well as 10 Gram Sabhas. Basti district police is headed by a Superintendent of Police. It has 06 Circle Offices and 17 Police Stations. Basti is well connected to other places by railway lines and metalled roads. All the blocks and tehsil headquarters of the district are also connected through rail or road network.

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2.2 DEMOGRAPHY

In 2011, Basti had population of 2,464,464 of which male and female were 1,255,272 and 1,209,192 respectively. Average literacy rate of Basti in 2011 were 67.22 compared to 67.22 of 2001. Male and female literacy were 77.88 and 56.23 respectively. Sex Ratio in Basti stood at 963 per 1000 male and child sex ratio is 929 girls per 1000 boys as per 2011 census data. Literacy rate in rural areas of Basti district is 66.27 % as per census data 2011. The density of Basti district for 2011 is 917 people per sq. km.

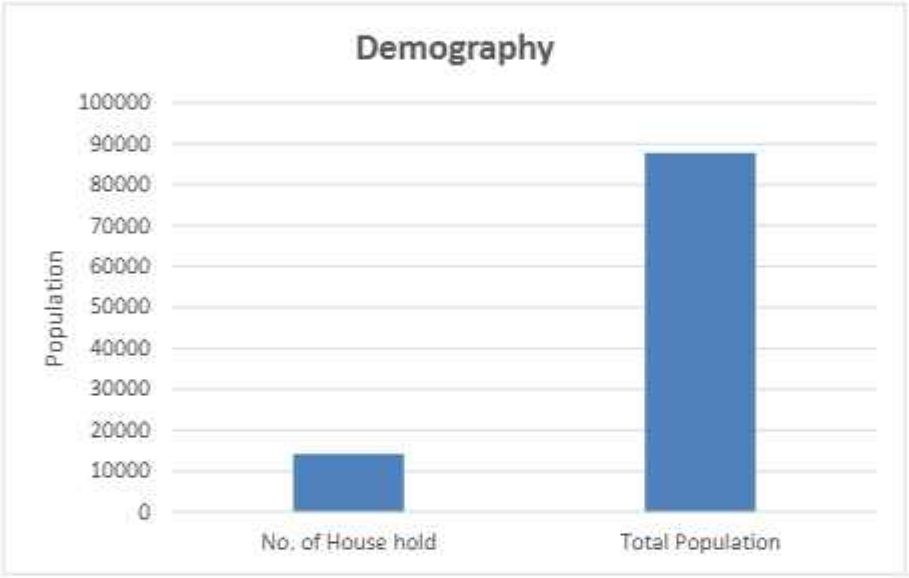

Fig 3: Total population along with number of households in the villages of Basti on the River Banks of Ghaghra

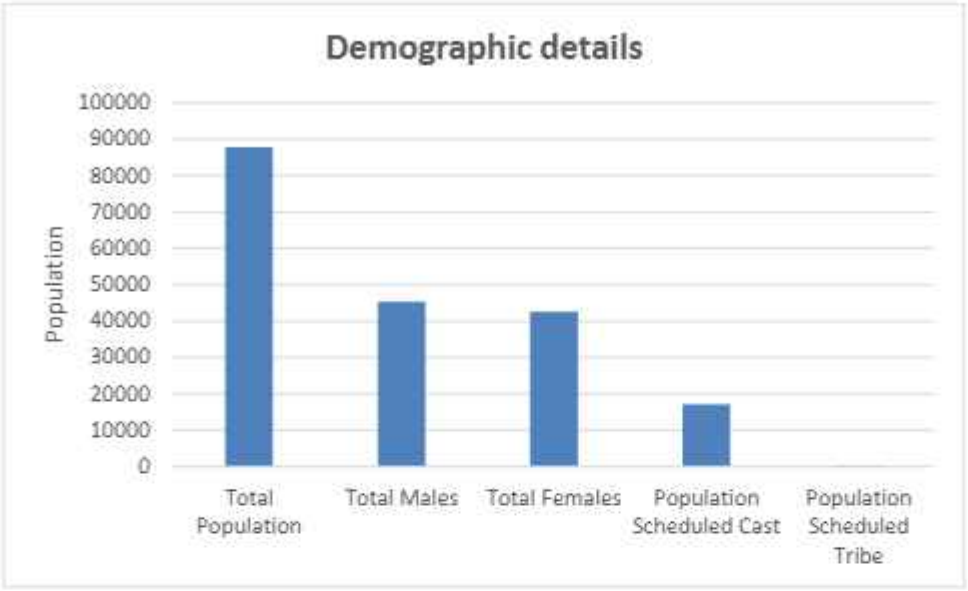

Fig 4: Total population, males, females along with SC/ST population in the villages of Basti on the River Banks of Ghaghra

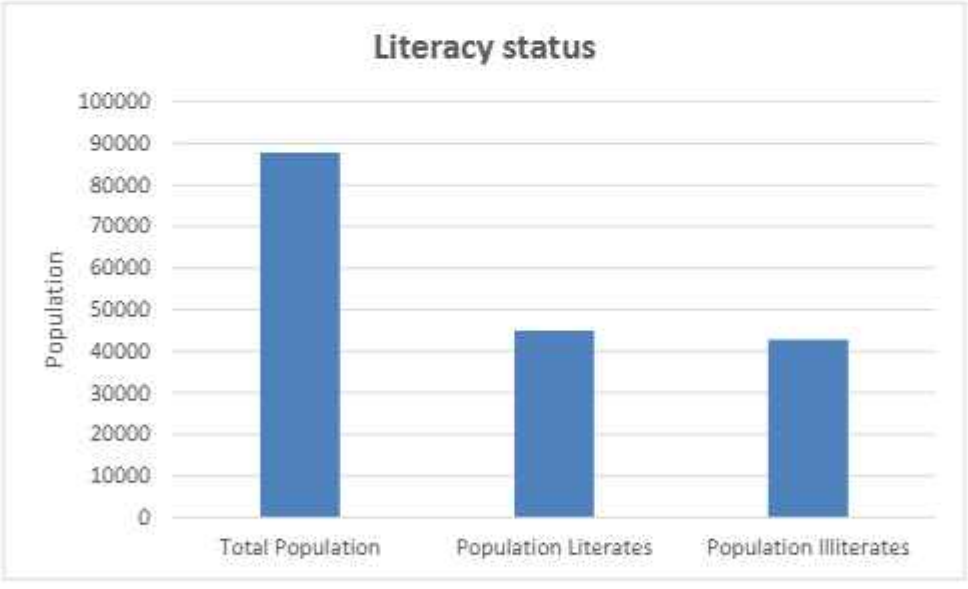

Fig 5: Literacy status in the villages of Basti on the River Banks of Ghaghra

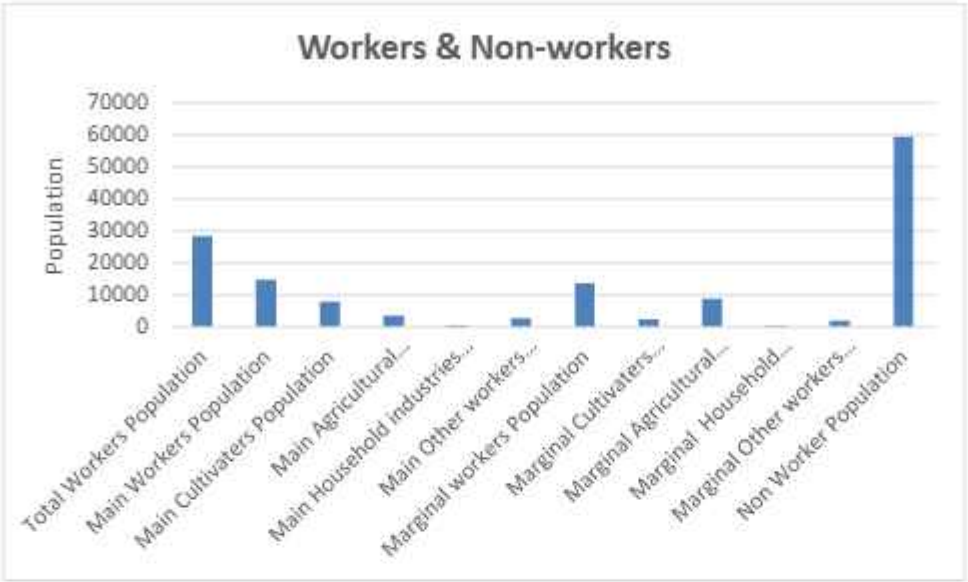

Fig 6: Worker and non-workers in villages of Basti on the River Banks of Ghaghra

Table 2: Villages of Basti in the study area

S. No.	Tehsil	Name of Village	S. No.	Tehsil	Name of Village
1.	Bhanpur	Achalpur	2.	Harraiya	Gokul
3.	Bhanpur	Dagdaua	4.	Harraiya	Paikoliya
5.	Bhanpur	Pakari Chaube	6.	Harraiya	Mahil Gaon
7.	Bhanpur	Shivpur	8.	Harraiya	Akala
9.	Harraiya	Macha	10.	Harraiya	Pure Laxiram
11.	Harraiya	Barsav	12.	Harraiya	Balua Pacha Bheti
13.	Harraiya	Pure Ori Raya	14.	Harraiya	Balua Rudani
15.	Harraiya	Tendhwa	16.	Harraiya	Jajupur
17.	Harraiya	Devnathpur	18.	Harraiya	Bhikhi Ban
19.	Harraiya	Mirjapur	20.	Harraiya	Ahra Pureno
21.	Harraiya	Gauriya Nain	22.	Harraiya	Gobindapur

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23.	Harraiya	Laxmanpur	**24.**	Harraiya	Baidauliya
25.	Harraiya	Chhitauna	**26.**	Harraiya	Kashipur
27.	Harraiya	Sadalpur	**28.**	Harraiya	Sarverpur
29.	Harraiya	Vikramjot	**30.**	Harraiya	Pati Mafi
31.	Harraiya	Sahjaura Pathak	**32.**	Harraiya	Chandaha
33.	Harraiya	Kalyanpur	**34.**	Harraiya	Pariyadih
35.	Harraiya	Marthapur	**36.**	Harraiya	Himayupur
37.	Harraiya	Kaulpur	**38.**	Harraiya	Basavanpur
39.	Harraiya	Bagha Nala	**40.**	Harraiya	Dhirauli Babu
41.	Harraiya	Lalpur	**42.**	Harraiya	Gangapur Dube
43.	Harraiya	Paraura	**44.**	Harraiya	Jaitapur
45.	Harraiya	Ram Nagar	**46.**	Harraiya	Ramvapur
47.	Harraiya	Keshawapur	**48.**	Harraiya	Niyamatpur
49.	Harraiya	Ranipur	**50.**	Harraiya	Banipur
51.	Harraiya	Kadkaniya	**52.**	Harraiya	Pure Motiram
53.	Harraiya	Madoi	**54.**	Harraiya	Sanghwapur
55.	Harraiya	Munderipur	**56.**	Harraiya	Pure Narga
57.	Harraiya	Khatan Sarai	**58.**	Harraiya	Ram Nagar
59.	Harraiya	Raidaspur	**60.**	Harraiya	Chhapiya Malik
61.	Harraiya	Sauri	**62.**	Harraiya	Bardiya Lohar
63.	Harraiya	Lakani Dubey	**64.**	Harraiya	Pithiya Laskari
65.	Harraiya	Narsinghpur	**66.**	Harraiya	Araji Duhi Muntasil Pithia Las
67.	Harraiya	Shambhupur	**68.**	Harraiya	Rasoolpur
69.	Harraiya	Khemrajpur	**70.**	Harraiya	Majha Begam Ganj
71.	Harraiya	Chandawaliya	**72.**	Harraiya	Majha Akhanpur

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73.	Harraiya	Bara Gaon	**74.**	Harraiya	Ashokpur
75.	Harraiya	Aaliya Jugram	**76.**	Harraiya	Bhuwaria
77.	Harraiya	Trilokpur	**78.**	Harraiya	Sakhiyapur
79.	Harraiya	Jagarnathpur	**80.**	Harraiya	Khushhal Ganj
81.	Harraiya	Sukhrampur	**82.**	Harraiya	Dubaulia Khas
83.	Harraiya	Salempur	**84.**	Harraiya	Bisun Daspur
85.	Harraiya	Kajipur	**86.**	Harraiya	Banjariya Subi
87.	Harraiya	Bharpapur Gairmustakham	**88.**	Harraiya	Katariya
89.	Harraiya	Betavan	**90.**	Harraiya	Gangapur
91.	Harraiya	Pure Chetan	**92.**	Harraiya	Bhiura
93.	Harraiya	Ashaji Duhi Pure Chetan	**94.**	Harraiya	Avdhut Nagar
95.	Harraiya	Puresoni	**96.**	Harraiya	Bisunpura
97.	Harraiya	Karvana	**98.**	Harraiya	Tilakpur
99.	Harraiya	Tursi	**100.**	Harraiya	Majhiyar
101.	Harraiya	Pure Teli	**102.**	Harraiya	Bhankharpur
103.	Harraiya	Sikaraha Panday	**104.**	Harraiya	Gaura
105.	Harraiya	Dudhaura Pure Kuwar	**106.**	Harraiya	Tiwaripur
107.	Harraiya	Pure Hemghar	**108.**	Harraiya	Shukulpura
109.	Harraiya	Jamuar Siddik	**110.**	Harraiya	Dalpatpur
111.	Harraiya	Galriha	**112.**	Harraiya	Baragal
113.	Harraiya	Pure Riksha	**114.**	Harraiya	Devara Ganj Barar
115.	Harraiya	Badhuapar	**116.**	Harraiya	Chandpur
117.	Harraiya	Ramvapur Panday	**118.**	Harraiya	Dharmupur

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119.	Harraiya	Sugaha Badali	**120.**	Harraiya	Kaithaliya
121.	Harraiya	Arjunpur	**122.**	Harraiya	Natava Jot
123.	Harraiya	Kanja Misir	**124.**	Harraiya	Saraiya Baxi
125.	Harraiya	Kakari Panday	**126.**	Harraiya	Bhatiha
127.	Harraiya	Pakari Sangram	**128.**	Harraiya	Para
129.	Harraiya	Gopalpur Panday	**130.**	Harraiya	Mojpur
131.	Harraiya	Shiv Garh	**132.**	Harraiya	Karmi Gosain
133.	Harraiya	Pure Hasan Nalband	**134.**	Harraiya	Unji Mustahakam
135.	Harraiya	Naipura	**136.**	Harraiya	Ghosiyapur
137.	Harraiya	Pipari Sangram	**138.**	Harraiya	Dingrapur Ahatmali
139.	Harraiya	Pure Sangram	**140.**	Basti	Pikaura
141.	Harraiya	Majha Bhatna	**142.**	Basti	Chilwaniya
143.	Harraiya	Pure Keshavdas	**144.**	Basti	Jaipur
145.	Harraiya	Chirgahna	**146.**	Basti	Dakhi
147.	Harraiya	Kuraniya	**148.**	Basti	Lutfabad
149.	Harraiya	Bhat Purva	**150.**	Basti	Bairari Ahatmali
151.	Basti	Deoria Urf Tenghriha Babu	**152.**	Basti	Mahuwapur Kalan
153.	Basti	Chakiya	**154.**	Basti	Mahuapar Khurd
155.	Basti	Deoria Urf Tengriha Raja			

The data above indicates the potential population which can be positively or negatively impacted by riverbed mining. There is potential impact on direct and indirect employment opportunities which needs to be focused by the district administration.

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3.0 RAINFALL

The average and real rainfall in the year 2011 were 1,166 m.m. and real rainfall was 808 m.m. respectively. Maximum rainfall occurs during the monsoon period i.e. June to September having 87% of annual rainfall. July is the wettest month having the normal rainfall of 341.50 mm followed by August with normal rainfall of 311 mm. The rainfall becomes more in southern area in comparison of northern region. The rainy season commences by late June when south western monsoon sets in over the State. The humidity gradually increases and reaches above 80%. August is the peak rainy season

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
16.8	13.2	11.1	7.2	24.6	130	348.9	291.8	216.4	52.4	1.5	7.2

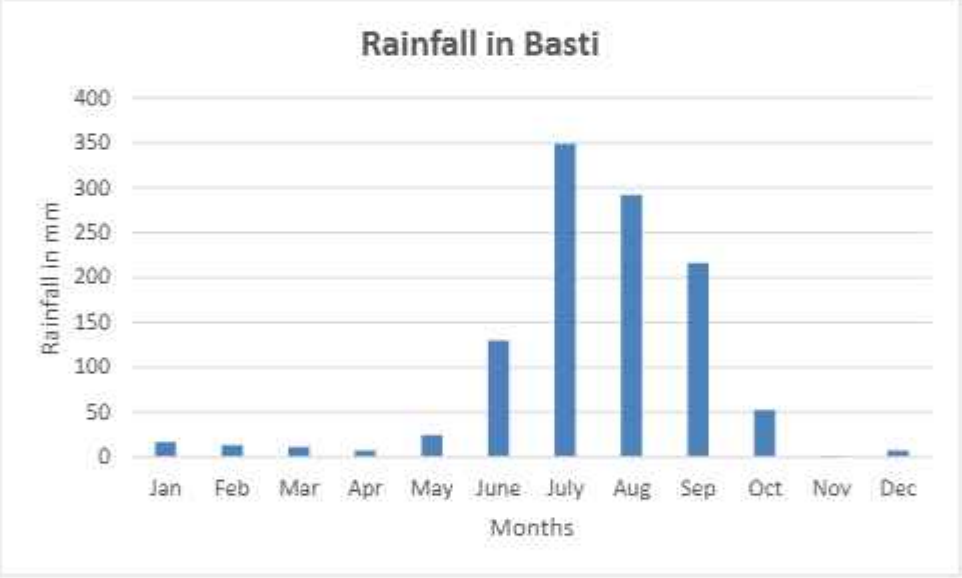
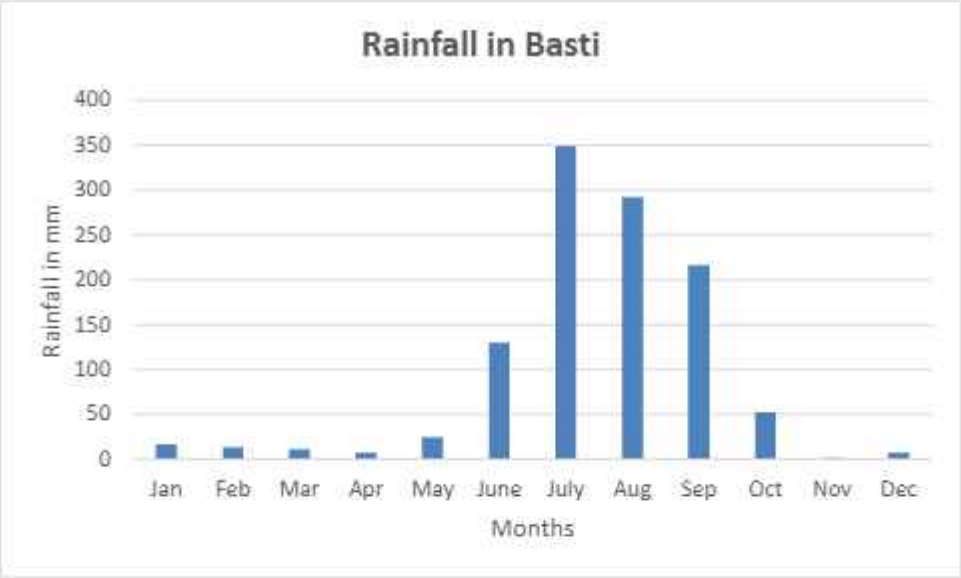


Fig 7: Rainfall in Basti District

3.1 ANNUAL RAINFALL OF THE DISTRICT

The rainy season commences by late June when south western monsoon sets in over the State. The humidity gradually increases and reaches above 80%. August is the peak rainy season.

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
16.8	13.2	11.1	7.2	24.6	130	348.9	291.8	216.4	52.4	1.5	7.2



Rainfall in Basti

The bulk of annual rainfall about 85% occurs during monsoon period (June to September). The rainfall is variable over the District ranging from maximum 348.9 to minimum of 1.5 mm.. The annual rainfall for the year 2021 is 1121.1 mm. The amount of average monsoonal rainfall of 987.1 mm.

Monsoon Rainfall	Non-Monsoon Rainfall	Total Rainfall
987.1	134	1121.1

(Source: GWYBUP 2021-22)

The climate of Basti somewhat resembles that of the other sub montane tracts in the north of Rohilkhand and Avadh, though it is milder than in the case with the districts in west. The heat in the summer months is less extreme and the west winds of the hot weather are rarely experienced. On the other hand the cold of the winter months is less extreme, and frost seldom occurs. For a number of years no thermo metrical observations have been recorded in the district, but past experience shows that the maximum temperature is (seldom) 43.0^{0}C in the shade in summer, and that the minimum on few occasions falls to 5.6^{0}C.

3.2 TOPOGRAPHY & TERRAIN

The district, in spite of its apparent uniformity of aspect, is divided topographically into several distinct tracts namely, the low valley of the Ghaghra in the south, extending from that river to its tributary, the Kuwana; the central upland, between the latter river and the

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rapti; and the low and ill-drained paddy belt between the Rapti and the Nepal boundary.The altitude of the Basti district ranges between76 to 92 m amsl. The district can be almost divided into two identifiable units, the upland plains underlain by Older Alluvium and the lowland plains underlain by Newer Alluvium. Younger alluvial plain is found along the Ghaghra river and it is flat to sloping slightly undulated terrain. It is produced by extensive deposits of alluvium and usually occur adjacent to flood plains and consist of various fluvial land forms which include back swamp, oxbow lake, old meander, meander scar, paleochannel and point bar. It mainly comprises of younger unconsolidated alluvial materials of varying lithology. In the younger alluvial plain area the ground water table is very shallow and ground water yield prospects are excellent. Older alluvial plain is similar to younger alluvial plain but are formed at the earlier stage of depositional regimes comprising of unconsolidated sediments, hence occurring comparatively far from the present flood plains of the river. Groundwater prospects are good to very good.

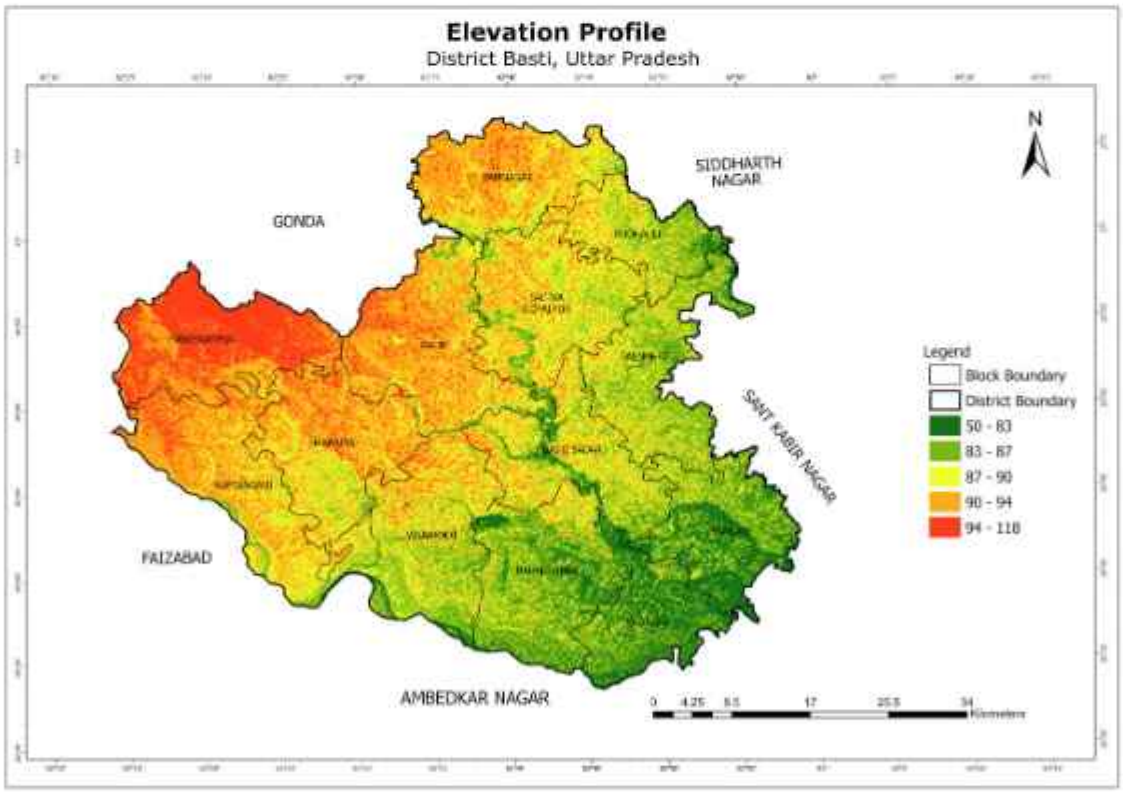

Fig 8: Elevation profile of Basti District

3.3 WATER COURSE & HYDROLOGY

Ground water occurs in the pore spaces of unconsolidated alluvial material in the zone of saturation. The near surface, clay kankar and sand beds support mainly open wells where ground water occurs under water table conditions. Kankar occurring at shallow depths, also yield sufficient water. Most of shallow tubewells tap water only from kankar and sandy horizons. The shallow aquifers occur under unconfined conditions, while deeper aquifers occur under semi confined to confined state of disposition. The confining layers are impermeable clay beds. Aquifer geometry Alluvial tract of Basti district is underlain by sands of various grades, gravels, silt and clay. The actual thickness of the sediments is not known as CGWB has not carried out exploration in Basti district and the deepest well-constructed by state government is only down to depth of 134.12 m bgl. However exploratory well have been constructed by CGWB in adjoining district Siddharthnagar upto a depth of 310 m bgl. The result of exploratory drillings indicates that the aquifers vary great deal in extent, both vertically as well as laterally. The southern part of the district is characterized by thicker aquifers, where sand and gravel predominate over clays. The northern part comprises of thinner granular zones and lenses of sand of varying lateral extent, dominated by thick clay. Broadly, a two (2) tier aquifer system can be inferred in the area down to depth of 300 mbgl. The sticky and yellowish clay marks the boundary between these aquifers at 114 m bgl.Ground water in the topmost aquifer occurs under phreatic or water table conditions while in intermediate and deeper aquifer it occur under semi confined to confined condition.

3.4 GROUND WATER DEVELOPMENT

The stage of ground water development in the district is 75.43 %.Ground water development in all blocks is above 60%. Less ground water development has been observed in Kudraha and Ramnager block. Depth to water level is shallow in most part of the district, shallow tubewell (upto depth of 35 m), constructed by hand boring sets, is suitable to meet out the domestic/irrigation requirement. Rotary (direct/Reverse) is suitable for construction of shallow tubewell. Deep tubewell is constructed through direct rotary method. The well assembly for moderately deep tubewells may have 40-50 m housing, tapping 30 to 40 m of granular zone. Since fine sand are encountered in granular zones, it is advised that slot size is between 0.75 to 1.00 mm. To increase the life and

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discharge of well, after lowering of well assembly tube well should be developed initially by air compressor followed by turbine pump till water is sand free.

3.5 WATER LEVEL FLUCTUATION

As per depth to water level data of ground water monitoring stations of Basti district of year 2012, pre monsoon water level varies from 2.75 mbgl (Kalwari) to 5.67 mbgl (Basti) .In Post monsoon period depth to water level varies from 1.92 mbgl (Rudauli) to 4.57 mbgl (Basti). Annual water level fluctuation (2012) varies from 0.13 to 3.19 meters. The perusal of the pre - monsoon depth to water level map reveals that depth to water level in the central part is deep, having water level in the ranges of 5 – 6 mbgl whereas in the rest of the district shallower water levels(2-5 mbgl) are observed. The highest annual decline in the water levels is was observed at Basti 0.092 m/year.

4.0 LAND UTILIZATION PATTERN OF THE DISTRICT: FOREST, AGRICULTURE, HORTICULTURE, MINING ETC.

This district lies in the north part of Ganga, Ghaghra plain and in the north of Saryu River, thus the whole land of the district is cultivable land & fertile. The land level is plain and most fertile of the total area available for cultivation, most of the area is used as double cropped area. The position of land holdings in the district are mostly small size holding but some land holding in the district are categorized in medium and large stake holder. The land is covered by the forest area, cultivable banjar land, fallow (parti) land, Usar and uncultivable land and land use other than agriculture. The total reported area of the district was 295239.23 hectares. There are total 3160 inhabited villages in the district having total area 295239.23 hectares. The percentage of cultivable area to total area is 77.06 percent in the district. At district level 83.23 percent of total cultivable area has got the irrigation facility

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Table 3: Land use pattern of Basti District

Land Use Types	Land Use Classification	Area (in Sq. Kms.)
Agriculture	Crop land	2136.85
	Current Shifting cultivation	
	Fallow	57.81
	Plantation	57.78
Barren/unculturable/ Wastelands	Barren Rocky	
	Gullied / Ravinous Land	
	Rann	
	Salt Affected Land	2.58
	Sandy Area	
	Scrub Land	20.34
	Mining	3.90
Builtup	Rural	100.77
	Urban	50.12
Forest	Deciduous	43.24
	Evergreen/Semi evergreen	
	Forest Plantation	0.16
	Scrub Forest	
	Swamp / Mangroves	
Grass / Grazing	Grass / Grazing	
Snow and Glacier	Snow and Glacier	
Wet lands / Water bodies	Inland Wetland	12.09
	Coastal Wetland	
	River/Stream/Canals	134.85
	Water bodies	11.60

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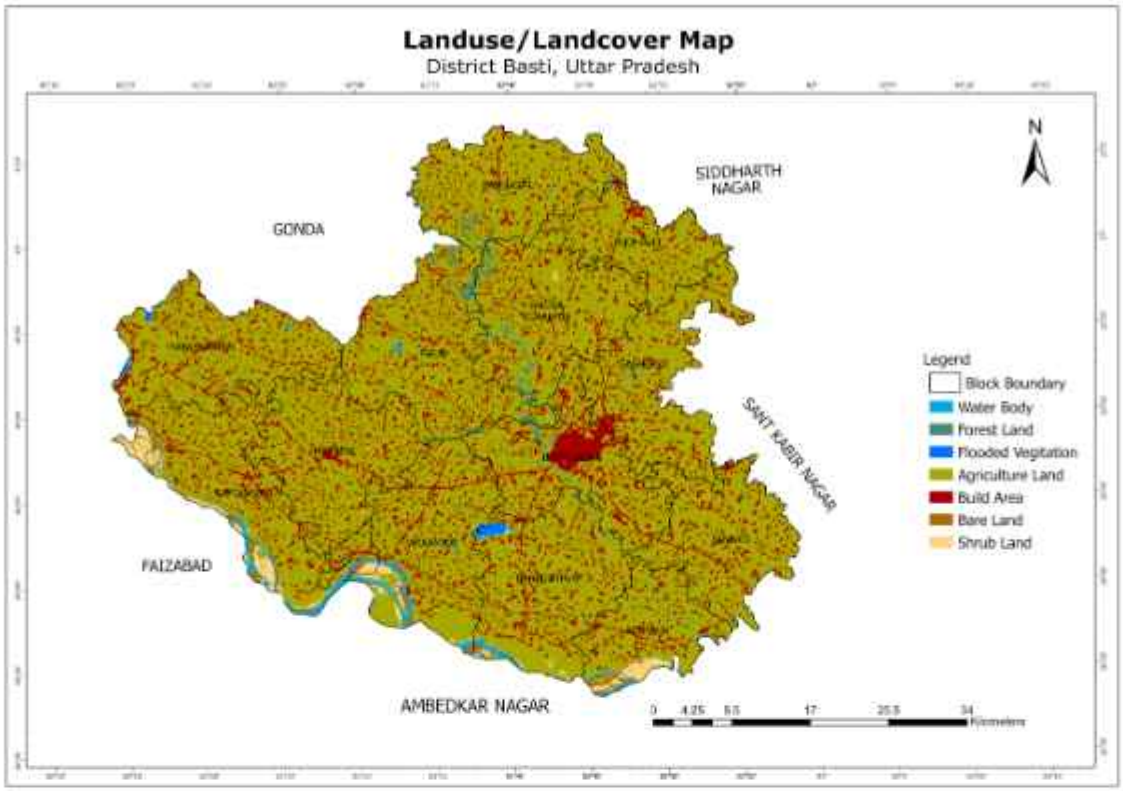

Fig 9: Land use Map of Basti District

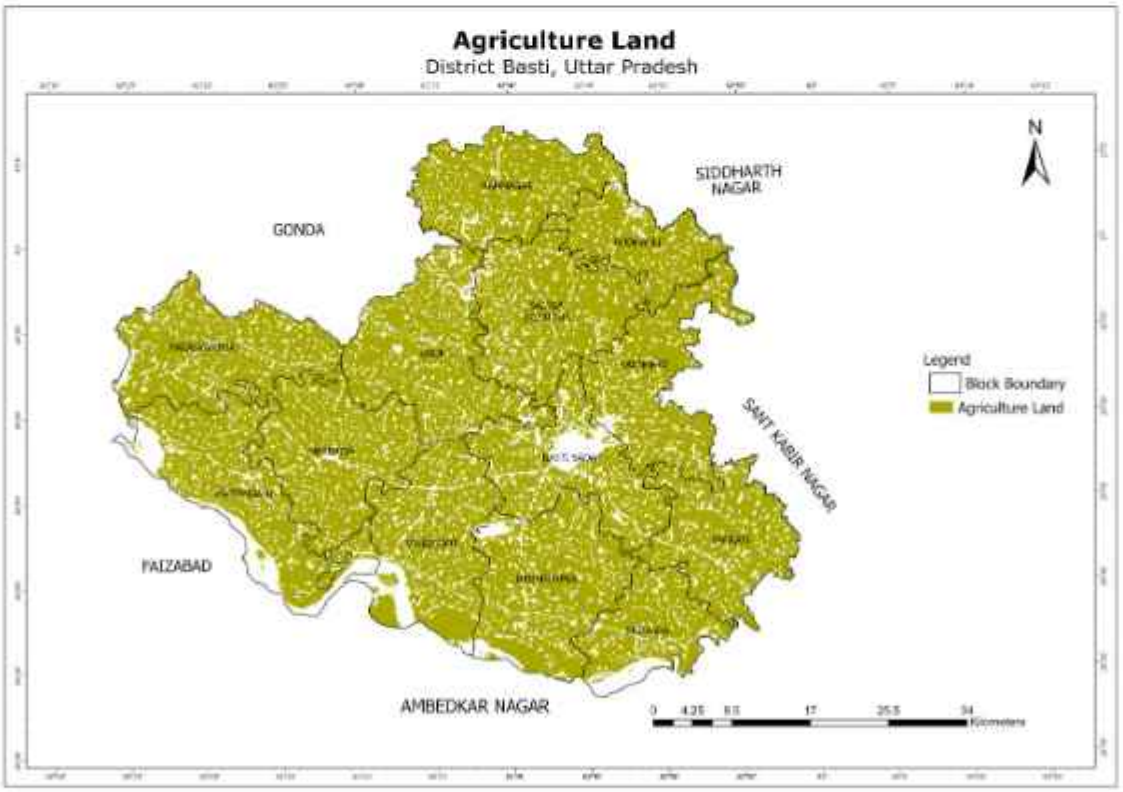

Fig 10: Agricultural land use Map of Basti District

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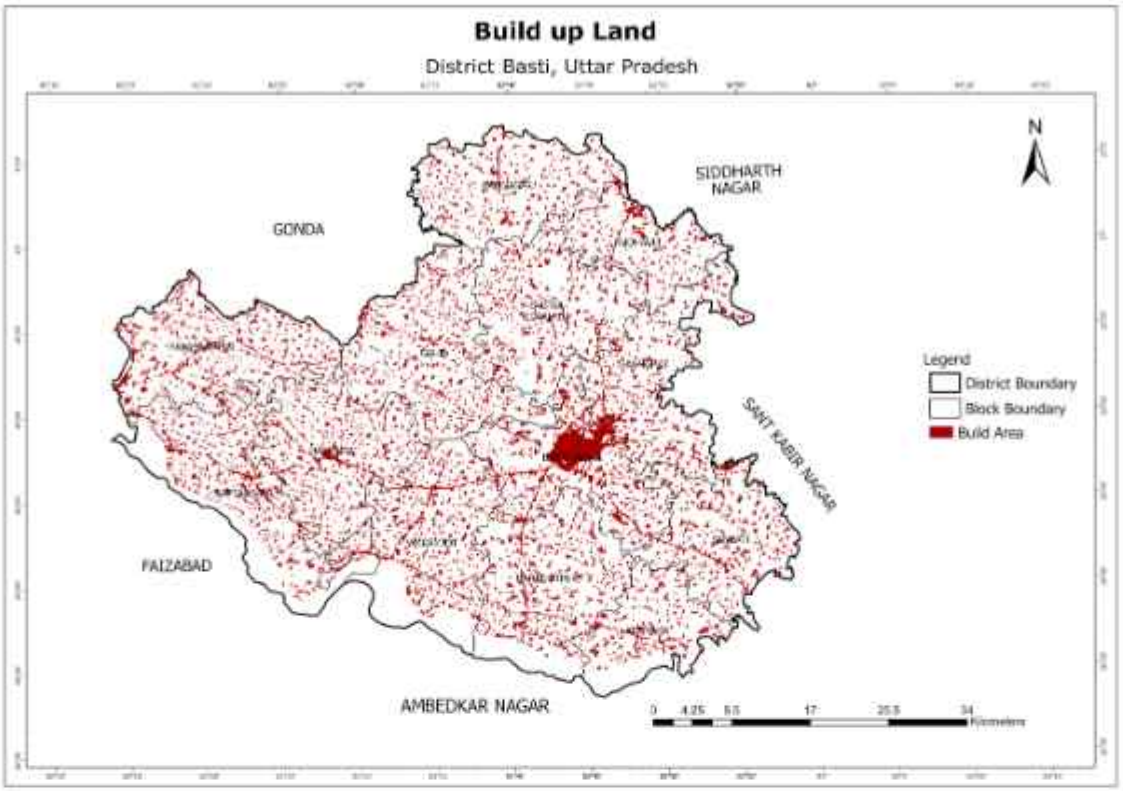

Fig 11: Buildup Map of Basti District

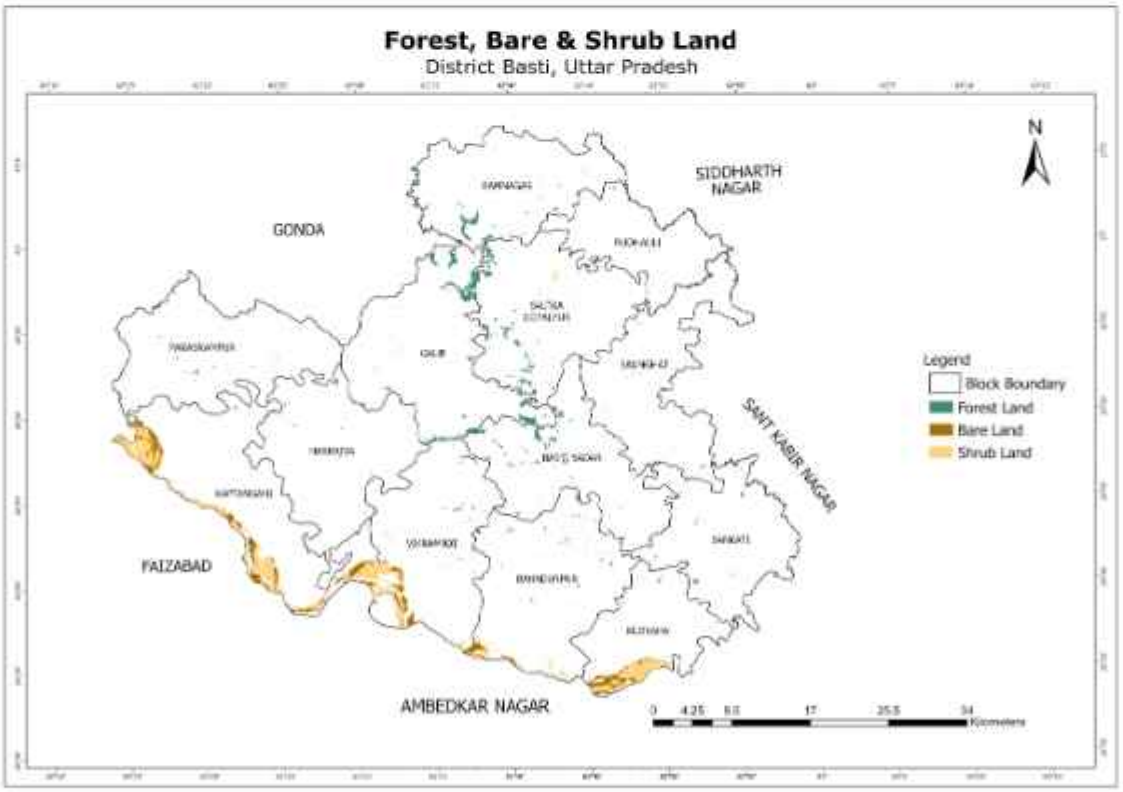

Fig 12: Forest land use Map of Basti District

5.0 GEOLOGY OF THE DISTRICT

The north portion of the district is along with the boundary of district Siddharta Nagar. In this area there are small nalas & ponds. The river Ami is flowing on the north eastern border. The Garia River is regularised the eastern border of the district, at some distance. In the middle and southern part of the district, the river Kuwana and Ghaghara are the main rivers, besides these rivers there are so many rivers, nalas and ponds in the area. The whole land of the district is made by the soil carried out by the Ghaghara and tributaries. This is generally plain and fertile land which is situated in the north revage of Ghaghra River. The normal flow of water is in the direction of northwest to southeast. The district is drained by Ghaghara like big rivers along with so many small & big nalas. The river Ghaghara is flowing through the south corner of the district towards the Tehsil Harraiya, Basti in the direction of west to east and makes the boundaries of district Basti and Ayodhya and the river Kuwana is flowing through the tehsil Basti & Bhanpur. The river Manwan is flowing through tehsil Harraiya, Basti in northwest to southeast direction. The river Ami, in the north, has been divided, the boundaries of district Basti & Siddharth Nagar and in the east, the river Garia makes the boundary line of district Sant Kabir Nagar and flows in Tehsil Basti in east direction.

On the Basis of geology, soils, topography, climate and natural divisions, the district is sub divided into the following two regions.

1. Basti Plain
2. Ghaghara Khadar

1. Basti Plain:

It covers the central and major part of the district. The plain is locally known as 'Uparhar'. It is an upland zone which has higher surface area in the western side and slopes towards southeast direction. There are numerous streams which originate from the western side and drains this tract. These are Kuwana, Ami and Garia etc. Which are the parts of the Ghaghara drainage systems known for their flood havoc. Many embankments along with streams have been constructed to provide protection from the flood water. In the region, there numerous water bodies which are basically the abandoned courses if the rivers. The plain is very rich in agriculture.

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2. **Ghaghara Khadar:**

The region is situated parallel to Ghaghara river in east-west direction. Its northern extent is delimited by watershed line of the Kuwana river. The area in immediate neighbourhood of the river is low land tract. Flood causes change in the course of river. The tracts in between deep stream and higher bank is known as manjha which are invariably flooded but in north of this it is called as Tarhar or Khadar. The Tarhar zone ends in Basti plain in different proportion, Natural levees, dead arms of the rivers and deposits ox bow lakes are the other physiographic features. To protect the flood, embakments have been constructed at different places.

5.1 Regional Geology

Geologically the district forms part of the vast Indo-Gangetic alluvial tract, of which the origin is attributed to a sag in the Earth's crust formed in the upper Eocene times, between the northwardly drifting Gondwana land and the rising Himalayan belt, and gradually filled in by sediments so as to constitute a level plane with a very gentle slope. The alluvium formation of the District, comprising sand, silt & clay with occasional gravel, is of the early quaternary to sub- recent age. The older alluvium called Bhangar, forms slightly elevated terraces usually above the flood level. It is rather dark in colour generally rich in concentrations and nodules of impure calcium carbonate, locally known as kankar. The newer alluvium called Khadar, forming the lowlands between the Ghaghra and Bhangar, is right coloured, poor in calcareous contain and composed of lenticular beds of sand, gravel and clays. The economic minerals found in the district are kankar, reh and sand. The Basti district is a part of the Central Ghaghra alluvial plain manly constituted of clay, silt, sand, gravel and kankar sediments of Quaternary age.

The district is underlain by Quaternary alluvium comprising and of various grades, gravel, kankar and clay. The Alluvium can be classified into two groups, the Older alluvium and the Newer alluvium. Older alluvium:- It is of middle Pleistocene age and generally occupies high ground which is not affected by floods during the rainy season. The Newer alluvium:- It covers the lower height and is mainly conferred to the flood plains along the river channels and belongs to the upper Pleistocene to the recent age.

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Group	Age	Formation	Lithology
Quaternary	Recent to Upper Pleistocene to	Newer Alluvium	Unconsolidated sand, silt and clay
	Upper Pleistocene to Lower Pleistocene	Older alluvium	Fairly consolidated clay with kankar, sand, fine to medium with same gravel
Purana	Pre-Cambrian	Vindhyan	Sand Stone & Shale and Lime stone

5.2 Local Geology

The facies of the river bank deposits are sandy, silty and clayey. The sandy older alluvium is located at an elevation of 10-20m above the river level and makes the higher interfluve areas. It is free from frequent flooding and therefore most suitable for settlement and agriculture. Newer alluvium forms the river valley terrace and is located at an elevation of 5-7 m above river level. This terrace and is located at an elevation of 5-7 m above river level. This terrace is not suitable for settlement but can be used for agriculture, as it is often affected by flood.

5.3 SOIL

The soils of the district are slightly matiyar and baluai, domat in the north and middle region. The region which is close to district Siddharth Nagar and situated in the eastern part of the Khalilabad, the soil of this area are slitely calcarium. Generally this district lies in the north part of Ganga, Yamuna plain and in the north of Saryu river, thus the whole land of the district is cultiviable land & fertile. Basti has Alluvial plain, densely populated and in some parts highly cultivated, though the level is only broken by the shallow valleys of the rivers, which generally run in a south-easternaly direction. The surface of the country is a gentle slope from the North West to the south east. The mean elevation is about 290 feet above the sea, this is the height of the railway station of Basti while in south of district the level drops from 306 feet above the sea at Belwa, The nearest point to Ayodhya to 300 feet at Harraiya.

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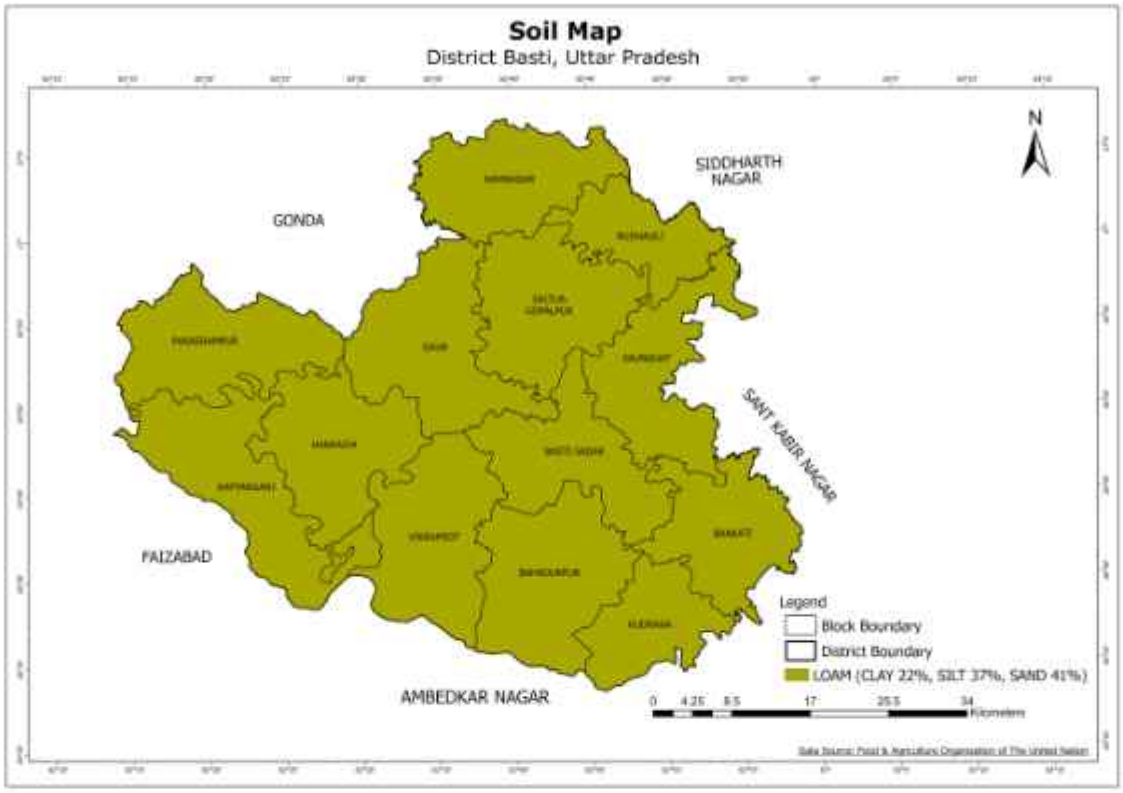

Fig 13: Soil Map of Basti District

Soils are formed by the weathered rock and are dominant in the district. The minerals of Basti include earth material for filling and brick making and sands from the river Ghaghra. Since the entire area is characterized by alluvium the soil consists of sand, clay, kankar and silt. The coarser sediments are part of newer alluvium. Finer sediments are observed in older alluvium. Loam and clay are characteristic soils of uplands. In most parts of the uplands there is a large amount of kankar in subsoil. The silty loam deposits are found all over flood plains in the district. Soil of the Upland area is pale reddish – brown colour, kankar disseminated throughout the area. The main mineral wealth of the district is sand and the local geology of the area is sandy. No mineral deposit is available in Basti except for Ordinary sand/ clay reported in some parts of the District.

6.0 PROCESS OF DEPOSITION OF SEDIMENTS IN THE RIVERS OF THE DISTRICT (RIVER GEOMETRY)

The river rises in Tibet, flows through Nepal and, crosses the Himalayas at Chisha Pani before finally confluence with the Ganga. The substrate is largely composed of sand and silt. Riverbanks are largely sandy and both the banks were exposed. the Ghaghara river at this site is characterized by a braided morphology and is anabranched with large alluvial islands, small mid channel bars and lateral bars. The channel is mostly asymmetric with a wide main channel (avg. 300 m in low flow condition) and is susceptible to floods along the right bank of the channel belt. A sandy channel substrate and banks are noted. Many reaches upstream as well as downstream are identified as highly aggrading. A sandy channel substrate and banks are noted, with calcretic bed material exposed in some areas in low flow condition and portions of pedogenic calcrete bank material. The sediment load at Ayodhya site is 398217 tonnes per day (145.45million tonnes/year) for 80,889 km^2 i.e. 4.92 tonnes per day per km^2. This corresponds to a catchment denudation rate of 1.29 mm/year. In low flow years the sediment load is low while the high flow years have high sediment load. The sediment load is maximum in the month of August in correspondence to stream flow. In lean flow years the sediment load is low while the high flow years have high sediment load. The sediment load is maximum in the month of August in correspondence to stream flow. T h e Ghaghara Sinuosity index is indicating high sinuous in nature due to high discharges and sudden reduction in gradients as well as flow velocity in the channel during the river's different flow conditions. The high discharge during the monsoon is the most prominent effective factor behind the flood of the Ghaghara River during its course. This seems to be a heavy rainfall receiving area in the Ghaghara River Basin. The result reveals that morphological activity which indicates mature stage of topographic evolution and erosion on the hydrological significance as well and analysis provides information that identification of flood process to study of Sinuosity indexes leading destroyed infrastructural equipment and houses and agricultural plants. The river's hydrology is influenced by the South Asian monsoon and glacial melt in its source region in the Himalayas. Heavy rains occur during the summer monsoon (June to September), and the glaciers provide their greatest amount of water to the river during the same period. Vegetation varies from low-lying alpine plants at high elevations to tropical forest where the river crosses the Siwalik Range.

6.1 EVOLUTION

The sandy units of Ghaghara include planar cross-bedding, trough cross-bedding, and ripple lamination makes the major portion and is present in the lower to middle part of the channel bar deposits. Silt and clay unit, showing climbing ripple lamination and laminated mud, constitutes minor portion and is present above the sandy facies. Aeolian sandy facies, if present, makes the negligible percentage of the channel bar deposits. The facies of the river bank deposits are sandy, silty, and clayey. The sandy facies is prominent in the lower and middle part. This 120- to 200-cm thick unit is devoid of sedimentary structures, only faint low-angle discordances are visible at some places. The sandy unit is underlain by 20- to 40-cm thick silty unit. The upper most part is 40- to 50-cm thick clayey unit. The facies of the river bank deposits are laterally persistent, only thickness and percentage of different litho units may vary from place to place. The granulometric parameters indicate that the sediment size is 2.4 and 2.28 Ø for lateral and braid bar deposits, respectively. The sediments are fine sand, and its size varies between 2 and 3 Ø for different sandy facies of the channel bar deposits. The sediment size in the river bank deposits varies from 2.3 to 3.5 Ø for sandy units. The river bank sediments are made up of fine sand. Sand is a non-cohesive granular material with low degree of compaction and has a capacity for sliding, removal, and scouring. Finer sediment (clay) has resistance against sliding, removal, and scouring action.

6.2 PROCESS OF DEPOSITION

Rivers are one of the major sources to supply sand and gravel for construction projects. Heavy water flow in key rivers will bring alone fresh sand and fill deep pits on riverbeds. The factors for the replenishment of the river are such as catchment area, tributaries, general profile of the river system- geology/lithostratigraphy, climate and annual precipitation, erosion and weathering, sedimentation and transportation, engineering structures like stop dam, check dam, barrage, activity near river bank, turbidity, bird habitat, riparian habitat, flora and fauna, groundwater etc. Depending on river morphology and hydraulic characters, sediment transport capacity may vary. It is important to study in detail about pre-monsoon and post-monsoon status of river and sand 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

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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).

6.3 MODE OF SEDIMENT TRANSPORT

The sediment load of a river is transported in various ways although these distinctions are to some extent arbitrary. The loose boundary (consisting of movable material) of an alluvial channel deforms under the action of flowing water and the deformed bed with its changing roughness (bed forms) interacts with the flow. The resulting movement of the bed material (sediment) in the direction of flow is called sediment transport and a critical bed shear stress (t) must be exceeded to start the particle movement. Such a critical shear stress is referred to as incipient (threshold) motion condition, below which the particles will be at rest and the flow is similar to that on a rigid boundary.

6.4 REPLENISHMENT

Distribution of various rock types in the Ganges River Basin are as follows: Recent Alluvium (57%), Deccan and Rajmahal traps (10%) (Tertiary), Granites, Gneisses and Charnokites (11 %) (Tertiary), (Archean) Granites and Gneisses (5%), Cambrian and Upper Precambrian sedimentary rocks (16%). The impact of the monsoon in leading to highly episodic sediment transport has been observed the different size fractions which make up the sediment load carried by the River Ganges. It has to be recognised that changes in sediment load through time, or over space, may simply be reflecting the addition from different sources or the subtraction in different locations of material of a specific size. Other sediment properties, in addition to particle size, are also known to vary

in Indian rivers. Clay mineralogy, for example, is known to be dominated by illite also called hydromica or hydromuscovite in May, but by kaolinite in August. Sand may be replaced from one location to another on the river course. It may not increase the existing (sand) stock, but will partially refill the pits, where sand was mined in the past, as water flows from the upstream, Sand will not replenish with just a rain or excessive inflow, it takes centuries for the process.

High water during monsoon, low degree of compaction of the sediments, and a large amount of runoff materials from watershed cause the river channel to shift laterally. It is considered that the stream bank erosion is caused by flooding and erosion is greater on sandy than on silty soils. The lateral erosion is common all along the Ghaghara River, but is more prevalent in the in middle reaches where narrow channel is confined within wide valley made up of sandy and silty sediments with low degree of compaction. Such events may become more frequent and severe in future with changes in land use and rapid urbanization. The main tributaries of Ghaghara are Sharda, Sarju, Chauka, Kuwana, Rapti, Chhoti Gandak, Jharahi, and Daha. Rapti and Chhoti Gandak rivers join with Ghaghara near Barhaj in Deoria district of Uttar Pradesh. Ghaghara is very notorious and is prone to fluvial hazards. Ghaghara is a unique river with respect to fluctuation of discharge (Very high discharge during monsoon and very low discharge during dry season), high sediment load, and channel instability. It has higher discharge than the Ganga before its confluence near Maharajganj, Chhapra district of Bihar. It consists of alluvium deposited by various river systems under different climatic conditions and surface processes in which coarser sediments were deposited under high-energy environment and finer sediments during low energy environment. Older alluvium (Bhangar) and newer alluvium (Khadar) are the two morpho-stratigraphic units in the classical literature of the Ganga Plain. Older alluvium is located at an elevation of 10–20 m above the river level and makes the higher interfluve areas. It is free from frequent flooding and therefore most suitable for settlement and agriculture. Newer alluvium forms the river valley terrace and is located at an elevation of 5–10 m above river level. This terrace is not suitable for settlement but can be used for agriculture, as it is often affected by flood. The flood plain is located at an elevation of 2–5 m above the river level. Water reaches almost every year on this plain. It is neither suitable for settlement nor for agriculture.

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6.5 SEDIMENT DISCHARGE RATE

The Ganga River is one of the world's largest sediment dispersal systems, with a channel length of 2974 km and a basin area of 965 936 km^2, transporting an extremely high suspended sediment load of 356 × 10^6t $year^{-1}$. The Ganga and Brahmaputra rivers yield approximately 10^9t $year^{-1}$ of suspended sediment at a point in Bangladesh about200 km from the ocean, which is perhaps the highest suspended load carried by any river system in the world (Wasson2003). Abbas and Subramanian (1984) estimated the sediment load of the Ganga at Farakka to be nearly 7.29 × 10^8t $year^{-1}$ of which 328 × 10^6t $year^{-1}$ is transported downstream. The Himalayas are the major supplier of sediments to the Ganga plain but the southern peninsular rivers have also contributed significantly to alluvial fills in the geological past (Sinha and Sarkar2009). The Himalayan rivers are characterized by higher flows higher basin relief, larger catchment area, greater basin instability involving landslides and earthquakes, and younger geological formations as compared to the peninsular rivers. In addition, they also differ in terms of climatic conditions, degree of urbanization and in the use of water resources, which affect the magnitude and nature of sediment transport (Subramanian1996).Sinha and Friend (1994) categorized the Himalayan River system into three distinct classes on the basis of the source area: mountain-fed, foothills-fed and plains-fed river systems. The mountain-fed rivers (e.g. Kosi, Gandak) derive their water and sediments from the High Himalayas and they have a much larger hinterland compared to the alluvial part. The foot-hills-fed (e.g. Baghmati, Rapti) and plains-fed rivers (e.g. Burhi Gandak, Gomti) drain the inter-fluve region between the fans and derive sediments partly from the foothills but mostly within the plains. The plains-fed rivers cause rigorous and repeated reworking of the sediments deposited by the mountain-fed or foothills-fed rivers. In the Himalayan region, natural hazards such as floods, landslides (triggered by heavy monsoon and tectonic activity) and glacial lake outburst floods (GLOFs) are frequent and they contribute large volumes of sediments. Human activity has significantly altered the unregulated flow characteristics of the Ganga River system. The Ghaghara river at this site is characterized by a sinuous pattern and hosts large lateral bars, mid channel bars and few alluvial islands. The channel is mostly asymmetric with a wide main channel (avg. 450 in low flow condition) and is susceptible to floods along the right bank of the channel belt. A sandy channel substrate and banks are noted, with calcretic bed material exposed in some areas in low flow condition and portions of pedogenic calcrete bank material. In lean flow years the

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sediment load is low while the high flow years have high sediment load. The sediment load is maximum in the month of August in correspondence to stream flow.

6.6 SEDIMENTATION YIELD

Sediment, the end product of erosion, has a twofold effect:

1- It depletes the Land from which it is derived

2- It impairs the quality of the water-resources in which it is entrained and deposited.

The importance of the sediment-yield-surveys, as preventive and corrective measures, can be attributed to the erosional-processes. (Kumar, 1992) Naturally, sand is a granular material consisting of rock particles and fine minerals measuring between 0.06 mm to 2 mm. Sand is formed from decompactions of rocks due to mechanical strength where decomposed rocks form gravel and then sand. The Ganga basin mainly consists of alluvial sediments, which has been collected over most of the Quaternary period building one of the largest alluvial plains in the world. The basin covers 11 States of India, viz., Uttarakhand, Uttar Pradesh, Madhya Pradesh, Rajasthan, Haryana, Himachal Pradesh, Chhattisgarh, Jharkhand, Bihar, West Bengal and Delhi. With a mean annual flow of $5.9\times10^{11}m^3yr^{-1}$ and sediment load of $1600x10^{12}gyr^{-1}$ the Ganges river ranks second and third, respectively, in terms of water flow and sediment load among the world's rivers. Considering the enormous sediment transport by Ganges to the Bay of Bengal, a study was conducted on the size distribution and mineral characteristics of the suspended sediments of the Ganges river and is reported here. Most of the sediment load has a size range between <4–5.75 φ). The sediments are mostly medium to coarse silt and are poorly sorted. Mica dominates among the clay minerals, followed by chlorite, vermiculite, kaolinite, and smectite. Due to differences in geology, smectite becomes a major clay mineral in downstream rivers. The Ganges River system has wide diurnal, seasonal and annual variations in the sediment-carrying capacity and it varies from 403 to 660 × 10^6 tonnes/year (Subramanian, V. et al, 1984).

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7.0 DRAINAGE SYSTEM WITH DESCRIPTION OF MAIN RIVERS

The district has two main river systems namely, the Ghaghra and Rapti, both of which ultimately form a part of the great Gangetic system. The other streams of the district are the Kuwana, its tributaries are, the Rawai, the Manwar and the Katnehia, and the Ami is a tributary of Rapti. River Ghaghra is formed by the combined waters of Kauriyala, Girwa, Chauka and other streams, which have their origin in the mountains of Kumaun and Nepal. The Ghaghra forms the southern boundary of the district. The river flows continually shifting channel within a broad sandy bed. During the rains it carries immense volume of water, but in dry weather it shrinks to small dimensions. The river has a constant tendency to change its course during the floods, and in this manner large tracts of land from time to time are shifted either to the northern or southern banks, rendering the total area of the district subject to incessant variation. Many point bar deposits are present within the course of river, locally known as Deyara. In monsson season Ghaghra river cross its bank and submerges adjoining areas. Manwar & Kuwana are tributaries of Ghaghra River in the district. In spite of its apparent uniformity of aspect, the district is divided topographically into several tracts roughly speaking these comprise the low valley of the Ghaghara in the south extending from that river to it's tributary Kuwana. The central upland extends between the Kuwana and the Ami river. These two belts contain several minor divisions, which call for a more detailed description; generally, it may be summarised that Basti is very similar in its conformation to the Avadh districts. Basti has wide alluvial plain, densely populated and in some parts highly cultivated, though the level is only broken by the shallow valleys of the rivers, which generally run in a south-easterly direction.

The Ghaghra

The Ghaghra River is one of the largest tributaries and a significant river of the Ganga river system. The Ghaghra is also known as Manchee or Karnali River in Nepal. The Himalayan glaciers, at an elevation of 5,500 m near Shinglabtsa, 60 km south-west of lake Manasarowar in, Tibet supply melt water to the river. Thus the Ghaghra is an international river flowing through Tibet, Nepal and states of Uttar Pradesh, and Bihar in India. The Ghaghra river is a perennial river, and bounded by longitude 79°30' to 85°0'E and latitude 25°45' to 30°15'N. River Ghaghara flows from WNW–ESE to W–E direction i.e. parallel to the lineament/fault.

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The River originates from the high Himalayas and flows largely through the very steep gorge in the mountain, enters into the Terai. The composition of sediments that accumulate within individual sedimentary environment is primarily a reflection of three main factors

1. The sediment source (catchment lithology).
2. The processes of sediment transport and deposition, which determine whether sediment is retained or transported through a specific environment.
3. The chemical process operating within the sediment or water column, for example, carbonates.

Ghaghara is a unique river with respect to fluctuation of discharge (Very high discharge during monsoon and moderate discharge during dry season), high sediment load, and channel instability. The channel banks and sand-bar deposits are made up of sand and silt and are prone to erosion, scouring, and mass movement, leading to lateral erosion.

In dry season fractures developed on the river banks as the clayey facies, deposited parallel to the direction of the river dried and shrunk. During low-discharge period, frequency and size of these fractures is high (5–10 cm wide and 10–20 m in length) which widen, collapse, and fall due to mass movement and enhance lateral erosion. During high-discharge period, when sandy facies are submerged, sand becomes wet and consolidated. However, during low-discharge period, the sandy facies that makes the middle and lower part of the channel bar and river bank is exposed and causes lateral erosion. However rate of lateral erosion is not uniform.

Singh et al. (1997) studied the mineralogy, chemical composition and isotope ratios of strontium, oxygen, and carbon for the source waters of the Ganga, Ghaghra, and the Indus rivers. Krishnaswami and Singh (1998) observed that major ion and Sr isotope geochemistry is controlled by silicate and carbonate weathering in the basins of the Ganga-Ghaghra-Indus head waters. Rani et al. (20 1 0) studied the seasonal changes in the water quality of the Ghaghra. English et al. (2000) studied that the solute chemistry of the river and its tributaries is strongly controlled by lithology. In their study the weathering budget shows that >70% of the TDS in the river is derived from carbonate weathering. They have also suggested that the Sr is mainly derived from the weathering of carbonate

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rocks in the Tethyan Sedimentary Series/Greater Himalayan Series and upper Nawakhot Group of the Lesser Himalayan Series.

These qualities of Ghaghra make it impossible to predict the amount that will be replenished or measure the amount that may be deposited post monsoon. This volume is often considered as sustainable yield of that river. The replenishment rate approach has the virtue of scaling extraction to the river load in a general way, but bed load transport can be notoriously variable from year to year. Thus, this approach is probably better if permitted extraction rates are based on new deposition that year rather than on long-term average bed load yields. The mined reach is the "upstream" sediment source for downstream reaches, so mining at the replenishment rate could be expected to produce hungry water conditions downstream.

The average annual soil loss of the River Basin in Nepal alone was found to be 38.17 t ha-1 yr-1 (Pandey et al., 2015). The sediment load recorded at Ayodhya site is 398217 tonnes per day (145.45 million tonnes/year) for 80,889 km2 i.e. 4.92 tonnes per day per km2 . This corresponds to a catchment denudation rate of 1.29 mm/year. In low flow years the sediment load is low while the high flow years have high sediment load. The sediment load is maximum in the month of August in correspondence to stream flow (Kumar, 2021). Singh and Awasthi (2010) identified flooding and lateral erosion as natural hazards in the Ghaghra River system in India. They have also identified the flooding and lateral erosion as fluvial hazard associated with the river.

The seasonal flood cycle and erodible alluvial soils of the rivers determine the physical character and vegetations of the floodplain region over time and space. Sedimentation on the inside bends and erosion at the outside bends of meanders, causing the main channel to migrate across the floodplain.

Tributaries of the Ghaghra:-

The Ghaghra receives directly hardly any of the drainage of the district, as exception the immediate neighborhood of its bands, all the surplus water is intercepted by its affiance. Occasionally the river overflows its banks and submerges the adjoining lowlands, with the result the water is actually transferred from the river to the Manwar or Kuwana. The latter, in its lower reaches near Bhanpur, is joined with the Ghaghra by cross channel and from that point onwards it acts as an arm of the Ghaghra.

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The Kuwana

The Kuwana also known as Kuano, rises in the low ground in the east of Bahraich district and thence flows through the centre of Gonda. It first touches the district in the stream west of Rasulpur. It then separates the Basti east pargana from Basti West, Nagar West, Nagar East and after passing through Mahuli West and Mahuli East leaves the district in the south-Easter corner, at short distance from its junction with the Ghaghra in Gorakhpur.

Tributaries of the Kuwana

It has several tributaries, the important ones being Rawai, Manwar and Katnehia.

The Rawai

The Rawai joins the Kuwana on the right bank and is a small stream which rises in the north of Amorha and thence flows between steep and sandy banks frequently infected with reh, through the western half of paragana Basti for a short distance and ultimately joins the Kawana.

The Manwar

The Manwar Manorama, rises in Gonda and flows in an easterly direction along the edge of Sikri forest to the district boundary. For a short distance it separates the latter district from Gonda and is then joined by the Chamnai, a small and sluggish stream. after the junction the Manwar bents to the south-east and flows through the centre of pargana Amorha, on the eastern boundary of which it receives a small tributary called Ramrekha on its right bank. It then passes through the two paraganas of Nagar East and Nagar West and joins the Kawana in Lalganj in Mahuli West.

The Kathnaya

The only tributary of any importance that is received by the Kuwana on its left bank is the Katnehia, which rises in the swamps to the north of Basti East and flows in the south easterly direction along the borders of the Nagar East, where it units with the Garehia, a similar stream which has its origin in the south of Rasulpur. Their combined water

continues in a south easterly direction along the borders of Nagar East and Mahuli West parganas, then turning south to join the Kuwana at Mukhlishpur in Mahuli East.

The Ami

The Ami is the chief tributary of the Rapti. The Ami is a stream which commences at a short distance from Rapti in Rasulpur and form a large tract of paddy land.

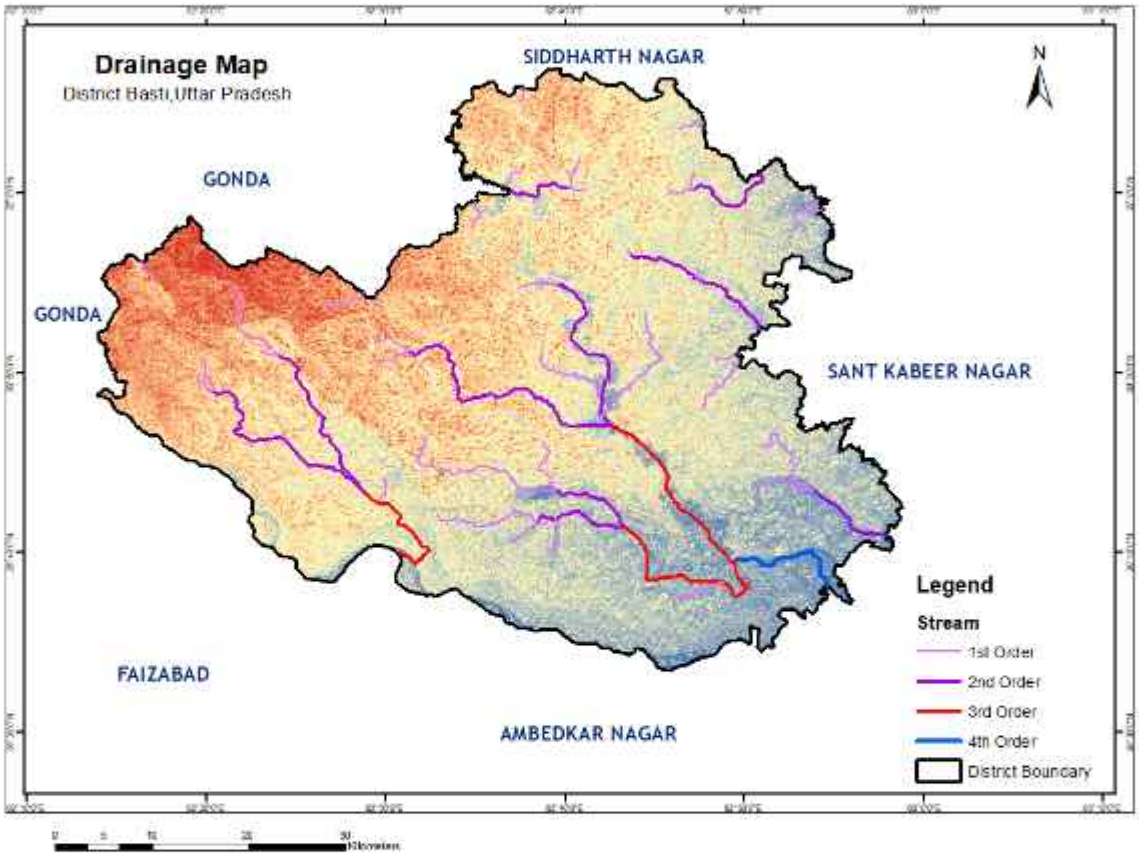

Fig 14: Drainage map of Basti District

8.0 GUIDELINES FOR SUSTAINABLE SAND MINING

Ministry of Environment, Forests & Climate Change (MoEF&CC), Government of India, in the *Sustainable Sand Mining Management Guidelines, 2016* has identified the following impacts on account of sand and gravel mining:

I. Extraction of bed material in excess of replenishment by transport from upstream causes the bed to lower (degrade) upstream and downstream of the site of removal.

II. In-stream habitat is impacted by increase in river gradient, suspended load, sediment transport, sediment deposition. Excessive sediment deposition for replenishment increases turbidity which prevents penetration of light required for photosynthesis and reduces food availability of aquatic fauna.

III. Riparian habitat including vegetative cover on and adjacent to the river banks controls erosion, provide nutrient inputs into the stream and prevents intrusion of pollutants in the stream through runoff. Bank erosion and change of morphology of the river can destroy the riparian vegetative cover.

IV. Bed degradation are responsible for channel shifting. causing loss of properties and degradation of landscape, it can also undermine bridge supports, pipe lines or other structures.

V. Degradation may change the morphology of the river bed, which constitutes one aspect of the aquatic habitat.

VI. Degradation can deplete the entire depth of gravelly bed material, exposing other substrates that may underlie the gravel, which could in turn affect the quality of Aquatic habitat. Lowering of ground water table in the flood plain because of lowering of riverbed level as well as river water level takes place because of extraction and draining out of excessive ground water from the adjacent areas. So, if a floodplain aquifer drains to the stream, groundwater levels can be lowered as a result of bed degradation.

VII. Lowering of the water table can destroy riparian vegetation.

VIII. Excessive pumping of ground water in the process of mining in abandoned channels depletes ground water causing scarcity of irrigation and drinking water. In extreme cases it may create ground fissures and subsidence in adjacent areas.

IX. Flooding is reduced as bed elevations and food heights decrease, reducing hazard for human occupancy of floodplains and the possibility of damage to engineering works.

X. The supply of overbank sediments to floodplains is reduced as flood heights decrease.

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XI. Rapid bed degradation may induce bank collapse and erosion by increasing the heights of banks.

XII. Polluting ground water by reducing the thickness of the filter material especially if mining is taking place at top of recharge fissures.

XIII. Choking of filter materials for ingress of ground water from river by dumping of finer material, compaction of filter zone due to movement of heavy vehicles. It also reduces the permeability and porosity of the filter material.

XIV. Removal of gravel from bars may cause downstream bars to erode if they subsequently receive less bed material than is carried downstream from them by fluvial transport.

XV. Ecological effects on bird nesting, fish migration, angling, etc.

XVI. Direct destruction from heavy equipment operation; discharges from equipment and refueling.

XVII. Bio-security and pestrisks.

XVIII. Impacts on coastal processes.

The other deleterious impacts of indiscrete mining include-

Loss of riparian habitat resulting from direct removal of vegetation along the steam bank to facilitate the use of a dragline or through the process of lowering the water table, bank undercutting, and channel incision.

The physical composition and stability of substrates are altered as a result of in-stream mining and most of these physical effects may exacerbate sediment entrainment in the channel.

Sustainable Sand Mining Guidelines -MoEF&CC

Sand is naturally occurring granular material composed of finely divided rock and mineral particles between 150 micron to 4.75 mm in diameter. Sand is formed due to weathering of rocks due to mechanical forces. In the process the weathered rocks forms gravel and then to sand.

Sand and gravel known as aggregate, represent the highest volume of raw material used on earth. The mining of aggregate has been continuing for many years. Now the mining of aggregates has reached a level threatening the environment and ecosystem besides also reaching a level of scarcity that would threaten the economy. It is recommended that sand &

aggregate mining, and quarrying should be done only after sound scientific assessment and adopting best practices to limit the impact on the environment.

It is also felt that the greater use of substitute material (manufactured sand) & construction technology, and sustainable use of the resource could drastically reduce adverse impact of mining on the environment.

The Guidelines has been based on the following principles:

- Uncontrolled sand mining is not sustainable.
- Compliance with present and future legislation and regulations on the subject is mandatory and not voluntary.
- Each lease holder should be given the opportunity to self-regulate to the extent that it can demonstrate compliance with legislation and regulations.
- Where self- regulation fails to deliver compliance with legislation and regulations, increased formal enforcement and monitoring should be implemented with punitive measures applied in line with the legal framework.
- There is a need to protect the environment and the right of the population to live in clean and safe surroundings, with the need to use natural resources in a way that will make a positive and sustainable contribution to the economy.

Approaches to Sustainable Sand and Gravel Mining:

Following considerations should be kept in mind for sand / gravel mining:

- Parts of the river reach that experience deposition or aggradations shall be identified first. The Lease holder/ Environmental Clearance holder may be allowed 1to extract the sand and gravel deposit in these locations to manage aggradations problem. .
- 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.
- Sand and gravel may be extracted across the entire active channel during the dry season.

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- Abandoned stream channels on terrace and inactive floodplains be preferred rather than active channels and their deltas and food plains. Stream should not be diverted to form inactive channel.
- 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.
- Sand and gravel shall not be allowed to be extracted where erosion may occur, such as at the concave bank.
- 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.
- Sand and gravel shall net 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.
- 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.
- 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.
- Alternatively, off-channel or floodplain extraction is recommended to allow rivers to replenish the quantity taken out during mining.
- 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.

- Mining depth should be restricted 1o 3 meter and distance from the bank should be 3 meter or 10 percent of the river width whichever less.
- 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 entre to centre should be left the borrow pits.
- Demarcation of mining area with pillars and geo-referencing should be done prior to start of mining.

9.0 VOLUME ESTIMATION

The original ground level was recorded at an interval not more than 10M x 10M along & across the length of the river and 7.5 meters wide safety barrier is taken into the consideration. The depth up to which sand is proposed to be mined out is maximum 3 meter, however depth of mining is kept above 1 m above the ground water.

The original ground level recorded at an interval not more than 10M x 10M along & across the length of the river and minerals reserve for river bed area is calculated on the basis of maximum depth of 3 meters

However while deciding the depth of sand mining it is kept into the consideration that the ultimate depth of mining must be remain 1 m above the ground water table.

A safety barrier of 7.5 m width is also taken in to the consideration as no mining zone.

At any rate the mineable volume must not be more than 60 % of the Geological Reserve.

10.0 REPLENISHMENT IN THE LEASES IN BASTI

Detrital input reaching river Ghaghra is generated from various sources i.e. exposed fresh and weathered rocks recycled marine martial and fluvial sediment and soils. The

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catchments outcrops are exposed to variable rates and intensity of weathering and there weathering products may vary mineralogical characteristics because of mixing mineral component during erosion and transport prior to final deposition.

CMPDI had taken up the replenishment study in 2022 by measuring the river bed at strategic locations in pre and post monsoon season by using DGPS survey and drone survey. The result obtained in this study is tabulated below:

Table 4: Details of replenishment study done by CMPDI in 2022

District	River	Site Name	Area	Reserve Quantity	Rate of Replenishment	Replenished Quantity	Total Quantity	Maximum Quantity available for mining
			Ha	Cum	Cum / ha	Cum	Cum	Cum
Basti	Ghaghra	Bardiya Lohar	3.34	58951	-8364	-36298	22653	22653
Basti	Ghaghra	Mahuapar Khurd	10.0	103534	12094	120941	224474	224474
Basti	Ghaghra	Majha Akhanpur	13.0	99674	11781	153154	252828	252828

Rivers at the time of more rainfall, exhibit higher discharge as there is more water entering the channel. Transportation also increases with discharge. As energy increases so do the capacity of rivers to transport material. Heavy rainfall causes the ground to be saturated. This can lead to mass movement on river sides such as slumping and sliding which can result in material entering the river channel. When the volume of water in a river high and the river channel is deep and wide, and the land around the river is flat, energy in the river is at its lowest, and deposition occurs. During the monsoon season (when rainfall is normal), water containing large quantities of alluvium (river silt) pours over the flat valley floor. The water slowly recedes, leaving behind the deposited sediment. The suspended load bounces in line with the rise and fall in the velocity of the river; whereas low rainfall intensity reduces the flow of water in a river. This leads to less transportation and erosion. Mass movement is also less likely to occur.

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Table 5: Outcome of the Replenishment Study done by CMPDI 2022

S. No.	Lease	Area of Patch surveyed in Mine Lease Area (Ha)	Volume of Sand (Cum) Replenished (Approx.)	River
1	Village – Bardiya Lohar Tehsil - Harraiya Gata No. 413 Da/1Mi, 413 Mi, 412 Da Mi, 413 Ka/53	4.34 ha	36,298 cum	Ghaghara
2	Village – Majha Sitarampur Tehsil - Harraiya Gata No. 109/7	-	-	Ghaghara
3	Village – Majha Kala Tehsil - Sadar Gata No. 1456 Mi	-	-	Ghaghara
4	Village – Devariya Urf Tengariya Babu Tehsil - Sadar Gata No. 568 Ka/63,	-	-	Ghaghara

Table 6: Status of Sand Replenishment vis-à-vis annual planned production

S. No.	Name of Lease	Lease Area (ha)	Minable Area Less safety margin of 7.5 m offset from 3 sides	Total Volume (cum)	Volume As per LOI (cum)
1	Village – Bardiya Lohar Tehsil - Harraiya Gata No. 413 Da/1Mi, 413 Mi, 412 Da Mi, 413 Ka/53	4.34 ha	41,298.40 sqm	93,899	86,800
2	Village – Majha Sitarampur Tehsil - Harraiya Gata No. 109/7	10.125 ha	98,234.39 sqm	2,94,703	2,93,625

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3	Village – Majha Kala Tehsil - Sadar Gata No. 1456 Mi	1.02 ha	7,692.02 sqm	23,076	30,600
4	Village – Devariya Urf Tengariya Babu Tehsil - Sadar Gata No. 568 Ka/63,	1.09 ha	7,722.61 sqm	23,168	30,700

The present Volume Estimation (Replenishment)

A joint site visit done by SDC members and consultant in Sep. - Oct., 2024, thick layers of sand deposition is observed at the site. The volume of sand deposited is more than sufficient for next 3 years. The data collected during site visit of the sites in Basti is represented in table below:

Table 7: Details of Resource Estimation Study in Pre-Monsoon Season (2024)

S. No.	Name of Lease	EGL (Existing Ground Elevation)		Area (sqm) Elevation Zone-wise	Zone wise Depth (m)	Volume (cum)
		Min (m)	Max (m)			
1	Village – Bardiya Lohar Tehsil - Harraiya Gata No. 413 Da/1Mi, 413 Mi, 412 Da Mi, 413 Ka/53	88.30	91.30	39995.03	2.25	89988.8175
		91.30	94.30	1303.37	3.00	3910.11
	Minable Area after safety Margin			**41,298.40 sqm**		**93,899 cum**
2	Village – Majha Sitarampur Tehsil - Harraiya Gata No. 109/7	86.34	89.34	69204.21	3.00	2,07,613
		89.34	92.34	15314.95	3.00	45,945
		92.34	95.34	11960.85	3.00	35,883
		95.34	98.34	1754.38	3.00	5,263
	Minable Area after safety Margin			**98,234.39 sqm**		**2,94,703 cum**
3	Village – Majha Kala Tehsil - Sadar Gata No. 1456 Mi	200.00	203.00	7692.02	3.00	23,076
	Minable Area after safety Margin			**7,692.02 sqm**		**23,706 cum**
4	Village – Devariya Urf	82.14	85.14	7722.61	3.00	23,168

	Tengariya Babu Tehsil - Sadar Gata No. 568 Ka/63,					
	Minable Area after safety Margin			**7,722.61 sqm**		**23,198 cum**

Rainfall intensity is directly associated with sediment transport and replenishment is directly proportionate.

11.0 LEASE WISE DESCRIPTION OF REPLENISHMENT STUDY

Lease-01

The mining site is situated on the river bank of Ghaghra at Gata No. 413 Da/1Mi, 413 Mi, 412 Da Mi, 413 Ka/53, is having an area of 4.34 Ha Village – Bardiya Lohar, Tehsil - Harraiya, District- Basti , U.P, The co-ordinates of Mining lease area are:

Pillar No.	Latitude E	Longitude N
A	82°24'23.54"E	26°40'44.50"N
B	82°24'26.22"E	26°40'45.48"N
C	82°24'25.16"E	26°40'55.74"N
D	82°24'25.18"E	26°41'03.71"N
E	82°24'22.99"E	26°41'04.18"N
F	82°24'22.46"E	26°40'55.53"N

Physiography & Drainage

Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology. The lease area is in the river bed and government barren land with. The river bed is mostly dried, undefined stream track with break in sand bed. The area surrounding the lease is mostly agricultural land.

Estimation of Replenishment sand

The lease area has an area of 4.34 ha (4,34 ,000 sqm) and the minable area less safety margin of 7.5 m is 41,298.40 sqm. 89,998.8175 cum sand were replenished up to 2.25 m in 39995.03 sqm. 3910.11 cum sand was accumulated up to a depth of 3.00 m in 1303.37 sqm area. The volume of total sand replenished in the lease are in pre-monsoon season (2024) was **93,899** cum. A map depicting details is attached as annexure-

EGL (Existing Ground Level)		Area (sqm)	Depth (m)	Volume of sand replenished in cum
Min (m)	Max (m)			
88.30 sqm	91.30 sqm	39995.03	2.25	89988.8175
91.30 sqm	94.30 sqm	1303.37	3.00	3910.11
		41.298.40 sqm		**93,899** cum.

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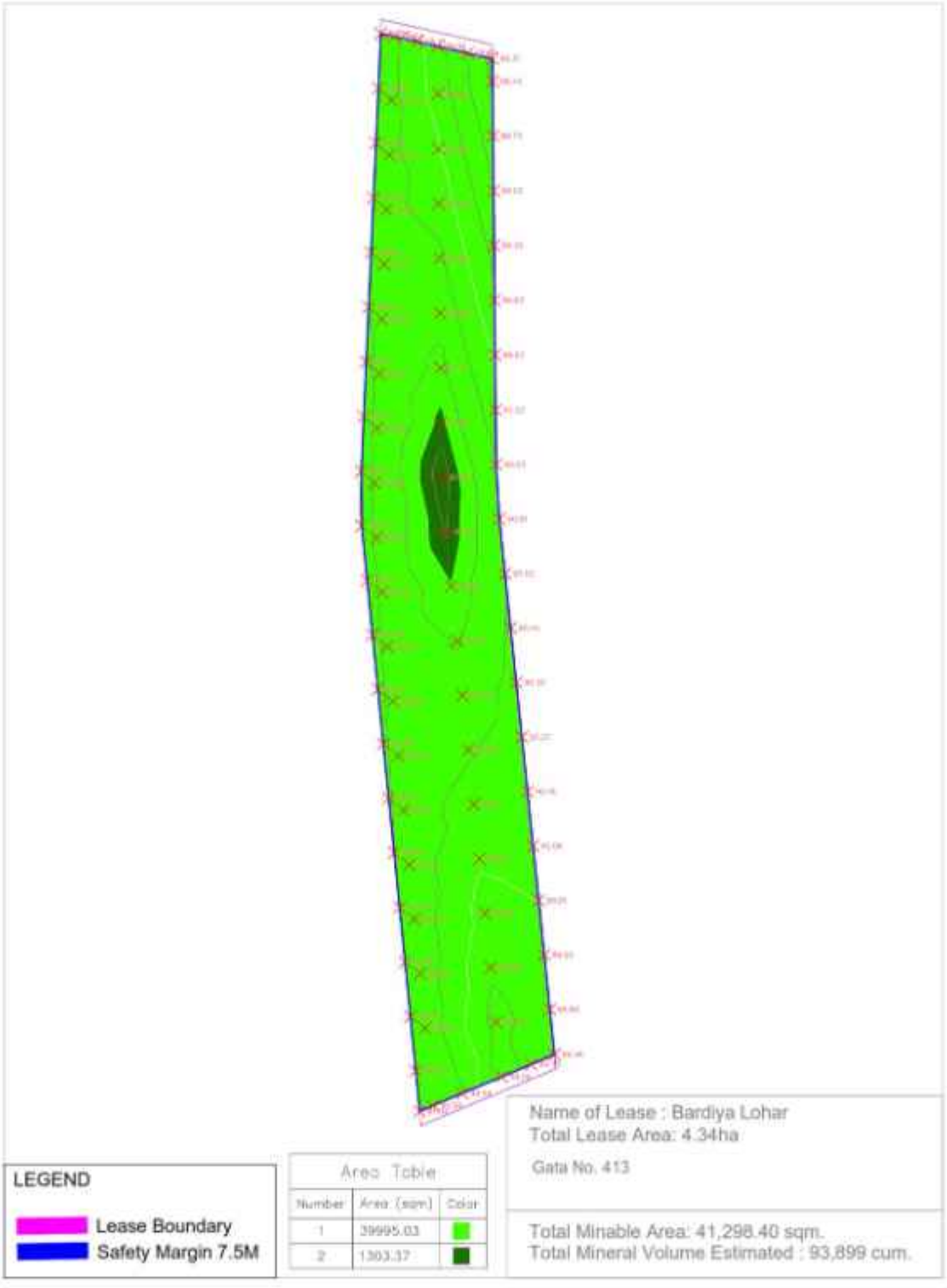
LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number
Area (sqm)
Color
1
39995.03
2
1303.37
Name of Lease : Bardiya Lohar
Total Lease Area: 4.34ha
Gata No. 413
Total Minable Area: 41,298.40 sqm.
Total Mineral Volume Estimated : 93,899 cum.

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Lease-02

The mining site is situated on the river bank of Ghaghra at Gata no. 109/7, is having an area of 10.125 Ha Village – Majha Sitarampur, Tehsil - Harraiya, District- Basti , U.P, The co-ordinates of Mining lease area are:

Pillar No.	Latitude E	Longitude N
A	82°14'02.28"E	26°47'44.15"N
B	82°14'3.16"E	26°47'51.77"N
C	82°13'45.55"E	26°47'57.40"N
D	82°13'44.67"E	26°47'51.60"N

Physiography & Drainage

Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology. The lease area is in the river bed and government barren land with. The river bed is mostly dried, undefined stream track with break in sand bed. The area surrounding the lease is mostly agricultural land.

Estimation of Replenishment sand

The lease area has an area of 10.125 ha (1,01,250 sqm) and the minable area less safety margin of 7.5 m is 98,234.39 sqm. 2,94,703 cum sand was replenished up to 3.0 m in 98,234.39 sqm . The volume of total sand replenished in the lease are in pre-monsoon season (2024) was 2,94,703 cum. A map depicting details is attached as annexure-

EGL (Existing Ground Level)		Area (sqm)	Depth (m)	Volume of sand replenished in cum
Min (m)	Max (m)			
86.34 sqm	89.34 sqm	69204.21	3.00	2,07,613
89.34 sqm	92.34 sqm	15314.95	3.00	45,945
92.34 sqm	95.34 sqm	11960.85	3.00	35,883
95.34 sqm	98.34 sqm	1754.38	3.00	5,263
		98,234.39 sqm		2,94,703 cum

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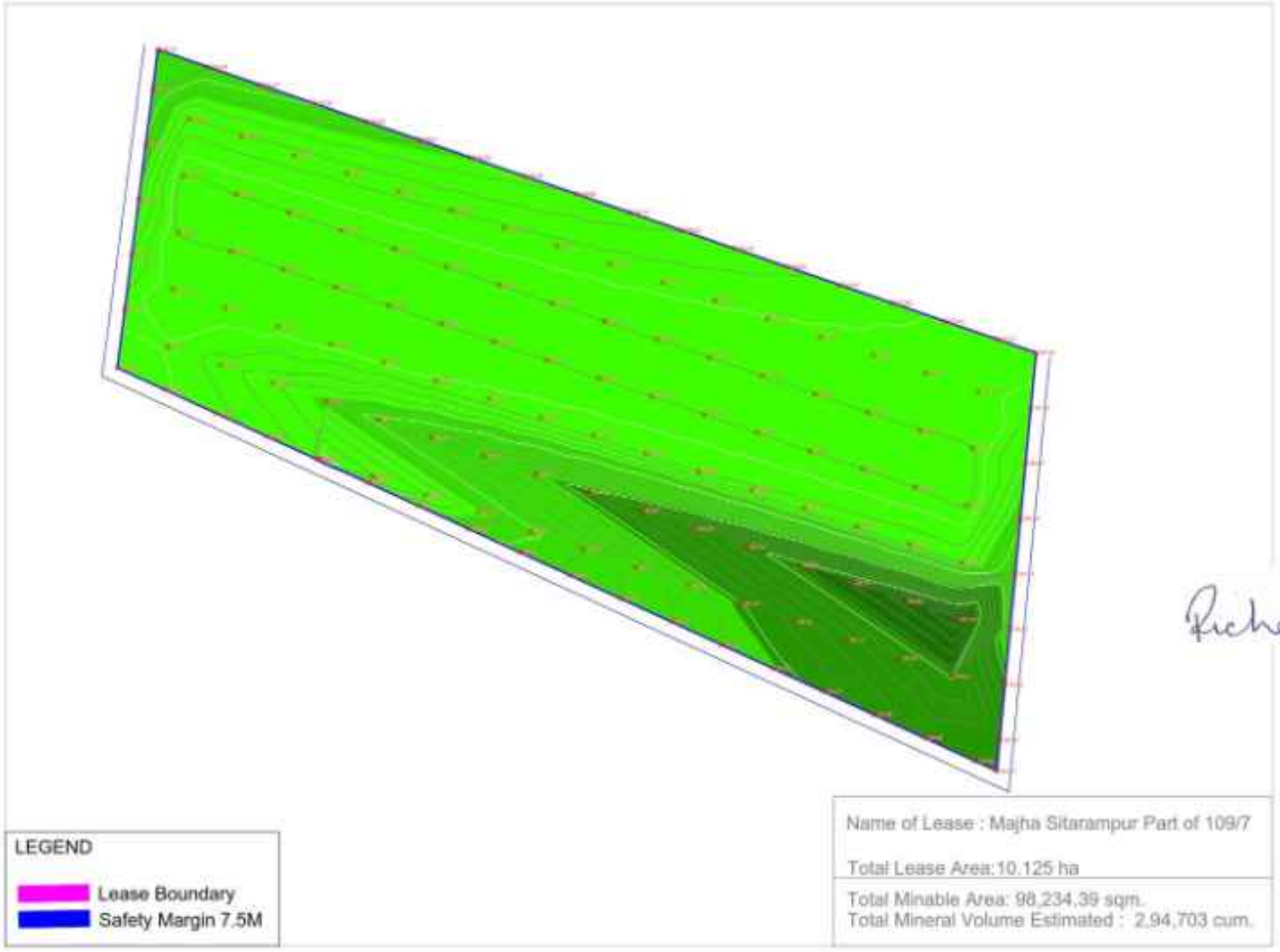
LEGEND
Lease Boundary
Safety Margin 7.5M
Name of Lease : Majha Sitarampur Part of 109/7
Total Lease Area:10.125 ha
Total Minable Area: 98,234.39 sqm.
Total Mineral Volume Estimated : 2,94,703 cum.

Lease-03

The mining site is situated on the river bank of Ghaghra at Gata No. 1456 Mi, is having an area of 1.02 Ha Village – Majha Kala, Tehsil - Sadar, District- Basti , U.P, The co-ordinates of Mining lease area are:

Pillar No.	Latitude E	Longitude N
A	26°35'57.28"N	82°39'24.37"E
B	26°35'58.37"N	82°39'20.95"E
C	26°35'55.06"N	82°39'19.49"E
D	26°35'53.88"N	82°39'22.43"E

Physiography & Drainage

Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology. The lease area is in the river bed and government barren land with. The river bed is mostly dried, undefined stream track with break in sand bed. The area surrounding the lease is mostly agricultural land.

Estimation of Replenishment sand

The lease area has an area of 1.02 ha (1,02 ,000 sqm) and the minable area less safety margin of 7.5 m is 7,692 sqm. 23,076 cum sand was replenished up to 3.0 m in 7,692.02 sqm. The volume of total sand replenished in the lease are in pre-monsoon season (2024) was **23,076** cum. A map depicting details is attached as annexure-

EGL (Existing Ground Level)		Area (sqm)	Depth (m)	Volume of sand replenished in cum
Min (m)	Max (m)			
200.00 sqm	203.00 sqm	7692.02	3.00	23,076
		7692.02 sqm		23,076 cum

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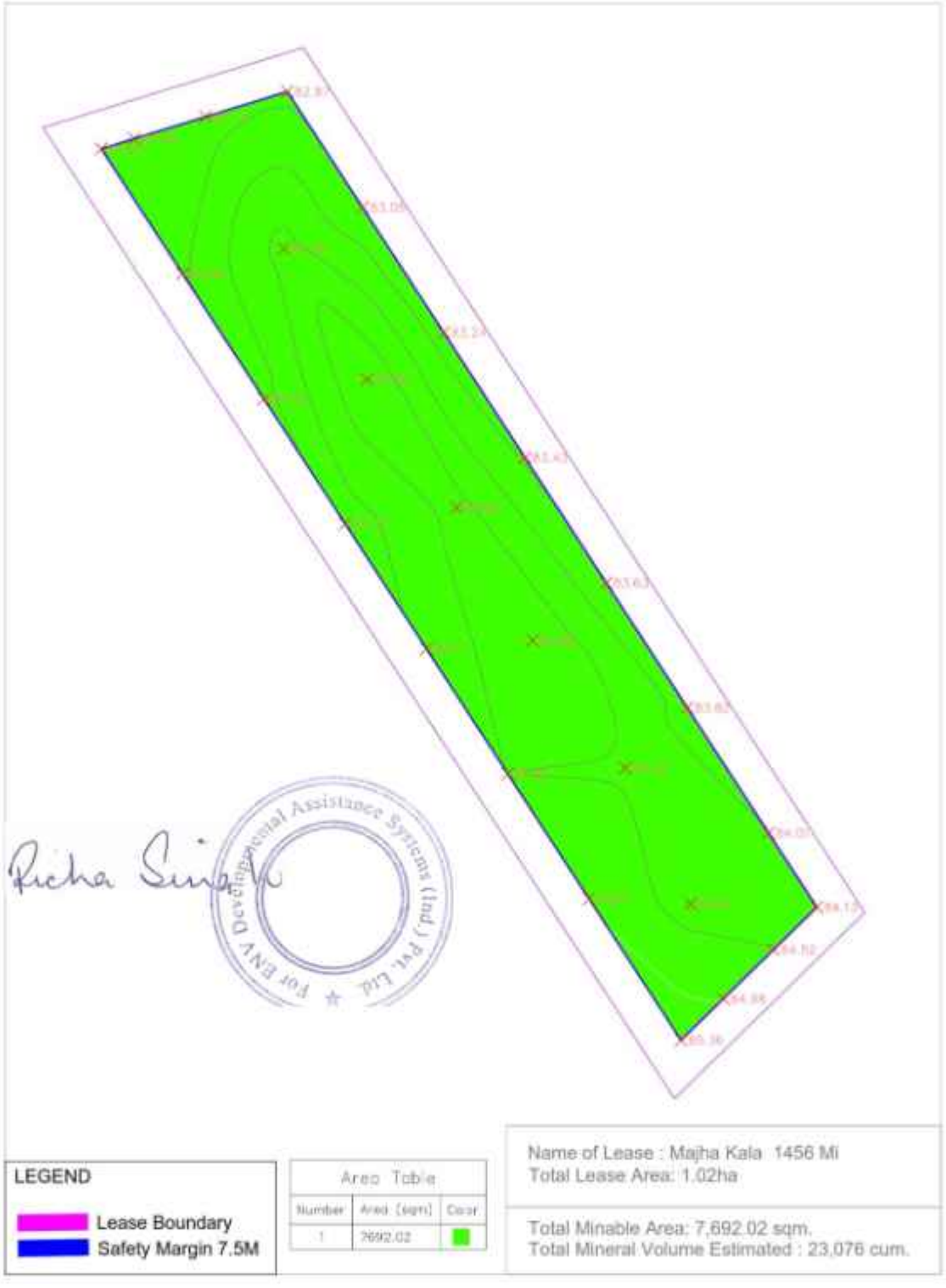
LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number
Area (sqm)
Color
1
7692.02
Name of Lease : Majha Kala 1456 Mi
Total Lease Area: 1.02ha
Total Minable Area: 7,692.02 sqm.
Total Mineral Volume Estimated : 23,076 cum.
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Lease-04

The mining site is situated on the river bank of Ghaghra at Gata No. 568 Ka/63, is having an area of 1.09 Ha Devariya Urf Tengariya Babu, Tehsil - Sadar, District- Basti , U.P, The co-ordinates of Mining lease area are:

Pillar No.	Latitude E	Longitude N
A	26°34'46.23"N	82°48'17.33"E
B	26°34'46.51"N	82°48'22.70"E
C	26°34'44.10"N	82°48'22.90"E
D	26°34'44.00"N	82°48'17.30"E

Physiography & Drainage

Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology. The lease area is in the river bed and government barren land with. The river bed is mostly dried, undefined stream track with break in sand bed. The area surrounding the lease is mostly agricultural land.

Estimation of Replenishment sand

The lease area has an area of 1.09 ha (1,09 ,000 sqm) and the minable area less safety margin of 7.5 m is 7,722.61 sqm. 23,168 cum sand was replenished up to 3.0 m in 7,722.61 sqm. The volume of total sand replenished in the lease are in pre-monsoon season (2024) was 23,168 cum. A map depicting details is attached as annexure-

EGL (Existing Ground Level)		Area (sqm)	Depth (m)	Volume of sand replenished in cum
Min (m)	Max (m)			
82.14 sqm	85.14 sqm	7722.61	3.00	23,168
		7,722.61sqm		**23,168** cum.

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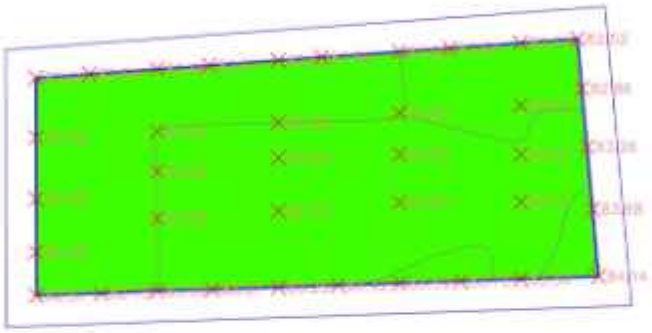

LEGEND

Lease Boundary
Safety Margin 7.5M

Area Table

Number	Area (sqm)	Color
1	7722.61	

Name of Lease : Dewariya Urf Tengariya Babu
Gata No. 568 Ka/63
Total Lease Area: 1.09ha

Total Minable Area: 7,722.61 sqm.
Total Mineral Volume Estimated : 23,168 cum.

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DISTRICT - SHAMLI

(UTTAR PRADESH)

SAND/MORRUM REPLENISHMENT STUDY REPORT (Resource Estimation)

YEAR - 2024

CONTENT

LIST OF FIGURES, TABLES, ANNEXURES AND PLATES

1.0 INTRODUCTION

District Shamli is a newly created district. Earlier, it came under district Muzaffarnagar and, was a well-known tehsil. It was known as Prabuddhnagar first time, when this district came into focus. It is situated on Delhi-Shamli national highway, it is 100 km away from Delhi, 65 km from Saharanpur, 38 km from Muzaffarnagar and only 38 km away from Panipat (Haryana). Border of this district is connected with district Muzaffarnagar in East and with Haryana in West and with Saharanpur in North and with district Shamli it is connected in South. Shamli district was carved out from Muzaffarnagar District on 28 September, 2011 as Prabudh Nagar and renamed Shamli in July 2012. Shamli is the headquarter of the district. The district, covering an area of 1341 sq km lies in the north-west of Uttar Pradesh. It lies to the east of the Yamuna River, which marks the borders of two Indian states, Haryana and Uttar Pradesh. The district falls in Survey of India Toposheet No. 53G, covering north latitudes $29^0$45'49.33" and $29^0$42'33.33" and east longitude $77^0$23'10.06'' and $78^0$08'13.18".

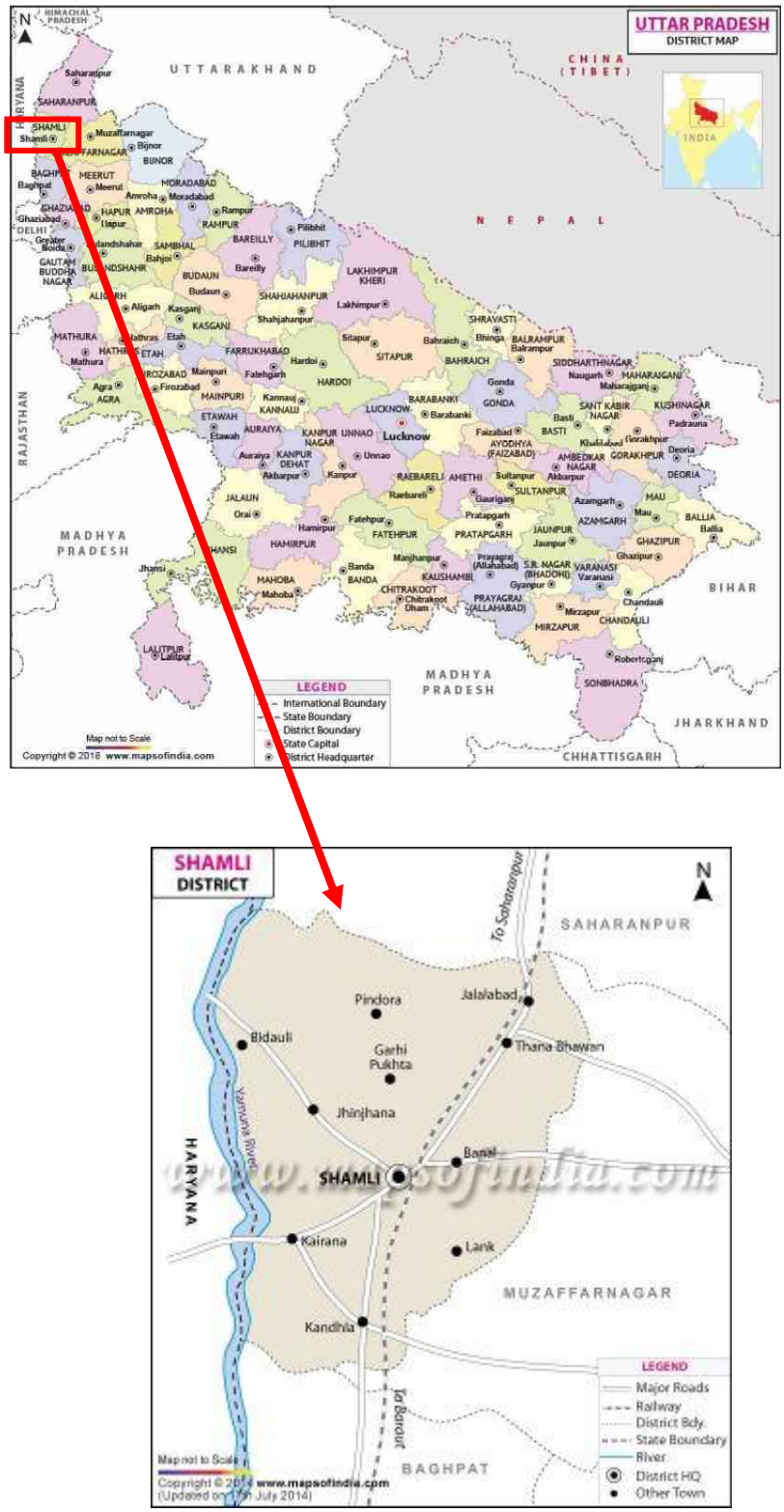


Fig 1: Location map of District Shamli

2.0 GENERAL PROFILE OF THE DISTRICT

Shamli District is situated in the western corner of Uttar Pradesh and falls under upper gangetic plains – western plains agro climatic zone. The Hindon river forms the Eastern boundary while Yamuna river forms the western boundary of the district. The total geographical area of the district is 13.33 lakh ha. The district has a population of 11.64 lakh with a density of 865 persons per sq km as against the state average of 689 persons per sq km.

a. ADMINISTRATIVE DETAILS

For administrative purpose, Shamli is divided into 5 blocks viz., Shamli, Kandhla, Unn, Thanabhawan, Kairana and 3 tehsils. Shamli is the headquarters of the district, which is in the shape of a north-south rectangle. To the north of Shamli district is Muzaffarnagar, to the east Meerut district, to the south Ghaziabad district, and to the west, across the Yamuna, Delhi, and Sonipat district in Haryana state.

Fig 2: Administrative Map of District Shamli

Table 1: List of Blocks of Shamli District

S. No.	Block	Tehsil	S. No.	Block	Tehsil
1.	Shamli	Shamli	2.	Thanabhawan	Shamli
3.	Kandhala	Shamli	4.	Kairana	Kairana
5.	Unn	Unn			

b. DEMOGRAPHY

As per the Census India 2011, Shamli Tehsil has 113304 households, population of 687324 of which 366378 are males and 320946 are females. The population of children between age 0-6 is 101403 which is 14.75% of total population. The sex-ratio of Shamli Tehsil is around 876 compared to 912 which is average of Uttar Pradesh state. The literacy rate of Shamli Tehsil is 60.88% out of which 68.78% males are literate and 51.85% females are literate. The total area of Shamli is 610.46 sq.km with population density of 1126 per sq.km. Out of total population, 68.51% of population lives in Urban area and 31.49% lives in Rural area. There are 13.82% Scheduled Caste (SC) and 0% Scheduled Tribe (ST) of total population in Shamli.

Table 2: Socio economic status of study area in Shamli

S. No.	Demographic classification	Details
1.	**No. of House hold**	9506
2.	**Total Population**	59612
3.	**Total Males**	31712
4.	**Total Females**	27900
5.	**Population Scheduled Cast**	3855
6.	**Population Scheduled Tribe**	1
7.	**Population Literates**	28433
8.	**Population Illiterates**	31179
9.	**Total Workers Population**	18628
10.	**Main Workers Population**	15150

11.	**Main Cultivaters Population**	6145
12.	**Main Agricultural Labourers Population**	6011
13.	**Main Household industries Population**	367
14.	**Main Other workers Population**	2627
15.	**Marginal workers Population**	3478
16.	**Marginal Cultivaters Population**	687
17.	**Marginal Agricultural Labourers Population**	1687
18.	**Marginal Household industries Population**	705
19.	**Marginal Other workers Population**	573
20.	**Non Worker Population**	40984

3.0 RAINFALL

a) ANNUAL AND MONTHLY RAINFALL

The average annual rainfall in the district is 869 mm. About 80% of rainfall takes places from June to September. During monsoon surplus water is available for deep percolation to ground water. The climate is sub humid and it is characterized by general dryness except in the brief period during the monsoon season. Summer is hot and winter is pleasant cold season. There is a meteorological observatory at Meerut, which may be taken as representative of meteorological condition. May is the hottest month. The mean daily maximum temperature is about 400C, mean daily minimum temperature is about 240C and maximum temperature some time rises to 440C. With the onset of southern monsoon by the end of June, there is appreciable drop in temperature. January is the coldest month with mean daily temperature at about 200C and mean daily minimum at 70C.The air is dry during the major parts of the year. In southwest monsoon season, the air is very humid and April and May are usually driest months. The mean monthly relative humidity is 67%. The mean wind velocity is 6.70 Km.p/h. The potential evapotranspiration is 1545.90 mm. The oppressive dry summer in the characteristic of the district. The temperature may rise to 44°C in May and June and fall to 20°C in winter. The wet season normally starts in the end of June. The average rainfall is 768 mm the winter months are virtually dry. The average annual rainfall in the district is 869 mm. About 80% of rainfall takes places from June to

September. During monsoon surplus water is available for deep percolation to ground water. The climate is sub humid and it is characterized by general dryness except in the brief period during the monsoon season. Summer is hot and winter is pleasant cold season.

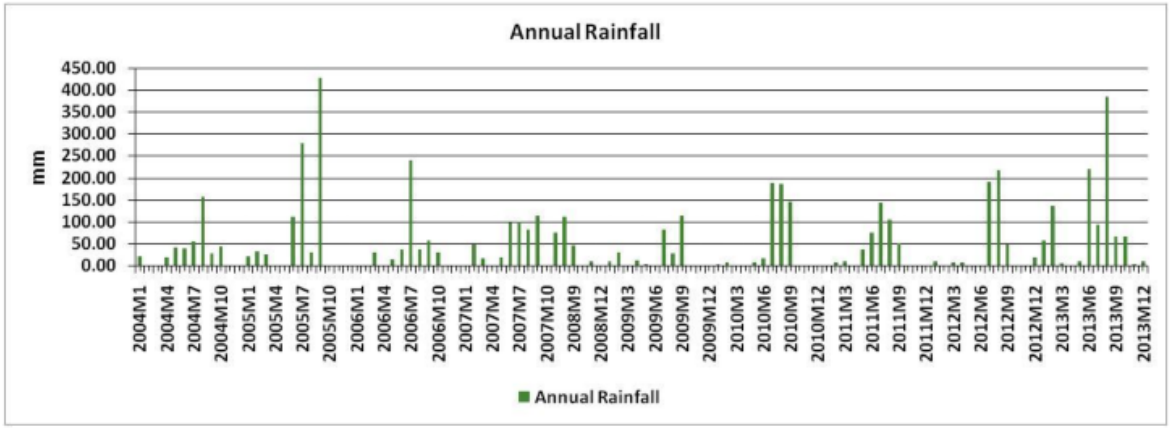
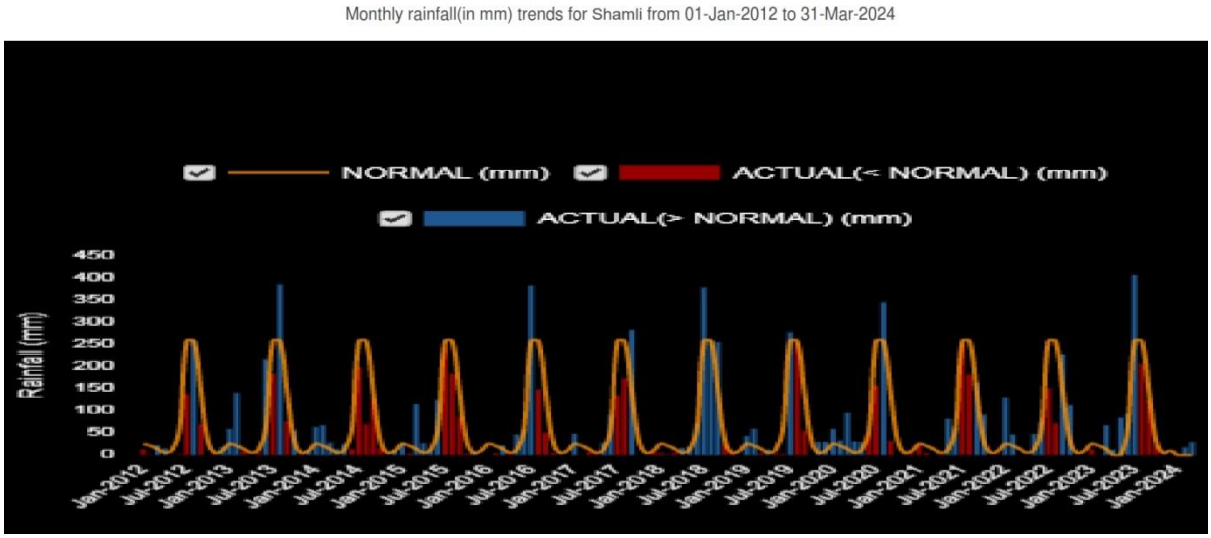


Fig 3: Annual Rainfall in District Shamli

Months	2012	2013	2014	2015	2016	2017	2018
January	13.14	58.47	63.12	27.21	0.41	48.7	5.34
February	1.2	140.38	67.58	3.75	4.22	1.14	2.33
March	21.97	8.9	27.36	114.88	21.35	6.68	5.8
April	15.01	0.58	13.91	26.44	3.37	4.48	16.13
May	0.3	5.24	25.03	13.95	46.49	27.1	18.29
June	2.54	215.59	13.44	124.36	57.76	90.6	70.91
July	136.05	184.13	197.41	242.22	381.59	133.43	377.1
August	259.17	384.35	69.38	183.37	147.98	171.86	259.08
September	69.65	76.83	125.45	86.77	50.93	281.63	254.38
October	0.53	55.02	14.73	3.6	5.17	0	25.19
November	2.05	2.56	0	7.14	0	0	3.83
December	18.27	12.48	11.33	0.01	0.02	6.7	0.04

Months	2019	2020	2021	2022	2023	2024
January	42.95	58.76	24.25	128.88	12.48	0.01

February	59.52	33.18	5.22	45.92	0	17.05
March	5.15	95.55	0.02	0	67.43	28.22
April	13.13	29.97	2.95	0.07	12.43	
May	4.15	28.42	81.81	47.9	85.02	
June	3.05	49.2	61.11	76.34	93.23	
July	276.6	157.13	247.17	150.64	405.64	
August	251.08	343.47	181.07	71.36	205.43	
September	53.97	30.84	162.55	226.18	124.32	
October	0.38	0	91.18	113.36	21.87	
November	28.62	1.88	0	0	1.75	
December	28.94	3.56	2.13	0	0.13	



b) <u>TOPOGRAPHY & TERRAIN</u>

The eastern part of the district occupies by Ganga basin and western part of the district by Yamuna Sub basin. The district forms a part of Yamuna-Hindon doab in Yamuna sub-basin of Indogangetic plain. It occupies part of interfluvial belt of Ganga-Yamuna in the extreme western part of the state. The area presents an even topography with elevation of land surface from 218 to 233 m above mean sea level. The area shows a gentle slope with general average gradient 0.15m/km. The central part of the district exhibit slightly higher region which acts as water divide between

rivers Yamuna and Hindon. The main eastern Yamuna canal is flowing along this, divide from north to south.

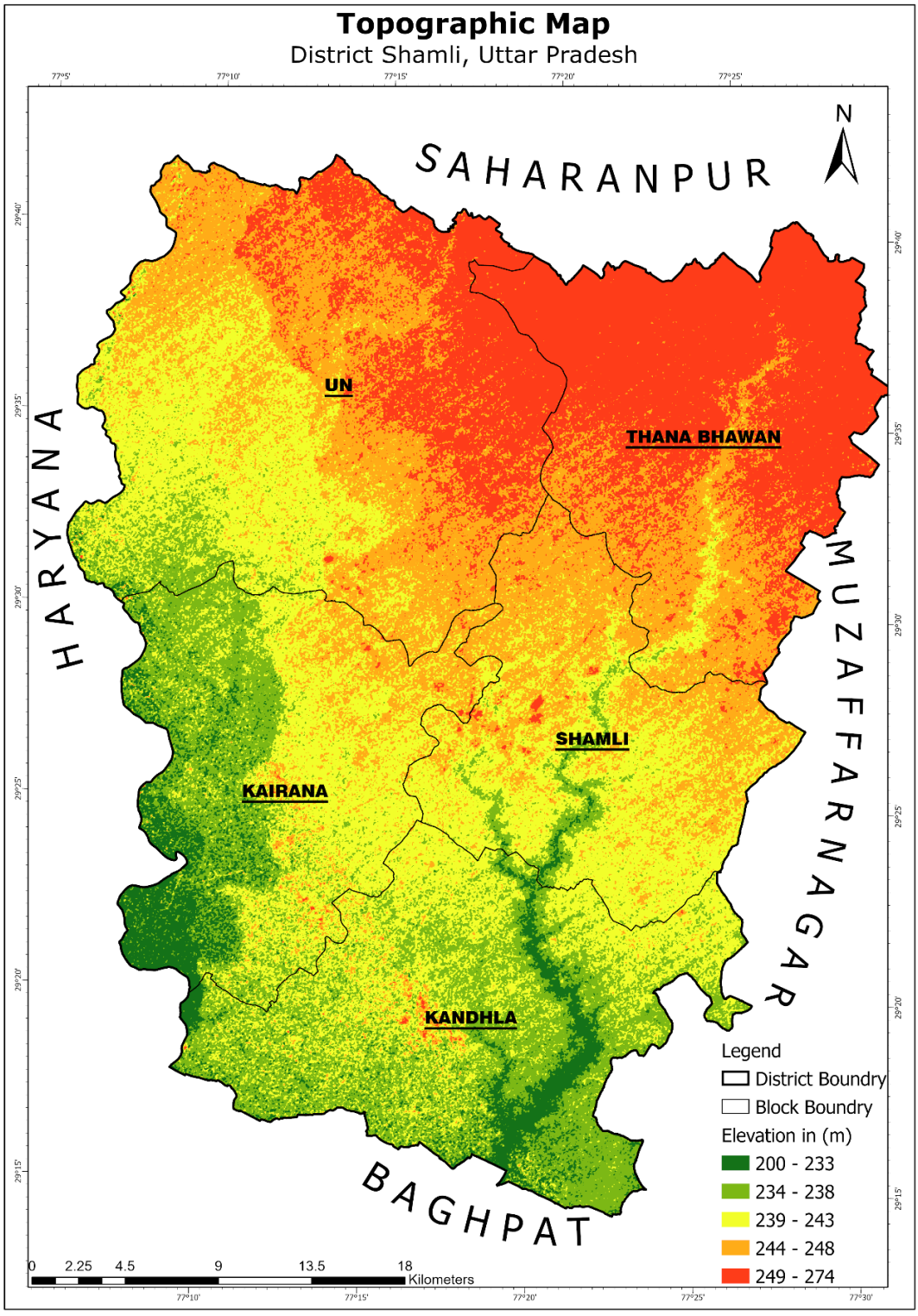


Fig 4: Topographic map of District Shamli

c) WATER COURSE & HYDROLOGY

Shamli district is underlain by Quaternary alluvium deposited by Ganga and Yamuna river system. Lithologically the alluvial sediments comprise of sand, silt, clay and kankars in varying proportions. Perusal of all available lithological logs of tubewells in the area reveal the complex configuration of alluvium showing alteration from finer to coarser sediments in quick succession. By and large there are four distinct groups of aquifers occurring in the area down to 452.00 mbgl. The entire district is underlain by top sandy clay bed ranging in thickness from 5 to 35m and followed by first aquifer with varying in thickness at different places and continues down to 160mbgl (Bottom between 128 and 160mbgl). Lithologically the aquifer comprises medium to coarse sand but gravels and kankars are also encountered sometimes. This aquifer at places can also be sub divided into two sub groups due to the presence of either clay lenses or sub regional clay layers. The second aquifer occurring at varying depths between 114mbgl (Top between 114 and 185 mbgl) and 320mbgl (Bottom between 203 and 327 mbgl) is separated by 10- 15m thick clay layer from the first aquifer. The second group of aquifer consists of finer sediments than that of first one and at places kankar and clay lenses are also found. The separating clay layer at places pinches out merging the first and second aquifer groups. The third aquifer is separated by second aquifer with thick clay layer. The fine grained third aquifer lies between the depths from 219 (Top between 219 and 384mbgl) to 452mbgl (Bottom between 283and 452 m bgl). At places the truncated third aquifer is followed by a clay layer and underlain by fourth aquifer between the depths of 283- 452mbgl. The aquifer material becomes coarser from north to south. The top clay layer is thickest at in the north western part of the district. In general it can be observed that the river Ganga has deposited coarser material compared to those deposited by the Yamuna in river system.

d) GROUND WATER DEVELOPMENT

The stage of ground water development in the district is 116.61 %. This is quite high and calls for adoption of a careful strategy for further ground water development due to declining ground water trend. In canal command area, strategy of conjunctive use of surface and ground water needs to be adopted for future ground water development.

Keeping in view the negative availability of ground water resources in the district, Out of 5 blocks, three blocks falls under over exploited category which are Unn, Kairana, and Kandhla and rest two (2) blocks (Shamli and Thana Bhawan) are under Critical category and very high overall stage of development for whole of the district, there is no feasibility for further ground water abstraction structures in the district.

e) WATER LEVEL FLUCTUATION

Ground water occurs under phreatic to semi confined and confined conditions. The near surface aquifer is under unconfined / water table condition. The shallow phreatic aquifer is tapped by dug wells. In 2015 the depth to water level ranges from 11.46 to 23.27mbgl during pre-monsoon whereas it ranges from 11.00 to 22.35mbgl in post-monsoons. The pre & post monsoon water level fluctuation varies from -0.86 to 0.93 m. Deeper water levels are observed in the eastern, western as well as southern part of the district whereas relatively shallower water levels are present in northern and central part of the district and groundwater flow directions are broadly North-Southeast in eastern part of the district whereas it is Northwest- Southeast in the western part of the district towards Yamuna river. It shows that major river system in the district is perennial in nature. Long Term Fluctuation: The long term water level fluctuation for the period 2006-2015 indicates both rise and fall in water level. There was negligible rise recorded in pre-monsoon year while a fall in water level ranges from 01 to 54 cm per year.

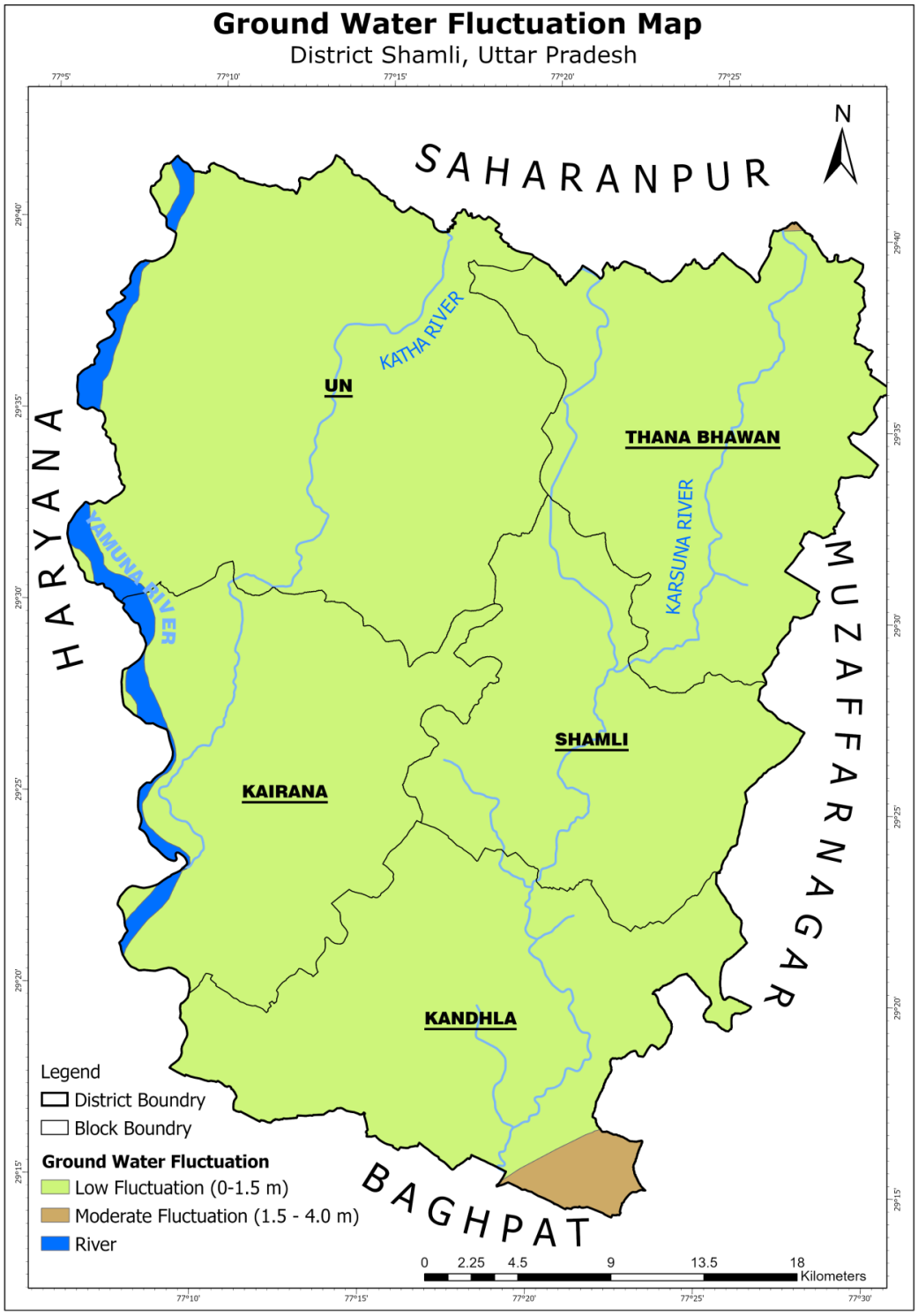


Fig 5: Groundwater Fluctuation map of District Shamli

4.0 LAND UTILIZATION PATTERN OF THE DISTRICT: FOREST, AGRICULTURE, HORTICULTURE, MINING ETC.

The land use pattern in the district has been indicated in the Table 3. The total Geographical area of the district is 307 ha and the net sown area is 194.1 ha. The cropping intensity in the state is 153.60 %. Land use Pattern in Shamli district is given below:

Table 3: Land use pattern of Shamli

Sl. No.	Particulars	Shamli
1.	Total Geographic area (ha)	307 ha
2.	Forest (ha)	1.4
3.	Barren and uncultivable land(ha)	11.5
4.	Non-agricultural land use (ha)	40.7
5.	Cultivable land(ha)	250.9
6.	Permanent Pasture and grazing land(ha)	2.4
7.	Land under miscellaneous trees, crops and groves (ha)	10.2
8.	Cultivable waste land(ha)	6.9
9.	Current fallows(ha)	24.1
10.	Other fallows(ha)	15.6
11.	Net area sown(ha)	194.1
12.	Area sown more than once(ha)	104
13.	Cropping intensity	153.6%
14.	Net irrigated area	173.4
15.	Gross irrigated Area	266.1

(Source: Statistical Bulletin, 2006, District Shamli.)

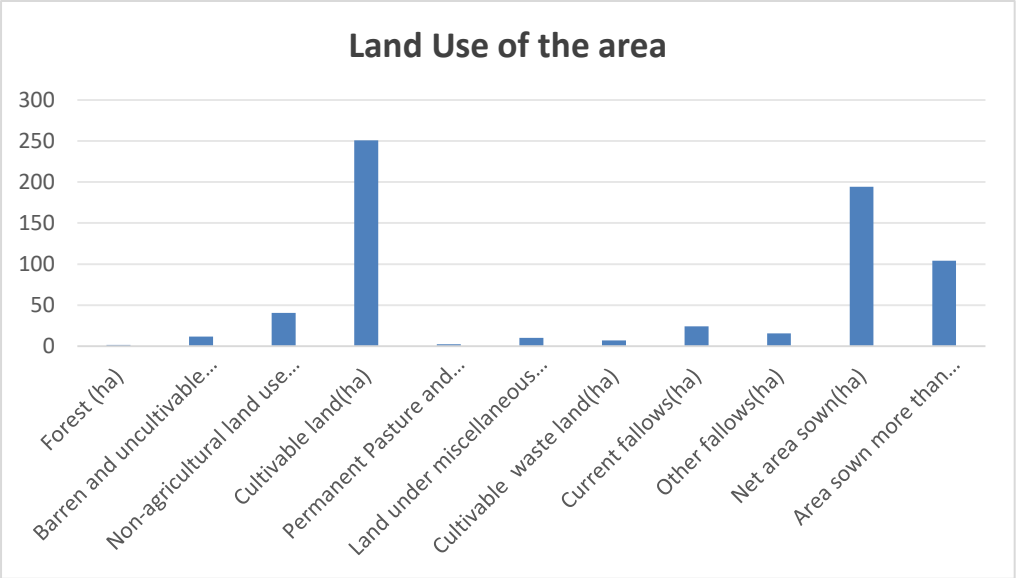


Fig 6 : Land Use Map of the area

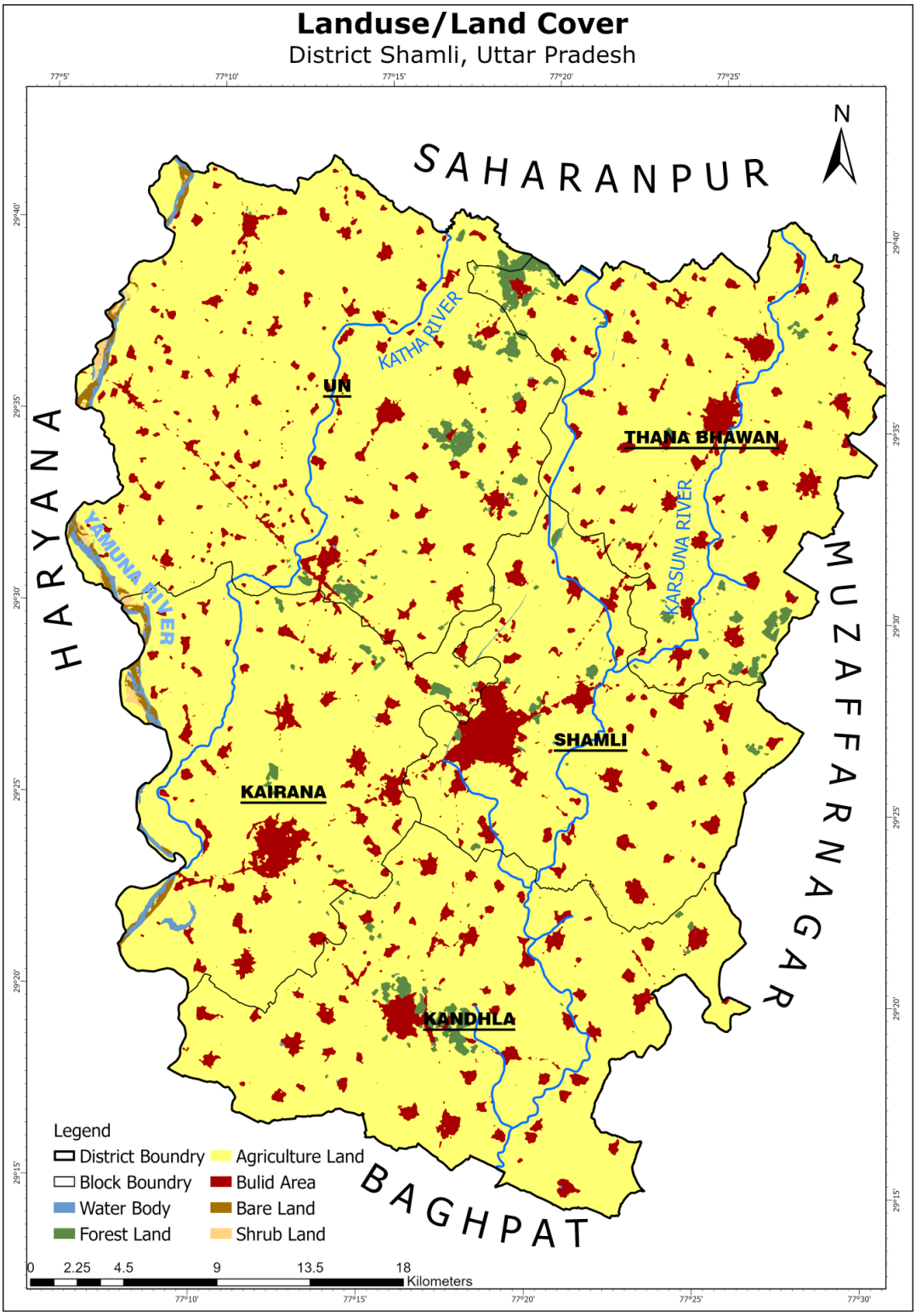


Fig 7: Land Use / Land Cover map of District Shamli

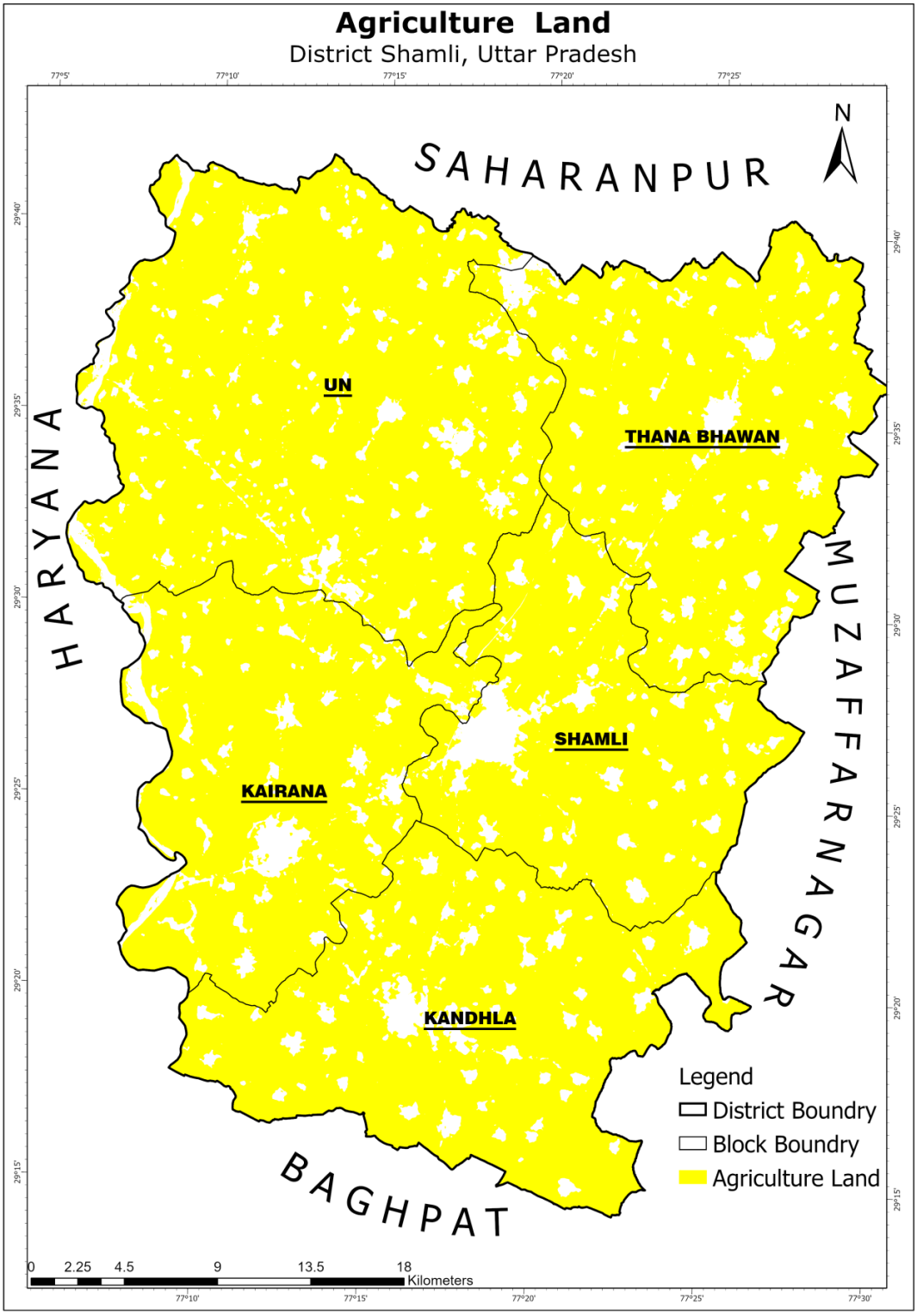


Fig 8: Agriculture map of District Shamli

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.

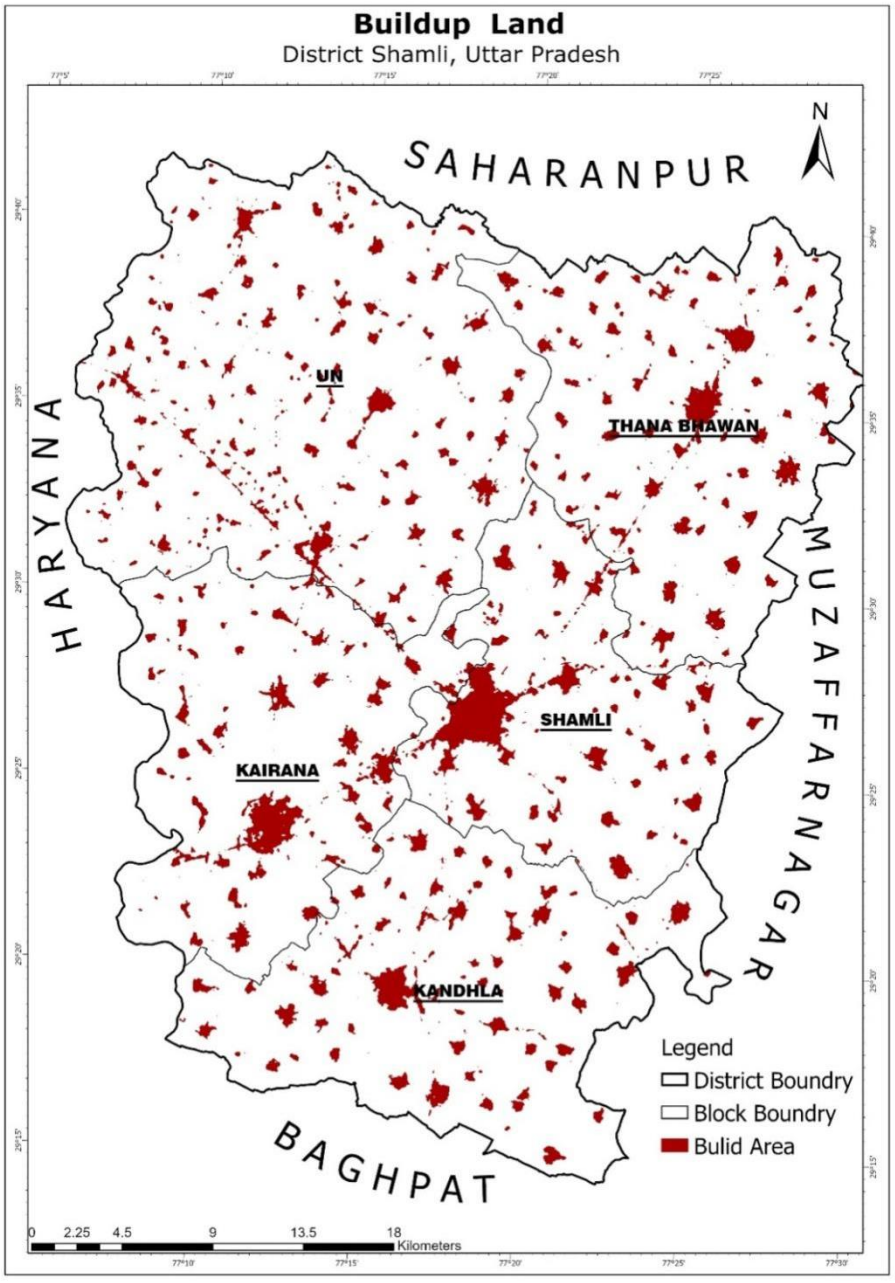


Fig 9: Build-up Land map of District Shamli

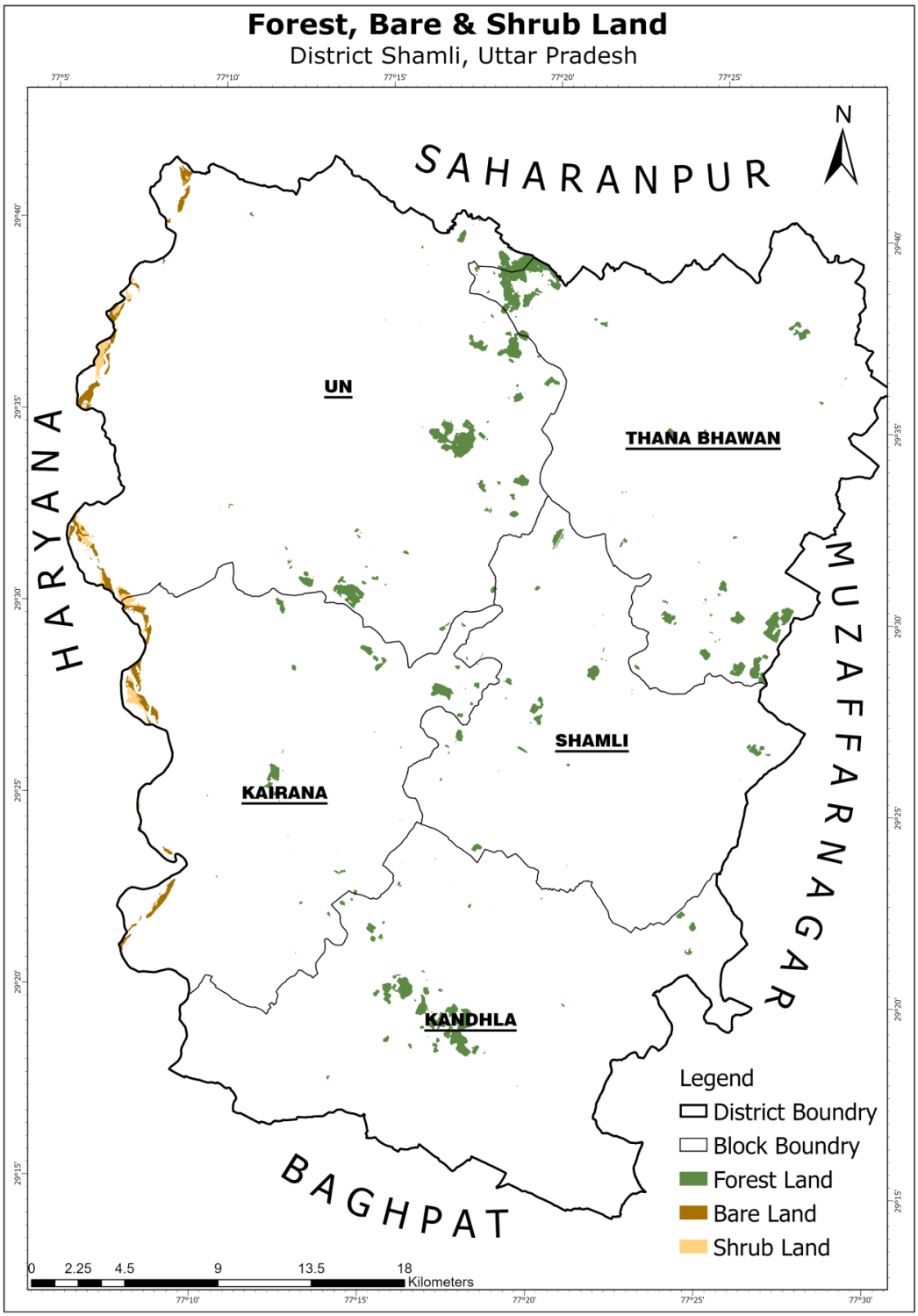


Fig 10: Forest, Bare & Shrub Land map of District Shamli

5.0 GEOLOGY OF THE DISTRICT

Physiographically, the area is divided into southern and western stretches confined by the Yamuna River and ravines which further divided into Khadar lowland, Trans Yamuna plain, Yamuna upland and Yamuna-Chambal ravines. The climate is semi-arid with an average rainfall of 752.26mm. Topography of the Yamuna River basin excluding the Himalayan catchment, the upper Yamuna catchment falls into three defined physiographic belts: the Lesser Himalaya, the Siwalik, and the Doon Valley.

a. REGIONAL GEOLOGY

The district virtually forms a flat terrain forming a part of Yamuna Plains. Geologically the area is underlain by thick fluvial Quaternary sediments, deposited by Yamuna River and its tributaries. Sediments comprise sand, silt, clay and kankars. (calcareous concretions) in varying proportions and show quick alteration from finer to coarser at places. The alluvium is subdivided into Older Alluvial and Younger Alluvial Plain. Older alluvium occupies higher elevation whereas newer alluvium is of recent origin and is restricted to river courses.

b. LOCAL GEOLOGY

The entire Shamli district is a flat terrain falling in middle Yamuna plain. The highest point in the district is 265.00 m (amsl) in the north and the lowest 230.00 m (amsl) in the south, giving rise to an average slope of about 0.40 m/ km towards south. The district can be sub divided into five geographic units.

a. Sand Bars:

It occurs along the courses of Yamuna river, the characteristic sand bars are changing dynamically during the floods.

b. Flood Plain:

It is a flat, low lying poorly drained area adjacent to river Yamuna forming the flood plains and gets flooded during monsoon season.

c. Ravines:

In the western part of the district, this unit is characterized by the deep gullies along the river Krishni. This is probably due to the erosion of unconsolidated material by localized surface run off forming channels and ultimately giving rise to undulating topography and hence the formation of ravines.

d. Younger Alluvial Plains:

This unit occupies the eastern bank of Yamuna River. The gently sloping (southward) and slightly undulating terrain having ox-bow lakes, back swamp and paleo-channels. This unit is also called as Khadar. The Yamuna Khader lying in east of river Yamuna.

e. Older Alluvial Plain:

Older alluvial plain may be Tract between Krishni and Yamuna rivers. This area lies between the Khadar of Yamuna and Krishni rivers. Topography along the rivers is uneven due to poor soil character. This area is drained by Yamuna Canal and Katha Nala flows through it forming a depression along the tract with development of reh all along the course.

f. Land Forms:

Palaeo-channels: In the western part of the district, cut-off meanders forming oxbow lakes suggest the buried paleo-channels along the Yamuna River in the younger alluvial plains.

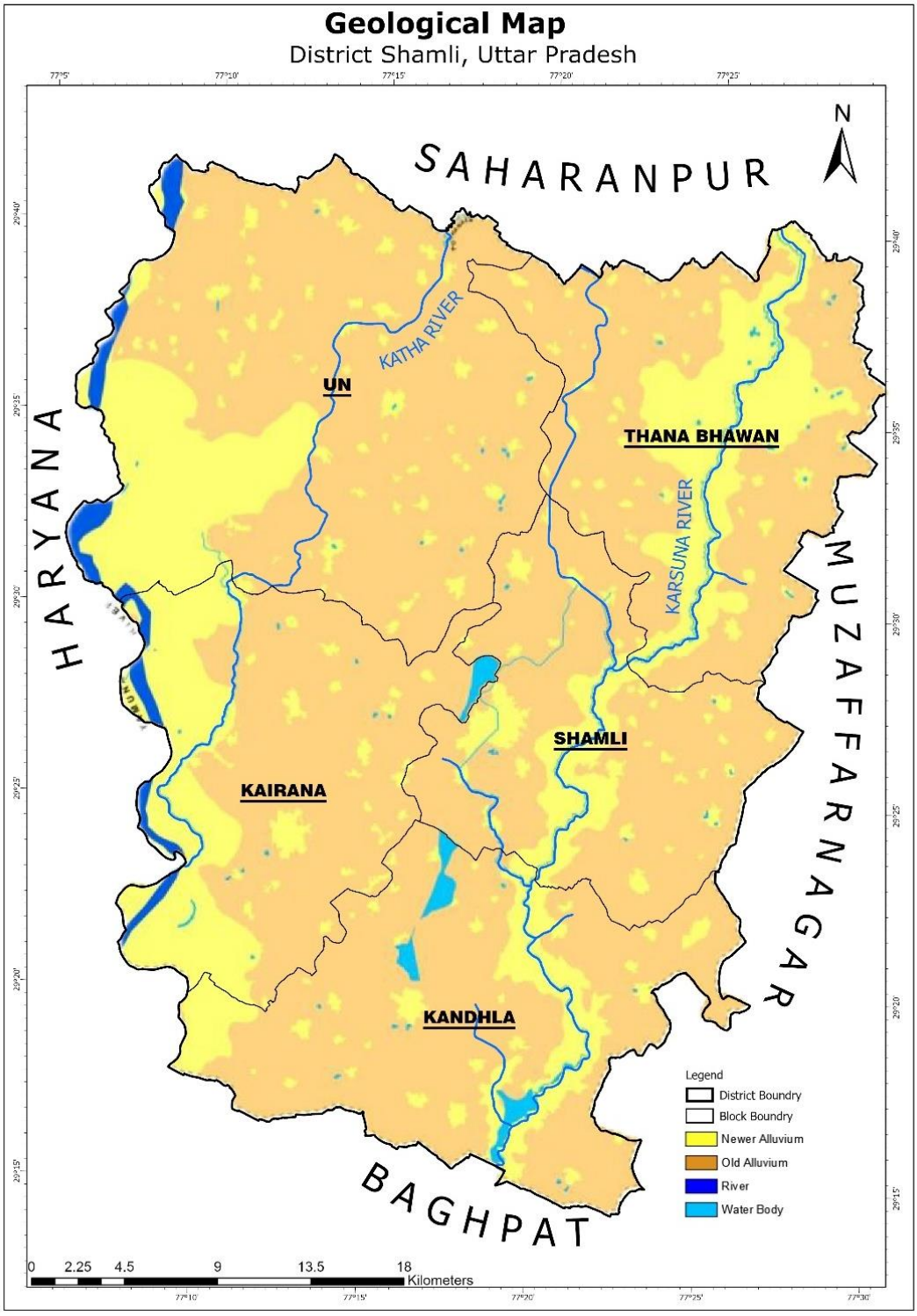


Fig 11: Geological map of District Shamli

c. SOIL

The development of soils in the district can be attributed to differential erosional and depositional activities. Different morphological units have been bestowed with different types of soils. The soil ranges from pure sand to stiff clays and with combinations of these are two extreme litho units. The pure sand is called Bhur, clay is called Matiyar. When the sand is mixed with clay in equal proportion, the soil may be termed as Domat or loam – a good agricultural soil. Depending upon the contents of sand and clay, there can be further classification of Domat. The word Kalhar is used to denote the bold patches where nothing grows and may be infested with Reh at patches. Alluvial soil occurring in flood plain of river is called Kamp and yield good crop – Gauhan is highly manured soils and is restricted close to villages. The area is also marked by the development of ravines and bad land at places along the banks of Yamuna, Hindon and Krishni rivers. The ravinous soils are generally rich in (Fe) iron and (Al) aluminium contents.

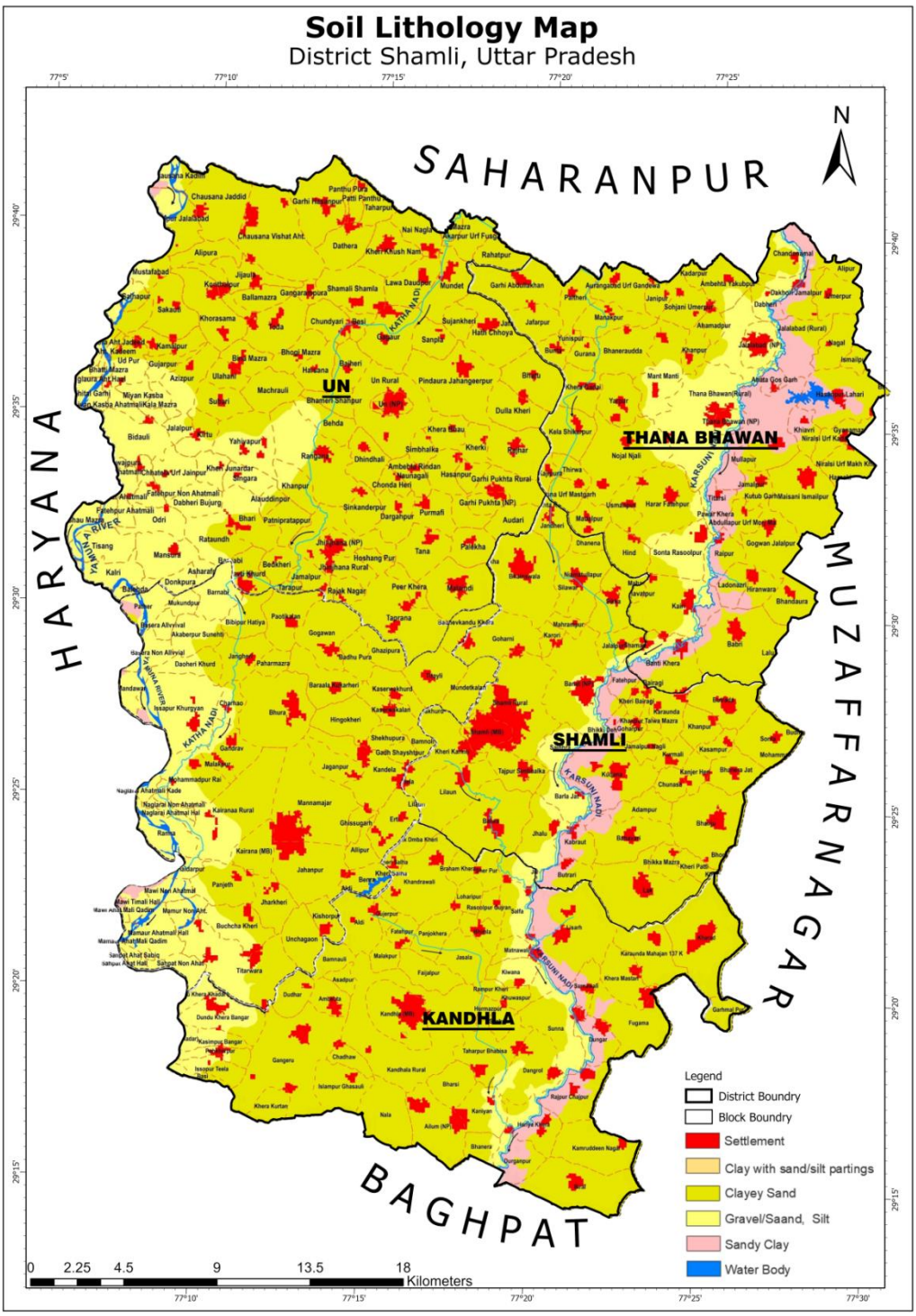


Fig 12: Soil Lithology map of District Shamli

6.0 DRAINAGE SYSTEM WITH DESCRIPTION OF MAIN RIVERS

Shamli district is demarcated by rivers Yamuna in the west and Krishni in the east. In fact, the drainage pattern of the district is strictly governed by these rivers which form western boundary of Haryana state and eastern boundary of Muzaffarnagar district. Both the rivers in their respective course flow more or less north to south. The district occupies the northern part of Ganga basin and Yamuna Sub basin.

Drainage of Shamli:-

Yamuna River- Yamuna enters in Shamli District in Bodha village then passes through Tanda village. Subsequently river passes through Dhaka, Badrakha and Subhanpur is the last census village through which Yamuna river passes through in District Shamli. Bed of the stream is tortuous and uncertain. At the several points the river cuts towards the east, but only to be thrown to the west lower down. At four places in its course the channel takes a sharp turn to the west and river has tendency to flow straight on at the duration of floods.

Kantha - It is a small stream, which flows along the North West corner of the district, it is depressed and flow roughly parallel to the Hindon River. It joins Yamuna River in village of Muhamadpur Rain in the three miles northwest of Kairana.

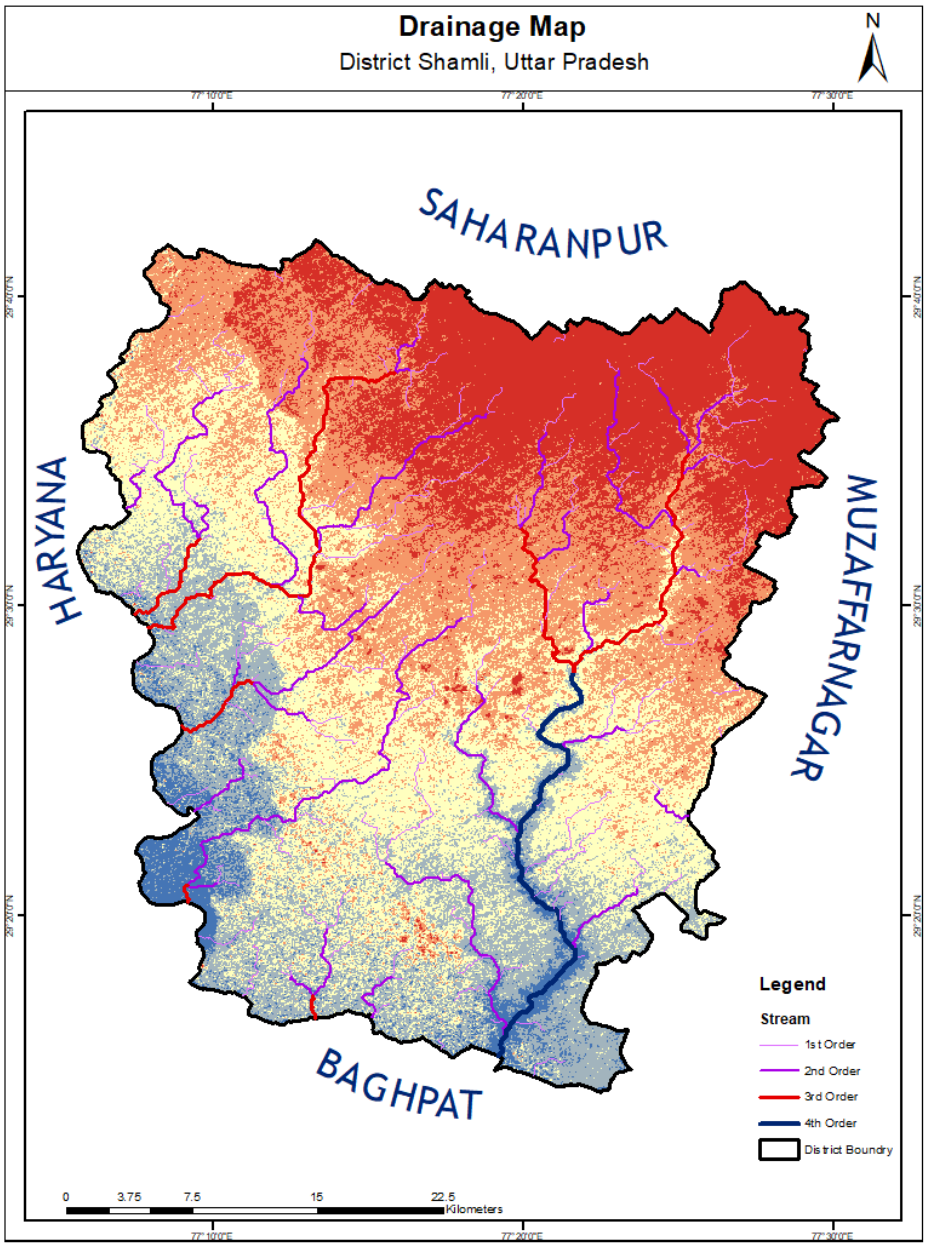


Fig 13: Drainage map of District Shamli

Krishni- It flows in a southerly course and parallel to the Hindon River in Thana Bhawan then enter in Shamli at the village of Kairi. Here it bends to the south-west but turns south again at Banat, where it is bridged and crossed by the road from Shamli to Muzaffarnagar.

Hindon - River Hindon enters in District Shamli through Avelagarhi Reserved Forest and the last village through which it exits from Shamli District is Buranpur Kalan. It is fordable except after heavy rainfall, and it is neither used for irrigation nor navigation.

In north banks are steep, but towards the south they are sloping and the low lands are broader.

DRAINAGE SYSTEM WITH DESCRIPTION OF MAIN RIVERS

S. No.	Name of River	Length Covered	% Area Covered
1.	**Yamuna River**	63.87 km (44 km close flight / aerial distance)	4.64
2.	**Kantha River**	16 km	-
3.	**Krishni / Karsuni River**	50 km	-

7.0 PROCESS OF DEPOSITION OF SEDIMENTS IN THE RIVERS OF THE DISTRICT (RIVER GEOMETRY)

a. EVOLUTION

There is a geochemical split between the river channel and suspended sediments of the Yamuna River for sharing different sources, i.e., the dominant contribution of felsic sources to the river channel and mafic sources to the suspended sediments like felsic crystallines and sedimentary lithologies of the Aravalli range, Bundelkhand and Chhotanagpur granite and gneisses, and Vindhyan sandstones. Whereas, the mafic lithologies such as the Deccan traps and mafic components of the felsic lithologies appear to be the major sources of the suspended sediments. Within the range of intermediate composition, the overbank sediment chemistry reflects more contribution of the mafic sources. The geochemical split between the river channel and suspended sediments of the Yamuna river's sediments for the different provenances indicates differential weathering of the Deccan basalts, Bundelkhand crystalline, and Vindhyan sedimentary rocks; and also the hydrodynamic control of the Yamuna rivers during erosion, transport, and deposition. River Yamuna in its upper stretch in the plains is River Hindon, which originates in the Sivalik hills and drains an area of about 7,080

sq. km along its 256-km-long route running parallel to River Yamuna. Hindon joins the Yamuna on its left bank only downstream of Delhi (at Ballabhgarh in Haryana). River Yamuna is relatively shallow, with an average depth of about 3 m during the monsoon season. Its channel width ranges from about 30 m in the Himalayan stretch to >200 m in the plains. However, at several places within the Himalayan stretch, the river passes through very wide valleys. The rivers carries large boulders and gravel in its upper reaches which turn to fine gravel and coarse sand as the river enters the plains. Further down between Yamunanagar and Delhi, the bed sediments are sandy being derived chiefly from basaltic rocks, and often have large proportions silt.

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).

b. MODE OF SEDIMENT TRANSPORT

The sediment load of a river is transported in various ways although these distinctions are to some extent arbitrary. The loose boundary (consisting of movable material) of an alluvial channel deforms under the action of flowing water and the deformed bed with its changing roughness (bed forms) interacts with the flow. The resulting

movement of the bed material (sediment) in the direction of flow is called sediment transport and a critical bed shear stress (t) must be exceeded to start the particle movement. 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.

c. SEDIMENT DISCHARGE RATE

The soil characteristics of the Yamuna have a large spectrum of particle sizes from 30 μm to 1 mm. A flow velocity of 0.75 m/s can move only silt-sized particles of size up to ~ 60 μm. The total monsoon discharge for a set of average monsoon river stages and the corresponding water flow velocity in the main channel and in the shoulder areas were estimated. The average monsoon river stage of 208.9 m amsl (above mean sea level) corresponds to the flow of 3.9 TMCM (~ 36% of the total mean annual monsoon flow) through the river Yamuna. The velocity in the main river channel at this total discharge was estimated at ~ 1.57 m/s. This velocity of flow can dislodge sediment particles of size ~ 265 μm. An average monsoon flow of 5.5 TMCM (50% of the total mean annual monsoon flow) through river Yamuna corresponds to a river stage of 209.2 m amsl. The velocity in the main river channel at this total discharge was estimated at 1.8 m/s. This velocity of flow can dislodge sediment particles of size ~ 340 μm (medium sand). The main channel can thus be cleared of the larger and heavier sediments more efficiently at this flow velocity. Field-based observations show average monsoon peak flow to be approximately 1.4 m above the average monsoon river stage. Based on this, the peak flow associated with the average monsoon river stage of 209.2 m amsl (corresponding to total flow of 5.5 TMCM) would be 210.6 m amsl. The flow velocity in the main river channel at the river stage of 210.6 m amsl would be 3.4 m/s. This river flow velocity is sufficient to dislodge particles of size ~ 1200 μm (1.2 mm; coarse sand). Hence this river flow velocity will efficiently remove most of the heavy sediments and grit from the main river channel and prevent siltation and shallowing of the river channel. The water flow velocity in areas adjacent to the main river channel corresponding to the monsoon flow of 5.5

TMCM at a river stage of 209.2 m amsl has been estimated at 0.93 m/s). This flow velocity can dislodge sediments particle of size ~ 95 μm (very fine sand). Such well-sorted sediments will have higher permeability leading to enhancement in river bank storage during the monsoon floods. Empirically, it is clear that the river is heavily silted and at present has a depth of only 0.6 m in summer. To remove all riverbed particles of diameter up to 1–2 mm (coarse sand to very fine gravel) will require a monsoon flow larger than 50% (5.5 MCM), but we also have to balance this with reality (agricultural needs). A 50% (5.5 MCM) monsoon flow can dislodge particles of diameter up to ~ 1.2 mm; however, when such particles are transported and desilting occurs, the main channel will deepen enhancing the flow velocity. Consequently, even particles of larger size will be transported. We conclude that at least 50% (5.5 TMCM) of the monsoon virgin flow of river Yamuna is the flushing flow required in this stretch (Soni *et al*., 2014).

d. SEDIMENTATION YIELD

Sediment, the end product of erosion, has a twofold effect:

1- it depletes the Land from which it is derived

2- it impairs the quality of the water-resources in which it is entrained and deposited.

The importance of the sediment-yield-surveys, as preventive and corrective measures, can be attributed to the erosional-processes. (Kumar, 1992) Naturally, sand is a granular material consisting of rock particles and fine minerals measuring between 0.06 mm to 2 mm. Sand is formed from decomposition of rocks due to mechanical strength where decomposed rocks form gravel and then sand. Almost the entire suspended load of Yamuna River is transported during the monsoon period; quartz and illite are the dominant minerals of these suspended sediments. Basin lithology, tributary contributions, and sediment grain size seem to control mineral distribution in the sediments. Trace metal concentrations of Yamuna core sediments reflect their mineralogical composition. Illite is the chief clay mineral of the Himalayan river sediments.

The mineralogical characteristics of the Himalayan river sediments differ significantly from the Peninsular Indian Rivers, which chiefly carry montmorillonite. The annual sediment load of Indian rivers is a little more than 1.2 billion tonnes which is roughly 10% of the global sediment flux to the world oceans. Indian rivers show pronounced seasonal and spatial variability in their sediment discharge. Maximum mass transfer, in the Yamuna River takes place during the monsoon season. The sediment load constitutes 58–86% of the total load carried by the river depending upon the sites. Tributaries carry sediments more actively than the mainstream. The total load of the river seems to be controlled by lithology. At Prayagraj, the Yamuna carries 64×10^6 tonnes sediment load to the Ganges River. The TSM/TDS ratio shows that upstream physical weathering is more dominant than chemical weathering. The negative relation between basin area and total erosion rate and the positive relation between the chemical and sediment erosion in the Yamuna basin agrees with the global trend. The average chemical erosion rate (165 tonnes $km^{-2}yr^{-1}$) of the Yamuna is much higher than that of the Ganges and the Indian average. The total erosion rate (973 t $km^{-2}yr^{-1}$) is 1.7 times greater than that of the Ganges. Upstream, the Yamuna removes 1.04 mm yr^{-1} of the basin surface; the removal rate decreases downstream to 0.19 mm yr^{-1} at Prayagraj, the point of confluence with the Ganges (Jha *et al.,* 1988). The rate of sedimentation at the station Saharanpur (UP) the highest rate of sedimentation (5.99 cm/y) was noticed, most probably due to deforestation and other human influences in the Himalayan regions, while the lowest rate was observed in Hamirpur (UP) (2.48 cm/yr). Yamuna River sediments are mainly composed of very fine sand, silt and clay derived from the Himalayan region. Granulometric analysis shows that the ~20-mm particles are found in the Yamuna River sediments. The total river sediment shows the presence of quartz, feldspar and illite minerals in bulk mineralogical composition. Metal ratios for the river sediments show various degrees of enrichment. A river has two sources of heavy metals: lithogenic sources from weathering of rocks and anthropogenic. The values are greater than one except

for *Manganese, Iron* and to some extent for Cobalt. High ratios of Chromium, Nickle, Copper, Zinc, Lead and an exceptionally high ratio of Cadmium for some sediment samples have been found.

8.0 GUIDELINES FOR SUSTAINABLE SAND MINING

Ministry of Environment, Forests & Climate Change (MoEF&CC), Government of India, in the Sustainable Sand Mining Management Guidelines, 2016 has identified the following impacts on account of sand and gravel mining:

- Extraction of bed material in excess of replenishment by transport from upstream causes the bed to lower (degrade) upstream and downstream of the site of removal.
- In-stream habitat is impacted by increase in river gradient, suspended load, sediment transport, sediment deposition. Excessive sediment deposition for replenishment increases turbidity which prevents penetration of light required for photosynthesis and reduces food availability of aquatic fauna.
- Riparian habitat including vegetative cover on and adjacent to the river banks controls erosion, provide nutrient inputs into the stream and prevents intrusion of pollutants in the stream through runoff. Bank erosion and change of morphology of the river can destroy the riparian vegetative cover.
- Bed degradation are responsible for channel shifting. causing loss of properties and degradation of landscape, it can also undermine bridge supports, pipe lines or other structures.
- Degradation may change the morphology of the river bed, which constitutes one aspect of the aquatic habitat.
- Degradation can deplete the entire depth of gravelly bed material, exposing other substrates that may underlie the gravel, which could in turn affect the quality of Aquatic habitat. Lowering of ground water table in the flood plain because of lowering of riverbed level as well as river water level takes place because of

extraction and draining out of excessive ground water from the adjacent areas. So, if a floodplain aquifer drains to the stream, groundwater levels can be lowered as a result of bed degradation.

I. Lowering of the water table can destroy riparian vegetation.
II. Excessive pumping of ground water in the process of mining in abandoned channels depletes ground water causing scarcity of irrigation and drinking water. In extreme cases it may create ground fissures and subsidence in adjacent areas.
III. Flooding is reduced as bed elevations and food heights decrease, reducing hazard for human occupancy of floodplains and the possibility of damage to engineering works.
IV. The supply of overbank sediments to floodplains is reduced as flood heights decrease.
V. Rapid bed degradation may induce bank collapse and erosion by increasing the heights of banks.
VI. Polluting ground water by reducing the thickness of the filter material especially if mining is taking place at top of recharge fissures.
VII. Choking of filter materials for ingress of ground water from river by dumping of finer material, compaction of filter zone due to movement of heavy vehicles. It also reduces the permeability and porosity of the filter material.
VIII. Removal of gravel from bars may cause downstream bars to erode if they subsequently receive less bed material than is carried downstream from them by fluvial transport.
IX. Ecological effects on bird nesting, fish migration, angling, etc.
X. Direct destruction from heavy equipment operation; discharges from equipment and refueling.
XI. Bio-security and pestrisks.
XII. Impacts on coastal processes.

The other deleterious impacts of indiscrete mining include-

Loss of riparian habitat resulting from direct removal of vegetation along the steam bank to facilitate the use of a dragline or through the process of lowering the water table, bank undercutting, and channel incision.

The physical composition and stability of substrates are altered as a result of in-stream mining and most of these physical effects may exacerbate sediment entrainment in the channel.

1.2 Sustainable Sand Mining Guidelines -MoEF&CC

Sand is naturally occurring granular material composed of finely divided rock and mineral particles between 150 micron to 4.75 mm in diameter. Sand is formed due to weathering of rocks due to mechanical forces. In the process the weathered rocks forms gravel and then to sand.

Sand and gravel known as aggregate, represent the highest volume of raw material used on earth. The mining of aggregate has been continuing for many years. Now the mining of aggregates has reached a level threatening the environment and ecosystem besides also reaching a level of scarcity that would threaten the economy. It is recommended that sand & aggregate mining, and quarrying should be done only after sound scientific assessment and adopting best practices to limit the impact on the environment.

It is also felt that the greater use of substitute material (manufactured sand) & construction technology, and sustainable use of the resource could drastically reduce adverse impact of mining on the environment.

The Guidelines has been based on the following principles:

- Uncontrolled sand mining is not sustainable.
- Compliance with present and future legislation and regulations on the subject is mandatory and not voluntary.
- Each lease holder should be given the opportunity to self-regulate to the extent that it can demonstrate compliance with legislation and regulations.

- Where self- regulation fails to deliver compliance with legislation and regulations, increased formal enforcement and monitoring should be implemented with punitive measures applied in line with the legal framework.
- There is a need to protect the environment and the right of the population to live in clean and safe surroundings, with the need to use natural resources in a way that will make a positive and sustainable contribution to the economy.

Approaches to Sustainable Sand and Gravel Mining:

Following considerations should be kept in mind for sand / gravel mining:

- Parts of the river reach that experience deposition or aggradations shall be identified first. The Lease holder/ Environmental Clearance holder may be allowed 1to extract the sand and gravel deposit in these locations to manage aggradations problem. .
- 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.
- Sand and gravel may be extracted across the entire active channel during the dry season.
- Abandoned stream channels on terrace and inactive floodplains be preferred rather than active channels and their deltas and food plains. Stream should not be diverted to form inactive channel.
- 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.
- Sand and gravel shall not be allowed to be extracted where erosion may occur, such as at the concave bank.
- 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.
- Sand and gravel shall net 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.

- 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.
- 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.
- Alternatively, off-channel or floodplain extraction is recommended to allow rivers to replenish the quantity taken out during mining.
- 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.
- Mining depth should be restricted 1o 3 meter and distance from the bank should be 3 meter or 10 percent of the river width whichever less.
- 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 entre to centre should be left the borrow pits.
- Demarcation of mining area with pillars and geo-referencing should be done prior to strat of mining.

9.0 VOLUME ESTIMATION

The original ground level was recorded at an interval not more than 10M x 10M along & across the length of the river and 7.5 meters wide safety barrier is taken into the consideration. The depth up to which sand is proposed to be mined out is maximum 3 meter, however depth of mining is kept above 1 m above the ground water.

The original ground level recorded at an interval not more than 10M x 10M along & across the length of the river and minerals reserve for river bed area is calculated on the basis of maximum depth of 3 meters

However while deciding the depth of sand mining it is kept into the consideration that the ultimate depth of mining must be remain 1 m above the ground water table.

A safety barrier of 7.5 m width is also taken in to the consideration as no mining zone.

At any rate the mineable volume must not be more than 60 % of the Geological Reserve.

10.0 REPLENISHMENT IN THE LEASES IN SHAMLI

Detrital input reaching river Yamuna is generated from various sources i.e. exposed fresh and weathered rocks recycled marine martial and fluvial sediment and soils. The catchments outcrops are exposed to variable rates and intensity of weathering and there weathering products may vary mineralogical characteristics because of mixing mineral component during erosion and transport prior to final deposition.

Rivers at the time of more rainfall, exhibit higher discharge as there is more water entering the channel. Transportation also increases with discharge. As energy increases so do the capacity of rivers to transport material. Heavy rainfall causes the ground to be saturated. This can lead to mass movement on river sides such as slumping and sliding which can result in material entering the river channel. When the volume of water in a river high and the river channel is deep and wide, and the land around the river is flat, energy in the river is at its lowest, and deposition occurs. During the monsoon season (when rainfall is normal), water containing large quantities of alluvium (river silt) pours over the flat valley floor. The water slowly recedes, leaving behind the deposited sediment. The suspended load bounces in line with the rise and fall in the velocity of the river; Whereas low rainfall intensity reduces the

flow of water in a river. This leads to less transportation and erosion. Mass movement is also less likely to occur.

Table 4: Outcome of the Replenishment Study done by CMPDI (2022-23)

S. No.	Name of Lease	Area of Patch surveyed in Mine Lease Area (Ha)	Volume of Sand (Cum) Replenished (Approx.)	River
1.	Ishopur Khurgan-02	4.50	72126	Yamuna River
2.	Ishopur Khurgan-01	3.39	27059	Yamuna River
3.	Mamoor Ahatmal	16.30	163583	Yamuna River
4.	Mandawar-04	16.32	190500.8	Yamuna River
5.	Naglarai Ahatmal	24.71	379747	Yamuna River
6.	Mandawar-03	20.57	167845	Yamuna River
7.	Bidauli	23.71	162459	Yamuna River

Estimated Volume of Sand in leases of Shamli District for season ending 2022

S. No.	Name of Lease	Mine Lease Area (Ha)	Total Replenishment (CuM.)	Resource available at Pre-monsoon (Cum)	Total Resource (CuM.)
1.	Ishopur Khurgan-02	4.50	63471	29268	92739
2.	Ishopur Khurgan-01	3.39	33551	68246	101797
3.	Mamoor Ahatmal	16.30	158680	171111	329791
4.	Mandawar-04	16.32	237426	51395	288820
5.	Naglarai Ahatmal	24.71	383028	0	383028
6.	Mandawar-03	20.57	165974	48023	213997
7.	Bidauli	23.71	226592	73750	300342

The Present Volume Estimation (Replenishment) in 2024

A joint site visit done by SDC members and consultant in Sep. - Oct., 2024, thick layers of sand deposition is observed at the site. The volume of sand deposited is more than sufficient for next 3 years.

The data collected during site visit of the sites in Shamli is represented in table below:

Table 5: Status of Sand Replenishment vis-à-vis annual planned production

S. No.	Name of Lease	Lease Area (ha)	Minable Area Less safety margin of 7.5 m offset from 3 sides	Total Volume (cum)	Volume As per LOI (cum)
1	Village – Mandawar Tehsil - Kairana Gata No. 624MA, 622MA (khand no. 04)	20.34 ha	1,88,774.60 sqm	3,25,025	2,03,400
2	Village – Mandawar Tehsil - Kairana Gata No. 624MA, 622MA (khand no. 03)	20.34 ha	1,93,305.62 sqm	3,11,318	2,03,400
3	Village – Naglarai Ahatmal Tehsil - Kairana Gata No. 20,57,58,59,61m,62,67m ,68,6970,7172,73KH,82 m,83,84,314m,86,87,88, 306,310,311,312m,313m ,317m,321m,322/39	24.92 ha	2,16,022.84 sqm	5,63,205	3,54,440
4	Village – Bidauli, Tehsil - Unn Gata No. 228	20.46 ha	1,97,540.97 sqm	3,88,652	3,07,035

Rainfall intensity is directly associated with sediment transport and replenishment is directly proportionate.

Table 6: Details of replenishment study in pre-monsoon season (2024)

S. No.	Name of Lease	EGL (Existing Ground Level)		Area (sqm)	Depth (m)	Volume (cum)
		Min (m)	Max (m)			
1	Village – Mandawar Tehsil - Kairana Gata No. 621MA, 622MA (khand no. 04)	201.00 sqm	204.00 sqm	614.96	0.00	0
		204.00 sqm	207.00 sqm	2741.47	0.00	0
		207.00 sqm	210.00 sqm	5628.12	0.00	0
		210.00 sqm	213.00 sqm	9557.27	0.50	4778.635
		213.00 sqm	216.00 sqm	14309.36	0.50	7154.68
		216.00 sqm	219.00 sqm	18389.18	0.50	9194.59
		219.00 sqm	222.00 sqm	24777.26	1.50	37165.89
		222.00 sqm	225.00 sqm	33606.99	1.50	50410.485
		225.00 sqm	228.00 sqm	14086.2	1.50	21129.3
		228.00 sqm	231.00 sqm	45775.71	3.00	137327.13
		231.00 sqm	234.00 sqm	19288.08	3.00	57864.24
	Minable Area after safety Margin			**1,88,774.60 sqm**		**3,25,025**
2	Village – Mandawar Tehsil - Kairana Gata No. 621MA, 622MA (khand no. 03)	229.00 sqm	232.00 sqm	86841.53	0.50	43,421
		232.00 sqm	235.00 sqm	102990.95	2.50	2,57,477
		235.00 sqm	238.00 sqm	3473.14	3.00	10,419
	Minable Area after safety Margin			**1,93,305.62 sqm**		**3,11,318**
3	Village – Naglarai Ahatmal Tehsil - Kairana Gata No. 20,57,58,59,61m,62, 67m,68,6970,7172,7 3KH,82m,83,84,314 m,86,87,88,306,310, 311,312m,313m,317 m,321m,322/39	200.00 sqm	203.00 sqm	87.81	0.00	0
		203.00 sqm	206.00 sqm	589.66	0.00	0
		206.00 sqm	209.00 sqm	715.12	0.00	0
		209.00 sqm	212.00 sqm	911.31	0.00	0
		212.00 sqm	215.00 sqm	1217.92	0.00	0
		215.00 sqm	218.00 sqm	1578.55	1.50	2,368
		218.00 sqm	221.00 sqm	2018.97	2.50	5,047
		221.00 sqm	224.00 sqm	2928.69	2.50	7,322

		224.00 sqm	227.00 sqm	10551.39	2.50	26,378
		227.00 sqm	230.00 sqm	47299.63	2.50	1,18,249
		230.00 sqm	233.00 sqm	82569.36	2.50	2,06,423
		233.00 sqm	236.00 sqm	42382.25	2.50	1,05,956
		236.00 sqm	239.00 sqm	23172.18	2.50	57,930
		239.00 sqm	242.00 sqm	12019.1	2.50	30,048
		242.00 sqm	245.00 sqm	1393.38	2.50	3,483
	Minable Area after safety Margin			**2,16,022.84 sqm**		**5,63,205**
4	Village – Bidauli, Tehsil - Unn Gata No. 228	233.00 sqm	236.00 sqm	13336.97	0.25	3,334
		236.00 sqm	239.00 sqm	75340.29	1.50	1,13,010
		239.00 sqm	242.00 sqm	90336.78	2.50	2,25,842
		242.00 sqm	245.00 sqm	18231.04	2.50	45,578
		245.00 sqm	248.00 sqm	295.89	3.00	888
	Minable Area after safety Margin			**1,97,540.97 sqm**		**3,88,652**

11.0 Lease wise description of Replenishment Study

Lease-01

The mining site is situated on the river bank of Yamuna at Gata No. 621MA, 622MA (Khand no. 04), is having an area of 20.34 Ha Village – Mandawar, Tehsil - Kairana, District-Shamli, U.P, The co-ordinates of Mining lease area are:

Pillar No.	Latitude	Longitude
A	29°27'21.79"N	77° 8'15.08"E
B	29°26'57.48"N	77° 8'13.42"E
C	29°26'57.59"N	77° 8'17.59"E
D	29°26'58.67"N	77° 8'25.16"E
E	29°27'9.49"N	77° 8'25.03"E
F	29°27'14.84"N	77° 8'24.46"E
G	29°27'15.02"N	77° 8'28.28"E
H	29°27'16.66"N	77° 8'28.45"E
I	29°27'14.95"N	77° 8'26.02"E
J	29°27'21.36"N	77° 8'15.07"E
K	29°27'19.05"N	77° 8'14.96"E

Physiography & Drainage

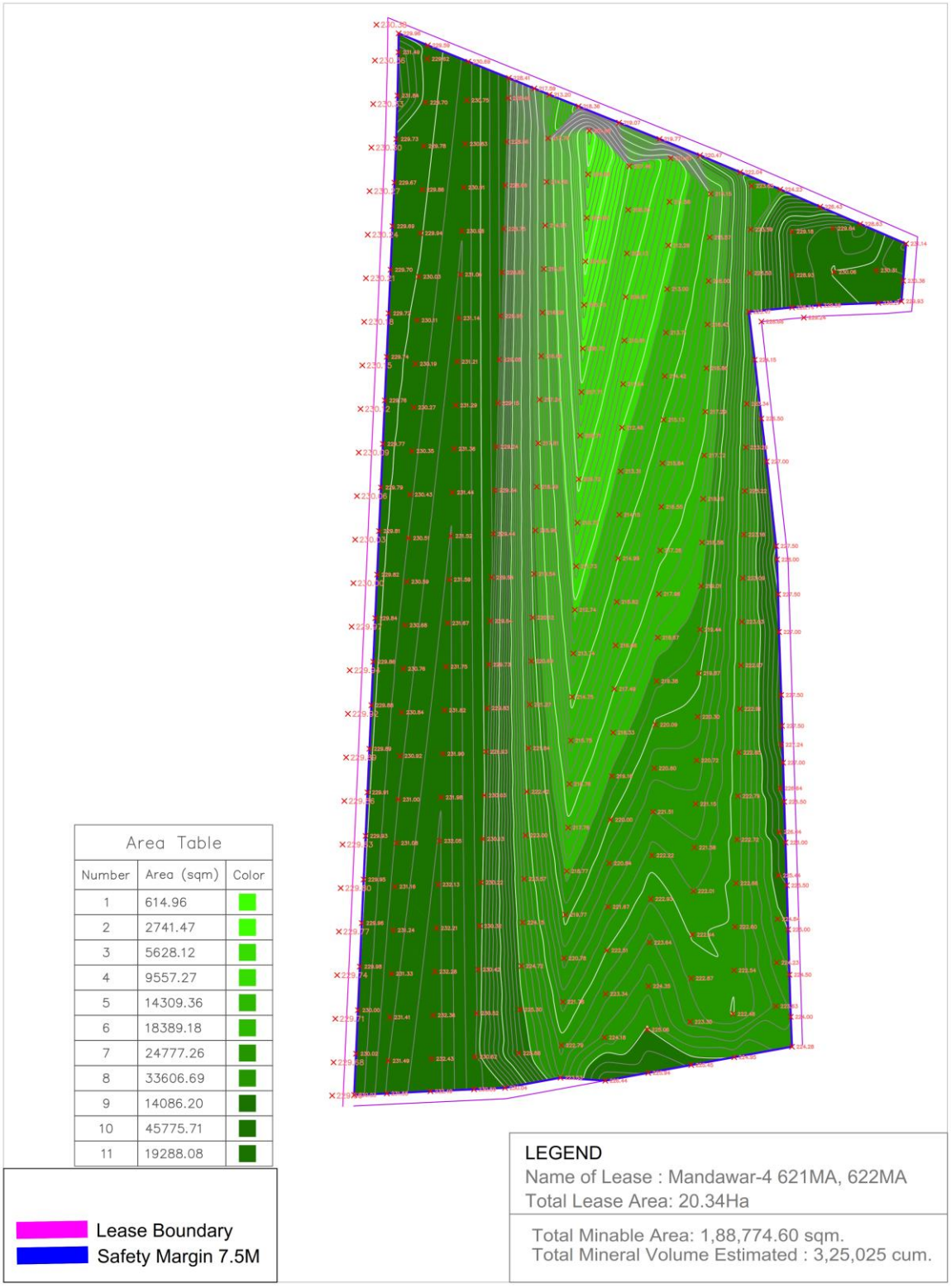
Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology. The lease area is in the river bed and government barren land with. The river bed is mostly dried, undefined stream track with break in sand bed. The area surrounding the lease is mostly agricultural land.

Estimation of Replenishment of sand

The lease area has an area of 20.34 ha (20,34 ,000 sqm) and the minable area less safety margin of 7.5 m is 1,88,774.60 sqm. No Sand was deposited in 8984.55 sqm area,while 21,127.905 cum sand was replenished up to 0.50 m in 42255.81 sqm. 87,576.375 cum sand was accumulated up to a depth of 1.50 m in 72,470.45 sqm area. 195191.37 cum Sand was deposited up to a depth of 3.0 m in 65063.79 sqm area. The volume of total sand replenished

in the lease are in pre-monsoon season (2024) was **3,25,025** cum. A map depicting details is attached as annexure-

EGL (Existing Ground Level)		**Area (sqm)**	**Depth (m)**	**Volume of sand replenished in cum**
Min (m)	**Max (m)**			
201.00 sqm	204.00 sqm	614.96	0.00	0
204.00 sqm	207.00 sqm	2741.47	0.00	0
207.00 sqm	210.00 sqm	5628.12	0.00	0
210.00 sqm	213.00 sqm	9557.27	0.50	4778.635
213.00 sqm	216.00 sqm	14309.36	0.50	7154.68
216.00 sqm	219.00 sqm	18389.18	0.50	9194.59
219.00 sqm	222.00 sqm	24777.26	1.50	37165.89
222.00 sqm	225.00 sqm	33606.99	1.50	50410.485
225.00 sqm	228.00 sqm	14086.2	1.50	21129.3
228.00 sqm	231.00 sqm	45775.71	3.00	137327.13
231.00 sqm	234.00 sqm	19288.08	3.00	57864.24
		1,88,774.60 sqm		**3,25,025**



Area Table		
Number	Area (sqm)	Color
1	614.96	
2	2741.47	
3	5628.12	
4	9557.27	
5	14309.36	
6	18389.18	
7	24777.26	
8	33606.69	
9	14086.20	
10	45775.71	
11	19288.08	

Lease Boundary
Safety Margin 7.5M

LEGEND
Name of Lease : Mandawar-4 621MA, 622MA
Total Lease Area: 20.34Ha

Total Minable Area: 1,88,774.60 sqm.
Total Mineral Volume Estimated : 3,25,025 cum.

Lease-02

The mining site is situated on the river bank of Yamuna at Gata No. 621 MA, 622MA (Khand No. 03), is having an area of 20.34 Ha Village – Mandawar ,Tehsil - Kairana, District-Shamli, U.P, The co-ordinates of Mining lease area are:

Pillar No.	Latitude	Longitude
A	29°27'21.79"N	77° 8'15.08"E
B	29°26'57.48"N	77° 8'13.42"E
C	29°26'57.59"N	77° 8'17.59"E
D	29°26'58.67"N	77° 8'25.16"E

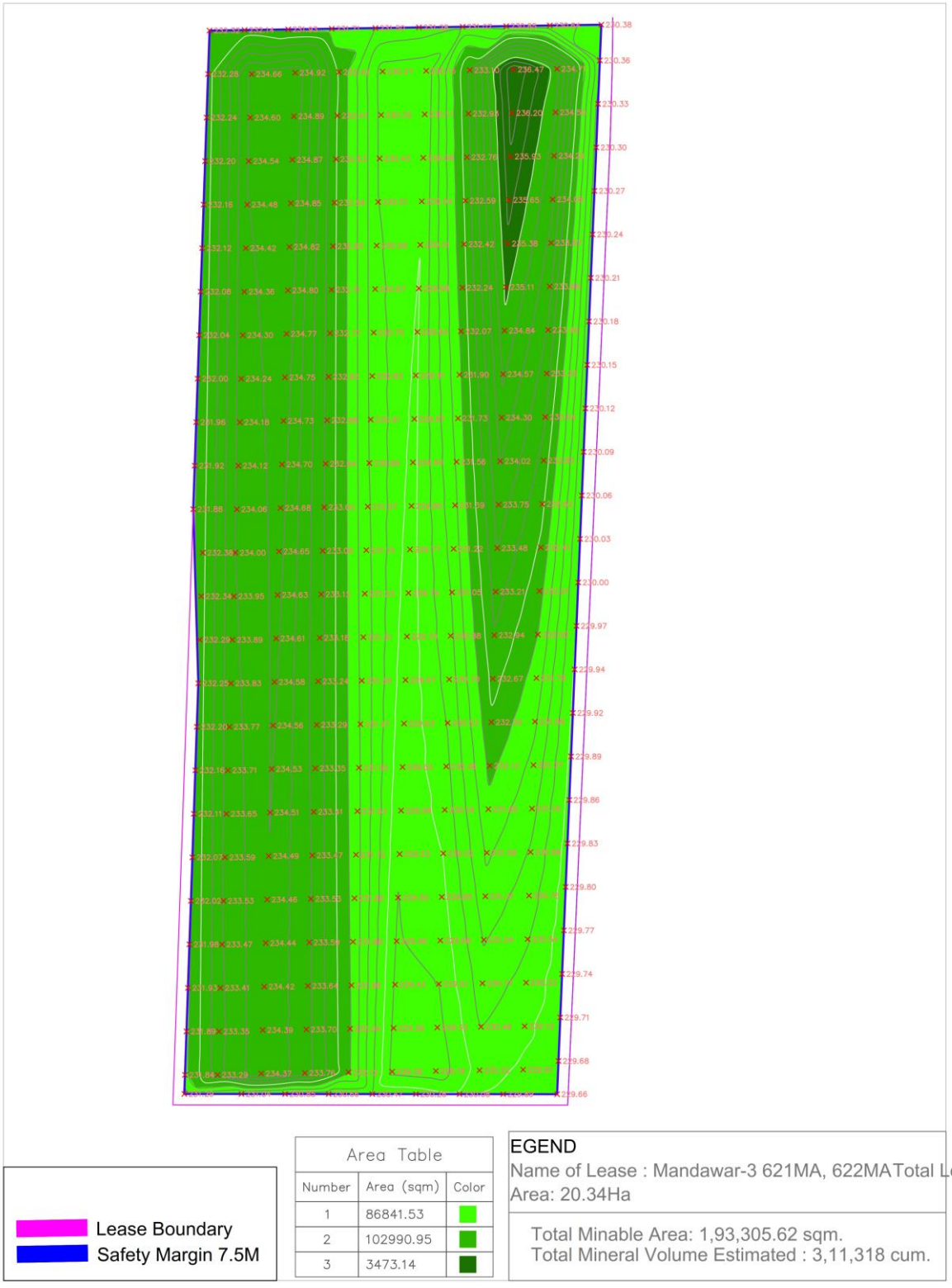
Physiography & Drainage

Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology. The lease area is in the river bed and government barren land with. The river bed is mostly dried, undefined stream track with break in sand bed. The area surrounding the lease is mostly agricultural land.

Estimation of Replenishment of sand

The lease area has an area of 20.34 ha (20,34 ,000 sqm) and the minable area less safety margin of 7.5 m is **1,93,305.62 sqm**. 43,421 cum Sand was deposited up to a depth of 0.50 m in 86841.53 sqm area, while 2,57,477 cum sand was replenished up to 2.50 m in 102990.95 sqm. 10,419 cum sand was accumulated up to a depth of 3.00 m in 3473.14 sqm area. The volume of total sand replenished in the lease are in pre-monsoon season (2024) was **3,11,318** cum. A map depicting details is attached as annexure-

EGL (Existing Ground Level)		Area (sqm)	Depth (m)	Volume of sand replenished in cum
Min (m)	Max (m)			
229.00 sqm	232.00 sqm	86841.53	0.50	43,421
232.00 sqm	235.00 sqm	102990.95	2.50	2,57,477
235.00 sqm	238.00 sqm	3473.14	3.00	10,419
		1,93,305.62 sqm		**3,11,318**


Lease Boundary
Safety Margin 7.5M
Area Table
Number | Area (sqm) | Color
1 | 86841.53
2 | 102990.95
3 | 3473.14
EGEND
Name of Lease : Mandawar-3 621MA, 622MATotal Lea
Area: 20.34Ha
Total Minable Area: 1,93,305.62 sqm.
Total Mineral Volume Estimated : 3,11,318 cum.

Lease-03

The mining site is situated on the river bank of Yamuna at Gata No. 20, 57, 58, 59, 61m, 62, 67m, 68, 69, 70, 71, 72, 73KH, 82m, 83, 84, 314m, 86, 87, 88, 306, 310, 311, 312m, 313m, 317m, 321m, 322/39, is having an area of 24.92 Ha Village – Naglarai Ahatmal, Tehsil - Kairana , District- Shamli, U.P, The co-ordinates of Mining lease area are:

Pillar No.	Latitude	Longitude
A	29^0 25' 22.65"N	77^0 8' 20.17"E
B	29^0 25' 21.93"N	77^0 8' 18.37"E
C	29^0 25' 15.26"N	77^0 8' 17.45"E
D	29^0 25' 12.17"N	77^0 8' 12.61"E
E	29^0 25' 05.76"N	77^0 8' 9.70"E
F	29^0 24' 59.99"N	77^0 8' 13.26"E
G	29^0 24' 56.14"N	77^0 8' 10.31"E
H	29^0 24' 54.03"N	77^0 8' 13.80"E
I	29^0 24' 51.18"N	77^0 8' 11.90"E
J	29^0 24' 53.40"N	77^0 8' 7.50"E
K	29^0 24' 53.10"N	77^0 8' 5.80"E
L	29^0 24' 50.90"N	77^0 8' 6.08"E
M	29^0 24' 48.90"N	77^0 8' 11.38"E
N	29^0 24' 44.48"N	77^0 8' 9.35"E
O	29^0 24' 42.31"N	77^0 8' 7.24"E
P	29^0 24' 40.15"N	77^0 8' 7.28"E
Q	29^0 24' 37.81"N	77^0 8' 11.37"E
R	29^0 24' 27.51"N	77^0 8' 11.72"E
S	29^0 24' 29.19"N	77^0 8' 7.57"E
T	29^0 25' 00.91"N	77^0 8' 3.88"E
U	29^0 25' 12.50"N	77^0 8' 7.22"E
V	29^0 25' 23.09"N	77^0 8' 12.26"E

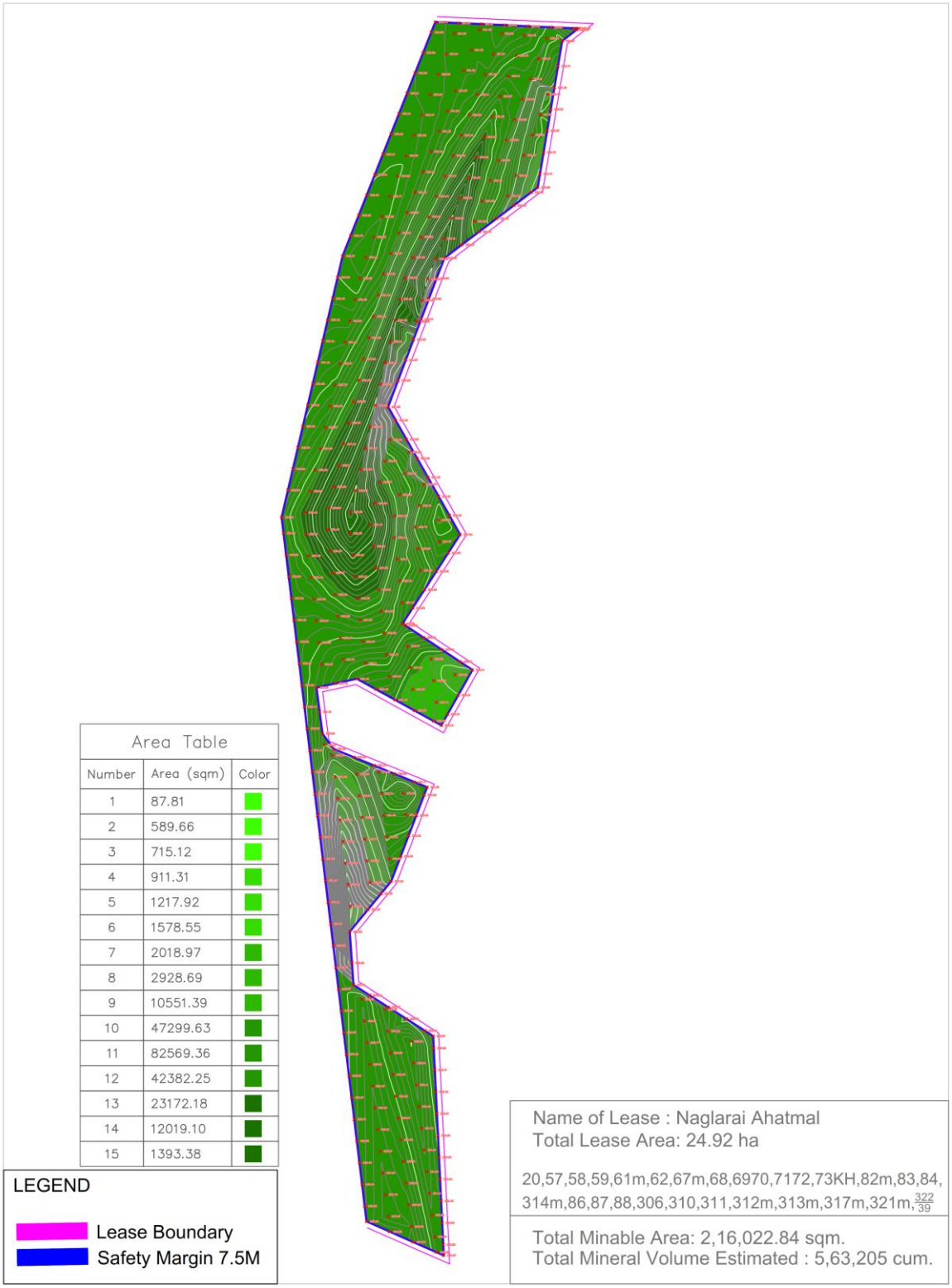
Physiography & Drainage

Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology. The lease area is in the river bed and government barren land with. The river bed is mostly dried, undefined stream track with break in sand bed. The area surrounding the lease is mostly agricultural land.

Estimation of Replenishment of sand

The lease area has an area of 24.94 ha (2,49,400 sqm) and the minable area less safety margin of 7.5 m is **2,16,022.84 sqm**. No Sand deposition is observed in 3521.82 sqm area, while 2,368 cum sand was replenished up to 1.50 m in 1,578.55 sqm. 5,60,836 cum sand was accumulated up to a depth of 2.50 m in 224334.95 sqm area.The volume of total sand replenished in the lease are in pre-monsoon season (2024) was **5,63,205** cum. A map depicting details is attached as annexure-

EGL (Existing Ground Level)		**Area (sqm)**	**Depth (m)**	**Volume of sand replenished in cum**
Min (m)	**Max (m)**			
200.00 sqm	203.00 sqm	87.81	0.00	0
203.00 sqm	206.00 sqm	589.66	0.00	0
206.00 sqm	209.00 sqm	715.12	0.00	0
209.00 sqm	212.00 sqm	911.31	0.00	0
212.00 sqm	215.00 sqm	1217.92	0.00	0
215.00 sqm	218.00 sqm	1578.55	1.50	2,368
218.00 sqm	221.00 sqm	2018.97	2.50	5,047
221.00 sqm	224.00 sqm	2928.69	2.50	7,322
224.00 sqm	227.00 sqm	10551.39	2.50	26,378
227.00 sqm	230.00 sqm	47299.63	2.50	1,18,249
230.00 sqm	233.00 sqm	82569.36	2.50	2,06,423
233.00 sqm	236.00 sqm	42382.25	2.50	1,05,956
236.00 sqm	239.00 sqm	23172.18	2.50	57,930
239.00 sqm	242.00 sqm	12019.1	2.50	30,048
242.00 sqm	245.00 sqm	1393.38	2.50	3,483
		2,16,022.84 sqm		**5,63,205**


Area Table
Number | Area (sqm) | Color
1 | 87.81
2 | 589.66
3 | 715.12
4 | 911.31
5 | 1217.92
6 | 1578.55
7 | 2018.97
8 | 2928.69
9 | 10551.39
10 | 47299.63
11 | 82569.36
12 | 42382.25
13 | 23172.18
14 | 12019.10
15 | 1393.38
LEGEND
Lease Boundary
Safety Margin 7.5M
Name of Lease : Naglarai Ahatmal
Total Lease Area: 24.92 ha
20,57,58,59,61m,62,67m,68,6970,7172,73KH,82m,83,84,
314m,86,87,88,306,310,311,312m,313m,317m,321m,322/39
Total Minable Area: 2,16,022.84 sqm.
Total Mineral Volume Estimated : 5,63,205 cum.

Lease-04

The mining site is situated on the river bank of Yamuna at Gata No. 228, is having an area of 20.46 Ha Village – Bidauli, Tehsil - Unn, District- Shamli, U.P, The co-ordinates of Mining lease area are:

Pillar No.	Latitude	Longitude
A	29°34'54.07"N	77°06'16.84"E
B	29°34'57.59"N	77°06'02.54"E
C	29°34'33.62"N	77°06'15.33"E
D	29°34'34.77"N	77°06'28.58"E

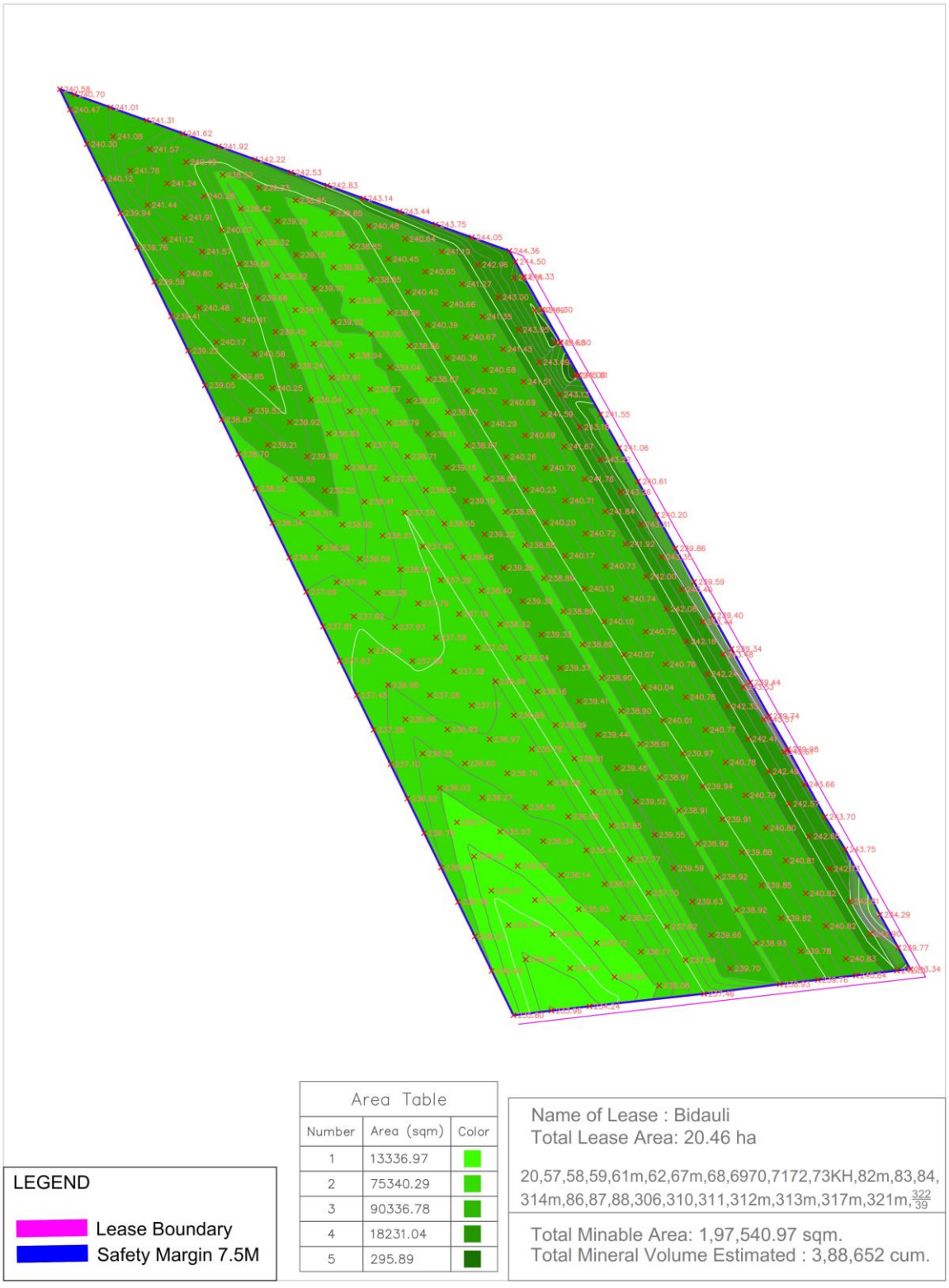
Physiography & Drainage

Lease and adjoining area is by and large undulating plain covered under river sand concealing the subsurface geology. The lease area is in the river bed and government barren land with. The river bed is mostly dried, undefined stream track with break in sand bed. The area surrounding the lease is mostly agricultural land.

Estimation of Replenishment of sand

The lease area has an area of 20.46 ha (2,04,600 sqm) and the minable area less safety margin of 7.5 m offset from 3 sides is **1,97,540.97** sqm. 3,334 cum Sand was deposited up to a depth of 0.25 m in 13336.97 sqm area,while 1,13,010 cum sand was replenished up to 1.50 m in 75340.29 sqm. 2,71,420 cum sand was accumulated up to a depth of 2.50 m in 108567.82 sqm area. 888 cum Sand was deposited up to a depth of 3.0 m in 295.89 sqm area. The volume of total sand replenished in the lease are in pre-monsoon season (2024) was 3,88,652 cum. A map depicting details is attached as annexure-

EGL (Existing Ground Level)		Area (sqm)	Depth (m)	Volume of sand replenished in cum
Min (m)	Max (m)			
233.00 sqm	236.00 sqm	13336.97	0.25	3,334
236.00 sqm	239.00 sqm	75340.29	1.50	1,13,010
239.00 sqm	242.00 sqm	90336.78	2.50	2,25,842
242.00 sqm	245.00 sqm	18231.04	2.50	45,578
245.00 sqm	248.00 sqm	295.89	3.00	888
		1,97,540.97 sqm		3,88,652


LEGEND
Lease Boundary
Safety Margin 7.5M
Area Table
Number | Area (sqm) | Color
1 | 13336.97
2 | 75340.29
3 | 90336.78
4 | 18231.04
5 | 295.89
Name of Lease : Bidauli
Total Lease Area: 20.46 ha
20,57,58,59,61m,62,67m,68,6970,7172,73KH,82m,83,84,
314m,86,87,88,306,310,311,312m,313m,317m,321m,322/39
Total Minable Area: 1,97,540.97 sqm.
Total Mineral Volume Estimated : 3,88,652 cum.

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ANNEXURE-2

प्रेषक,

सदस्य सचिव,
एस0ई0आई0ए0ए0,
गोमती नगर, लखनऊ।

सेवा में,

निदेशक,
भूतत्व एवं खनिकर्म विभाग, उ0प्र0,
लखनऊ।

पत्रांक : 414 /पर्या./सामान्य/2023 दिनाँक 07 अगस्त, 2024

विषयः— **District Survey Report (DSR) of District- Banda के सम्बन्ध में।**

महोदया,

कृपया अवगत कराना है कि ड्राफ्ट डी0एस0आर0—जनपद बांदा की राज्य स्तरीय विशेषज्ञ मूल्यांकन समिति की बैठक दिनांक 18.07.2024 तथा राज्य स्तरीय पर्यावरण प्रभाव निर्धारण प्राधिकरण, उ0प्र0 की बैठक दिनांक 01.08.2024 मे निम्न शर्तो के साथ अनुमोदन प्रदान किया गया :—

1. The period of validity of DSR Banda shall be for the period of 05 years from the date of its approval.
2. Out of 110 (109 leases + 01Patta land) areas in the DSR, 08 lease are withheld because document verification is in process and other 02 leases are held in abeyance and will be approved after resolution of complaints. So 100 lease areas will be approved in present DSR.
3. If any new lease is identified, its validity will be co-terminus with the validity period of current DSR and Sub-Divisional Committee will follow the entire procedure every time on the basis of existing DSR.
4. After approval of DSR from SEIAA, the District Administration shall upload the DSR in public domain along with Lease Wise Digital Maps showing the status of deposits and pillar wise coordinates of existing and proposed areas.
5. The District Administration shall utilize the District Mineral Foundation Funds as per notification no. 866/86-2017-132/2016 dated 15/05/2017 issued by Department of Geology and Mining, Government of U.P. or any modification in it by competent authority.
6. DMF fund should also be utilized for the development and maintenance of haulage road.
7. The lease shall periodically conduct audits of operative mine leases and take corrective measures as per the directions of District Administration in case of adverse observations and, a yearly report on this shall be sent to SEIAA as compliance.
8. Replenishment study on the basis of which the mineral availability is assessed should be uploaded on websites of District and Mining Department and submitted to SEIAA along with methodology adopted for study and details like geo-coordinates etc. of study points.
9. The District shall prepare a schedule for conducting replenishment study annually. This study should be done by a reputed Central or State Govt. institute and should be uploaded on the websites of district, Geology and Mining Department and submitted to SEIAA on its website. Quantity mined and auctioned shall be strictly based on replenishment study. District administration as well as Mining Department will follow all norms and procedure to ensure no illegal mining takes place.

10. Mining Department shall be responsible for demarcating the leases where-ever needed after the monsoon.
11. SEIAA noted that in draft DSR unit of quantity used is not uniform, for example, under list of potential mining leases (existing and proposed) and Final List of Potential Mining Leases (existing & proposed) ,hence a clarification must be submitted and units of mineral availability should be same as that mentioned in LOI as well as in mining plans.
12. Validity of this DSR is 5 years from the date of approval and if during the currency of this DSR new areas are added information should be submitted to SEIAA.

समिति/प्राधिकरण की बैठक मे लिये गये निर्णय के आलोक मे सम्बन्धित कार्यवृत्त की प्रति इस अनुरोध के साथ प्रेषित है कि उक्त के सम्बन्ध मे आवश्यक कार्यवाही करवाने का कष्ट करें।

संलग्नक– यथोक्त।

भवदीय,

(संजीव कुमार सिंह)
सदस्य सचिव,
एस0ई0आई0ए0ए0

प्रतिलिपि- जिलाधिकारी, बांदा को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित।

(संजीव कुमार सिंह)
सदस्य सचिव,
एस0ई0आई0ए0ए0

ANNEXURE-3

प्रेषक,

सदस्य सचिव,
एस0ई0आई0ए0ए0,
गोमती नगर, लखनऊ।

सेवा में,

निदेशक,
भूतत्व एवं खनिकर्म विभाग, उ0प्र0,
लखनऊ।

पत्रांक : 416 /पर्या./सामान्य/2023 दिनाँक 07 अगस्त, 2024

विषयः— **District Survey Report (DSR) of District- Basti के सम्बन्ध में।**

महोदया,

कृपया अवगत कराना है कि ड्राफ्ट डी0एस0आर0–जनपद बस्ती की राज्य स्तरीय विशेषज्ञ मूल्यांकन समिति की बैठक दिनांक 19.07.2024 तथा राज्य स्तरीय पर्यावरण प्रभाव निर्धारण प्राधिकरण, उ0प्र0 की बैठक दिनांक 01.08.2024 मे निम्न शर्तो के साथ अनुमोदन प्रदान किया गया :–

1. The period of validity of Revised DSR Basti shall be for the period of 05 years from the date of its approval.
2. It was informed that out of 10 (05 Regular Govt. leases + 05 Patta land) areas in the DSR.
3. If any new lease is identified, its validity will be co-terminous with the validity period of current DSR and Sub-Divisional Committee will follow the entire procedure every time on the basis of existing DSR.
4. After approval of DSR from SEIAA, the District Administration shall upload the DSR in public domain along with Lease Wise Digital Maps showing the status of deposits and pillar wise coordinates of existing and proposed areas.
5. The District Administration shall utilize the District Mineral Foundation Funds as per notification no. 866/86-2017-132/2016 dated 15/05/2017 issued by Department of Geology and Mining, Government of U.P. or any modification in it by competent authority.
6. DMF fund should also be utilized for the development and maintenance of haulage road.
7. The lease shall periodically conduct audits of operative mine leases and take corrective measures as per the directions of District Administration in case of adverse observations and, a yearly report on this shall be sent to SEIAA as compliance.
8. Replenishment study on the basis of which the mineral availability is assessed should be uploaded on websites of District and Mining Department and submitted to SEIAA along with methodology adopted for study and details like geo-coordinates etc. of study points.
9. The District shall prepare a schedule for conducting replenishment study annually. This study should be done by a reputed Central or State Govt. institute and should be uploaded on the websites of district, Geology and Mining Department and submitted to SEIAA on its website. Quantity mined and auctioned shall be strictly based on replenishment study. District administration as well as Mining Department will follow all norms and procedure to ensure no illegal mining takes place.
10. Mining Department shall be responsible for demarcating the leases where-ever needed after the monsoon.
11. Validity of this DSR is 5 years from the date of approval and if during the currency of this DSR new areas are added information should be submitted to SEIAA.

समिति/प्राधिकरण की बैठक मे लिये गये निर्णय के आलोक मे सम्बन्धित कार्यवृत्त की प्रति इस अनुरोध के साथ प्रेषित है कि उक्त के सम्बन्ध मे आवश्यक कार्यवाही करवाने का कष्ट करें।

संलग्नक– यथोक्त।

भवदीय,

(संजीव कुमार सिंह)
सदस्य सचिव,
एस0ई0आई0ए0ए0

प्रतिलिपि- जिलाधिकारी, बस्ती को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित।

(संजीव कुमार सिंह)
सदस्य सचिव,
एस0ई0आई0ए0ए0

ANNEXURE-4

प्रेषक,

सदस्य सचिव,
एस0ई0आई0ए0ए0,
गोमती नगर, लखनऊ।

सेवा में,

निदेशक,
भूतत्व एवं खनिकर्म विभाग, उ0प्र0,
लखनऊ।

पत्रांक : 415 /पर्या./सामान्य/2023 दिनाँक 07 अगस्त, 2024

विषयः– **District Survey Report (DSR) of District- Shamli के सम्बन्ध में।**

महोदया,

कृपया अवगत कराना है कि ड्राफ्ट डी0एस0आर0–जनपद शामली की राज्य स्तरीय विशेषज्ञ मूल्यांकन समिति की बैठक दिनांक 19.07.2024 तथा राज्य स्तरीय पर्यावरण प्रभाव निर्धारण प्राधिकरण, उ0प्र0 की बैठक दिनांक 01.08.2024 मे निम्न शर्तो के साथ अनुमोदन प्रदान किया गया :–

1. The validity period of Revised DSR of District, Shamli shall be for the period of 05 years from the date of its approval.
2. It was informed that out of 8 (07 Regular Govt. leases + 01 Patta land) areas in the DSR.
3. If any new lease is identified, its validity will be co-terminous with the validity period of current DSR and Sub-Divisional Committee will follow the entire procedure every time on the basis of existing DSR.
4. After approval of DSR from SEIAA, the District Administration shall upload the DSR in public domain along with Lease Wise Digital Maps showing the status of deposits and pillar wise coordinates of existing and proposed areas.
5. The District Administration shall utilize the District Mineral Foundation Funds as per notification no. 866/86-2017-132/2016 dated 15/05/2017 issued by Department of Geology and Mining, Government of U.P. or any modification in it by competent authority.
6. DMF fund should also be utilized for the development and maintenance of haulage road.
7. The lease shall periodically conduct audits of operative mine leases and take corrective measures as per the directions of District Administration in case of adverse observations and, a yearly report on this shall be sent to SEIAA as compliance.
8. It was also discussed that haulage route construction to the leases of the District must be facilitated through District Mineral Fund by Mining Department.
9. Replenishment study on the basis of which the mineral availability is assessed should be uploaded on websites of District and Mining Department and submitted to SEIAA along with methodology adopted for study and details like geo-coordinates etc. of study points.
10. The District shall prepare a schedule for conducting replenishment study annually. This study should be done by a reputed Central or State Govt. institute and should be uploaded on the websites of district, Geology and Mining Department and submitted to SEIAA on its website. Quantity mined and auctioned shall be strictly based on replenishment study. District administration as well as Mining Department will follow all norms and procedure to ensure no illegal mining takes place.
11. Mining Department shall be responsible for demarcating the leases where-ever needed after the monsoon.

12. Validity of this DSR is 5 years from the date of approval and if during the currency of this DSR new areas are added information should be submitted to SEIAA.

समिति/प्राधिकरण की बैठक मे लिये गये निर्णय के आलोक मे सम्बन्धित कार्यवृत्त की प्रति इस अनुरोध के साथ प्रेषित है कि उक्त के सम्बन्ध मे आवश्यक कार्यवाही करवाने का कष्ट करें।

संलग्नक– यथोक्त।

भवदीय,

(संजीव कुमार सिंह)
सदस्य सचिव,
एस0ई0आई0ए0ए0

प्रतिलिपि- जिलाधिकारी, शामली को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित।

(संजीव कुमार सिंह)
सदस्य सचिव,
एस0ई0आई0ए0ए0