Environment Impact Assessment (EIA) Report with Regional Environment Management Plan (REMP) for MorrumMining from Riverbed of Betwa River

located at Khand No. 26/3, Village- ChandwariGhurauli,
Tehsil- Sarila, District – Hamirpur
Sanctioned Area –24.0291 ha.
Proposed Production of Morrum–4,85,747 m^3/year

Prepared on the basis of TOR issued by SEAC, UP

File No. 4404

Submitted by:

M/s New Eoan Associates

Proprietor ShriDharmendra Singh Tomar
S/o Shri Krishna Kumar Tomar
Address :R/o House No. 101, Tansen Nagar, Gwalior (M.P.)

Submitted to

State Level Environment Impact Assessment Authority, U.P.

Directorate of Environment, Govt. U.P.

Baseline Consultant

Research Institute of Material Sciences, New Delhi

Environment Consultant

ENV Developmental Assistance Systems (India) Pvt. Ltd. Lucknow

(QCI-NABET Accredited for Category 'A' Projects)
D-2247, Indira Nagar, Lucknow-226016, Ph: +91 522 4007470, 4107624 TeleFax: 0522 4021236
Email: admin@dasindia.org, Website: www.dasindia.org

October, 2018

To reduce the size, all the figures and illustration are removed from soft copy only.

All annexures are already uploaded with the Form-1 and PFR.

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A Environmental Impact Assessment (EIA) is an environmental framework that evaluates environmental impacts and associated risks at a strategic level.

The EIA assesses the potential cumulative impact of the project on the environment in combination with other known developments in the wider area and will consider cumulative impacts. These may include carrying capacity of the area.

An EIA can only address a limited range of alternatives and mitigation measures, while REIA Considers a broad range of potential alternatives over a wider location.

1.1 GENERAL

The spectacular growth of the construction industry has unforseen consequences for every river in India through mining of sand — which is an essential part of construction.Modern cities are built with sand. Most of it is used in the construction industry to make concrete and asphalt. No surprise, then, that Asia is the biggest consumer of sand. The UN forecasts that, by 2030, there will be over 40 “megacities” home to more than 10million inhabitants (up from 31 in 2016), which means more housing and infrastructure will need to be built , this can explain the the country's breakneck pace of construction. Sand also has industrial uses: it is used to make glass, electronics, and to help extract oil in the fracking industry.

1.1.1 Sand mining in India

Sand is a good source of revenue for state governments. The huge gap between supply and demand of natural sand has seen an increase in the illegal filter sand business (washing of sandy loam soil and selling it as sand) in the state. The farmers along the riverbeds, tank beds and streams are extracting sand and selling it for Rs 6,000 to Rs 9,000 per truckload, depending on the quality.The increase in the construction of apartments, townships, roads and bridges has pushed up the demand for sand. Sand is an expensive commodity today, though the price varies in different markets. Soaring demand for sand due to massive construction poses a threat not just to the environment but to society at large, and urgent measures are needed to tackle the problem.With real estate mushrooming and construction of highways and roads booming, there is huge demand for sand. Apart from the big bucks, the livelihood of hundreds of thousands of people, from truck drivers to construction labourers, are linked to the business. Any disruption in supply is expected to push up the project costs, and slow down building activity. Already builders are facing the heat. The real estate sector is one of the largest employers. Officially blocks are earmarked and then auctioned by the state government after environment clearance is granted.

1.1.2 Present status of sand Mining

The mining of sand and gravel has emerged as a major regulatory concern in the last decade, especially because of the global construction boom and the spread of urbanisation. The removal of sand, which was earlier only for low-scale, household purposes or as a managementexercise to prevent flooding, is now one of the most unregulated mining sectors in India

1.1.3 Sand Mining in Uttar Pradesh

The scale of mining happening for minor minerals including sand is difficult to ascertain. Information on various factors such as number of leases, production, and royalty earnings etc., is poorly documented. It is largely because a lot of mining happens illegally and there are no records. However, according to information obtained by CSE in 2016 from the Directorate of Geology and Mining of Uttar Pradesh through an RTI, there are more than 1,367 minor mineral leases in UP. Out of these, only 175 are of sand or murram mining—this translates into just 13 per cent of the total minor mineral leases. But this remains a gross underestimation of the scale of mining actually happening in the state. Nevertheless, the data available indicates that amount of sand mined in UP has been steadily increasing. Between 2012–13 and 2014–15, sand production more than doubled (see Table 1.1: Sand mining in Uttar Pradesh).

Table 1.1: Sand mining in Uttar Pradesh

There has been a relentless growth in the amount mined

Year	Royalty (in lakh Rs)	Production (cubic metre)	Estimated value (in lakh Rs)
2012–13 (72 districts)	8,905	29,681,667	53,427
2013–14 (74 districts)	6,619	22,062,467	39,712
2014–15 (74 districts)	3,875	13,840,393	24,913

1.2 PURPOSE OF EIA& REGIONAL EMP

The proposal for EIA has been put forth during various TOR presentations and detail outline was explained and SEAC was agreed with the proposal. The standard TOR will form the basis of this EIA as no additional TORs were issued by the SEAC, Uttar Pradesh.The total mine lease area of the project **M/s New Eoan Associates, ChandwariGhurauli, Sarila, Hamirpur is 24.291 ha and it is situated in study area-1 having mineable area of** 303.64 Ha(inclusive of upcoming projects for which Public Hearing/EC is awaited) and the total annual production will be 5456724(inclusive of upcoming projects for which Public Hearing/EC is awaited)cum/annum .These morrum sites are present in the Betwa River Bed between - 25°46'12.48"N & 79°19'13.34"E to 25°52'2.99"N & 79°46'49.50"E . ThisEIA study will lead to systematic assessment of the potential environmental effects including cumulative effects of strategic initiatives, policies, plans or projects for a particular region. The REMP fulfills the need for macro-level environmental integration, which the project-oriented EIA is unable to address effectively.

If environmental effects are considered at regional level, then the cumulative environmental effects of all the projects within the region can be assessed & accounted for.

Table 1.2 Various stages of Mining activities.

Mining Stages	**Process Description**
Precursors to mining	
Prospecting	Searching for sand resources using multiple exploration techniques
Exploration	Determining the possible size and value of the sand deposit using different evaluation techniques

Mining Stages	Process Description
Mining	
Developing	Setting-up and commissioning facilities to extract, treat and transport sand
Exploitation	Large scale sand production
Post mining	
Closure and reclamation	Returning the land to its original state

Source : Environmental Impacts of Sand Exploitation. Analysis of Sand Market by Marius Dan Gavriletea, Sustainability 2017, 9(7), 1118;

1.3 LEGISLATION APPLICABLE TO MINING OF MINOR MINERALS

The mining sector has separate set of legislations covering management, conservation, grant and operation of mining lease. In addition there are environmental/forest regulation, applicable to mining of minor minerals as prescribed by MoEF& CC, attached as **Annexure-XXIII**

1.3.1 LEGISLATION

The mining sector has separate set of legislations covering management, conservation, grant and operation of mining lease. In addition there are environmental/forest regulation, applicable to mining of minor minerals as prescribed by MoEF& CC and CPCB.

Table. No. 1.3: Acts, Policies and Rules applicable to the project

S.No.	Acts and Legislations	Year
1.	The Mines Act	1952
2.	The Mines and Mineral (development and Regulation) Act	1957
3.	Mines Rules	1955
4.	Mineral Concession Rules	1960
5.	Mineral Conservation and Development Rules	1988
6.	Uttar Pradesh Minor Mineral Concession Rules	1963
7.	The Environment (Protection) Act,	1986
8.	Notification on Environment Impact Assessment of Development projects (and amendments) (referred to as the Notification on Environmental Clearance)	2006, 2009, 2015, 2018
9.	Wildlife Protection Act, MoEF	1972
10.	The Forest (Conservation) Act,	1980
11.	Water (Prevention and Control of Pollution) Act (and subsequent amendments)	1974
12.	The Water (Prevention & Control of Pollution) Rules	1975
13.	The Water (Prevention & Control of Pollution) Cess Act	1977
14.	The Water (Prevention & Control of Pollution) Cess Rules	1978
15.	Air (Prevention and Control of Pollution) Act (and	1981

	subsequent amendments)	

In order to keep the local & regional environment intact and to achieve the goals of sustainable development, all the mining activities under mining operations of the proposed project will be carried out within the framework of governmental policies, acts and rules of mining, forest conservation and environmental protection. The Environment (Protection) Act, 1986, is the most comprehensive law on the subject. The law grants power to the Central and State Government to take all measures necessary to protect and improve the quality of environment and to prevent pollution of the environment. The following rules, notifications and standards under the Environment (Protection) Act, 1986 are particularly relevant in this case:

1. Environment (Protection) Rules, 1986 and its amendments.
2. The Water (Prevention and Control of Pollution) Rules, 1975
3. The Air (Prevention and Control of Pollution) Rules, 1982
4. Noise Pollution (Regulation & Control) Rules, 2003 and its amendments.
5. EIA Notification, 2006 and its amendments.
6. National Ambient Air Quality Standards and its amendments.
7. Solid Waste Management Rules, 2016

1.4 Extract of EIA Notification

As per the provisions of the EIA Notification issued on 14th September 2006 and subsequent amendments till date:

- All projects and activities are broadly categorized in to two categories - Category A and Category B
- Category 'A' in the Schedule requires prior environmental clearance from the MoEF&CC and Category 'B' in the Schedule, from the State/Union Territory Environment Impact Assessment Authority (SEIAA).

- An application seeking prior environmental clearance in all cases shall be made in the prescribed Form –I along with the pre-feasibility project report.
- "Scoping" refers to the process by which the Expert Appraisal Committee in the case of Category 'A' projects or activities, and State level Expert Appraisal Committee in the case of Category 'B1' projects or activities, determine detailed and comprehensive Terms of Reference (TOR) for the preparation of an Environment Impact Assessment (EIA) Report in respect of the project or activity for which prior environmental clearance is sought. However after the introduction of standard TOR for each sector amendment of EIA notification the issued on 10th April, 2016 it was stated that "Standard TOR developed by the Ministry inconsultation with the sector specific Expert Appraisal Committees shall be the deemed approved TOR for the projects or activities. These standard TOR shall enable the Project Proponent to commence preparation of an Environment Impact Assessment Report after successful online submission and registration of the application.
- All Category 'A' and Category B1 projects or activities shall undertake Public Consultation. But now as per Gazette notification amendment S.O. 3977(E) dated on 14.08.2018 issued by the MoEF of India, the Public consultation are not required for B_2 Sub-category under B category project.

Table 1.4: Project Activity Schedule as per EIA Notification 2006 & Amendments

PROJECT ACTIVITY	Category With Threshold Limit		Conditions, if any
	A	B	

1 (a)	Mining of minerals	> 100 ha. of mining lease area in respect of non-coal mine lease. > 150 ha of mining lease area in respect of coal mine lease Asbestos mining irrespective of mining area.	≤ 100 ha of mining lease area in respect of non-coal mine lease.	General Conditions shall apply except: (i) for project or activity of mining of minor minerals of Category 'B2' (up to 25 ha of mining lease area); (ii) for project or activity of mining of minor minerals of Category 'B1' in case of cluster of mining lease area; and (iii) River bed mining projects on account of inter-state boundary. Note: (1) Mineral prospecting is exempted; (2) The prescribed procedure for environmental clearance for mining of minor minerals including cluster situation is given in Appendix XI;

1.4.1 Environmental Clearance

Environmental Clearance of Cluster of mine leases of area ≥ 25 hectares with individual lease size ≤ 100ha will fall in category 'B1' . For Environmental clearance Form –I, PFR, DSR and Approved Mine Plan and one EIA/EMP for all leases in the Cluster will be submitted.The purpose of the preparation of EIA Report is not only to obtain Environmental Clearance from SEAC U.P., and State Pollution Control Board, but also to understand the likely impacts and to take Environmental Protection measures during and after commissioning of the project. This EIA report is prepared on the basis of primary data generated between March to May 2018and secondary data collected during year 2017& 2018

1.4.2. Objective of EIA Study

The overall objective of this study is to identify all significant environmental repercussions arising from the construction and implementation of the project. The study seeks to establish present environmental conditions at the project site by available information supported by field studies and data available from secondary sources, wherever necessary; to predict the impacts on relevant environmental attributes due to the construction & operation of proposed project. It is essential, therefore to recommend adequate mitigation measures for minimal impacts and to prepare an Environmental Impact Assessment (EIA) report including Environmental Management Plan (EMP) so as the construction works to be carried out in sound environmental standards. An EIA study basically covers:

- Baseline Environmental Features.
- Project Specific Activities.
- Analysis of Impacts.
- Environmental Management Plan.

There are total 11 morrum mining sites at Betwa River Bed in inclusive of 08 B_1 category & 03 B_2 category mines in this group of leases.

Lease is granted by District Magistrate Hamirpur through e-tenderingforexcavation of Sand/Moram fromRiverbedofBetwaRiver. LOI ofthe leaseis annexed as **Annexure-II**. The Mining Plan has been approved by Directorate of Geology & Mining. The copy of standard TOR is annexed as **Annexure-III**. Given below are the details of projects forEnvironmental Impact Assessment (EIA).

1.5PROJECT / PROPONENT DETAILS

1.5.1 Details of Project and Project Proponents in the study area

M/s New Eoan Associates Proprietor ShriDharmendra Singh Tomar S/o Shri Krishna Kumar Tomar R/o House No. 101, Tansen Nagar, Gwalior (M.P.)

1.5.2. **Brief description of nature, size, location of the project and its imoportance to the country, region**

a. **Nature**

The proposed morrum mining projects is new mining lease where the PPwas granted morrum mining for the lease period of Five years. In the meanwhile on the enforcement of

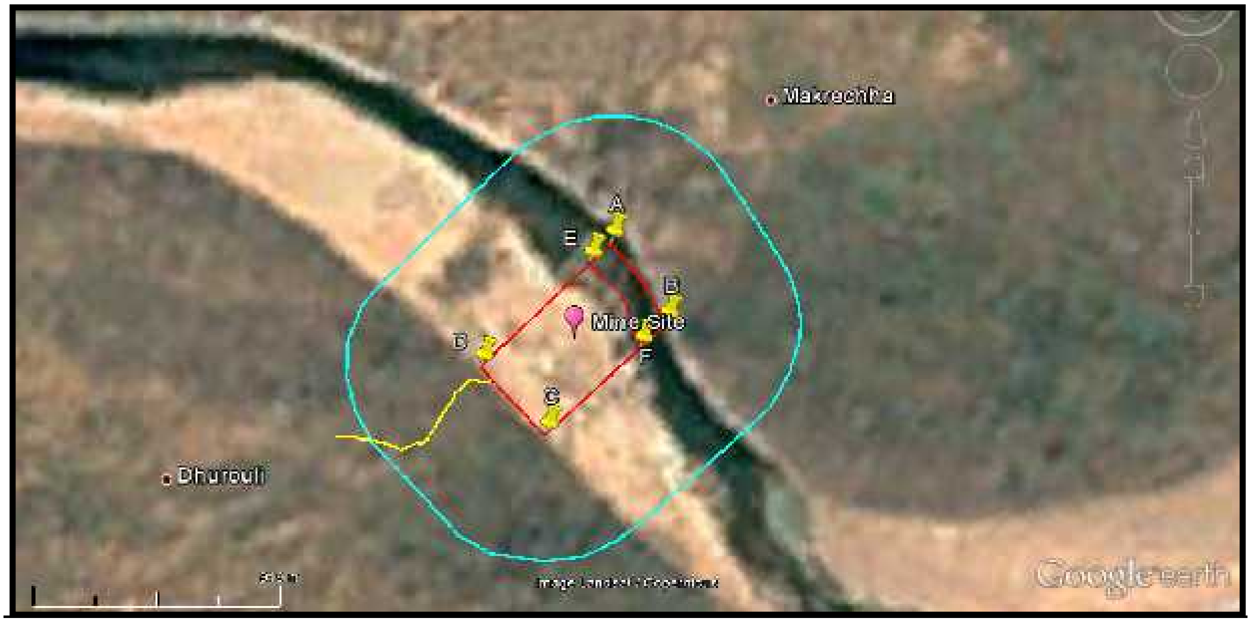

Fig.1.2. Location of the project.

MoEF& CC notification dated, 2006 as amended in 2009, 2016 and 2018, DM, Hamirpur has ordered the PP to submit EC to commence the morrum mining in the sanctioned lease area to get Environmental Clearance. Copy of Letter of Intent is attached as **Annexure-II.**The proposed projectis to mine morrum from dry river bed sustainably and scientifically. Mining will be done by semi mechanized/OTFM (Other Than Fully Mechanized) method using light earth mover machines e.g. bar scrapers and loaders along the river bed keeping the banks unaffected. Google Map of 10 km radius from proposed project site showing surrounding features is given below:

b. **Brief History of Projects in the study area**

The lease is granted by District Magistrate,Hamirpur through e-tenderingforexcavation of S a n d / Moram f r o m R i v e r b e d o f B e t w a R i v e r . LOI of the leasesis annexed as **Annexure-II**. The Mining Plan has been approved by Directorate of Geology & Mining. The copy of standard TOR is annexed as **Annexure-III**.

c. Size

Proposed mine leases has been sanctioned over for period of five years. Only morrum will be excavated. It has been proposed that 4,85,747 cum/ yearof morrum will be excavated.

d. Area and categorization of Projectin the study area

Although the area of the project is only 24.291 ha and it is B2 category project, but according to the cluster certificate another mine in 500 m radius of the proposed project form a cluster of 48.582 ha. So it also becomes a B1 category project.

1.5.3. Location, brief description of project & its topography and physiography

2. The proposed project is situated in Khand No. 26/3, ChandwariGhurauli, Sarila, Hamirpur. Toposheet of the study area is attached as Fig.1.3

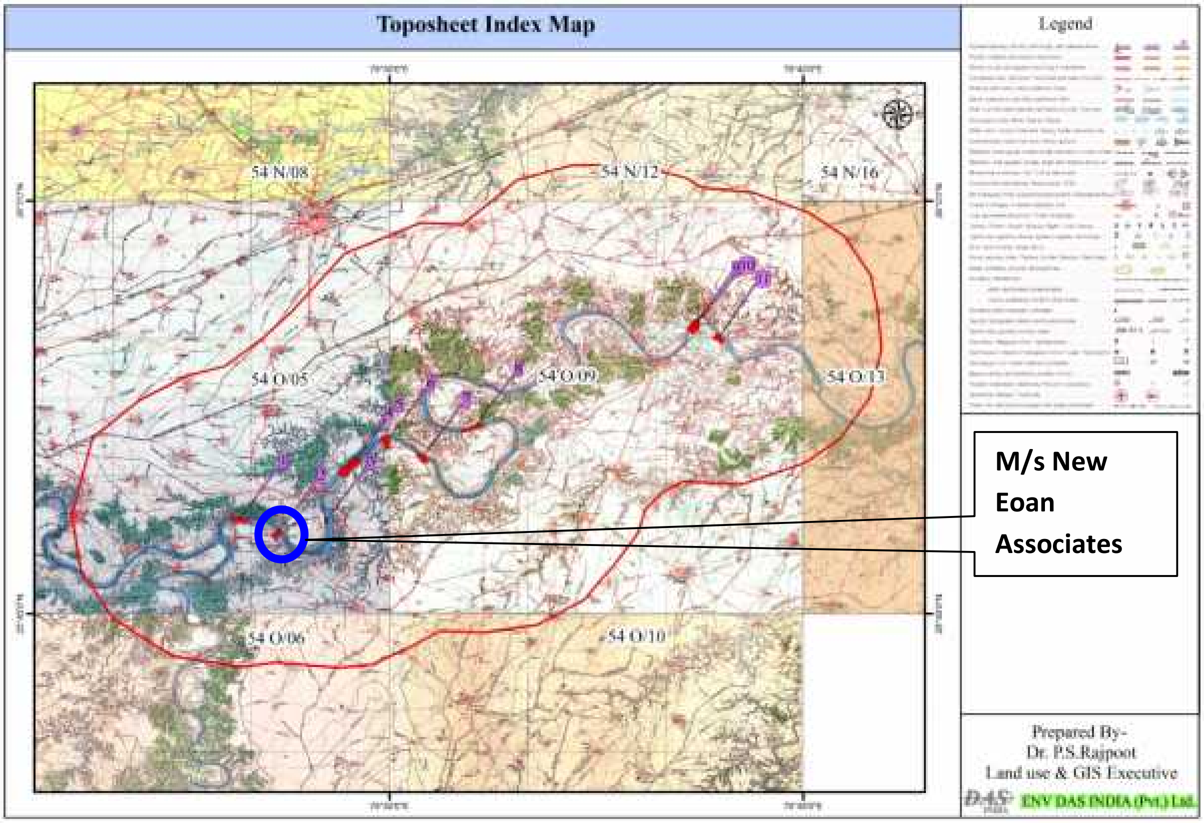

Fig 1.3Toposheet of the stretch of Betwa covered in EIA of study area-1

e. Location of Lease Area.

The proposed project is situated in Khand No. 26/3 ,ChandwariGhurauli, Sarila, Hamirpur.

1.6 PROJECT IMPORTANCE TO THE COUNTRY AND REGION

Due to the increased industrial and infrastructural growth of the rural and urban areas demand of morrum is very high. Morrum has become a very important mineral for the expansion of society. With the increase of urbanization thedemand for morrum is growing in infrastructure sector in our country. The mineral is used for making concrete, filling roads, building sites, brick making, making glass, morrum papers, reclamations etc. Individual and private companies are increasingly demanding morrum for construction purposes and this has immense pressure on morrum resources. This increasing demand makes this an environmental issue. Similar initiates are also being taken up in road sector by National Highway Authority of India and Ministry of Transport. Achieving such a huge infrastructure requires basic building materials and morrum, bajri and boulders is one of primary building material required for the purpose. The mining activities are the backbone of all construction and infrastructure projects as raw material for construction is available only from such mining. The mining being undertaken will support demand for morrum, stone and bajri in the area. Simultaneously, the morrum excavation helps in channelizing the river, which minimizes the hazards of floods and water logging in the region.

1.7 **SCOPE OF THE STUDY**

The present EIA report of the study area is prepared as per requirement of the standard TOR issued by MoEF&CC and SEAC, UP attached as **Annexure II**. The monitoring and analysis study for the project was done during March 2018 – May 2018 around study area is also attached as **Annexure XII**. Toposheet of the study area is attached as **Annexure-XVIII**.

1.8 **NATURE AND SIZE OF GROUP OF LEASES**

The mining lease area is 24.291 ha. It has been proposed that 4,85,747 cum/ year of morrum will be excavated. The plan period of the entire lease is 05 years.

a. **Nature of Mines**

The proposed project is sand/morrum mining projects. Area wise the project is falling under category B2 having area of less then25 ha but are treated as B1category because of cluster situation. The spirit of EIA notification is the cumulative impact assessment of two small mines which individually are believed to cause less impact. The buffer zones of various mines on the stretch of river Betwa are overlapping each other, that is the need for impact assessment on the large scale and EIA is undertaken.

1.9 **CARRYING CAPACITY OF AREA**

Predicting future growth and assessing the extent of infrastructural development (industrial, commercial other such activities) the region can support based on the load based discharge and pollutant concentration which does not adversely affect the natural resource base and existing ecosystem of the region. mining and removal of sand from in-stream and upstream of several rivers, which may have serious environmental impact on ephemeral, seasonal and perennial rivers and river beds and sand extraction may have an adverse effect on bio-diversity as well. Further it may also lead to bed degradation and sedimentation having a negative effect on the aquatic life. Carrying capacity refers to the number of individual projects which can be supported in a given area within natural resource limits, and without degrading the natural social, cultural and economic environment for present and future generations. The carrying capacity for any given area is not fixed. It can be altered by improved technology, but mostly it is changed for the worse by pressures which accompany a population increase. As the environment is degraded, carrying capacity actually shrinks, leaving the environment no longer able to support even the number of people who could formerly have lived in the area on a sustainable basis. No population can live beyond the environment's carrying capacity for very long. We must think in terms of "carrying capacity" not land area. The effects of unfettered population growth drastically reduce the carrying capacity Extraction of alluvial material within or near a river bed has an impact on the rivers physical habitat characteristics, like river stability, flood risk, environmental degradation, loss of habitat, decline in biodiversity, it is not an answer to say that the extraction is in blocks of less than 5 hectares, separated by 1 kilometre, because their collective impact may be significant, hence the necessity of a proper environmental assessment plan. Damaging lakes, riverbeds and groundwater leading to drying up of water beds and causing water scarcity on account of quarry/mining leases and mineral concessions granted by the State Governments, even if the area was small, the collective impact on environment was significant. Mining of minerals, whether major or minor have a direct bearing on the hydrological regime of the area. Besides, affecting the availability of water as a resource, it also affects the quality of water through direct run of going into the surface water bodies and infiltration / leaching into groundwater. Further, groundwater withdrawal, dewatering of water from mine pit and diversion of surface water may cause surface and sub surface hydrologic systems to dry up. An ideal situation would require that quarrying should be restricted to unsaturated zone only above the phreatic water table and should not intersect the groundwater table at any point of time.

Sand is vital for sustenance of rivers. It has now beenestablished beyond doubt that u ncontrolled sand mining from the riverbed leads to thedestruction of the entire river s ystem. If sand and gravel are extracted in quantitiesexceeding the capacity of the river s to replenish them, they lead to changes in itschannel form, physical habitats and food webs – the river's ecosystem. The removal of sand fromthe river bed increases the velocity of the flowing water, with the distorted flow-regimeeventually eroding the river banks. Beside these on-site effects, the off-site effects are also quitelethal. Sand acts like a sponge, which helps in recharging the water table; its progressivedepletion in the river is accompanied by declining water tables in the nearby areas, adverselyimpacting people's daily lives and ultimately, their livelihood. River sand, therefore, is vital forhumanwell being. However, from the point of view of mineral conservation, it may not be desirable to impose blanket ban on mining operation below groundwater table. However, the activity as a whole is seen to have significant adverse impacts on environment. It is, therefore, necessary that the mining of minor minerals is subjected to simpler but strict regulatory regime and carried out only under an approved framework of mining plan, which should provide for reclamation and rehabilitation of the mined out areas. reclamation and rehabilitation of mined out areas. Mining Plan should take note of the level of production, level of mechanisation, type of machinery used in the mining of minor minerals, quantity of diesel consumption, number of trees uprooted, export and import of mining minerals, environmental impact, restoration of flora. Environmental management plan which will take care of all environmental issues and also evolve a long term rational and sustainable use of natural resource base and also the bio-assessment protocol. Sand mining, it may be noted, may have an adverse effect on biodiversity as loss of habitat caused by sand mining will effect various species, flora and fauna and it may also destabilize the soil structure of river banks and often leaves isolated islands.

IBM, Nagpur has developed guidelines, which states "Mineral occurrences in several cases found to shallow depth, isolated, detached and fragmented in nature in virtue of either origin or mode of emplacement or dislocation due to geological disturbances or mechanical weathering, transportation by wind, water and wave actions and deposited in shorter distance. In such conditions mining activities are undertaken in small scales in group of leases of mines on regional levels. Group of leases of minor mineral mining for which environmental clearance is to be required on regional level.Environmental impact assessment for group of leases of mining is to be assessed and its mitigation measures need to be tackled in the Environmental Management Plan.

Environmental Management Programme for group of leases of Mining: The objective would be to manage the Environmental risk by –

• Increasing awareness of environmental issues at the regional scale,

• Agreeing upon the planning, implementation and programme of actions that will help understand and improve the environmental situation at the regional scale,

• Elaborating an environmental fund to support the Environmental actions

• Enforcing the Environmental monitoring

• Pooling and communicate the results of the Environmental monitoring

• Proposing mitigation measures based on the results of the regional monitoring

• Introducing environmental education programme among the workers and the villagers.

On Regional scale solutions are to be found concerning issues that are not directly under the responsibility of a mine owner such as

1. Water Treatment at the Regional scale At the regional scale, investigate the possibility of setting up a (or a few) regional waste water treatment plant(s) that will treat the effluents collected from a number of mines, and that will discharge a treated water of acceptable quality. The characteristics of the flows of water discharged from each mine to nalas has to be investigated in details in order to evaluate the feasibility study of a (or a few) regional waste water treatment plants.

- Improvement of Infrastructure
- Tap un-polluted ground water supply
- There is a need for a specific geohydrological study in order to defind the best location for a good quality water and a high yield
- Improvement of road :

2. Regional actions related to geotechnical engineering for EMP
   - Regional hydrogeology
   - Regional geology
   - Meteorological data
   - Related techniques and specific materials Communication and training for above techniques applied to mining industry has to be promoted by mining associations, educational system as well as regional government levels.
3. Development of Green Belts
   - This helps in prevention of dust and screening noise
   - Maintaining ecological balance
   - Increasing aesthetic value
   - Plantation to be carried out on both sides of the roads.
   - Saplings will be planted at an interval of 2 m.
4. Environmental Monitoring Items for monitoring based on observation:
   - Slope failure on mine faces, dumps, and barrier,
   - Land erosion in mined out areas, dumps, and flood protection barrier,
   - Blockage due to silting or loose material,
   - Plantation.

5. Monitoring based on sampling and chemical analysis:
   - Surface water
   - Groundwater, to determine scale of contamination.
   - Ambient air quality is monitored by High Volume Sampler (HVS) for effectiveness of the dust prevention and control actions.
6. Restoration, Reclamation and rehabilitation in a group of leases: - Where large numbers of small mines are situated and worked out in group of leasess, at such places the provisions of quarrying of minor minerals should be done in a systematic and scientific manner. The programme of restoration and reclamation of the mined out area and rehabilitation must be made jointly in phased manner in the abandoned areas in an entire group of leases of the minor minerals. Environmental clearance may be obtained by corporate body or the concept of Environmental Assessment (REA) and Environmental Management Plan (REMP) prepared accordingly

The group of leases lying in close vicinity and involving the same river stretch with common mineral beneficiation. The present group of leases lies at Betwa River Bed in Hamirpur and Jalaun District inclusive of 08 B_1 category mines and 03 B_2 Category mines for morrum excavation(inclusive of upcoming projects of B1-sub-category for which Public Hearing is awaited and B2- sub-category projects for which EC is awaited).

1.9.1 Environmental rationale considered for group of leasesing of mines

Ambient Air Quality in group of Mines leases

The group of mines is having common transport and dispatch network. This will ensure better assessment and prediction of air pollution load, thereby enabling common control and mitigation measures.

Surface Hydrology

Water regime of group of leases can be effectively assessed and mitigated through common measures.

Pre-dominant wind Direction

The emission of air pollutants will remain confined to the group of leases area only hence merely affecting the nearby area

Ecological Restoration

Plantation of native species of plants in consultation with DFO, Hamirpur and Jalaun.

Socio economic Environment

Each mine has individual CSR plans which will be implemented in nearby areas. As a result the nearby areas will be economically improved. Below given are the activities that are proposed as a part of Corporate Social Resonsibility; however the execution of these proposed activities will be done in consultation of local authorities.

1.10 STRUCTURE OF EIA REPORT

- This EIA report has been presented as per requirements of ToR of the EIA Notification of Ministry of Environment and Forests (MoEF), Government of India.However after the introduction of standard TOR for each sector amendment of EIA notification the issued on 10th April, 2018 it was stated that "Standard TOR developed by the Ministry inconsultation with the sector specific Expert Appraisal Committees shall be the deemed approved TOR for the projects or activities. These standard TOR shall enable the Project Proponent to commence preparation of an Environment Impact Assessment Report after successful online submission and registration of the application.

Chapter-1: **Introduction:** The present section deals with the EIA study, scope of work, magnitude of efforts, and methodology for EIA. It also provides the identification of the project proponent, location and of its importance to the country and background information.

Chapter-2: **Description of the Project:**This chapter includes the general features, manmade features, river valley project design and planning etc. The information on category, needs of the project with location is also provided.

Chapter-3: **Description of the Environment:** This section describes the existing environmental scenario (baseline data) in detail. The sections on meteorological baseline, components of the biophysical and natural environments, cultural properties along the project site and quality of life add up to give a comprehensive picture of the existing environment around the project site and its area of influence.

Chapter-4: **Anticipated Environmental Impacts and Mitigation Measures:** This section details out environmental impacts, mitigation, avoidance and enhancement measures including environmental management plans. In addition to the avoidance and mitigation measures for the biophysical and natural environmental components, this chapter discusses various environmental enhancements suggested by the project

Chapter-5: **Alternative sites:** In this chapter different sites are analyzed for suitability of the proposed irrigation project. Based on various criteria, the justification is given for selection of the most optimum site identified for setting up of the project

Chapter-6: **Environmental Monitoring Program:** This chapter covers the planned Environmental Monitoring Program. It includes the technical aspects of monitoring the effectiveness of mitigation measures.

Chapter-7: **Disaster Management Plan,:**This chapter is intended to guide the concerned officers in identifying, monitoring, responding to and mitigating the emergency situations. It is also useful to assist the officials to take immediate action in a critical situation. This chapter also details about the families and persons who are going to be directly affected by the project. It further discusses about the displacement, resettlement, rehabilitation and compensation to the affected families

Chapter-8: **Project Benefits:**This chapter covers the benefits accruing to the locality, neighborhood, region and nation as a whole. It brings out the details of benefits by means of improvement in the physical infrastructure, social infrastructure, employment potential and other tangible benefits

Chapter-9: **Cost-Benefit Analysis:** This chapter discusses about thetechnique used for testing the financial viability of the project i.e. whether the investment to be made is worth and whether the project is financially rewarding. Costs here are described as the intended or unintended negative effects of project investment, whereas, benefits is described as the intended or unintended positive effects of the project

Chapter-10: **Regional Environment Management Program:**This chapter comprehensively presents the Environmental Management Plan (REMP), which includes the administrative and technical setup, summary matrix of EMP, the cost involved to implement the EMP, both during the construction and operational phases.

Chapter-11: **Summary & Conclusion:**This chapter forms the summary of the full EIA report. It provides the overall justification for implementation of the project and how the project is going to benefit the local people. It also explains how the adverse effects are proposed to be mitigated

Chapter-12: **Disclosure of Consultant:**This chapter includes the names of the consultants engaged, along with a brief resume and nature of consultancy rendered

This report is based on scientific principles and professional judgment with resultant subjective interpretation. Professional judgments expressed herein are based on the

available data/comments/feedback/modifications and comments from Functional Area Experts and finally compiled by EIA Coordinator.

CHAPTER- II

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2.1 DESCRIPTION OF THE PROJECT

Lease is granted by District Magistrate Hamirpur through e-tenderingforexcavation of Sand/Moram from Riverbed of Betwa River. LOI ofthe leaseis annexed as **Annexure-II**. The Mining Plan has been approved by Directorate of Geology & Mining. The copy of standard TOR is annexed as **Annexure-III**.

The proposed projects are to mine morrum from dry river bed sustainably and scientifically. Mining will be done by semi mechanized/OTFM (Other Than Fully Mechanized) method using e.g. bar scrapers and loaders along the river bed keeping the banks unaffected. Although the area of the project is only 24.291 ha and it is B2 category project, but according to the cluster certificate another mine in 500 m radius of the proposed project form a cluster of 48.582 ha. So it also becomes a B1 category project.Proposed mine leases has been sanctioned over for period of five years. Only morrum will be excavated. It has been proposed that 3,88,608 cum/ yearof morrum will be excavated. The proposed project is situated in Khand No. 26/3 ,ChandwariGhurauli, Sarila, Hamirpur.

2.2 STUDY AREA DESCRIPTION

The project is included in the study area-1 because there are 10 other leases (B1 and B2) are situated on the River Betwa between - 25°46'12.48"N & 79°19'13.34"E to 25°52'2.99"N & 79°46'49.50"E

The study includes information on:

- Type of mining areas (B1 and B2) proposed currently .
- Constraints to mining in terms of infrastructure, skilled labour, *etc.*
- Typical environmental impacts associated.
- Synergistic and cumulative impacts which can be identified
- Relative importance of each of these impacts

The study will allow the regulators to focus attention on priority environmental issues and mining regions. The study can be used by stakeholders and roleplayers to determine the level of small-scale mining on a regional basis. It can also be used by interested and affected parties to identify the type of environmental impacts that could be expected from the various mining lease area on a stretch.

The process include following steps:

- Inventarization of the leases on the stretch
- Undertake Initial Screening Site Visits
- Undertake regional site surveys
- Collate survey findings
- Utilization of Environmental assessment tools

Sand mining have a widespread impact on a national level, if mining is done by unscientific methods. Extraction of alluvial material from within or near a streambed has a direct impact on the stream's physical habitat characteristics. These characteristics include channel geometry, bed elevation, substrate composition and stability, instream roughness elements (large woody debris, boulders, etc.) depth, velocity, turbidity, sediment transport, stream discharge and temperature (Hill &Kleynhans, 1999). Altering these habitat characteristics can have deleterious impacts on both instream biota and the associated riparian habitat. The interconnectedness of channels and riparian systems requires the simultaneous evaluation of potential disruptions of the riparian zone and channel activities. For example, aggregate mining involves the channel and boundary but requires land access and material storage that could adversely affect riparian zones, e.g. construction and access roads. Singly, many of the effects of mining on the environment may well be non-significant. However, when they occur simultaneously, their significance may increase by orders of magnitude. The overriding principle is That the greater the number of small-scale mines in an area, the greater the cumulative impacts are on the water environment. The major cumulative impacts include:

- Loss of riparian habitat due to large areas of riparian vegetation being removed.
- Riverbank destabilisation after vegetation removed.
- Soil erosion of arable land adjacent to mined areas.
- Increased surface areas of discard (sand, rock and other forms of waste) that can be mobilised during rain and ultimately are deposited in the rivers.
- Increased mobilisation of sediments, which become available and clog the aquatic environment.
- Increased incidents of oils (from machinery) and chemical (if refinement takes place) spills into rivers.
- Increased potential of mobilisation of metals, sulphates,
- Loss of arable land due to no rehabilitation.
- Large tracts of land becoming a safety hazard (for people and livestock).

The duration of these impacts is mainly long term. For example, many areas along the Rivers and the environmental footprints will remain prevalent. Unless appropriate rehabilitation takes place in areas that are on the riverbanks, theland largely remains unusable unless the area is naturally restored by for example, floods. Themining that takes place within the riverbed or flood plain has more chance of being restoredback to its original status over time due to floods.The majority of the water-related impacts of small-scale mining are localised to theimmediate vicinity of the mine. If, however, many mines occur within the same area then thecumulative impacts will be felt over a much larger area. Typically, the major impact wouldoccur during high rain events when the mined areas will produce large volumes of silt, whichwill be washed downstream.The size, type, and locality of each mining operation was assessed in order to compare therelative impact of each operation to the cumulative impacts.

a. **Specific features of study area**

2.3 CONNECTIVITY

NH 81 is passing through 10 km radius area of above mentioned leases. Two state highways SH-91 and SH-42 passes through the vicinity of the projects along with other metalled road.

Table.2.4 Major roads of Study area

S.No.	Sub Category Name	Name Of Road	Road Number	Length (In Km.)
Hamirpur				
1	National Highway	Kanpur Saagar Road	NH0086	61.000
	National Highway	Jhansi Mirzapur Road	NH0076	6.000
2	State Highway	BilrayaLakhimpurSitapurHardoiKannaujJalaunPanwariMarg	SH0021	42.741
	State	HamirpurRathGursarai Jhansi Marg	SH0042	92.260

	Highway			
	State Highway	HamirpurKalpiMarg	SH0091	22.000
3	Major District Road	MuskaraMaudahaKapsa Banda Marg	MD010B	17.050
	Major District Road	KalpiDagwaRathMarg	MD019B	29.350
	Major District Road	TidwariMailaniJaspuraSumerpurMarg	MD040B	15.500
	Major District Road	RathJalalpurMarg	MD041B	37.400
	Major District Road	MuskaraMaudahaKapsa Banda Marg	MD510B	10.050
	Major District Road	MuskaraMaudahaKapsa Banda Marg	MD610B	29.700
Jalaun				
1.	National	Lucknow Kanpur Jhansi Shivpuri Road	NH0025	72.000

	Highway			
2.	State Highway	JalaunBhindMarg	SH0070	30.680
	State Highway	BilrayaLakhimpurSitapurHardoiKannaujJalaunPanwariMarg	SH0021	66.107
	State Highway	HamirpurKalpiMarg	SH0091	29.900
3.	Major District Road	KalpiMadaripurMarg	MD023B	40.049
	Major District Road	JalaunKonchMarg	MD027B	23.066
	Major District Road	KalpiRathMarg	MD519B	22.00

The study area comprises of 03 districts namely, Hamirpur and Jalaun along the stretch of Betwa River, and part of Jhansi. The road network of Hamirpur and Jalaun given below:

2.4 TOPOGRAPHY & PHYSIOGRAPHY

Hamirpur and JalaunDistrictissituatedonthesouthernpartoftheStateofUttarPradeshandsurroundedby the district Allahabad in the east, Fatehpurin the west, Chitrakootin the south and district

Pratapgarhinnorth.Thetotalgeographicalareaofthedistrictis1903.17 Sq.Km.Itisanoldtown situatedonthenorthernbankofYamuna, about55kmwestofAllahabad. Totallandareaofdistrict liesinbetweentheholy rivers GangainnorthandYamunainsouthandcomprises ofalluvialsoil grouphaving sandyandsandyloamsoil.Initsgeneralaspectthedistrictisalevelplainwithoutany hills.The onlyvariationsinthesurfacearecausedbytheuneven landalongthestreams thatdrainit. Depressionsofvaryingdepthandextentarefoundhereandthere,inwhichthesurfacedrainage of the interiorcollects. No mineraldepositisavailableinHamirpur and Jalaunexcept for Ordinary Morrum reportedinsomepartsofthedistrict.GangaandYamunaRiverarethemainrivers flowing throughHamirpur and Jalaun District.TheplainareaofthedistrictissituatedinbetweenGangaand Yamuna Riversotheseriversplayavery pivotalroleintheagriculturaldevelopment ofthedistrict. Hamirpur and JalaunDistricthasamoderateclimate.Atmosphere ofthedistrictispleasant.Inthesummer seasonweatheristoohotandinthewintertheweatherisvery cold.Butintherainy seasonthe weatherisgoodandpleasant.SoilofHamirpur and JalaunDistrictishighlyfertile.The present mining geological study area lies between the coordinates **25°46'12.48"N & 79°19'13.34"E to 25°52'2.99"N & 79°46'49.50"E** in which River Betwa flows has a major area covered by **Banda Alluvium** which has developed over the basement of **BundelkhandGranitoid Complex (BGC)** which comes under the Group of Older Alluvium.

Banda Alluvium is spread all over the part of Jalaun, Hamirpur and Jhansi districts falling within the study area. Banda Alluvium is of Red to deep brown sand due to the presence of red-quartzofeldspathic with gravel lenses, of brownish silt and clay with kankar. The **BundelkhandGranitoid Complex** (BGC) which forms the base of **Banda Alluvium** mainly consists of Granite and Gneiss with the origin of Archean to Proterozoic age (Regional geology map is attached as **Annexure XXIV**).

Within the area of study-1, Dhasan river joinsthe Betwa river (25°47'31.99"N 79°23'43.85"E)at the beginning of the study area-1, around the point of confluence of two rivers is the low lying area. On river Betwa patches of **Channel alluvium** found near and around Villages Kamtha (25°47'45.63"N 79°22'40.62"E), Makrechha, Patti Air (25°47'51.20"N 79°26'57.56"E), Bandhauli, Gurha, Simiriya (25°50'47.88"N 79°32'39.53"E) and around KarwiBuzurg(25°53'41.15"N 79°31'2.53"E) in Jalaun district which is mostly partially or wholly submerged during monsoons. Channel bars and point bars are formed within the channel of the river and these sediment deposits are called as Channel alluvium. Rest part of the district falling within the study area is covered with **Banda Alluvium**and **Terrace Alluvium**.

Terrace Alluvium is found all along the river stream flowing from south-west to east direction and is mostly deposited on the older flood plains which are low lying and this sediment deposition is younger in nature and mostly preserved by the incision of rivers as it keeps on getting deposited in the forms of terrace. In this particular stretch, the deposition of alluvium is mainly Morrum in nature which are coarse to very coarse in texture having red colour due to presence of quartzofeldspathic sand.

As the river Betwa enters the Jalaun district and till the point where it joins the Dhasan river the deposition of sediments varies in depth within the 10km buffer zone of our study area around Kamtha (25°47'45.63"N 79°22'40.62"E) the thickness of sediment deposit varies from 30m-07m from the water level in the river which is on average 114m on the concave side of the river.

The course river Betwa is meandered through out this stretch and just after the river Dhasan joins it around villages Chandwari&Dhuroli (25°47'54.24"N 79°24'30.27"E) towards the concave side the sediment deposit are found of thickness of approx. 18m-7m from the average water level of the river which is approx. 110m.

The water level/zero level of the river Betwa around the theBandhauli, Gurha, Simiriya (25°50'47.88"N 79°32'39.53"E) along the steep bend in the water channel is approx. 107m and the thickness of sediment deposition is approx. 35m- 12m.

The meandering of the river facilitates the deposition of sediments further down the course around villages Idhora and Benda Dariya (25°52'32.53"N 79°32'59.12"E) with the thickness of 28m-12m from the average water level in the river which is approx. 106m.

futher down the stream around the villages Jitkari, Kahata, Parsan etc.(25°54'41.34"N 79°38'12.22"E) the thickness of sediment deposits varies 30m- 10m from the water level which is approx. 102m. **Terrace Alluvium** is found all along the river Betwa in both the Jalaun and Hamirpur districts within the study area on the older flood lowland plains which has got high permeability and low compressive strength and is suitable for monocrop cultivation. The water table level along the Betwariver within this study area varies from 10-20m bgl. The whole stretch of this particular cluster has average slope of 0.9% with maximum slope of 3.8%.

2.5 RIVER PROFILE

The Betwa forms the boundary with Jhansi along the southern border from a point a few kilometers east of the town of Erichh to its junction with Dhasan. Its course, which up to the junction runs due east tends then somewhat to the north-east and it meanders along the south-eastern side of tahsilOrai and Kalpi, separating them from Hamirpur. Like the Yamuna it leaves the district on Baoni border. It flows in a tortuous channel with many loops and bends. Its total length along the district border is approximately 96 kilometers, but from point to point it does not exceed 64 kilometers. Both the banks are fringed for some distance inland by uncultureableravines.Pahuj in Hamirpur - The Pahuj river rises in Gwalior district of Madhya Pradesh and flow through Jhansi, enters Jalaun in the south-western corner of tahsilKonch at the village of Savaiya-Buzurg. The river forms the western boundary, except at few points where the district projects here and there beyond the stream. It is a much smaller river than the Betwa and flows in a deep channel between high banks in a sinuous course along the western side of that tahsil and pursues its way north wards along the border of Madhogarh. Within 10 kilometers north-west of this town it flows though the erstwhile jagir of Rampura and the village of Jaghar joins the Sindh river. On both sides of the river the banks are to a considerable distance cut up into ravines and nullahs.ThePahuj has no tributaries in the district except, Dhumna, a small stream which rises in Kailia and joins it near Maheshpur.

a.Geology

The study area is underlain by alluvial deposits of Pleistocene to Recent age. Of these Older Alluvium, believed to be Middle Pleistocene in age is not touched by highest flood level because it forms the high ground. The Newer Alluvium, which in general occupies the areas of lower altitude, is restricted to the present flood plains along river channels. The Older Alluvium belongs to Middle to Upper Pleistocene age while the Newer Alluvium belongs to upper Pleistocene to Recent age. The rocks of the Vindhyan system comprising shale and limestone form the basement. These rocks are overlain by laterite and mottled clay, which are succeeded by the Gangetic alluvium and top soil. The thick beds of limestone are present at a depth of about 220 m below land surface. Limestones are hard, grey, fine grained and chert like in appearance. Shales are present at a depth of about 180 m to 190 m below the land surface. Shales are greenish gray in colour, moderately hard and cleavable. Some of the shale was sandy in nature indicating probably the presence of laminae of sandy shale in shale bed. Laterite and mottled clays – (clays of red, orange, pink, and yellow colour) - occur as a distinct zone above the bed rock (Vindhyans). The clays off this group, which are deeply coloured, are distinct from the clays of the older alluvium, which are earthy brown or buff coloured. The mottled clays containing varying amounts of quartz, sand and lateritic gravel are hard to soft and plastic to gritty. Some times the mottled clays are ochreous in nature enclosing, occasionally, a core of ferruginous material. The Older Alluvium comprising clay, silt, sandy clay, fine to very coarse grained sand, gravel, a small proportion of pebbles, kanakar and indurated sand occur immediately above the laterite and mottled clay group.The Betwa river is a tributary of Yamuna River. Its basin extends from longitude 77^0 to 81^0E and latitude $23^08'$ to 26^00N. The Betwa River originates at an elevation of 470m in Bhopal district in M.P. After traversing a distance of 590m, the river joins the Yamuna River near Hamirpur at an elevation of 106.68m The total catchment area of the Betwa River is 46580 sq. km of which 31,971 sq. km (68.64%) lies in M.P. and 14,609 sq. km (31.36%) lies in U.P. The basin is saucer shaped with sandstone hills around the perimeter. The Dhasan River is the important tributaries of the Batwa River.

Betwa River plays vital role in the formation of Alluvium in the Bundelkhand region. Alluvium deposit is the main source of morrum, which plays very important role in economy of the Bundelkhand region.

Betwa River flows from south west to north east in Jhansi. Jalaun and Hamirpur district, forming a large meanders. The deposition of sediments occur as point bars and channel bars Geologically the catchment area of Betwa river comprises rocks of Bundelkhand Granitic complex of Archean to Proterozoic age and Alluvium of quaternary period.

Dhasan River flows from south to north and meet with river Betwa on the right bank of Betwa river in Jhansi district. The catchment of Dhasan river is occupied by Bundelkhand Granitic Complex which is overlain by alluvium of quaternary age.

Betwa river in Jalaun, Hamirpur and Kanpur District comprises rocks of Bundelkhand Granitic Complex . Bundelkhand Granitic complex consists of granite of different types , gneiss and migmatite intruded by dolerite and quartz dykes. Metamorphosed rocks occur as enclaves . Granites are porphyritic to fine grained , non foliated and jointed. Quartz dykes commonly known as (quartz reef) trend NE-SW and extends several km. around Jaitpur,Kulpahar , Charkhari and south of Gorahari.

The Alluvium unconformably overlying Bundelkhand Granitic Complex is divisible into Older Alluvium and Newer Alluvium. Older Alluvium contains oxidized (brown , yellow khaki color) sediments and Newer Alluvium comprises unoxidised (grey and khaki color) sediments. Banda Alluvium and Varanasi Alluvium of Pleistocene period represent older Alluvium. The Banda Alluvium consist of brownish silt – clay with kankar, red-quartzofeldspathic and gravel .The Varanasi Alluvium overlies Banda Alluvium and contains polycyclic sequence of micaceous sand , silt and clay with Kankar.

The Newer Alluvium of Holocene age , consist of Terrace Alluvium and Channel Alluvium . Terrace Alluvium consisting of 8-15 m. thick sequence of sand, silt and clay occupies terraces of Betwa river . Loose sand of point and channel bars constitute Channel Alluvium of Betwa river.

Table No. 2.5. The generalized stratigraphical sequence of area

Era/Period	Age/ Group	Formation	Lithology
Quaternary	Recent to Upper	Newer Alluvium	Alluvium Sand, Silt

	Pleistocene		and Clay
	Upper to Middle Pleistocene	Older Alluvium	Clay with kankar, fine to coarse grained sand and gravel
Unconformity			
Meso to Neo-Proterozoic	VindhyanSupergroup	Rewa and Kaimur	Shale , Sandstone and Quartzite

The southern hilly tract of Uttar Pradesh known as Bundelkhand is roughly parallel to the North Ganga Yamuna Lineament. It is underlaid by granitic complex and overlaid by rocks of Mahakoshal (Bijawar) and Vindhyan super groups. These formations are characterized by rock formations of Archean age (Bundelkhand Granite gneisses). These rock formations are further layered by old sediments fills of granitic rocks. Proposed mining site area comes under district Jalaun, which lies in the Bundelkhand plains near Betwa River. This region is covered with a thick belt of alluvium/sediments of morrum and soil of sandy to sandy loam texture of alkaline nature. The colour of the soil varies from light red to red or dark coloured. There are no major fissures on the ground from the nearby localities of the proposed mining lease areas.

b. Local geology

The region dominantly composed of sand/morum. The sand is coarse to medium grained, derived from cratonic rivers. The morrum occur all along with the Betwa River in Jhansi, Jalaun and Hamirpur District, which is red in color. The red color sediments is the product of weathering and disintegration of granitic gneisses of Bundelkhand Complex

Morrum in this belt are gravelly in nature and mineralogically comprises of quartz , feldspar and other accessory minerals and is coarse to very coarse grained.

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Characteristic of Betwa Sands

On the banks of River Betwa lies "coarse sand" which derive their feldspar from granitic gneisses of the Bundelkhand complex. Based on its coarse grain size, high feldspar content and gravel clast type, the red sediment was derived from Betwa River.

c. Soil

In this region mainly four types of soils are found

1. Clay loam to sandy
2. Loam & Sandy Loam
3. Sandy loam to sodic soil
4. Sandy loam & clay are dominant

Different morphological units have different types of soil. The soil ranges from pure sand to stiff clays and including all combination of the two extreme litho units. The pure sand

is called Bhur and clay is called Matiar when the sand is mixed with clay in equal proportion, the soil may be termed as Dumat or Loam – a good agricultural soil. **Fig. 2.6** illustrate different soil types in different geomorphic setting in Hamirpur and Jalaun district, Uttar Pradesh. The soil found in the area under study shows different variations-

Hamirpur district comes under the doab region of Ken and Betwa rivers covered by the recent alluvium. Different erosion and depositional agencies contribute to the diversity of soil types. Different morphological unit have different type of soil ranges from pure to stiff clay and included all combinations of the two extreme litho units. The pure sand is called BHUR and clay is MATIAR. The soils consist of the well-known Bundelkhand varieties- **Mar, Kabar, Parua and Rakar**.

Mar is often called black cotton soil, containing soil lumps of kankar and varies greatly in colour.

Kabar ranges from a rich dark balck to light brown and due to extreme adhesiveness, hard blocks are formed.

Parua is a light coloured sandy soil, found in many forms. It is usually less rich in organic matter but its finer texture makes it more responsive to manure and irrigation.

Rakar is a refuse soil which occurs on sloping ground, where the action of water has trended to denude the earth of all its better qualities.

Soil of the district **Jalaun**can be grouped into four types that commonly occur in Bundelkhand region, which are **Mar, Kabar, Parwa and Rakar**.

Mar is a dark coloured clay soil mixed with calcareous nodules (Kankar) with swelling and shrinking character. The soil is friable in dry state, moisture retentive and highly fertile.

Kabaris also a fertile soil but contains fewer amounts of clay and lighter in colour than Mar. **Kabar**and **Mar** soils are commonly known as black cotton soil and occur in the area of central parts.

Parwagenerally occurs in the northern parts of area. This is a loamy soil, usually having grey colour.

Rakarsoil is coarse grained red soil, strewn with Kankar. It has less fertility and occurs on ravine slopes.

In **Jhansi**,the soil found may be classified into two group on the basis of colour and topography i.e. red (upland soils) and black (low land soils). On the basis of texture, the red soil is further divided into ‘Rakar’ and ‘Parwa’ and the black soil group into ‘Kabar’ and ‘Mar’.

d. Topography

The study area is situated in the southeastern part of the Indo-Gangetic alluvium plain, and is more or less flat having a few conspicuous topographical features. The plains of the area have been formed by the sediments brought down by rivers of the Ganga and Yamuna system and deposited over undulating surface of the Vindhyans and suffered erosions to such an extent that it becomes peniplain. The plain area has slope from west to east. The area is situated in the drainage basin of the Yamuna and its tributary Kilanhigh and SasurKhaderi rivers. These rivers are characterized by a slow tranquil flow wide flood plain and broad meander belts. The landforms observed in the alluvial plane are meander, point bars, back swamps etc. The altitude of the land surface varies between 75 m to 180 m above mean sea level.

e. Hydrology

River Betwa along with Birma form the main drainage system of the area. District lies in the doab of Ganga and Yamuna. Groundwater occurs in thick zone of saturation of unconsolidated sediments.

Major water bearing formation is Quaternary sediments deposited over concealed basement making to major freshwater aquifer groups.

Groundwater Exploration by CGWB (As on 2012):

Depth Range (m): 10166-282.60 mbgl

Discharge (litres per minute): 1000-4000

Transmissivity (m^2/day): 2935 to 3660

2.6 DRAINAGE

Betwariver,flows on Bundelkhand Granitic Complex in Jhansi, Jalaun and Hamirpur District. The regional geological succession of the area is as follows :

Geological Unit	**Lithologic Composition**	**Group**	**Age**
Channel Alluvium	Red and quartzofeld -spathic sand	Newer Alluvium	Holocene
Terrace Alluvium	Red and quartzofeld		

	-spathic sand		
Varanasi Alluvium	Brownish yellow silt, clay with kankar	Older Alluvium	Early to late Pleistocene
Banda Alluvium	Red to deep brown sand with gravel lenses ,silt and clay with kankar		
Bundelkhand Granitic Complex	Granite and gneisses and outcrops of granitoid , metasedimentaries and basites, dolerite and quartz reef	B.G.C.	Archean To Proterozoic

Betwa river in Jhansi, Hamirpur and Jalaun District comprises rocks of Bundelkhand Granitic Complex . Bundelkhand Granitic complex consists of granite of different types , gneiss and migmatite intruded by dolerite and quartz dykes. Metamorphosed rocks occur as enclaves . Granites are porphyritic to fine grained , non foliated and jointed. Quartz dykes commonly known as (quartz reef) trend NE-SW and extends several km. around Jaitpur,Kulpahar , Charkhari and south of Gorahari.

The Alluvium unconformably overlying Bundelkhand Granitic Complex is divisible into Older Alluvium and Newer Alluvium. Older Alluvium contains oxidized (brown , yellow khaki color) sediments and Newer Alluvium comprises unoxidised (grey and khaki color) sediments. Banda Alluvium and Varanasi Alluvium of Pleistocene period represent older Alluvium. The Banda Alluvium consist of brownish silt – clay with kankar, red-quartzofeldspathic and gravel .The Varanasi Alluvium overlies Banda Alluvium and contains polycyclic sequence of micaceous sand , silt and clay with Kankar.

The Newer Alluvium of Holocene age , consist of Terrace Alluvium and Channel Alluvium . Terrace Alluvium consisting of 8-15 m. thick sequence of sand, silt and clay occupies terraces of Betwa river . Loose sand of point and channel bars constitute Channel Alluvium of Betwa river.

a. **Drainage Pattern & Groundwater Trend:** Ground water is mainly controlled by drainage, topography and lithological behaviour; it occur underground water condition at shallow depths and under confined condition at deeper depths (Drainage map is attached as **Annexure-XIV**).

Drainage system & Ground water trend in district Hamirpur: Drainage of Hamirpur district is quite unique in characteristics because of diversifies geological formation with lithological and chronological formations, complex tectonic framework, climatological dissimilarities and various hydro-chemical conditions. Studies have revealed that aquifer groups of alluvial soil/ soft rocks even transcend the surface drainage boundaries. These are ravenous terrain and drainage density is very high and various small streams flow into the major rivers.

Table No. 2.7. Drainage of District Hamirpur

Sl. Nos.	Name of River	Area covered (in sq km)	% Area covered
1.	Yamuna	56	1.43%
2.	Betwa	94.60	2.42%
3.	Dhasan	23.20	0.59%
4.	Ken	8.87	0.23%

Due to various small streams flowing in major rivers of Hamirpur, drainage of the district has become very dense. To support the irrigation system of Hamirpur more than 25 minors, 10 canals and 5 distributaries are functional in Hamirpur. District contains more than 15 ponds which help in ground water recharge.

Groundwater trend: Depth to water level in pre-monsoon ranges between 4.08 mbgl at Kharela to 29.32 mbgl at Jalalpur with an average water level at almost places in district varies between 4.12 to 17.50 mbgl. Water level has become shallower and varies from 2.22 to 28.82 mbgl during the post-monsoon season. Annual seasoned fluctuation of water level has been determined from the pre-monsoon and post-monsoon (2012) water level data of ground water monitoring wells the fluctuation varies from minimum 0.02 mbgl at Kunheta and maximum 4.75 mbgl at Lalpura.

Ground water in shallow aquifers is colourless and slightly alkaline in nature, the specific conductance range from 550 to 1400 mhos/cm at 25˚C. It is suitable for drinking and domestic uses. Groundwater withdrawl is mainly through dug well, hand pumps and tubewells. The gross ground water draft for irrigation in the irrigation in the district (2009) was 20612.16ha-m whereas the ground water draft for the domestic and industrial was 2225.61ha-m. Hence, the existing gross groundwater draft for all uses in district was 22837.77 ha-m and net ground water availability for future and irrigation development in the district is 23393.51ha-m.

Drainage system &Groundwater trend in district Jalaun: This district is principally drained by the rivers Yamuna, Betwa and Pahuj. Yamuna and Betwa generally flow an east to south-easterly course finally confluencing near Hamirpur. Pahuj arising from the Bundelkhand rocky terrains of U.P. and M.P. flows in a northerly direction to meet Sind, a tributary to Yamuna. The other major tributaries of Yamuna in the area are Kuchmalanga and Non. Which arise locally from southern highlands mainly along Konch and Orai. The Kunchmalanga-Non drainage basins occupy the major part of the area in the south and east. These streams become perennial in their lower reaches and are mainly fed by groundwater effluences. The overall drainage of the area forms dendritic pattern. Besides, there is good network of canal system draining from Betwa river through Kuthaund and Jalaun branches. The entire area of Jalaun district is underlain by quaternary alluvium, comprising mainly clay, Kankar, sand, and gravel over the basement of Bundelkhand granites. The thickness of alluvium increases towards north which has good potential. Ground water potential in granites is poor as they have little porosity. The weathered zone in the granite rock usually hold good quantity of water. The ground water in the alluvium occurs under water table conditions in phreatic zones and under semi-confined conditions in the lower zone.

The natural divisions into which the district falls are clearly marked. Along the outer edge is the ravine belt fringed by rich alluvial soil, but for most part consisting of low hummocks thickly strewn with Kankar. The upland which succeeds the ravines is poor in quality. It has a light coloured hard soil, to the north there is a tract of loam, the characteristics of which resemble those of the doab, but practically the whole of the south and centre of the district beyond the upland, excluding, the area in tehsil Kalpi affected by the Non and Melunga is occupied by the dark kakar and the black cotton soil Mar. With the exception of two rocky outcrops near Saiyidnagar in tehsil Orai, here are no hills in the district and the red soil which is found in the hilly tracts of Jhansi is also absent but in other respects the district is a typical part of Bundelkhand.

Table No. 2.8. Drainage of District Jalaun

Sl. Nos.	Name of River	Area covered (in sq km)	% Area covered
1.	Yamuna	21.2	0.46%
2.	Betwa	14	0.30%
3.	Pahuj	1.65	0.036%

Groundwater trend: As per depth to water level data of ground water monitoring stations pre monsoon water level varies from 0.56 to 31.20 mbgl. In post monsoon period depth to water level varies from 1.48 to 29.65 mbgl. Seasonal water fluctuation varies from 2.58 to 3.80 mbgl.

As per the report on Dynamic Ground Water Resources of Uttar Pradesh as in year 2009, the net annual ground water availability of the district is 121062.53 ham.

The xisting gross water draft for all uses is 46953.01 ham. The average of the stage of ground water development for the district is 38.78%.

Groundwater trend in district Jhansi: The district is chiefly drained by the river Betwa and minor river like Dhasan and Pahuj. The Betwa and Pahuj rivers are tributaries of Yamuna and Dhasan is tributary of Betwa. The major tributaries of Dhasan are the Lakheri, Sukhnai, Kureraetc which are mainly ephemeral. All three main rivers are perennial.As per the reports of Central Ground water Board, the water level in the district varies between 2.95 to 15.12 mbgl during pre-monsoon period and the post monsoon water level has becomes shallower and varies from 2.47 mbgl to 16.07 mbgl. The seasonal annual water level fluctuation varies between 0.0308 to 1.0538 meters in the district.As per report on Dynamic Ground Water Resources of Uttar Pradesh as on 31.03.2004 annual ground water availability of the district is 66823.61 ham. The gross ground water draft for all uses is 28616.90 ham. The stage of ground water development is 42.82%.

b. **Water Course & Hydrology:** The study of Regional Environmental Impact Assessment (REIA) is being done along the river Betwa for the various sand mining projects situated in the river bed of River Betwa in two districts Hamirpur and Jalaun. The Betwa river is the Tributary of Yamuna River System which is the Sub-Basin of Ganga River System.

Yamuna Lower Sub-basin: The geographical extent of the Yamuna Lower sub-basin lies between 77° 6' to 81° 55' east longitudes and 22° 51' to 28° 1' north latitudes of the country.

The Sind, the Betwa, the Dhasan, the Ken rivers are the major tributaries in the Yamuna lower sub-basin. The Yamuna Lower sub-basin is the largest sub-basin of the Ganga basin with a total catchment area of 1,24,867 Sq.km. The sub-basin majorly covers the states of Uttar Pradesh and Madhya Pradesh.

Table No. 2.9 Major water Resource Asset

Sl. No.	Name of Sub-Basin	Area(sq.km)	No. of Dam	No. of B/W/A	No. of Reservoirs	No. of Surface	No. of HO

						water bodies	Stations
1.	Yamuna Lower	124867.19	201	17	199	16022	23

<u>Table No. 2.10 Watershed Statistics:</u>

Sl. No.	Name of Sub-basin	No. of Watersheds	Min. size of watershed(sq.km)	Max. size of watershed (sq.km)	Avg. size of Watershed (sq.km)
1.	Yamuna Lower	98	735.54	1781.43	1274.15

c. Betwa River

The Betwa River is a tributary of Yamuna River. Its basin extends from longitude 770 to 810 and latitude 23˚8' to 26˚0'N. The Betwa river originates at an elevation of 470 m in the Bhopal District in Madhya Pradesh. After traversing a distance of 590 km, the river joins the Yamuna River near Hamirpur at an elevation of 106,68 m. The total catchment area of the Betwa River is 46,580 sq km of which 31,971 sq km (68.64%) lies in M.P. and 14,609 sq km (31.36%) lies in U.P. The basin is saucer shaped with sandstone hills around the perimeter. The river has 14 principle tributaries out of which 11 are completely in Madhya Pradesh and 3 lies partly in Madhya Pradesh and partly in Uttar Pradesh. The Halali and Dhasan River are the important tributaries of the Betwa River.

I. Landform & seismicity of the region:

The area under study for this falls completely Zone II of the seismic zone as the all the four districts having their part included in the regional EIA study being conducted on the stretch of river Betwa namely Hamirpur, Jalaun, Kanpur Nagar and Fatehpur. Seismic zone II is liable to MSK VI or less and is classified as the Low Damage Risk Zone. The IS code assigns zone factor of 0.10 (maximum horizontal acceleration that can be experienced by a structure in this zone is 10% of gravitational acceleration) for Zone 2.

Hence, the study area of this regional EIA study is less prone to occurrence of earthquakes and no exclusive preparedness is required for the same.

II.High Flood Status: Rivers in alluvial plains are highly variable in their behavior and to an average man often unpredictable. A stream, which is quite trouble free during low flows, attains a threatening condition during high stages. It can develop unforeseen meanders, break through embankments, attack towns and important structures, outflank bridges and in general may create havoc. The highest flood level of the river Betwa flowing through districts Hamirpur and Jalaun was recorded at Sahijana as 108.67 HFL and Mohana as 133.35 HFL in the year 1983 respectively. The danger level for the flooding of river Betwa is 104.546 HFL & 122.664 HFL in Hamirpur and Jalaun districts respectively. The current status of river Betwa (as recorded in year 2017) in the district Hamirpur and Jalaun is 89.27 HFL and 110.61 HFL with the difference of 15.276 and 12.054 HFL with the Danger level of Flood status.

2.7 TYPE OF THE PROJECT

The proposed project is to mine sand from river bed sustainably and scientifically. Mining will be done by opencast and semi-mechanized/OTFM (Other Than Fully Mechanized) method using Bar Scaper and loader; along the Betwa River bed keeping both the shores unaffected. Only sand will be extracted for the mining lease period of 5 Years. It has been proposed that approximately **3,88,608 cum/ annum** ofmorrum will be extracted. During the lease period, the deposit will be worked from the top surface of river bed to 3 m bgl or 1 m above groundwater level whichever is less.

Table. No. 2.11: Characteristics of minerals (Minor)

S.No.	Ore Type	Chemical Constituent in percentage (%)				
1.	Morrum	SiO_2 upto 93%	Al_2O_3 upto 3%	Fe_2O_3 upto 2%	$Mn_2O_3 + TiO_2$ upto 1%	$Na_2O + K_2O$ upto 1%
2.	Morrum	SiO_2 upto 90%	Al_2O_3 upto 2%	Fe_2O_3 upto 5%	$Mn_2O_3 + TiO_2$ upto 2%	$Na_2O + K_2O$ upto 1%

Source: EIA Guidance Manual-Mining of Minerals

2.7.1. Need of the project

Morrum is very important minerals found in abundance in the riverbeds as major sediment. These minor minerals have become very essential for the society for their many uses, they can be used for making concretes, filling roads and buildings, brick making and reclamation etc. These minor minerals are replenished during the heavy rains of monsoon season.

The sediment in the form of river bed material (RBM) deposited in the last many years have raised the river bed from a valley to an elevated land. Because of this, every year during monsoon season, heavy and devastating floods damage large tracts of land lying on both the banks of the river. Hence, it is necessary to remove the materials so that the river gets channelized.The production of morrum will benefit the state in the form of revenue from mining lease. Apart from this project operation will provide employment directly and indirectly to the people residing in vicinity, thus improving the Socio-economic status of the area.

Achieving a huge infrastructure demand, as being envisaged by Government of India and state governments particularly in road and housing sector, requires basic building materials. The morrum, bajri and stone are primary building material required for the purpose. The mining activities are the backbone of all construction and infrastructure projects as such raw material for construction is available only from mining of this nature.Detailed milestones of the projects are

Project Proponent(s) & Name of Company (if any) & Residential Address	M/s New Eoan Associates Proprietor ShriDharmendra Singh Tomar S/o

	Shri Krishna Kumar Tomar R/o House No. 101, Tansen Nagar, Gwalior (M.P.)
Gata No (s)/ Araji No (s)/ Khand No (s)	Khand No. 26/3
Village	ChandwariGhurauli
Tehsil/ District	Sarila/ Hamirpur
Area (ha)	24
Date of issue of Letter of Intent (LOI)	18.07.2018
MP approved on	Yes on 13.08.2018
Date of submission of EC application to MoEF's Portal with acknowledgement number & File No.	23/07/2018, SIA/UP/MIN/28363/2018; File No. 4404
Report Submission date	27.08.2018
Date of presentation/ Agenda No. /Sl. No.	TOR- 30.08.2018, 354, 02
Date of submission of draft EIA for Public Hearing	27.08.2018
Date of grant of TOR/EC	25-07-2018
Public hearing conductance	PH on 19-09-2018

2.7.2. Location (maps showing general location, specific location, and project boundary & project site layout)

Project Location

Toposheet attached in chapter 1 as Fig.1.3, also attached as **Annexure-XVIII.**

Co-ordinatesof Leasehold areaof lease areas in riverbed of Betwa

Points	Latitude	Langitude
SanctionedLeaseArea		
B	25°47'54.70"N	79°26'7.88"E
C	25°47'40.71"N	79°25'51.78"E
A	25°48'4.95"N	79°26'0.55"E
D	25°47'49.30"N	79°25'43.09"E
Workable Area		
E	25°48'2.40"N	79°25'57.70"E
F	25°47'51.57"N	79°26'4.36"E
C	25°47'40.71"N	79°25'51.78"E
D	25°47'49.30"N	79°25'43.09"E

2.7.2.1. Production details

Proposed mine leases has been sanctioned over for period of five years. Only morrum will be excavated. It has been proposed that 4,85,747cum/ year of morrum will be excavated.

MINE LEASE AREA (Ha)	WORK ABLE AREA (Ha)	GEOLOGICAL RESERVE (m3)	PROPOSED PRODUCTION AS PER LOI (m3/annum)
24.291	21.191	655476	4,85,747

2.7.3. **Size or magnitude of operation (incl. Associated activities required by or for** the project)

The area of the project is only 24.291 ha and it is B2 category project, but according to the cluster certificate another mine in 500 m radius of the proposed project form a cluster of 48.582 ha. So it also becomes a B1 category project.

2.7.4. Estimation of the reserve

Estimation of the morrum reserve of the area is calculated on the basis of the sand bars well exposed over the riverbed of sanctioned mining lease surface area of. The total area of mining lease is **24.291 Ha** and **3,88,608 cum/annum**is proposed to be excavated from the river bed, which is well in proportion to the available reserve of the proposed mining lease area.

GEOLOGICAL RESERVES

The geological reserves estimated by cross-sectional method can be categorized into two major categories namely: Mineral reserve & Remaining resources and further can be classified as under:

1. Mineral Reserve

a) **Proved Reserves (111):**

All the quantities of Morrum occurring up to 2 m below surface has been considered as under proved category.

b) **Probable Reserve (122):**

The probable thickness of minor mineral below the proved reserve is considered as probable mineral reserves.

2.Remaining Resources

a) **Feasibility in mineral resource (211):**

The mineral blocked with statutory barrier with in proved zone has been considered as 211.

b) **Pre-feasibility Mineral Resource (222):**

Mineral blocked with in statutory barrier in probable zone has been considered as 222.

Mineable reserve has been taken as 60% of the geological reserve. In order to maintain the safety & stability of the river bank & riparian zone 40% of the lease area is to be left un-worked inside along the banks of the river.

2.7.5. Proposed schedule for approval and implementation

Mining plans are approved by DGM for river bed mining of Morrum and mining operation of the proposed morrum mining will be carried out as per rules of the act. However the schedule for approval and implementation will be depend upon govt policies, aoncerned authority meetings and other policy matters.The operation activities under the mining plan will be as follows:

Opencast, OTFM, No drilling blasting, No dredging, day time, dry season.

Mining activity will be purely opencast. To handle this quantity of Morrum light earth movers will be deployed in the mining area. Tractor/trolleys/trucks/tippers will be used for transportation of minor mineral to the local markets and manual/hand equipments will be used as per the requirements. Apart from this water sprinkler will also be used for dust suppression on haulage road during transportation.

Postulates of Mining methodology

- Morrum mining will be carried out strictly as per Mining Act/Rules.
- Dredging will not be done.
- Blasting and drilling not required.
- Main stream will not be disturbed.
- Mining from breaded, dune and accumulated areas.
- Mining in day time and in dry season only.
- No mining in rainy season.
- Required safe corridor will be maintained.
- Numbers of ramp will be less.
- Mining restricted to the depth of 3 m from the surface / 1 m above water level whichever is less.
- Only Morrum will be extracted.
- Mining will be carried out in slices/ladder form of 30 cm to 60 cm.
- Ground water will not be disturbed.
- Angle of repose for mining will not be more than 30 degree.

(ii) Haulage and Surface Transport

Mode of transportation of the mixed material is by trucks/ tractor trolleys. Trucks of larger size may also be used where the material is to be carried to a long distance to be used for out bound transportation. Mining areas are connected with a 'Kuccha' road up to the nearest pucca road and thereafter it is metalled road up to destination. The approach roads are adequate to permit easy maneuverability of trucks and it also provides cross-over and changing points. Waterwill be sprayed regularly by water sprinklers to suppress fugitive dust generation.

Above Figure shows the Haulage route which will be used by **M/s Sanewin Infrastructure Pvt. Ltd. &Ms New Eoan Associates** and also the part of haulage route which will be shared by the two. The path shown in **Blue colour**represents the unpaved road and Yellow colour represents the paved road both of which area further connected with SH-21(Orai-Rath road). Both M/s Sanewin Infrastructure Pvt. Ltd. &Ms New Eoan Associates have >8m and >9m wide unpaved road and 5.98 km paved road is being shared by the two.

(iii) Brief layout of mine working, layout mine faces & sites for disposal of overburden/waste.

Bar scalping or skimming is extraction of Morrum and gravel from the surface of bars. Historical scalping commonly removed most of the bar above the low flow water level, leaving an irregular topography. Present method generally requires that surface irregularities be smoothed out and that the extracted material be limited to what could be taken above an imaginary line sloping upwards and away from the water from a specified level above the river's water surface at the time of extraction (typically 0.3 - 0.6 m (1-2 ft)) bar scalping or skimming. Bar scalping is commonly repeated year after year. To maintain the hydraulic control provided to upstream by the riffle head, the preferred method of bar scalping is now generally to leave the top one-third (approximately) of the bar undisturbed, mining only from the downstream two-thirds.

1. Can create efficient channel.
2. Less disturbance on bar.
3. Smaller impact on riparian vegetation.
4. Can create pool habitat.
5. Can remedy channel braiding.
6. Useful for aggraded channels.

Mining faces shall be opened from top to down word. It will be advanced towards all directions. Approach & Haul roads of 6 m wide and 1:16 gradient shall be provided to each mining faces for transportation of mineral. No top soil exist within the area therefore, no proposal has been given for its management.

2.7.5.1 Mining plan

The proposed leases are simple open cast river bed morrum (minor mineral), and , mining plans, describing the methodology of mining operations, limitations, restrictions and mine closing along with layout, surface plan is prepared and discussed herewith:

i) Location & Basic Information of the Mining Lease Area:

Spreading over an area of 24.291 ha, the proposed project is to extract morrum from the river bed of BetwaRiver.

Demarcation of Mining Lease Area:

First of all the total proposed mining lease area will be demarcated by puccapillars at the

The area used for amenities include Site office, drinking facility, rest shelters for workers and the persons who will be staying on site during night as watchman/guards etc. ; portable toilets will also be using this space only.

1. **First year**

- The proposed mine leases falling within the Study Area-1are confined to the extraction of morrum up to 54,56,724 m^3/year from the riverbed of the effective workable area along the river bed

- Proposed mining project is an open cast mining where no drilling or blasting is required.
- Mining sites & points will be selected in the riverbed where the concentration of minor mineral is higher & preferably at places or points where the minor mineral is well exposed & present in dunes of higher elevation.
- The mining will be done by semi mechanized/OTFM (Other Than Fully Mechanized) method using Bar scrapers and loaders.
- To reduce the further chances of erosion & landslides at the bank of the river, mining will not be done in the concave areas of the rivers.

- To safe guard the river banks as per mining rules, mining will be done at least 7.5 m inside of the either banks inside the river bed in the lateral form. Mining will be done as given in SSMMG, 2016 and the depth of excavation shall not exceed 3 m or 1 m above water level, in proper bench form with suitable slope of gradient not more than 30°.
- Mining at any case will not be carried out below the water table.
- Mining will be done in the dry season only at places where the replenishment of sediments is high.
- Mining will be completely stopped during the monsoon.
- Mining operation will be carried out in the day time only.

2. **Subsequent years**

- Mining will be carried out in the dry season only & will be stopped completely during monsoon.
- Thus the mining area leftover will get replenished with the sediments of minor mineral in the monsoon itself.
- After the monsoon the filled excavated area will become re-mineable, and can be mined as per findings of the Replenishment study.

2.7.5.2. Replenishment Study: For calculation of actual replenishment, proposal of replenishment study on the basis of visit to extraction sites annually, reviews of cross-sectional survey data and estimation of the actual amount of replenishment during the flood season is proposed.

Replenishment term means refilling up-to former or previous level. Sediment transport process that determines the sand replenishment rate, hence, the volume of sand that can be extracted from the reach of the river channel.

In the first year following Letter of Intent a volume could be extracted from the reach of channel. Replenishment study would need to occur before subsequent extraction takes place.

The concept of annual replenishment accounts for the episodic nature of sediment transport. For example, during wet periods with high stream flows, and a high contribution of sediment from hill slopes and tributaries, monitoring data would show that sand and gravel bars are replenished quickly. During drought periods with low stream flow, and little sediment supply or transport, monitoring data would likely show that bars were replenished at a slower rate.

The use of monitoring data is essential in measuring when actual replenishment occurs. The use of the concept of annual replenishment protects long-term channel stability as well as aquatic and riparian habitat by extracting a volume sustainable by watershed processes. It is important to develop a system to allocate the total estimated annual replenishment between all of the operators.

- **Sediment transport process** determines the sand replenishment rate
- Replenishment study will be done **before the process of extraction** commence
- Concept of annual replenishment **protects long-term channel stability** as well as **aquatic and riparian habitat** by extracting the mineral sustainably by watershed processes.

Table No.2.12. Popular methods for Replenishment Study

Sediment Transport Equations	• Yang Equation • Engelund-Hansen Equation
River Modeling	• River Modelling Using HEC-RAS
Sediment Rating Curve Determination	• Flow Discharge based on Surveyed Cross Section • Sediment Distribution Curve • Total Bed Material Load Computation • Historical Flood Hydrograph • Extraction Volume Determination
Site Visits and Estimation of Actual Amount	• Visits to extraction site annually, reviews cross section survey data & estimates the actual amount of replenishment over the flood season.

The replenishment study by site visit and estimation of actual amount is given in **Chapter-7: Additional studies.**

LIMITATIONS AND RESTRICTIONS OF MINING

1. The mine owner will carry out mining work as per UPMMCR, 1963 and under all the rules and regulations, term and condition laid down therein.
2. Mining in any case will not be done below the water table. During the lease period, the deposit will be worked from the top surface of the river bed to 3m BGL or 1 m above groundwater level whichever is less.
3. Mining shall not be undertaken in a mining lease located in 200-500 meter of bridge, 200 meter upstream and downstream of water supply / irrigation scheme, 100 meters from the edge of National Highway and railway line, 50 meters from a reservoir, canal or building, 25 meter from the edge of State Highway and 10 meters from the edge of other roads except on special exemption by the Sub Divisional Level Joint Inspection Committee.
4. In order to reduce the noise pollution in the vicinity only PUC certified vehicles will be allowed for the transportation of minor mineral.
5. The mining will not be allowed below the water table.
6. No mining operation will be allowed in forest area
7. The project proponent will abide by U.P. Minor Mineral Concession Rules, 1963.
8. The Project Proponents will abide at the time of mining with the terms and conditions as laid down under Mines Act, 1952 and Mines & Minerals (Regulation and Development) Act, 1957, Forest (Conservation) Act, 1980 and the stipulations of the EIA/EMP.
9. The Project Proponent with the satisfaction of competent authority will provide drinking water, temporary rest shelter, and first aid box, welfare facilities as per Central and State Govt. labour laws.
10. No mining will be done during monsoon season and during night times.
11. The reclamation of mined out areas will be natural, as during the next monsoon the void will be filled up with sand, which will be available for fresh quarrying for the next dry season.

2.8.1. Lease areas at a Glance

Sl. No.	Item	Details
1.	Name of the Applicant	ShriDharmendra Singh Tomar S/o Shri Krishna Kumar Singh Tomar
2.	Mining Lease Area	SanctionedLeaseArea:24.291 ha EffectiveWorkingArea:20.290 ha
3.	Land Use	RiverBedofBetwaRiver(NonForestandBarren Land)
4.	Land Ownership	GovernmentLand
5.	Lapse period	The proposed project proposal pertains to new miningleasewhichwillbeexecutedaftergrantof EC from SEIAA,U.P.
6.	River	BetwaRiver
7.	Name of RF, PF, Wildlife Sanctuary, Eco-sensitive area	No,RF,PF,WildlifeSanctuary,Eco-sensitivearea is located within core and buffer zone of the proposed project site.
8.	Site Coordinates Sanctioned MLA Working area	(see coordinates table below)
9.	Location	Khand No. 26/3, Village- ChandwariGhuroli, Tehsil – Sarila, District- Hamirpur, U.P.
10.	Topography	Plain River bed of Betwa River with minor slope towards main stream.
11.	Minerals of mine	Sand/Morrum(Minor Mineral)
12.	Proposed production of mine	As per approved mine plan of the project the excavation /year is tabulated as under:

Points	Latitude	Langitude
SanctionedLeaseArea		
B	25°47'54.70"N	79°26'7.88"E
C	25°47'40.71"N	79°25'51.78"E
A	25°48'4.95"N	79°26'0.55"E
D	25°47'49.30"N	79°25'43.09"E
Workable Area		
E	25°48'2.40"N	79°25'57.70"E
F	25°47'51.57"N	79°26'4.36"E
C	25°47'40.71"N	79°25'51.78"E
D	25°47'49.30"N	79°25'43.09"E

		<table><tr><td>Year</td><td>Production in cum</td></tr><tr><td>Ist</td><td>4,85,747.00</td></tr><tr><td>IInd</td><td>4,85,747.00</td></tr><tr><td>IIIrd</td><td>4,85,747.00</td></tr><tr><td>IVth</td><td>4,85,747.00</td></tr><tr><td>Vth</td><td>4,85,747.00</td></tr><tr><td>Total</td><td>24,28,735.00 cum</td></tr></table>
13.	Method of mining	Mining operations will be opencast, semi mechanised/OTFM (Other Than Fully Mechanized) using LEMM (Light Earth Moving Machinery) like bar scrapers and loaders.
14.	Drilling/Blasting	No drilling and blasting is proposed.
15.	Estimated cost	Approx 17 crore 68 lacs
16.	Water demand	14.95 KLD (Drinking, Plantation and Sprinkling)
17.	Sources of water	Existing dugwells/borewells in nearby village(for drinking)
18.	Ultimate depth of Mining	3 m from the surface or 1 m above the water level of the river whichever is less
19.	Man power	Approximately 69 workers including site and supervisory staff (unskilled and semi-skilled)
20.	Solid Waste	Negligible solid waste will be generated and dustbin will be provided along with the mobile toilets to the worker.
21.	Nearest railway station	Bhua Railway Station- 14.0 km*(NW)
22.	Nearest state highway	SH 21(Rath-Orai Road)- 2.50 km* (N)
23.	Nearest Airport	Kanpur Airport- 117.50 km*(NE)
24.	Nearest city	City/Town: Orai
	Feature	**Distance**
	School	1.30
	Hospital	3.00
	Road (MDR)	-
	Railway station	14.00
	Chak road	0.30
	Bridge or embankment	3.0
	Water Supply	Not found in 5 km buffer zone radius

	/Irrigation Scheme	
	Reservoir / Canal	Not found in 5 km buffer zone radius

2.9 CLOSURE OF MINES

The proposed projects are opencast riverbed mining of morrum for 5 years, where the extraction of morrum is only 3,88,608cum/annumfrom an estimated sustainable mineable deposits. Thus, the extracted quantity of morrum from the river bed will get replenished of the sediments during the monsoon seasons.

2,9.1 Closing Plan/Rehabilitation

- **SAND MINING AREA**

At the end of project operation a closing plan or a rehabilitation programme should be undertaken by the sand mining operators. The following measures can be undertaken to rehabilitate the site:

❖ The site should be cleared of any machinery, equipment and structures.

❖ Any access routes, especially if they are not beneficial to the local community would need to be ploughed and replanted with native species.

❖ River bank should be stabilized by means of compaction and then planting with vegetation.

❖ Close and restore river bank where access ramps have been restored.

❖ Ensure river channel is not obstructed and that repaired banks are adequately fortified.

- **REVEGETATION**

❖ Tree species endemic to the area should be planted.

❖ Re-vegetate with indigenous plants which were removed from areas for the mining of sand as far as is reasonably practical.

❖ Plant trees along the riverbanks with no or minimal vegetation, irrespective of signs of erosion or not (ensure that species selected are indigenous species).

- **IMPROVEMENT OF RIVER BANKS**

Channel erosion often occurs on riverbanks with no or minimum vegetation cover. Secondary rehabilitation measures could include:

❖ Plant trees along the riverbanks with no or minimal vegetation, irrespective of signs of erosion or not. However, careful selection of species is required to ensure that trees are suitable for banks improvement as well as not interfering with the existing species.

2.10 TECHNOLOGY AND PROCESS DESCRIPTION

As per EIA Guidance Manual – Mining of Minerals as prepared by MoEF& CC - the proposed project is a surface mining. The typical scheme involved in surface mining is:

<u>Mining</u>

The mining process is opencast river bed mining of minor minerals. Before the mining process lease area will be demarcated with pucca pillars. Safety distance of 3.0 m or 10% of the width of the River whichever is more will be left intact as no mining zone. Drilling and blasting is not required.

<u>Working Depth (below ground level)</u>

During the entire lease period, the deposit will be worked from the top surface to 3 m bgl or above the ground water level whichever comes first.

The mining process is also detailed below:

Mining Process:

- Mining will be started at the farthest downstream end, moving upstream from there.
- At the cross section of the flood plain at the downstream end, the mining will be initiated from the middle of the cross section of the river bed.
- Mining will be continued in layers of 0.6 m depth to avoid ponding effect.

- Mining will be done in such a way that the process of mining remains confined to the middle of the flood plain. For achieving this purpose, a width of about 6m, suitable for locating the truck/trolley for simultaneous loading will be first excavated. To start with it may be covered with wooden plank or metal sheet if required to prevent any sagging.
- Having excavated that, the process will be continued to the flanks, of a truck width, alternating from one side to the other every time.
- After the first layer is excavated, the process will be repeated for next layers.
- 1.Cancreateefficientchannel.
- 2. Lessdisturbanceonbar.
- Smallerimpactonriparianvegetation.
- 4.Canremedychannelbraiding.
- 5.Usefulforaggradedchannels.

2.11 MINING TECHNOLOGY

Opencast,OTFM/SemiMechanized,Nodrillingblasting,Nodredging,daytime,dry season.

Mining activity inriverbedofBetwaRiverwillbeopencastandsemimechanized (OTFM).Themining methodwillbebarscalping/scraping(OTFM)usingbarscraperforMorrumscrapingformt he leaseareaandcollectingindesignatedareainMLA.LoaderwillbeusedforloadingofMorrum in tothetrucks/trolleyforfurthertransportationtotheLocalmarketBarscrapingisthemetho d approvedinSMMGG,2016issuedbyMoEF&CC,GOIDelhifor environmentalfriendlymining.

Method		Tools/Machines
BarScraping	OTFM(Semi-Mechanized)	Barscraper, Loader

2.11.1 Methodology

Barscalpingorskimming isextractionofMorrumandgravelfromthesurfaceofbars.Historical scalpingcommonly removedmostofthebarabovethelowflowwaterlevel,leavinganirregular topography.Presentmethodgenerallyrequiresthatsurfaceirregularitiesbesmoothedoutan dthat theextractedmaterialbelimitedtowhatcouldbetakenaboveanimaginarylineslopingupwar ds andaway fromthewaterfromaspecifiedlevelabove theriver'swatersurfaceatthetimeof extraction(typically 0.3-0.6m(1-2ft))barscalpingorskimming.

Barscalpingiscommonly repeatedyearafteryear.Tomaintainthehydraulic controlprovidedtoupstreamby therifflehead, thepreferredmethodofbarscalpingisnowgenerallytoleavethetopone-third(approximately) of thebarundisturbed,miningonlyfromthedownstreamtwo-thirds. Mining faceswillbeopenedfromtoptodownword.Itwillbeadvancedtowardsalldirections. Approach&Haulroadsof6.0 mwideand1:16gradientwillbeprovidedtoeachmining facesfor transportationofmineral.Notopsoilexistwithin theareatherefore,noproposalhasbeengivenfor itsmanagement

2.11.2. Machines to be utilized

Bar scrapper
Loader
Dumper
Trucks
Sprinkler
Bulldozer (optional) for rescue and salvage

2.11.3. Hand tools for SandExcavation:

These are generally used for smaller depths of excavations in small areas. Man power is required to operate these tools. The tools come under this category are explained below

Spade Spade is a tool which consists metal plate having sharp edges, the plate is attached to long handle which is generally made up of wood. Because of its sharp edges the sand can be dig easily. The metal plate having less curvature in the spade so, we cannot lift the sand by spade.
Shovel Shovel is tool which is used for the purpose of lifting of excavated sand. It is also similar to spade the difference between spade and shovel is the difference in leading edge. The curvature of metal plate of shovel is generally higher when compared to spade so we can hold the soil easily and lifted it. Shovel can also be used for digging purpose in case of soft soils, sand etc.
Hoe Hoe is an excavating tool which consists a metal plate attached to a long handle with acute angle. The plate having sharp edge is used to excavate the soil. For small work of excavation it is widely preferred tool. Sometimes metal plate is replaced by fork type plate.

Rake Rake is a tools which is having a horizontal rod having metal teeth and is used to remove the small layers of soil.
Trowel Trowel is hand sized tool which is generally used to dig the small trenches in soil or to remove the shallow roots in soil.
Pick axe Pick axe consists hard spike attached perpendicular to handle. They are used for excavating small trenches in soil. Pick axe can cut the soil even if the soil is of hard type. The metal spike is pointed on one side and wide blade is provided on the other side.
Mattock This looks like pickaxe. But serious digging is not possible with mattock. Generally it is used as lifting tool because of its curve shapes metal at its bottom.

2.12. LAND USE PATTERN

The variousmodificationsduetominingallied& an activity during next 5 year is givenbelow.

TOTAL	WORK	NON-	UNUSED	AREA	AREA	MINEAB

MINE LEASE AREA (ha)	ABLE AREA (ha)	WORKABLE AREA (ha)	AREA (ha)	USED FOR AMENITIES (ha)	LEFT AS SAFETY ZONE (ha)	LE AREA (ha)
24.3	15.3	8.2	0.7	0.2	0.9	14.4

2.13 LIFE OF MINE

The total production of Morrum is 3,88,608cum/ annum for plan period. Project tenure is 5.0 years.

2.14INFRASTRUCTURE FACILITIES

NH 81 is passing through 10 km radius area of above mentioned leases. Two state highways SH-91 and SH-42 passes through the vicinity of the projects along with other metalled road.

2.15. COST

The leasewise details of Project cost, Manpower and water requirement of the leases is given below:

TOTAL COST OF MACHINE (Rs.)	TOTAL LABOUR COST (Rs.)	EMP COST (Rs.)	TOTAL OPERATIONAL COST (Rs.)	TOTAL CER COST (Rs.)
12,92,50,000/-	3,89,06,057/-	34,30,403/-	17,71,97,271/-	**35,37,982/-**

	Components of Environment Mangement Plan (EMP)		
	Items	Units	Cost in Rs.
a	No. of plants (@5 plants/ha and 50% mortality rate)	182 saplings	18,218.00
b	Tree Guard (@2000/- per unit)	121 saplings	2,42,910.00
c	Water Demand for plantation (@ 0.5 litre/plant)	0.061 KLD	12,525.05

d	Sprinkling on haulage route for dust supression	13.14 KLD	18,06,750.00
e	Monitoring cost		13,50,000.00
Total			34,30,403.00

2.16 OTHER FEATURE

WATER

Water Demand (KLD) for Sprinkling on Unpaved haulage road	Water Requirement for plantation (KLD)	Drinking water - Day worker (KLD)	Drinking water - Floting population(KLD)	Drinking water - Fixed population(KLD)	Stored water (KLD)	Total Water
13.14	0.061	0.56	0.51	0.58	4.10	18.95

MANPOWER

The total manpower will include labours and supervisory staff .The light Earth Moving machinery operators are included in calculation regarding water consumption and waste generation.

UNSKILLED LABOUR	SKILLED LABOUR	OTHERS	FLOATING POPULATION
47	9	13	254

POWER

All the activities will be carried out in semi mechanized/OTFM (Other Than Fully Mechanized) manner. The operation will be done in day time.Also the labours will be hired locally. Althogh generators will be arranged on the sites for different purpose.

WATER SUPPLY

There will be very less requirement of water is anticipated to carry out operations as it will be done semi mechanized/OTFM (Other Than Fully Mechanized) using Bar scraper and loaders. The water will be required either for drinking purposes or for dust suppression. Hence, the total water requirement for the proposed project is given in project specific information.

The waste water from bathing and washing will be collected in the Mobile Sewage Treatment Plant for Camp and then will be reused for Dust suppression on Haulage Route.Mobile Sewage Treatment Plant for Camp is a compact system and occupies lesser area. Power requirement is much lower than conventional systems.Manpower requirement is less owing to it's process design and features. Mobile Sewage for camp sites have following features

- It is a compact system and occupies lesser area.
- It is a modular system; capacity may be enhanced by adding modules.
- Power requirement is much lower than conventional systems.
- Manpower requirement is less owing to it's process design and features.
- Pleasing appearance, no smell are among it's many more advantages than conventional system.
- Treated water shall be used for horticulture application as well as toilet flushing.
- The sludge collected shall be used as manure for the plants

WASTE GENERATION (LIQUID & SOLID)

The entire mineral extracted is saleable. The labours from nearby villages will be hired to carry out work in day time only, hence there will be no or very less waste is expected to generated on individual leases. Though, liquid waste generated on sites by workers/labours while washing their hands, drinlking and other losses will be balanced by using that discharged water excluding the transmission loss for dust suppression on haulage routes and sprinkling purposes.

The municipal workers or private contractors of district will be engaged in collection of un-segregated garbage (biodegradable and rubbish (non biodegradable) from bins from individual sites. Segregation of waste will be mainly of two types, Biodegradable and Non Biodegradable. These wastes will be collected individually from each site

Waste generation

MSW FOR FLOATING POPULATION (kg)	MSW FOR FIXED POPULATION (kg)	TOTAL MSW GENERATION (kg)
31.2	62.9	94.1

Water budgeting

TOTAL WATER (KLD)	DRINKING WATER (KLD)	FRESH WATER (KLD)	WASTE WATER (KLD)	LOSS OF WATER(KLD)
44.56	1.64	13.37	31.19	8.91

2.17 FACILITIES TO LABOURS

Rest Shelters

Drinking huts

Mobile toilets

Dustbins

Portacabin **Solar Light**

Health Check up Schedule

All workers will be subjected to Initial Medical Examination as per Mines Rule 1955 at the time of appointment. Periodical Medical Examination will be conducted at least once in a years. Medical camps will be organized. The detail of health check up and periodical medical examination schedule is given below.

S.N.	ACTIVITY	DETAIL
1.	Initial Medical Examination (Mine Workers)	At the time of appointment and before commencement ofminework all the mine workers will go through the initial Medical Examination like B.P., Weight, Height and other primary health parameters.
2.	Physical Check -up	Health checkup camp will be organized for mine workers as well as for Villagers in which physical parameters like height, weight and B.P. will be monitored and Psychological test & Respiratory Tests will be conducted. However the medicines will only be given or prescribed by Recognized Doctors at PHC of concerned Villages.
3.	Psychological Test	
4.	Respiratory Test	
5.	Eye Check -up	Regular Eye checks up camps are being organized by Government at Village levels. The proponent will arrange for a Bus or Van to carry the mine workers for specific location of Eye Check Up camps. The Panchayat will let the proponent know about the dates of check up camp and proponent will arrange for the transportation to & fro.
6.	Training (Mine Workers)	**The Mine workers will be trained by Environment officer for –** • Working conditions are hazardous details

		• Site specification • Emergency response • Providing first aid • Evacuation Plan • Report of Incidence • Emergency contact numbers The Mine Manager will be responsible for Training of Mine Workers.

Basic medical facility (First aid box), PPE and drinking water will be provided by the mining leasee/mine holder for workers during all the working hours of the lease period on site.PPEs like dust mask, Hard Hat, Shoes etc will be provided wherever necessary to the labors

2.18 DESCRIPTION OF MITIGATION MEASURES

Although the river morrum is worlds most plentiful and has got the ability to replenish itself, even then morrum mining is a coastal activity referring to the process of actual removal of the minor mineral from the riverbed, stream which causes hazards and pollutions to the surrounding environment. In order to overcome these environmental problems the lessee will follow the following mitigation measures for mining:

1. The main stream will not be diverted to form inactive channels from mining.
2. Mining below subterranean water will not be done.

Detailed mitigation measures are discussed in **chapter.4.**

2.18.1 ASSESSMENT OF NEW & UNTESTED TECHNOLOGY FOR THE RISK OF TECHNOLOGICAL FAILURE

No new or untested technology is adopted for the proposed mining. The project does not involve any processes as overburden removal, drilling, blasting and beneficiation. Mining will be done by Bar Scalping method which is approved in SSMMG, 2016. The sand will not be scraped more than 3 meter as proposed in mining lease and shall be in the lateral direction of the river. These pits get replenished during monsoon. The proposed mining lease project is a simple opencast mining where no drilling and blasting is required.

CHAPTER-III

S. NO.	CONTENTS
3.0	STUDY AREA
3.1	LAND ENVIRONMENT
3.2	PHYSICAL ENVIRONMENT
3.3	WATER ENVIRONMENT (GROUND & SURAFCE WATER)
3.4	AIR ENVIRONMENT
3.5	NOISE ENVIRONMENT
3.6	SOIL ENVIRONMENT
3.7	BIOLOGICAL ENVIRONMENT
3.9	SOCIO-ECONOMIC ENVIRONMENT

DESCRIPTION OF ENVIRONMENT

Environmental Impact Assessment should include a description of the present state of the environment in the location of the mining project. The compilation of the information on the state of the environment is a vital aspect of the whole EIA process. This information will facilitate the identification of environmental impacts and alternatives. It will also provide a basis for comparisons between the various project alternatives.

Mining activities invariably affect the existing environmental status of the site. It has both adverse and beneficial effects. Hence, the methods are required to be selected in such a manner so as to maintain environmental equilibrium ensuring sustainable development, and in order to maintain the environmental commensuration with the mining operation, it is essential to undertake studies on the existing environmental scenario and assess the impact on different environmental components. This would help in formulating suitable management plans for sustainable extraction.

Data must be collected of the present state of the environment regarding environmental parameters that can be expected to be significantly affected by the process of mining, such as water (Surface and Ground) quality, ambient air quality, noise quality, soil quality and biodiversity. It is also beneficial to investigate any existing polluting activities in the study area/region that may already affect the environment and to also determine the loads caused by these factors.

3.0 Study Area:

The study area for this particular regional study on the stretch of River Betwa covers three districts namely Hamirpur, Jalaun, and Jhansi. Total 11 Sand Mining projects (inclusive of upcoming projects of B1-sub-category for which Public Hearing is awaited and B2- sub-category projects for which EC is awaited) comprising 08 of Sub-category B1 and 03 of Sub-category of B_2 are situated on the river Betwa in two districts namely Hamirpur and Jalaun between **- 25°46'12.48"N &79°19'13.34"E to 25°52'2.99"N & 79°46'49.50"E** in the river bed of Betwa.

Project Description

The proposal for EIA has been put forth during various TOR presentations and detail outline was explained and SEAC was agreed with the proposal. The standard TOR will form the basis of this EIA as no additional TORs were issued by the SEAC, Uttar Pradesh.The total mine lease area of the project **M/s New Eoan Associates, Chandwari Ghurauli, Sarila, Hamirpur is 24.291 ha and it is situated in study area-1 having mineable area of** 303.64 Ha(inclusive of upcoming projects for which Public Hearing/EC is awaited) and the total annual production will be 5456724 (inclusive of upcoming projects for which Public Hearing/EC is awaited) cum/annum .These morrum sites are present in the Betwa River Bed between - 25°46'12.48"N & 79°19'13.34"E to 25°52'2.99"N & 79°46'49.50"E . Proposed mine leases has been sanctioned over for period of five years. Only morrum will be excavated. It has been proposed that 3,88,608 cum/ year of morrum will be excavated. Although the area of the project is only 24.291 ha and it is B2 category project, but according to the cluster certificate another mine in 500 m radius of the proposed project form a cluster of 48.582 ha. So it also becomes a B1 category project. The proposed project is situated in Khand No. 26/3 , Chandwari Ghurauli, Sarila, Hamirpur.

a. Methodology:

Baseline information is collected by field surveys, monitoring etc. for ambient air quality, ground and surface water quality, noise levels, present land use pattern, soil quality, biological environment, socio-economic status, health status etc. within the study area. Baseline environmental data was monitored and collected by a NABL Certified Lab “The Research Institute of Material Sciences”, New Delhi, for one full season i.e. March- May, 2018. The baseline data monitoring procedures conforms to the requirement of EIA Notification, 2006(amended in 2009 & 2016). The study area comprises of three districts Hamirpur, Jalaun, and Jhansi.

Additional information have been gathered from various secondary sources, to establish a correlation between existing physical, natural, socio-economic and cultural environment condition of the area under study which is been collected in consultation with the key persons. All relevant secondary data has been collected on regional environmental and social features from various reports pertaining to Government Agencies / Institutions and through literature reviews. Details regarding demographic and socio-economic features of the study area have been collected from the Census Data 2001 & 2011 (as available).

b. Secondary Data Collection

For getting the first hand information of study area we had collected and studied the secondary data regarding wind speed, annual rainfall,wind direction. The secondary data help us to set the course. Data collected indirectly from published records or documents suc h as project documents, village prof li e, maps, p hotos, internet sources etc. Secondary sources are mentioned in reference chapter.

3.1 LAND ENVIRONMENT

Under this section, the study of natural features like Geology, physical features, topography, terrain, land use/land cover, drainage pattern, ground water trend and soil is given.

a. **Regional Geology & physical features :**The study area for this particular regional study includes part of three districts i.e Hamirpur, Jalaun, and Jhansi along the river Betwa. Hence, the regional geology given here is of three districts:

- **District Hamirpur:** The district Hamipur is located in southern part of the state and is a part of Bundelkhand plateau. It lies between the latitude 25˚27’00” and 25˚57’00” N and longitude 79˚11’00” and 80˚19’00” E. The district falls in survey of India toposheet No. 54/0 and 63/0. The geographical area of district is 4139.09 sq.km.

  Geographically, the area comprises Bundelkhand granite gneiss complex and Recent alluvium. The thickness of alluvium varies from 120 to 150 m. the master slope of the district is due north-east. The Quaterny alluvial material overlies the granite.The district could be broadly divided into two physiographic regions.

a) The southern part of district between latitude 25°30’00” and 25°42’00” N of is mainly plain area with average elevation of 250 mamsl. The region is underlain by thn alluvial cover.
b) The northern part of district that is north latitude 25°42’00” N represent the flat topography. The average elevation of the region 120 m above mean sea level.

The general geological sequence of the formation present is as under:

Age	Formation	Lithology
Quaternary Recent to sub recent	Alluvium	Sand, Silt, Clay
-------------------------------Unconformity--		
Precambrian		Bundelkhand Massif

- **District Jalaun:** It forms the most portion of the Trans Yamuna tract of the country. Jalaun district is surrounded in all four directions by rivers Yamuna, Betwa, Pahuj and Dhasan. It encompasses a geographical area of 4544 sq.km. The area is bounded in the north by Yamuna river, in the south by Betwa river and its western boundary follows Pahuj river. The eastern border is shared with Hamirpur district. The area lies between latitude 26°26’ to 25°45’ N and longitude 79°57’ to 78°00’ E, falling in the survey of India Toposheet No. 54N and O.

  The district forms a part of marginal Ganga, alluvial plains. Geomorphology bears tremendous control on the ground water regime. The relief, slope, depth of weathering, type material, nature of deposits and thickness and overall assemblage of different land forms plays an important role in the ground water regime in hard rock as well as in the unconsolidated sediments. Various geomorphic units identified in the area are grouped into four major categories, which are:

  1) Pediment zone
  2) Alluvial zone
  3) Ravines land and
  4) Flood plains.

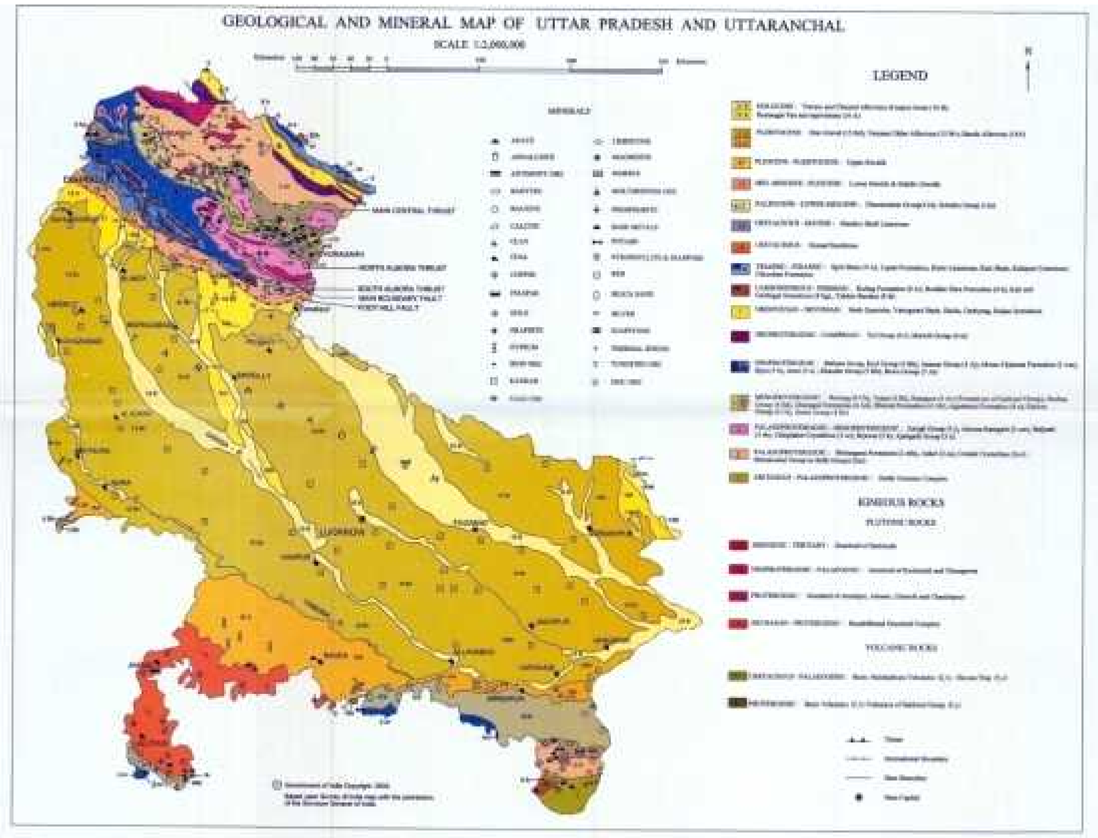
The main physical features of the district are largely determined by the three rivers- the Yamuna, the Betwa and the Pahuj, which nearly encircle it. They are surrounded by a deep network of ravines running 1-3 km from the streams. These ravines are succeeded by a bank or belt of higher land, these high lands border on the Khadir valleys of the Betwa and Pahuj, while low lands occupy the central tract. The low lands have a wide flat basin encircled by a narrow rim of higher ground which breaks up into network of ravines along the river banks, stretching for some km inland from the streams.The levels are clearly indicated from the situation and direction of the branches of the Betwa canal which follows the watersheds closely. The drainage of the central tract is supplied by two minor streams, the Non and the Melunga which flowing north-eastwards unite some l2 kilometers from the Yamuna bank and join that river at an equal distance to the north of the town of Kalpi, Like the larger rivers they too have carved deep ravines which increase in extent the nearer the Yamuna is approached and as a consequence of their action, the Kalpi Tahsil is cut by a tracery of ravines which have scored the greater portion of soil and having more barren and sterile land than in any other part of the district.

District Jhansi: Jhansi district in the southwestern part of the Uttar Pradesh lies between 250 07" and 250 57" north latitude and 780 10" and 790 25" east longitudes. Total Geographical areas of the district is 5024 sq. km. District headquarter is at Jhansi and there are four number of Tehsils namely Jhansi, Moth, Gauratha and Mauranipur. The area is comprised of Bundelkhand gneissic complex of archean age and alluvium of recent age. Physiographically, the area can be divided into two units i.e. Southern Bundelkhand Pediplane Province and Northern Highly Eroding Composite Plain Province.

Jhansi district area is gradually sloping in the north-easterly direction. The southern Bundelkhand plateau area in general resumes the height ranging from about 200m above mean sea level towards north to about 345 m. above mean sea level on the south. The district is geomorphically categorized into:

(a) southern Bundelkhand pediplain province and

(b) northern highly eroding composite plain province.



<u>Fig 3.4. Geological & Mineral Map of Uttar Pradesh</u>

b. Topography & terrain: The proposed area under study is a riverbed which is slightly undulating due to the deposition of sand/morrum minerals. The study area of this particular regional study includes part of four districts i.e Hamirpur, Jalaun, Kanpur Nagar and Fatehpur along the river Betwa. Hence, the topography and terrain given here is of four districts:

- **District Hamirpur:** The district can be divided into three topographical units:
  1. Bundelkhand Gneiss.
  2. Recent Alluvial Plain: The area occupied by the recent alluvium can be delineated all along Betwa and Ken river. These recent alluviums are semi-confined.
  3. Bundelkhand Granite Gneiss: the isolated hillocks and obstruction to topography of the regions.

- **District Jalaun:** The are forms part of the Gangetic alluvial plains which is bounded on the south by Bundelkhand rocky terrain of Jhansi. It si roughly demarcated by rivers Betwa, Pahuj and Yamuna in the South, west and North and North-east respectively. A few outliners of Bundelkhand granite forming low hillocks are met with in southern parts of the area protruding form the vast spread of alluvial plains. The area is otherwise characterised by monotonous a gradational surfaces of the Gangetic alluvial plains. The master slope is in a North to North-easterly direction becoming mainly easterly in the northern parts of the area. The bank zones of major streams are deeply eroded and ravenous forming bed lands which occur etensively along Pahuj and Yamuna rivers. The upper central portion of the area is significantly devoid of inland drainage and consequent land features which is however, prevalent in the southern and eastern parts of the area.

c. **Land use/Land cover:** Mining activities are subjected to the extensive land use changes even in the short period of time and have the direct impact on the land environment due to opencast mining. The total mine lease area is 303.64 ha. The core zone of the study area is taken as 500m all along the stretch of river Betwa and similarly the buffer zone as 10.0 km km from the river bank all along the stretch of river Betwa of the area under study. Other river which flow in the buffer zone is Dhasan river which flows for about 16.60 km towards South-west direction in the buffer zone which joins Betwa river at Kamtha village after which our mine leases start to appear on the stretch of river Betwa.

d. **Land use Pattern regional:** Land use pattern of the three district falling within the area under study of this particular Regional Environmental Impact Assessment study on the stretch of River Betwa is as follows:

Table No.3.1 Regional Land use Pattern of the districts under area under study

Sl. Nos.	Land use Pattern of the districts	Hamirpur (in,000 ha.)	Jalaun (in,000 ha.)
1.	Geographical Area	390.90	454.40
2.	Cultivable area	325.80	377.30
3.	Forest Area	24.50	28.20
4.	Land under non-	32.90	39.0

	agricultural use		
5.	Permanent pastures	0.50	0.20
6.	Cultivable wasteland	8.60	1.50
7.	Land under Miscellaneous tree, crops and groves	0.70	1.60
8.	Barren and uncultivable land	7.10	9.80
9.	Current Fallows	16.90	20.70
10.	Other Fallows	5.30	6.80

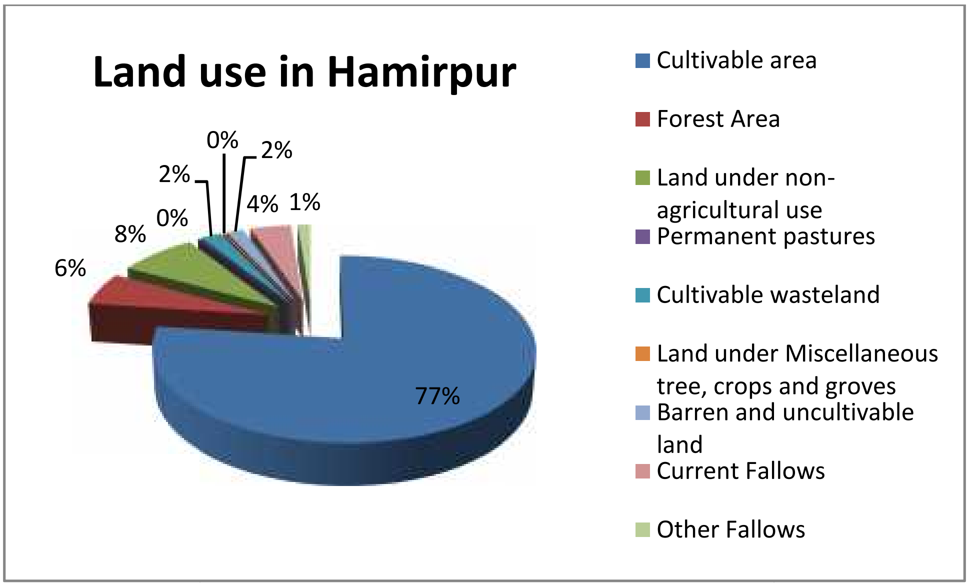


Fig. 3.8. Land use pattern of District Hamirpur

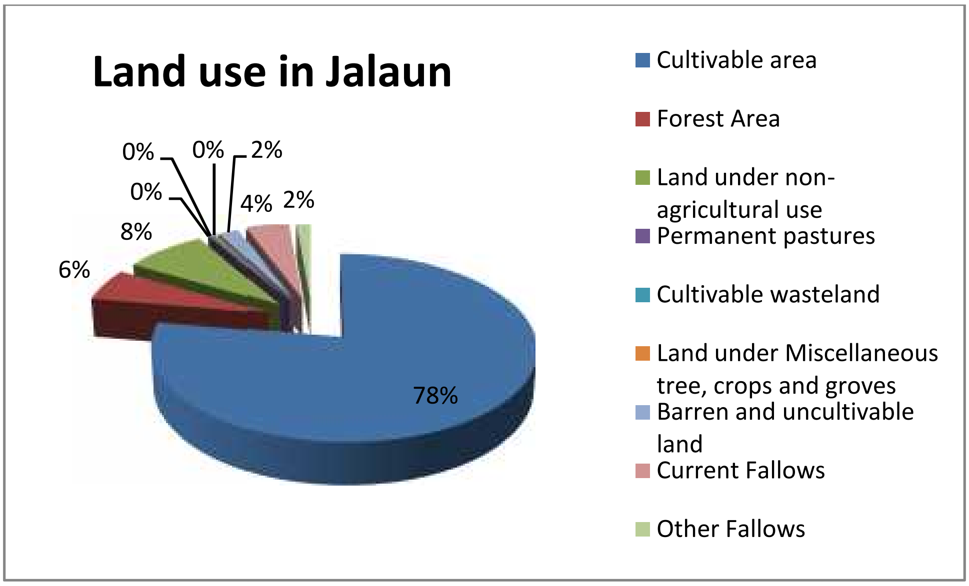


Fig. 3.9. Land use pattern of District Jalaun

Description of Land use/land cover

The buffer zone of study area-1 is almost 45 % crop land and 32% of land area is scrub land or with no scrub.The total builtup area in 10 km radius is 1.24 % and waste land is 4.89 or almost 5 % of the total area covered in the buffer zone of study area-1.

Table 3.2 : Land use of 500 m radius

Land use types	Area ha	% Area
River and water bodies	1085.41	13.20368
Land with or without scrub	1835.97	22.33402
Crop land (Horticulture)	911.82	11.09201
Sand	4387.31	53.37029

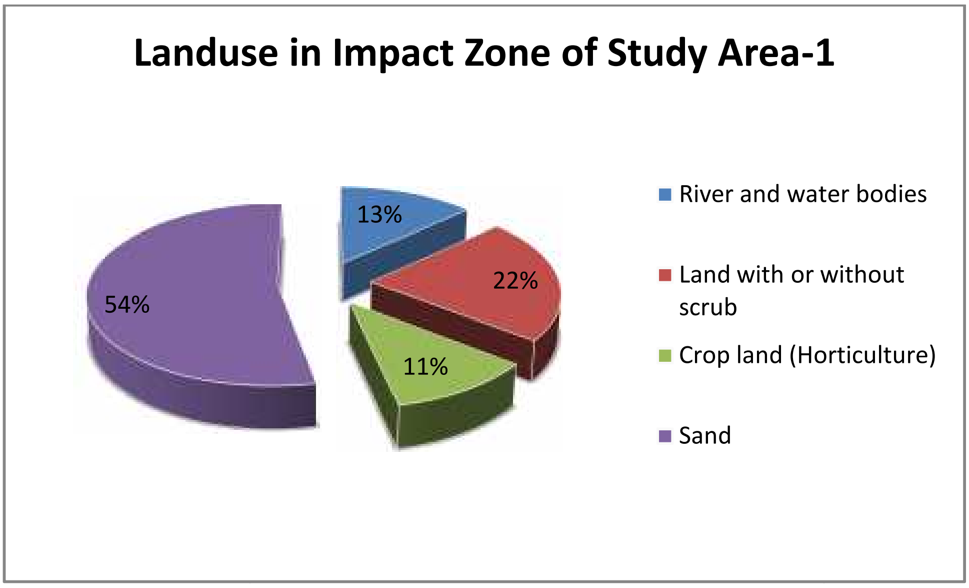


Fig No.3.12. Land use pattern in Imapct zone of Study area-1

Description of Land use/land cover within Impact Zone (within 500 m)

Within the impact Zone of Study Area-1, land use can be classifiedinto mainly four categories *viz.***River and water bodies, Land(with or withour scrub), Crop Land and Sand.** The maximum percentage i.e 54% lies within the impact zone is of **Sand** as the area is mainly the river bed of the river Betwa which is covered by the alluvial deposits brought by the river from all along its course. The next category which has 22% in the impact zone is of **Land with or without scrub,** there is some part which is not covered by the alluvial deposits and falls within the government land category which can be forther divided into scrub land and normal land and is either being used for different purposes or stays like that. The percentage of **River and water bodies** within the impact zone is 13%. The major river which flows within the study are and along which all the mine lease are located is river Betwa, there is River Dhasan which is also present within the Study area-1. But only river Betwa flows within the impact of the area of study. The **Crop** land has the least percentage which is 11% within the impact zone as the major portion of it is river bed of River Betwa hence, very less land is available for cropping and farming, still in few patches horticulture is being practiced.

Table.3.3 : Land use of 10 km radius

Land use types	Area ha	% Area
River and water bodies	1587.23	1.486124
Forest	14044.6	13.14996
Land with or without scrub	34793.1	32.57678
Crop land	48340.1	45.26084
Fallow land	1058.55	0.99112
Built-up land	1325.56	1.241122
Waste land	5327.26	4.987914
Sand	326.97	0.306142

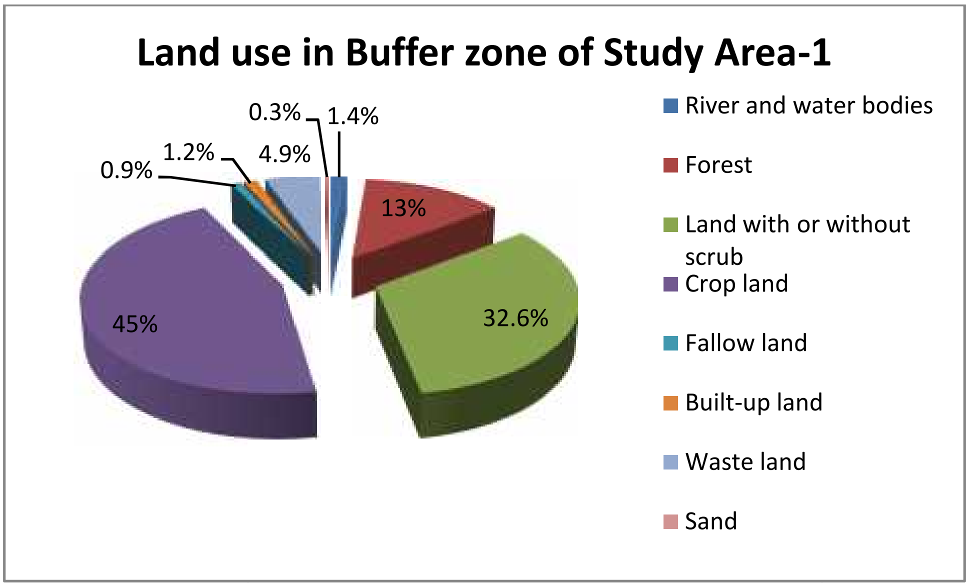


Fig. No.3.13. Land use pattern in Buffer zone of Study Area-1

Description of Land use/land cover within Buffer Zone (10 km)

Within the buffer Zone of Study Area-1, land use can be classified into mainly eight categories *viz.***River and water bodies, Forest, Land(with or withour scrub), Crop Land, Fallow land, Built-up land, Waste land and Sand.** The maximum percentage i.e 45% lies within the buffer zone is of **Crop land** as the buffer zone is of rural area, hence, the major landuse pattern is of cropping. The next categories which have 32.6% & 13% in the buffer zone are**Land with or without scrub and Forests** respectively**,** there is some part which is not covered by the alluvial deposits and falls within the government land category which can be forther divided into scrub land and normal land and is either being used for different purposes or stays like that, and within this buffer zone there are numerous number of Reserved and protected forests are found, aprroximately around 14 RFs and 07 PFs as given in **Table No.**. The percentage of **River and water bodies** within the impact zone is 1.4%. The major river which flows within the study are and along which all the mine lease are located is river Betwa, there is River Dhasan which is also present within the Study area-1. The **Wasteland** has the percentage which is 4.9 %, **Built-up land** has 1.2% and **Fallow land** has 0.99% within the buffer zone as the major portion is of Crop land hence, very less land is available for Waste land, Built-up and Fallow land. And the least percentage if of **Sand**i.e. 0.3% within the buffer zone as it is majorly present within the impact zone comprising of River bed of Betwa river.

3.2 PHYSICAL ENVIRONMENT

Under this section, the study of all-meteorological conditions viz. climate, rainfall and relative humidity and wind speed and wind direction of the study area/region is given.The study area for this particular regional study includes part of three districts i.e Hamirpur, Jalaun and Jhansi along the river Betwa. Hence, the climate given here is of three districts:

a. **Climate of the region/ area under study:** the study area includes the major part of two districts namely Hamirpur and Jalaun but it also includes part Jhansi district.

Hamirpur

The climate of the district is subtropical, characterized by prolonged summer summer, mild winter and moderately heavy rainfall during monsoon season, about 90% of which is received from south-west monsoons. The summer season is from March to about middle of June is followed by the south-west monsoon season from mid-June to the end of September. The cold season is from mid- November to February. May is the hottest month with temperatures having upto 47˚C and January is usually the coldest month with the temperatures as low as 2.6˚C.

The average rainfall of the district is 864 mm. The relative humidity during south-west monsoon is highest in August (70-80%) and lowest (40%) during peak summer month of April & May. Hamirpur district comes under Agro-Ecological sub Region(ICAR) – Central Plains Zone (Bundelkhand).

Jalaun

The climate of the district is sub-humid and is characterized by hot summers, humid monsoon and cold winters season. About 90% of the annual rainfall is received from south-west monsoon during the months from June to September. May and early June is the hottest part of the year with highest temperature recorded upto 47˚C and mean daily minimum temperature as 27.1˚C whereas mean daily maximum temperature as 42.6˚C . With the advancement of monsoon by about mid-June, temperature drops appreciably in nights, January is the coldest month with daily mean temperature as 8.4˚C. The average rainfall of the district is 862 mm. The mean monthly morning relative humidity is 57% and mean monthly evening relative humidity 42%. The mean wind velocity is 703 kmph. The potential evapotranspiration is 1603.3 mm.

b. Study Area:

The climatic condition of the study area ranges from sub-tropical to sub-humid and the average rainfall ranges from 862 mm to 932 mm. May is the hottest month and January the coldest and more than 90% of the rainfall are received from the south-west monsoons. The average humidity of the region also varies from 60%-75% and August records the maximum monthly relative humidity approx. 80-85% while May records the lowest approx.. 20-25%. Winds of the region are generally high with some increase in force during summer and south-west monsoon season.

A) **Temperature:** The temperature during the months in which environmental monitoring has been done is shown below in Fig.3.10. The graph represents the mean monthly variation in the months of March, April and May. The rainfall data has been gathered from the IMD monitoring stations in each district of the past 5 years.

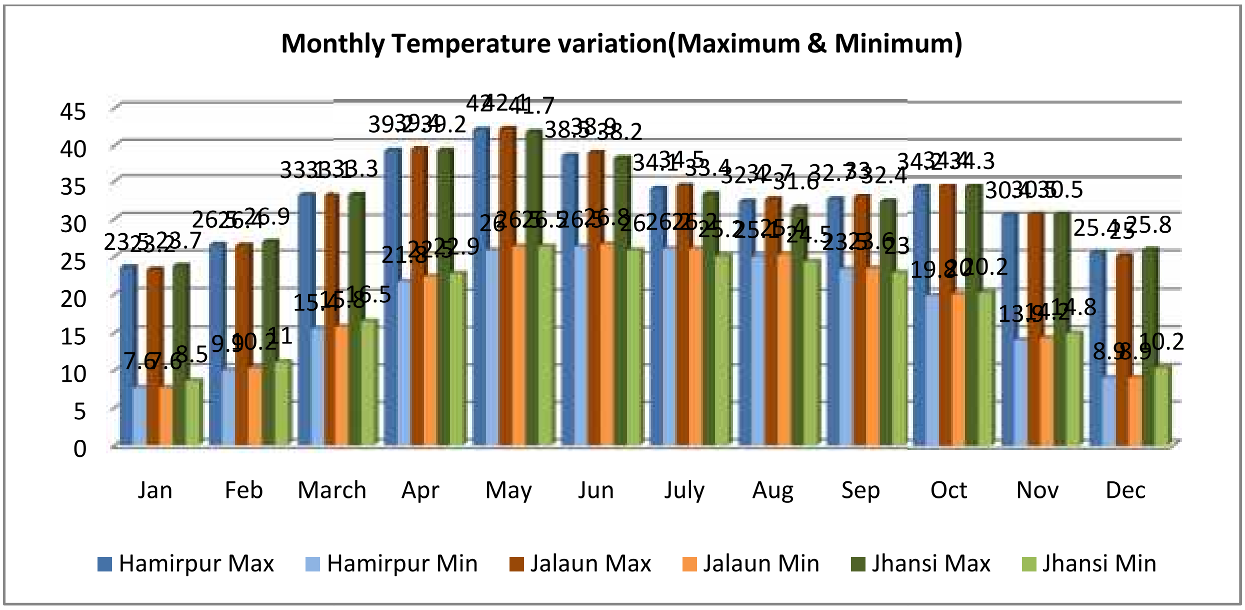
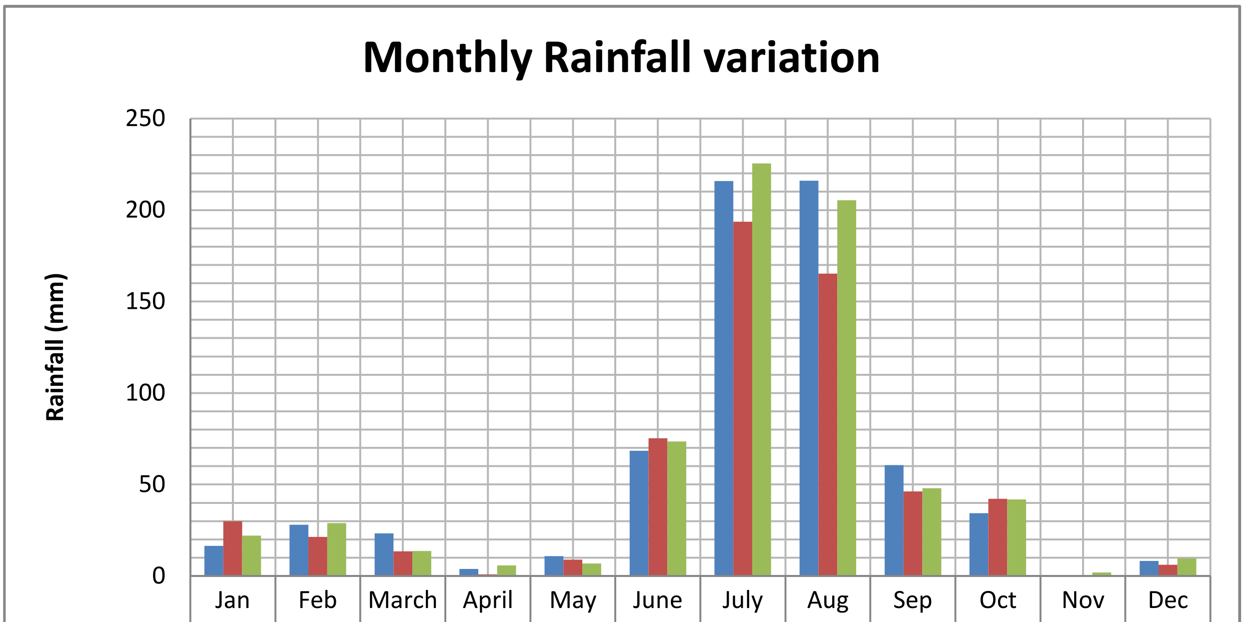


Fig 3.14. Monthly Temperature Variation for study area

B) **Rainfall:** The variation in rainfall during the duration of environmental monitoring is shown below in Fig.3.12. The graph represents the mean monthly variation in the months of March, April and May. The rainfall data has been gathered from the IMD monitoring stations in each district of the past 5 years.



	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Hamirpur	16.5	28	23.3	3.9	10.8	68.4	215.9	216.1	60.5	34.4	0.4	8.2
Jalaun	30	21.3	13.4	0.8	9	75.2	193.6	165.3	46.3	42.2	0	6.1
Jhansi	22	28.9	13.6	5.8	6.9	73.5	225.5	205.4	47.9	41.9	2	9.7

Fig 3.12. Mean monthly Rainfall variation in the study area

C) **Wind Speed and Wind Direction:** The winds are generally with an increase in force in summers and the early part of the south-west monsoon season. During the period from November to April winds are mostly from the west or North-east direction. With the advent of April strong and scorching winds locally called loo continue to blow till it is replaced by the rain bearing winds in the south-west monsoon season. By May easterlies and north- easterlies also appear. In the South-west monsoon season winds are either from the south-west and west or from the North-East and East direction. By October easterlies and North-easterlies become less common.

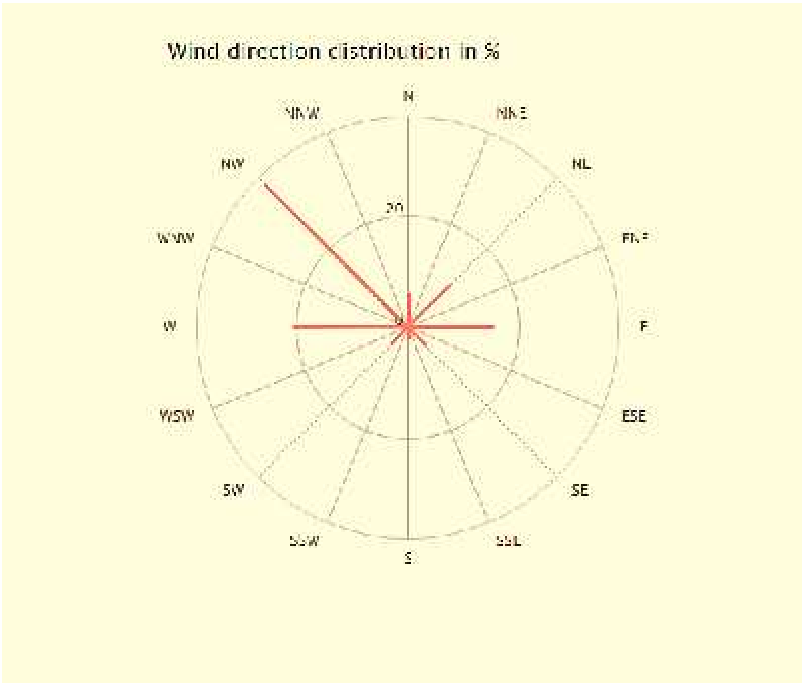


Fig 3.16 Windrose Diagram of the Study area-1

D) **Ground water:** Seasonal fluctuation in water levels in the study area-1 indicated minimal change in groundwater storage.Water table fluctuates in response to direct function of the above. Recharge take place mainly during rainy season. The minimum depth to water level in area is expected sometime at the close of monsoon or in the middle of monsoon period depending upon the intensity and duration of rainfall as well as soil characteristics and maximum depth to water level is expected to the rain fall. generally occur below the surface clay and weathered material whose thickness is The Granitic base has got very uneven configuration. The fresh rock generally occur below the surface clay and weathered material whose thickness is variable. The maximum thick 120.00 mts observed in Sulempur block and north of Betwa river is over 150.00 mts. : Aquifer system prevails I tier – Ground water level to phreatic II tier – 150 m to 200 mts at base.

3.3 WATER ENVIRONMENT (GROUND & SURAFCE WATER)

The working of the mine is unlikely to intersect with the groundwater as mining will be restricted well 1m above the ground water table. Water quality of surface and ground water resources in core and buffer zone of the study area has been studied for assessing the water environment. The two major aspects of the water environment related to mining activity is water availability and water quality. Water availability can be understood in reference of water consumption and its sources which will be required for the process of mining and other related activities.

Water Consumption and its sources: Total water requirement for all the mine lease sites included in the Regional study along the stretch or river Betwa situated in the district Hamirpur & Jalaun of Uttar Pradesh is approx. 287.2 KLD. The water required for the drinking purpose will be procured from wells situated in nearby villages and for other purposes like plantation, dust suppression etc. will be taken care of by proponents of individual mine lease sites. The breakup of water requirement of mine lease site is given .

Water Demand (KLD) for Sprinkling on Unpaved haulage road	Water Requirement for plantation (KLD)	Drinking water - Day worker (KLD)	Drinking water - Floting population(KLD)	Drinking water - Fixed population(KLD)	Stored water (KLD)	Total Water
13.14	0.061	0.56	0.51	0.58	4.10	18.95

Water Quality: Understanding of the water quality is essential in preparation of environmental impact assessment and to identify critical issues with a view to suggest appropriate mitigation measures for implementation. The purpose of this study is to:

- Assess the water characteristics for critical parameters;
- Evaluate the impacts on agricultural productivity, habitat conditions, recreational resources and aesthetics in the vicinity; and

- Prediction of impact on water quality through this project related activities.
- Suggest appropriate mitigation measures

The quality and quantity of ground water differ over area, as these depend on the physical and chemical parameters and also on topographical and hydro-geological characteristics of the area.To study the present water quality status of the area with respect to their physico-chemical, Biological & Bacteriological characteristics, 09 ground water & 07 surface water samples were collected and analyzed. Parameters for analysis of water quality were selected based on the utility of the particular source of water as per MoEF & CC guidance. Hence, quality of ground water was compared with IS: 10500 for drinking purposes and surface water quality were compared with CPCB Water Quality Criteria against A, B , C, D & E class of water.

The analysis was done as per APHA and IS-3025 procedures. Ground water is the major source of potable water in the study area. The water quality standards are annexed and the analysis of the groundwater samples collected from different monitoring stations as part of this EIA study are summarized in Table No3.3.

Methodology:

Monitoring locations were finalized based on following factors:

- Drainage pattern
- Location of major water bodies
- Location of residential areas representing different activities/ likely impact areas
- Areas which can represent baseline conditions

A) Ground water:

09 groundwater sources consisting of bore wells from site were examined during the study period for physic-chemical, heavy metals and bacteriological parameters in order to assess the effect of mining activities on ground water quality. The samples were analyzed as per the procedures specified in 'Standard Methods for the Examination of Water and Wastewater' published by American Public Health Association (APHA) as well as IS 3025. Samples for chemical analysis were collected in polyethylene carboys. Samples collected for metal content were acidified with 1 ml HNO_3. Samples for bacteriological analysis were

collected in sterilized glass bottles. Selected physico-chemical and bacteriological parameters have been analyzed for projecting the existing water quality status in the study area. Parameters like temperature, Dissolved Oxygen (DO), and pH were analyzed at the time of sample collection.

Water Sampling Locations:

Total 09 GW sampling locations 02 are dedicated to this project. The ground water sampling locations are listed below in Table No3.4 and represented in Google Map in Fig No.3.19.

Table No.3.4 Description of Ground water Monitoring Locations

Sl. Nos.	Station Code	Location	Study Area	Coordinates
1.	GW4	Mohana	Buffer Zone	25°49'18.37"N 79°27'3.12"E
2.	GW5	Chikasi	Buffer Zone	25°48'21.46"N 79°28'19.42"E

Fig 3.19. Location of Ground water Sampling sites

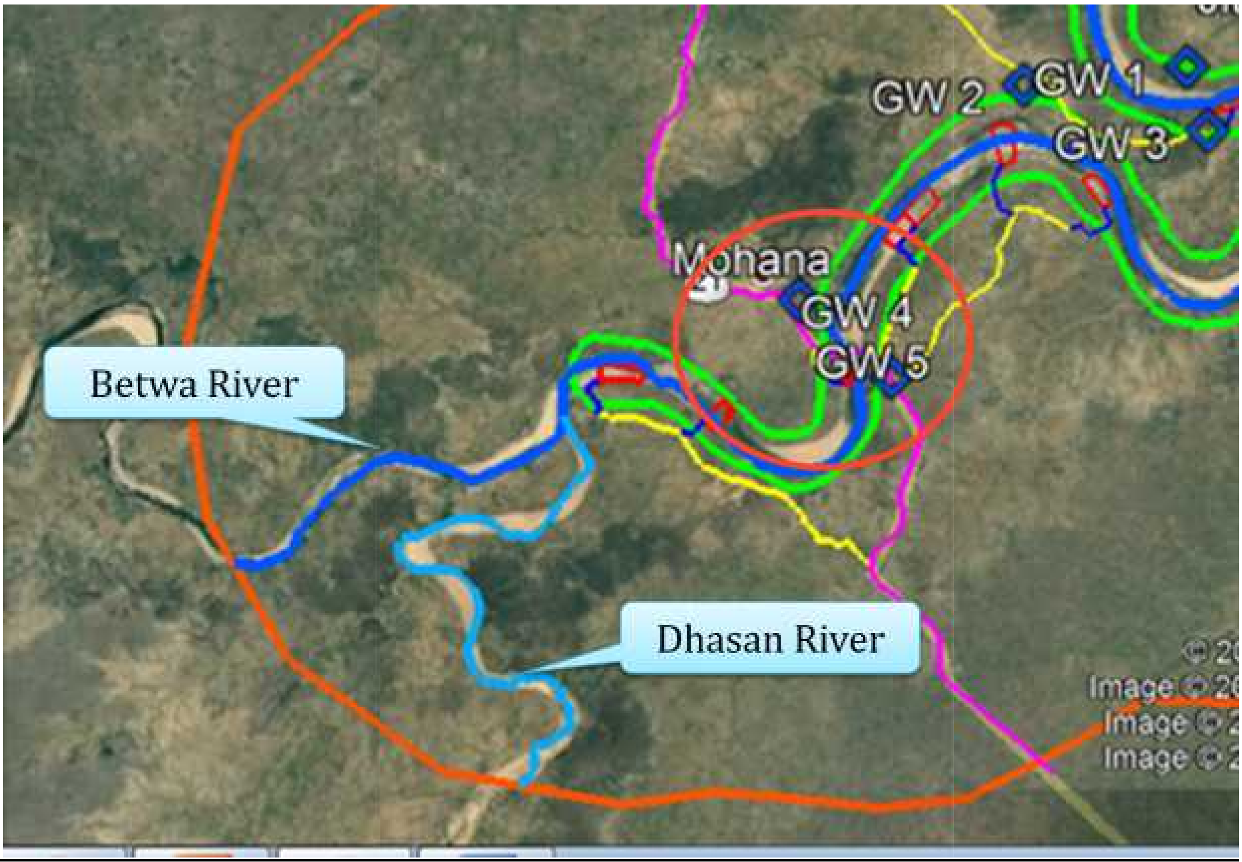


Table No 3.5 Analysis of Ground water Samples

SN	PARAMETERS	UNIT	GW4	GW5	Acceptable Limit	Permissible Limit
			2/3/2018	5/3/2018		
1	Colour	Hazen	< 1	< 1	5	15
2	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable
3	pH Value at 25°C	-	7.17	7.21	6.5	8.5
4	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable
5	Turbidity	NTU	0.6	0.2	1	5
6	Total Dissolve Solids	mg/L	440	451	500	2000
7	Chloride (as Cl)	mg/L	38.1	39.4	250	1000
8	Fluoride (as F)	mg/L	0.11	0.08	1	1.5
9	Free Residual Chlorine	mg/L	BDL	BDL	0.2	1
10	Iron (as Fe)	mg/L	0.08	0.13	0.3	0.3
11	Total Hardness (as $CaCO_3$)	mg/L	99	87	200	600
12	*E.coli*	MPN/100ml	<2	<2	Shall not be detected in 100ml sample	
13	Total Coliform	MPN/100ml	<2	<2	Shall not be detected in 100ml sample	

Results of Primary Data(Ground water):

GROUND WATER ANALYSES

1. pH

In general, a water with a pH < 7 is considered acidic and with a pH > 7 is considered basic. The normal range for pH for groundwater systems 6.5 to 8.5.water with a low pH (< 6.5) could be acidic, soft, and corrosive. Water with a pH > 8.5 could indicate that the water is hard.

The analysis result of pH of samples is between 7.13 to 7.39 which is within acceptable limit of 6.5 to 8.5.

2. ***Taste & Odour***

The ground water samples of the present study area are up to the mark for taste and odour, i.e. agreeable and denies the presence of any factors affecting the taste and odour.

3. ***TDS***

The amount and type of dissolved minerals within the ground water gives it the taste. Total dissolved solids (TDS), is defined as the concentration of all dissolved minerals in the water. TDS are a direct measurement of the interaction between ground water and subsurface minerals. High TDS, greater than 1000 mg/L, is commonly objectionable or offensive to taste. TDS levels over 2000 mg/L are generally considered undrinkable due to strongly offensive taste.

The present analysis of Ground Water at different sampling points of study area is within acceptable limit, i.e. below 500.0 mg/l. The minimum and maximum values of TDS are 440.0 & 476.0 mg/L respectively.

4. ***Turbidity***

Turbidity refers to any solid or organic material that does not settle out of water. This means that the material is not dissolved but is in suspension. Such material includes dust particles and colloidal organic matter. Clear **water** has low **turbidity** and cloudy or murky **water** has a higher **turbidity** level.

The turbidity level of every sample was below 1.0 NTU which is the Acceptable limit in case of ground water. The highest turbidity observed was 0.6 NTU and lowest 0.2 NTU.

5. ***Chloride***

Chloride in ground water originates from both natural and anthropogenic sources. High chloride content indicates heavy pollution. It can be due to the uses of inorganic fertilizer, landfills leachates, septic tank effluent and industrial and irrigation drainage.

The highest value of chloride is 47.6 mg/L and lowest is 38.1 mg/L. There is no such potential source in the study area to elevate the concentration of Chloride in ground water, hence its concentration are within acceptable limit, i.e. below 250 mg/l.

6. *Fluoride*

Most of the fluoride found in groundwater is naturally occurring from the breakdown of rocks and soils or weathering and deposition of atmospheric volcanic particles. Fluoride can also come from Runoff and infiltration of chemical fertilizers in agricultural areas, Septic and sewage treatment system discharges in communities with fluoridated water supplies & Liquid waste from industrial sources.

The analysis report of Fluoride is between 0.07 mg/l (Min) to 0.12 mg/l (max) and within the acceptable limit of 1.0 mg/l

7. *Iron*

The concentration of iron in natural water is controlled by both physico chemical and microbiological factors. It is contributed to ground water mainly from weathering of ferruginous minerals of igneous rocks such as hematite, magnetite and sulphide ores of sedimentary and metamorphic rocks.

As per our analysis, the concentration of iron is below acceptable limit of 0.3 mg/l. The minimum and maximum concentration is 0.07 mg/L and 0.14 mg/L respectively.

8. *Total Hardness*

Water hardness in most groundwater is naturally occurring from weathering of limestone, sedimentary rock and calcium bearing minerals. Hardness can also occur locally in groundwater from chemical and mining industry effluent or excessive application of lime to the soil in agricultural areas.

<u>Durfer and Backer Category of water depending upon Hardness</u>

Hardness Category	Equivalent Concentration of CaCO3
Soft	< 60 mg/l
Medium Hard	60 mg/L to < 120 mg/L
Hard	120 to < 180 mg/L
Very Hard	180 mg/L or greater

As per the analysis result, the minimum and maximum values for hardness are 86.0 & 115.0 mg/L respectively which indicates that the ground water of study area is Medium Hard to Hard.

9. ***E.coli & Total Coliform***

Not detected in any of the ground water sample of the study area.

Total 07SW sampling locations 02 are dedicated to this projectThesurface water sampling locations are listed below in Table No 3.6 and represented in Google Map in Fig3.22.

Table No 3.6.Description of surface water sampling sites

S. Nos.	Station Code	Location	Study Area	Coordinates
1.	SW4	Chadwari Danda	Core zone	25°48'11.44"N 79°23'46.85"E
2.	SW5	Muhana	Core zone	25°48'28.74"N 79°27'47.18"E

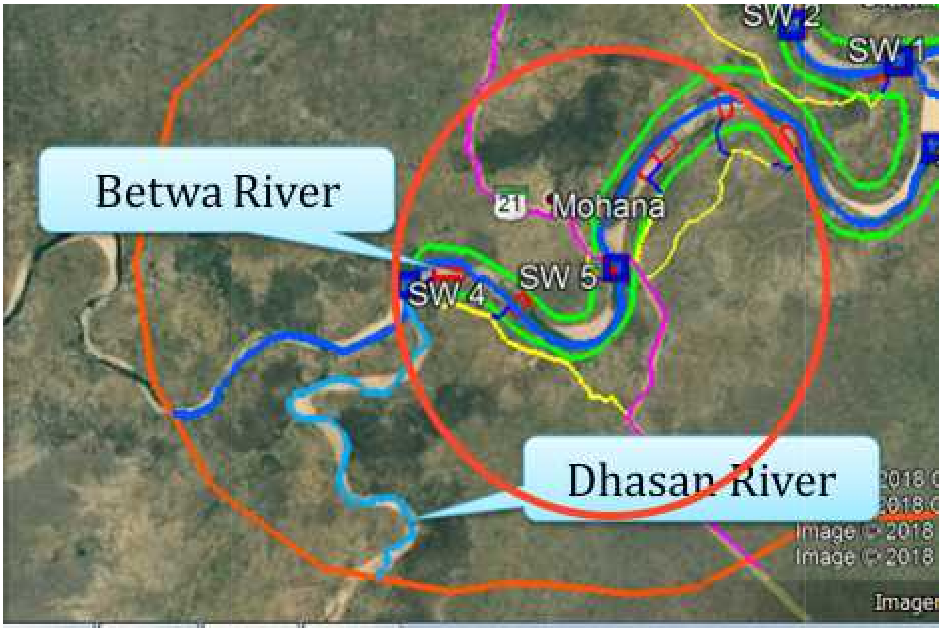


Fig 3.22.Location of Surface water Sampling sites

Table No3.7. Analysis of Surface water Samples

SN	Parameters	Unit	SW4	SW5
			8/3/2018	8/3/2018
1	Colour	Hazen	<1	<1
2	Odour	-	Agreeable	Agreeable
3	pH Value at 25°C	-	7.34	7.59
4	Total Dissolve Solids	mg/L	531	546
5	Total Suspended Solids	mg/L	17	20
6	Total Solids	mg/L	556	610
7	Temperature	°C	30.2	29.8
8	Conductivity at 25°C	µmhos/cm	760	775
9	Calcium (as Ca)	mg/L	53.2	58.4
10	Ammonical Nitrogen	mg/L	2.3	2.42
11	Chloride (as Cl)	mg/L	50.3	52.8
12	Iron (as Fe)	mg/L	0.18	0.19
13	Magnesium (as Mg)	mg/L	44.3	44.6
14	Nitrate (as NO_3)	mg/L	27.1	33.4
15	Potassium (as K)	mg/L	33.7	31.6
16	Phosphate (as PO_4)	mg/L	0.65	0.69
17	Sodium (as Na)	mg/L	165	110
18	Sulphate (as SO_4)	mg/L	44.1	46.7
19	Total Alkalinity (as $CaCO_3$)	mg/L	163	159
20	Total Hardness (as $CaCO_3$)	mg/L	330	318
21	Biochemical Oxygen Demand	mg/L	8	9
22	Dissolved Oxygen (DO)	mg/L	5.5	4.9

23	Chemical Oxygen Demand	mg/L	18	20
24	Faecal Coliform	MPN/100mL	48	53

Result of Primary Data

SURFACE WATER ANALYSES

CPCB Standards

A= Drinking water source without conventional treatment but after disinfection.

B= Outdoor Bathing (Organized).

C= Drinking Water source with conventional treatment followed by disinfection.

D= Propagation of wild life, fisheries.

E= Irrigation, Industrial, Cooling, Controlled Waste Disposal.

1. *Colour & Odour*

The surface water samples of the present study area are up to the mark for colour and odour , i.e. agreeable and denies the presence of any factors affecting the colour and odour. It matches the Class A Category of Surface Water as per CPCB Standards.

2. *pH*

In general, water with a pH < 7 is considered acidic and with a pH > 7 is considered basic. The normal range for pH for Surface water systems is 6.5 to 8.5. Water with a low pH (< 6.5) could be acidic, soft, and corrosive. Water with a pH > 8.5 could indicate that the water is hard.

The analysis result of pH of samples are between 7.34 to 7.96 which are within acceptable limit, i.e. between 6.5 to 8.5 of Class A Category of Surface Water as per CPCB Standards.

3. Total Dissolved Solids

The TDS varied from a minimum of 508 mg/L to a maximum of 604 mg/L . The values are generally higher in the summer seasons due to reduction in water volume. When TDS > 1000 mg/L , the water is likely to have objectionable tastes; however, no water sample in the present work, had TDS ≥ 1000 mg/L. Total dissolved solids represent the amount of soluble inorganic substances in the water and originates from natural sources, sewage, urban runoff, industrial wastewater and chemicals used in the water treatment process.

TDS results falls in Class A & B Category of Surface Water as per CPCB Standards.

4. Total Suspended Solid

The suspended or colloidal particles, commonly referred to as total suspended solids (TSS), are all the extremely small suspended solids in water which will not settle out by gravity. The minimum and maximum TSS are 17.0 mg/L & 29.0 mg/L respectively. These values are well within the limit of 100.0 mg/L as per BIS 2296 : 1982.

5. Conductivity

Conductivity is directly related to the concentration of ions in water. The more ions that are present, the higher the conductivity of water. Likewise, the fewer ions that are in the water, the less conductive it is.

The minimum value of conductivity is 760.0 µmhos/cm and Maximum 930.0 µmhos/cm and falls under ***Class, A, B & C Category of Surface Water as per CPCB Standards***

6. Calcium & Magnesium

Calcium and magnesium doesn't have wide variations in values. The minimum and maximum values of Calcium are 52.1 mg/L & 64.1 mg/L and that of Magnesium are 40.6 mg/L & 50.8 mg/L. None of the samples of Calcium crossed the limits of 75.0 mg/L as per the BIS Standards. The values for Magnesium are within the permissible limit of 100 mg/L as per BIS Standards.

7. Chloride

The minimum and maximum values of Chloride in the study area are 47.6 & 56.8 mg/L which are within ***permissible limits of Class ACategory of Surface Water as per CPCB Standards***.

High concentration of chloride makes water unpalatable and unfit for drinking and livestock watering. However, all the surface water sources show Cl values below the permissible limit of 250 mg/L which can be attributed to-

(i) The rate of percolation of agricultural and domestic wastes to the surface water bodies (the area is not industrial) is low .
(ii) The contributions from the geological formations of the area are not much significant preventing the sources from excessive chloride accumulation.

8. Iron

The iron content of surface water in the study area ranges from 0.12 mg/L (min) to 0.19 mg/L (max) in the months of March, April & May 2018.

These analysis reports are within the permissible limit (0.3 mg/L) ***of Class ACategory of Surface Water as per CPCB Standards***.

9. Nitrate

The surface water of the investigated area contains nitrate from 27.1 to 42.5 mg/L.
The higher values of nitrate indicate runoff from agricultural lands where manure and/or chemical fertilizers have been applied.
The values of Nitrate are far below than the permissible limit of 50 mg/L and falls in ***Class B & C Category of Surface Water as per CPCB Standards***.

10. Dissolved Oxygen

The average Dissolved Oxygen levels in water quality of River Betwa is meeting the desired levels of **Class 'C'** (4.0 mg/l) and **Class 'B'** (5.0 mg/l) of Drinking water source with conventional treatment followed by disinfection, and Outdoor bathing (Organized) respectively.
The minimum and maximum values of DO in the study area are 4.0 and 6.2 mg/L respectively.

11. Total Hardness

The total hardness of the surface water is dependent on the presence of Ca and Mg contents that enter the water bodies through residues of soaps, detergents and parent bed rock materials made up of Ca, Mg and other metal ions.

The total hardness values of the surface water samples varied from 287 – 340 mg/L..UsingDurfer and Backer classification, the surface water bodies in the study area are Very Hard.

12. Biological Oxygen Demand

The BOD levels in water quality of River Betwa vary from 8.0 mg/l to 16.0 mg/l. These values are slightly higher than the standards because of great amount of microorganisms, mainly aerobic bacteria due to faecal contamination of humans and animals into river water.

13. Faecal Coliform

The presence of faecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the faecal material of man or other animals.

However in the study area,the Faecal Coliform ranges from 18.0 – 53.0 MPN/100 ml.

River water can be considered fit for bathing if the faecal coliform count is between the desirable limit of 500 and maximum permissible limit of 2,500 mpn (most probable number) per 100 ml.

14. Total Alkalinity

The minimum and maximum values of total Alkalinity in the study area are 155.0 – 175.0 mg/L which are well within the limit of BIS standards.

As per BIS limit 1998, the desirable limit is 200 mg/L and permissible limit is 600 mg/L

3.4 AIR ENVIRONMENT

The ambient air quality for this region including core zone and buffer zone is studied for once complete season during **March,2018 to May, 2018** which is Pre-Monsoon- Summer Season. The ambient air samples were collected to monitor the amount of pollutants in the buffer zone in the different directions from the individual mine lease site and also from the point source within the core zone. Since, this Regional Environmental Impact Assessment study is undertaken to assess the impacts of individual mine lease areas and the cumulative impact of all mine sites on the complete stretch of the River Betwa under study. In this other point sources of pollution will also be identified (already existing ones) and a correlation will be established for the existing air quality and the anticipated impact of the new upcoming projects of Mining.

3.4.1 Selection of monitoring locations

The ambient air quality monitoring stations are selected in accordance with the wind rose drawn based on the wind direction, distance from the mine sites and the coverage factor of the sites are also taken into considerations. A general guide to the no. of minimum stations and its distribution needed for monitoring trends of the common pollutants in urban areas based on population consideration is recommended in IS 5182 Part 14; 2000.

Location of Sampling Stations

Some of the principal factors governing the locations of the sampling stations are the objectives, the particular method ofinstroment used for sampling, resources available, physical access and security against loss and tampering. Sampling locations may be fixed or mobile. Recommended procedures for insitu sampling are :- When the objective is to study the effects ofthe presence of a constituent in the atmosphere, namely, health hazards, material damage due to corrosion, etc, the sampling location should be as close as possible to specific locations where the effects are being studied. For example, the most appropriate location for studying health hazards are population centres and certain critical areas, such as hospitals and schools where more vulnerable section of the public is present. The ideal height, at which sampling should be done, is the breathing level.When the objectiveis to study material damage, similar principle should be followed. For example, for assessment of damage to vegetation, sampling-should be done at foliage level and that for damage to overhead electrical wire should be done at the level ofthe wires.

When the objective is to determine the background levels of pollution in a given area, an ideal system of location of the samplers is in the form of a grid, which may be rectangular or radial depending uponwhether the sources of pollution may be treated as an area source or an effectively single source respectively. The minimum number oflocations required for such a system depend upon the variability ofpoJlutant concentration over the area under survey. The spatial distribution of the samplers should be such that variation between adjacent sampling locations is sufficient to obtain the corroboration ofthe dispersion model used or to detennine the modification to the model, ifnecessary, to suit local conditions. Physical Requirements,the site where the station is located should fulfill one or more of the following requirements depending on the types of instruments used:

a) it should be available for a long period;

b) it should preferably be accessible any time throughout the year;

c) electrical power of sufficient rating should be available

d) it should be vandal-proof; and

e) it may need to be protected from extreme of temperatures.

The network density appears to have a seasonal vadation with fewer stations being required in the su miller than in the winter. This is because concentrations of pollution in summer are uniformly low particularly at residential areas thus single station is a good predictor of air quality over a relatively large neighbourhood.

. For generating background data on the ambient air quality around the proposed site of a development project, ambient air quality monitoring is necessary. When proposal relates to air quality trend analysis, the main criteria for network density is population. A city with population of 0.5 to 1 million should have 5 to 10 monitoring stations distributed so that one station represents 10 to 20 km^{2}In cities with large number of population with complex topography or with an unusually large large number of pollution sources one station per 5 to 10 km^2 is suggested.

Table No 3.8.Description of Ambient air Quality Sampling Locations

Sl. Nos.	Station Code	Location	Project Area	Coordinates
1.	AQ11	Chadwari Danda	Core Zone	25°48'2.62"N 79°24'15.72"E
2.	AQ12	Mohana	Buffer Zone	25°49'27.94"N 79°26'48.31"E
3.	AQ13	Magrauth	Buffer Zone	25°46'55.39"N 79°27'5.84"E
4.	AQ15	Atra	Buffer Zone	25°47'43.30"N 79°30'22.66"E

Fig3.28. Location of Ambient Air Quality Monitoring sites on Google Map

In addition to ambient air quality monitoring the National Ambient Air Quality data published by Central Pollution Control Board for the locations close to the project has also been reviewed.

Composite samples were prepared using three 8-hr samples collected at each location. Monitoring was done with a frequency of twice a week at each location. The monitoring duration was 3 months. The samples were analyzed for pollutants of interest (SiO_2, NO_x, SO_2, PM_{10} and $PM_{2.5}$) using the appropriate method prescribed by Bureau of Indian Standards and Central Pollution Control Board is given as an annexure. The ambient air quality monitoring was done for 3-month duration during March-May 2018.

The parameters monitored were:

- PM_{10}
- $PM_{2.5}$
- Sulphur dioxide (SO_2)
- Oxides of Nitrogen (NO_x)
- Carbon Monoxide (CO)

- Free Silica (SiO_2)

For gaseous samples, 8 hourly samples were collected, while 24 hourly sampling was conducted for PM_{10} and $PM_{2.5}$. NAAQ standards are attached as Annexure.

Table No. 3.9. Sampling and Testing Methodology

Parameter	Duration of Sampling	Recommended Analytical Procedure	Method of Test
PM_{10} and	24 hours – continuous	Gravimetric Method as per IS: 5182	IS 5182 Part 23: 2006
$PM_{2.5}$	24 hours – continuous		NAAQS Monitoring & Analysis Guidelines Volumes-1, 2011 CPCB
SO_2	8 hours – continuous	Pararosaniline – Colorimetric method (Modified West & Gaeke Procedure)	IS 5182 Part 2: 2001
NO_2	8 hours – continuous	Modified Jacob &Hochheiser Method	IS 5182 Part 2:2006
CO	8 hours – continuous		EPA Method 13
SiO_2	8 hours – continuous		NIOSH

Table No.3.10.Analysis of Ambient Air Quality

Parameters	AQ 11	AQ 12	AQ 13	AQ 15
$PM_{2.5}$ (Max)	69	62	63	64
$PM_{2.5}$ (Min)	42	44	42	44
Mean	54.38	50.21	50.5	51.42
Standard deviation	6.06	4.58	6.23	5.14
98 Percentile	65.78	60.16	63	60.32
PM_{10} (Max)	107	104	108	108
PM_{10} (Min)	80	76	74	82
Mean	90.96	86.5	86.88	92.46

Standard deviation	5.87	7.75	8.2	5.56
98 Percentile	102.86	101.7	107.08	103.4
SO_2 (Max)	11.2	9.2	11.1	10.2
SO_2 (Min)	6.5	6.7	7.2	6.5
Mean	8.08	7.58	8.11	8.42
Standard deviation	1.26	0.7	0.98	1.13
98 Percentile	11.06	8.92	10.36	10.2
NO_2 (Max)	12.8	13.5	14.8	14.4
NO_2 (Min)	8.3	8.2	8.9	8.6
Mean	10.52	10.49	10.9	10.44
Standard deviation	1.26	1.42	1.72	1.66
98 Percentile	12.62	13.22	14.39	13.66

Results of Ambient Air Quality

For Fugitive dust emission at any site, the most prevalent particulate sources, such as unpaved roads, bare ground, and loading. The upwind and downwind concentrations of TSP, PM_{10}, and $PM_{2.5}$ were measured. Emission of fugitive dust are influenced by moisture content, silt content, wind speed, and vehicle activity on unpaved roads, which includes vehicle speed and vehicle counts. The value of $PM_{2.5}$ is higher on all the monitoring locationsthan the NAAQS, 2009 (Attached as annexure-) standards with exception of AQ 5 i.e. Kutra. PM_{10} is also higher on all the monitoring stations except AQ 5 i.e. Kutra Higher $PM_{2.5}$ levels may be contributed due to traditional ways of cooking along with vehicular emission. PM_{10} in the area may be formed by physical processes of abrasion of surfaces and agricultural activities. The anthropogenic source are coarse particles are produced by the mechanical break-up of larger solid particles, wind blown dust such as road dust,soot, agricultural processes, combustion of fossil fuel . It also causes visibility reduction Almost all the monitoring locations are having higher PM_{10}. SO_2 and NO_2 are far below standards.

3.4.2. Free Silica

The NAAQ standards prescribed for Industrial, Residential, Rural and other areas do not define limits for standards of free silica in ambient air. Silica is a component of PM_{10}, standards for which are prescribed under the NAAQ. Crystalline silica is composed of SiO_2 whereas SiO_2 in the pure form (not combined with cations) is free silica.

Rock quarries, sand/morrum /minerals mining and rock crushing are potential crystalline silica sources. The size of crystalline silica particles is smaller than 4 µm (PM_4). There are no generally accepted methods of monitoring in ambient PM_4 air.

PM_{10} emissions as observed in the baseline study ranged from 74.0 to 118.0µg/m^3, inclusive of free silica, which was well within the standards specified for PM_{10} (100 µg/m^3). U.S.E.P.A has assumed that 10% of total PM_{10} inambient airwas crystalline silica.

This would indicate that the free silica content in ambient air based on PM_{10} concentrations would generally not be more than 7.40 or 11.80 µg/m^3. No corresponding studies for India are available.

The ambient air sampling protocol established as a guideline to the E.I.A clearance process by the CPCB also does not prescribe sampling for free silica in ambient air.

The incremental conc. of TSPM is expected to be 1.25µg/m^3. It has been assumed in studies that 85% of the TSPM is composed of PM_{10}. Under these circumstances, the maximum incremental PM_{10} is not likely to be beyond 1.06µg/m^3. It has also been reported that the percentage of silica in ambient air is almost the same as in the background source material. The percentage of SiO_2 in sand/morrum is about 90%. Assuming this, the incremental concentration of free silica is expected to be 0.954µg/m^3 (90% of 1.06µg/m^3). No standards are prescribed but the PM_{10} is within standards.

Inhaling finely divided crystalline silica dust in very small quantities overtime can lead to silicosis, bronchitis or cancer. The American Conference of Governmental Industrial Hygienists recommends 0.1 mg/m^3 (10µg/m^3)crystalline silica as respirable free silica as exposure limits.

Source*: Ambient Levels and Non-cancer Health Effects of Inhaled Crystalline and Amorphous Silica: Health Issue Assessment EPA/600/R-95/115 November 1996, Report to the Natural Resources Board, August 2011 AM-407, Wisconsin Department of Natural Resources,Hazard Prevention and Control in the Work Environment- Air Borne Dust- WHO/SOE/OEH/99.14, Baseline Monitoring and Fugitive Dust Modeling.*

Fig .3.33.Study area for 10 km buffer zone of sand/morrum mine project, Betwa River in District Jalaun/Hamirpur

AQ Stn. Name	Remarks
AQ 11	All pollutants concentrations were below the NAAQS permissible limit due to more distance from haulage and projects (about 700 m).
AQ 12	All pollutants concentrations were below the NAAQS permissible limit due to more distance from haulage road and projects (about 700 m).
AQ 13	All pollutants concentrations were below the NAAQS permissible limit due to more distance from haulage and projects (>2km).
AQ 15	All pollutants concentrations were below the NAAQS permissible limit due to more distance from haulage and projects (>5k m).

3.5 NOISE ENVIRONMENT

Noise attributed to roads depends on factors such as traffic intensity, the type and condition of the vehicles plying on the road, acceleration/deceleration/gear changes by the vehicles depending on the level of congestion and smoothness of road surface (IRC: 104-1988). High noise levels are a concern for sensitive receptors, i.e., hospitals, educational institutions, etc.

The Central Pollution Control Board has specified ambient noise levels for different land uses for day and night times. Importance was given to the timing of exposure and areas designated as sensitive. The noise standard specified by the Central Pollution Control Board is annexed in the end of report.

Note: (1) **Day-time:** 6 AM to 10 PM, **Night-time:** 10 PM to 6 AM;

The noise monitoring was conducted at **15 locations** within the study area. Out of which 04 are dedicated for this project. Normally, for selection of noise monitoring stations, sensitivity of sites is also considered. As per the CPCB standards, sensitive locations are covered under Silence Zone, which includes an area up to 100 m around premises as hospitals, educational institutions and courts.

The "A weighted" sound level was continuously measured using Noise meter at 60 minutes interval for one day in each survey locations as per the CPCB procedures. The parameters monitored are given as below:

- **L_{min}** - Minimum Noise Level Recorded
- **L_{max}** - Maximum Noise Level Recorded
- **L_d** - Day Equivalent (6 AM to 10 PM)
- **L_n** - Night Equivalent (10 PM to 6 AM)

The lists of location of ambient noise monitoring stations are given in the Table No3.11 and represented on the Google Map in Figure No3.38

Table No3.11. Ambient Noise Quality Monitoring Stations

Sl. Nos.	Station Code	Location	Project Area	Coordinates
1.	NQ 11	Chadwari Danda	Core Zone	25°48'2.62"N 79°24'15.72"E
2.	NQ 12	Mohana	Buffer Zone	25°49'27.94"N 79°26'48.31"E
3.	NQ 13	Magrauth	Buffer Zone	25°46'55.39"N 79°27'5.84"E
4.	NQ 15	Atra	Buffer Zone	25°47'43.30"N 79°30'22.66"E

Fig.3.38.Google Map of Ambient Noise Quality Monitoring Stations

Table No3.12. Noise Quality Monitoring Data

Location Code	N11	N12	N13	N15
Maximum	58.2	57.1	58.4	59.4
Minimum	37.2	41.2	37.9	41.3
Ld	53.9	52.6	53.4	53.8
Ln	40.3	41.6	41.7	40.6
Ldn	53.4	51.9	52.7	52.9

3.6 SOIL ENVIRONMENT

The normal mineral composition of plants is altered by alteration in the soil condition. To know the existing quality of the soil in and around the study area, **02** representative soil-sampling stations were located & set. Soil samples were tested for their physico-chemical & microbiological properties as per BIS specification.

For studying soil quality in the region, sampling locations were selected to assess the existing soil conditions in and around the study area representing various land use conditions. The physical, chemical and heavy metal concentrations were determined. The samples were collected by ramming a core-cutter into the soil up to a depth of 90 cm.

The present study of the soils establishes the cumulative baseline characteristics of the entire mine leases lying in the study area, this will help in future in identifying the incremental concentrations if any, due to the enhancement of capacity and allied operations for the wholen region.

The sampling locations have been identified with the following objectives:

- To determine the baseline soil characteristics of the study area
- To determine the impact of mining activities on soil characteristics
- To determine the impact on soils more importantly from agricultural productivity point of view.

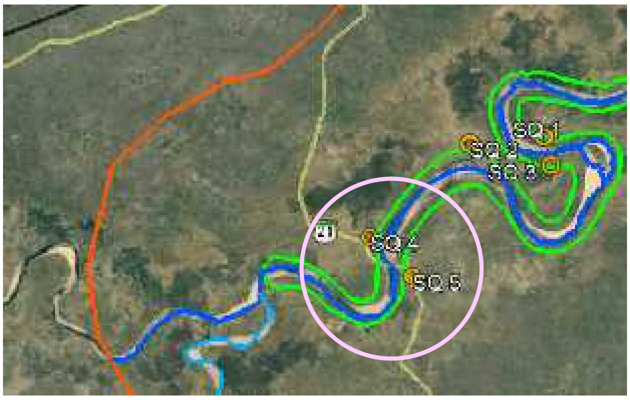
19 locations within the entire area under study were selected for soil sampling. At each location, soil samples were collected as per BIS specifications. The homogenized samples

were analyzed for physical and chemical characteristics. Samples were taken four times during the study period covering various seasons. The samples have been analyzed as per the established scientific methods for physico-chemical parameters.

The list of all sampling location is given in Table No3.15 and are depicted in Figure No.3.41 and the results for the same are discussed below.

Table No. 3.15.Description of Soil Quality Sampling Locations

Sl. Nos.	Station Code	Location	Project Area	Coordinates
4.	SQ4	Mohana	Buffer Zone	25°49'18.37"N 79°27'3.12"E
5.	SQ5	Chikasi	Buffer Zone	25°48'21.46"N 79°28'19.42"E



Figu.3.41. Location of Soil Quality sampling sites

Table No 3.16. Result of Soil Analysis

SN	Parameters	SQ4	SQ5
1	pH Value at 25°C	7.58	7.47
2	Conductivity at 25°C	585	612
3	Moisture	8.3	7.4
4	Sodium (as Na)	240	227
5	Potassium (as K)	120	100
6	Total Kjeldhal Nitrogen	522	541
7	Phosphorus	68	87
8	Organic Matter	1.04	1.14

9	Magnesium (as Mg)	95	89
10	Cation Exchange Capacity	15.6	14.5
11	Water Holding Capacity	20.4	19.2
12	Bulk Density	1.21	1.18
13	Porosity	15.2	14.8
		SQ4	**SQ5**
1	Sand	50.2	51.3
2	Silt	23.9	23.6
3	Clay	25.9	25.1

3.7 BIOLOGICAL ENVIRONMENT

A) WETLANDS: The Convention on Wetlands, signed in Ramsar, Iran, in 1971, is an intergovernmental treaty, which provides the framework for National action and International cooperation for the conservation and wise use of wetlands and their resources. As per the Ramsar Convention on Wetlands, 25 sites (as of February 2, 2007) in India are designated as Wetlands of International Importance. Only one wetland viz. Upper Ganga falls in Uttar Pradesh state, which is very far away from the project site.

National Wetland Conservation Programme identified 16 wetland sites in Uttar Pradesh as on June 26th 2009. Out of these, none of them is located within the study area of this regional EIA study.

Hamirpur: Hamirpur is located at 25.95°N latitude and 80.15°E longitude. It has an average elevation of 80 metres. The district is bounded by districts Jalaun (Orai), Kanpur and Fatehpur in the North, Banda in the East, Mahoba in South and Districts of Jhansi and Jalaun on the West.

The total wetland area in the district is **15283** ha. Major wetland types of the district are river/stream and reservoir/barrages and contribute 82 per cent area of the district. There are 3 reservoirs/barrages found in the district with 1336 ha area. There are 229 Tanks/ponds with 851 area (5.57%). In addition, 1373 small wetlands (<2.25 ha) identified and demarcated as point feature. Wetland area estimates of the district are summarized in Table No3.16.

Area under aquatic vegetation in pre-monsoon season is 533 ha during post-monsoon season while in pre- monsoon season it reduced to 259 ha. Water spread area in post-monsoon season is 8726 ha. Where as in pre-monsoon season the water spread area is 7158 ha. Low turbidity is observed in many wetlands during both the seasons. Area estimates are high in low turbidity class (6363 ha during post-monsoon season and 5652 ha during pre-monsoon season).

Table No 3.17.Area estimates of wetlands in Hamirpur (Area in ha)

Sl. Nos.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% wetland Area	Open Water	
						Post Monsoon Area	Pre-Monsoon Area
	1100	Inland Wetlands- Natural					
1	1101	Lakes/Ponds	52	403	2.64	233	118
2	1102	Ox-bow lakes/cut-off meanders	3	49	0.32	7	2
3	1103	High altitude wetlands	--	--	--	--	--
4	1104	Riverine wetlands	3	4	0.03	0	0
5	1105	Waterlogged	31	118	0.77	84	43
6	1106	River/Stream	63	11083	72.52	6612	6092
	1200	Inland Wetlands- Man-Made					
7	1201	Reservoirs/Barrages	3	1336	8.74	1335	811
8	1202	Tanks/Ponds	229	851	5.57	417	92
9	1203	Waterlogged	13	66	0.43	38	0
10	1204	Salt Pans	--	--	--	--	--
		Sub-Total	397	13910	91.02	8726	7158
		Wetlands(<2.25 ha), mainly Tanks	1373	1373	8.98	--	--
		Total	1770	15283	100.0	8726	7158
		Area under Aquatic Vegetation				533	259
		Area under turbidity levels					
		Low				6363	5652

Moderate	2342	71
High	21	1435

Fig3.43. Wetland Map of district Hamirpur

Jalaun: Jalaun district is adjoined by the districts of Etawah and Kanpur in the north across the river Yamuna, while Hamirpur District lies to the east and southeast, Jhansi District lies to the southeast, and Bhind District of Madhya Pradesh lies to the west. Jalaun district has its headquarters at Orai town, located at 25°59′ to 25.98°N latitude and 79°28′ to 79.47°E longitude. It has an average elevation of 131 metres.

The total wetland area in the district is 12719 ha. Major wetland types of the district are river/stream, tanks/ponds and waterlogged areas. There are 89 tanks/ponds, 214 natural waterlogged areas and accounts for 346 ha, 490 ha respectively There are 1411 small wetlands (<2.25 ha) identified and demarcated as point feature. Wetland area estimates of the district are summarized in Table No 3.17

Area under aquatic vegetation in pre-monsoon season is 203 ha during post-monsoon season while in pre- monsoon season it reduced to 94 ha. Not much variation is observed in open water area, which varied from 7286 ha in post-monsoon season to 6375 ha in pre-monsoon season. Low and moderate turbidity is observed in many wetlands during post-monsoon season. Most of the tanks have shown low turbidity.

Table No 3.18. Area estimates of Wetlands in district Jalaun (Area in ha)

Sl. Nos.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% wetland Area	Open Water	
						Post Monsoon Area	Pre-Monsoon Area
	1100	Inland Wetlands- Natural					
1	1101	Lakes/Ponds	6	39	0.31	10	3
2	1102	Ox-bow lakes/cut-off meanders	1	208	1.64	208	0
3	1103	High altitude wetlands	--	--	--	--	--

4	1104	Riverine wetlands	15	59	0.46	30	3
5	1105	Waterlogged	214	490	3.85	292	25
6	1106	River/Stream	51	10161	79.89	6527	6299
	1200	Inland Wetlands- Man-Made					
7	1201	Reservoirs/Barrages	--	--	--	--	--
8	1202	Tanks/Ponds	89	346	2.72	216	45
9	1203	Waterlogged	2	5	0.04	3	0
10	1204	Salt Pans	--	--	--	--	--
		Sub-Total	378	11308	88.91	7286	6375
		Wetlands(<2.25 ha), mainly Tanks	1411	1411	11.09	--	--
		Total	1789	12719	100.0	7286	6375
		Area under Aquatic Vegetation				203	94
		Area under turbidity levels					
		Low				3974	3596
		Moderate				3033	60
		High				279	2719

B) FLORA AND FAUNA

Biological environment is a dynamic complex of plant, animal and microorganism communities and non-living (abiotic) elements, all interacting as a functional unit.The biological environment is another important component of the EIA of the mining activity whichneed to be studied, however the major impact will be on land environment and also to an extent on the environment of river as mining will be done in dry river bed. In this Chapter the diversity of flora and fauna and their interaction with the abiotic environment are expressed.

India's tree and forest cover has registered an increase of 1% or 8,021 sq. km in two years since 2015, according to the latest assessment by the government (ISFR) 2017. Uttar Pradesh is the fourth largest state of the country with an area of 2,40,928km^2 constituting 7.33% of geographical area of the country. The recorded Forest area of the state is 16,580 km^2 which is 6.88 % of its geographical area. The Reserved Forests constitute (12,126 km^2) 72.79%, Protected Forests (1,223 km^2) 6.98% and Unclassed Forests (3,228 km^2) 20.23% *(FSI, 2017)*. Due to non-availability of digitized boundary of recorded forest area from the state, the updated green wash which is 13,523 km^2 has been used and the analysis of forest covers within and outside this area.

Table 3.19. Altitude-wise Forest cover (Area in sq km)

Altitude zone (m)	Geo. Area	Very Dense Forest	Moderate Dense Forest	Open forest	Total
0-500	2,40,458	2,617	3,883	7,771	14,271
500-1000	670	0	186	222	408
Total	2,49,928	2,617	4069	7,993	14,679

(Source :FSI,2017)

Table 3.20. Forest cover in different patch size classes

S.No.	Patch size (Sq.Km)	No of patch	Area (Sq.Km)	%age
1.	0.01-1.0	64,469	3,627	24.71
2.	1.0-10.0	728	1,934	13.17
3.	10-100	97	2,508	17.09
4.	100-500	20	4,086	27.84
5.	500-1000	4	2,524	17.19
	Total	**65,318**	**14,679**	**100.00**

(Source :FSI,2017)

Table No. 3.21.District wise list of forests

District	Geographical Area	Very Dense Forest	Mod. Dense Forest	Open Forest	Total	% of GA	Change*	Scrub
Hamirpur	4021	00	80	147	227	5.65	50	14
Jalaun	4565	00	61	188	249	5.45	4	36
Jhansi	5024	00	42	261	303	6.03	88	40

1.FLORA

QUALITATIVE STUDY OF TERRESTRIAL VEGETATION

In order to carryout qualitative study of the terrestrial flora, buffer zone of 10 km from river bank of Betwa all along the stretch under study has been surveyed extensively by criss-cross movement and records of field data were made. The plant species falling under dicots, monocots, pteridophytes, thalophytes, parasites, and epithytes were enlisted in alphabetical sequence with botanical, common and family name. The list thus produced is not absolute inventory but represents the maximum coverage.

The forests of Hamirpur, Jalaun and Jhansi districts belong to the Northern Tropical Dry-Deciduous type according to Champion & Seth Classification (group 4b). The forests of the district can be considered under the following broad sub-types:- (i) Teak forests: (a) Teak forest on alluvium, (b) Teak forest on sandstone, (ii) Mixed forests, (iii) Khair forests etc. The Forest cover of the State Uttar Pradesh is given in Fig. 3.20.

The area of study usually support a luxurious growth of teak saplings (*Tectona grandis*). Saj (*Terminalia tomentosa*) is the tree next in importance to teak, whose timber is largely used for houses and furniture. Koha (*Terminalia arjuna*) is another tree growing on river banks. Tendu or Ebony (*Diospyros tomentosa*) is fairly common. The black heartwood of this tree is valuable and is used for furniture and the fruit is edible.The southern half is almost bare without any sign of tree growth on black soil the hardy babul grows spontaneously and in the riverine tracts there is generally mixed jungle of small and stunted scrubtype. The Khair (*Acacia catechu*) is a common tree and the other trees include the hingol, karaunda (*Carisa opaca*) and karil (*Caparia decidua*). Other common species besides the mahua (*Mudhuca indica*) are the semal (*Salmalia malabarica*) dudhi (*Holarrhena antidyssentrica*), dhawa (*Anogeissus latifolia*) gurja (*Lannea coromandelica*), dhak (*Butea monospermal*), rioni khair and kardhai. Saleh (*Boswellia serrata*) is a common tree on the dry hillsides. It is considered of little value locally. The timber of this tree is of good quality when it grows to a large size but it is usually found as a small tree with little or no heartwood. The wood is sometimes used for planks and sports and is a bad fuel. The bark is used for tanning and the leaves for fodder. Kullu (*Sterculia urens*) is another tree characteristic of the hills and plateau and is conspicuous for its light coloured smooth bark. Sejo or Lendia (*Lagerstroemia parviflora*) is a common tree and is important as one of the best timbers of the mixed forests. Its wood is used for house pillars, rafters and agricultural implements.

Ghout (*Ziziphus xylopyrus*) is a small tree with grey or reddish brown bark and thick oblong exfoliating scales. This tree is a very frequent one and lac is grown on it. 1t has a large round fruit and three pointed leaves alike to that of the Bel tree (*Aegle marmelos*) but relatively small in size.

Hadlu (*Adina cordifolia*) is a fairly common and a beautiful, imposing tree with white rough bark and large round leaves. Chheola or Palas (*Butea monosperma*) is a tree of moderate size, common on both government and private forests. It has brilliant, scarlet orange flowers which are locally called Tesu and give a good, red, yellow dye. It exudes a ruby coloured gum when cut, which is used as medicine for dysentery. Ropes are made from the fibres of the roots and are said to withstand the rains better than ordinary hemp. Aonla (*Emblica officinalis*) is a small but pretty tree found both in the forests and in villages. The bark and leaves are used for tanning and as a medicine and the fruit is edible. This tree is considered sacred by the local people.

Dhavari (*Woodfordia floribunda*) is a large shrub conspicuous on dry hillsides and rocky ground with red flowers from which a dye is obtained for colouring silk. Kumhi (*Cochlospermum gossypium*) is a small tree with thick spreading branches and is characteristic of the driest and stoniest slopes. It is always conspicuous and covered with large brilliant yellow flowers, or in full foliage with glossy green leaves.

Achar(*Buchanania lanzan*) is a very common tree in the forestsand is only leafless for a short time. Its characteristic bark, dark grey or nearly black in colour and thick, rough and tessellated with regular boss-like prominences makes this tree conspicuous. The kernel of the fruit is called Chironji which is edible. Karonda (*Carissa carandas*) is a large thorny shrub whose branches are used for fencing. Neem (*Azadirachta indica*) is a common village tree and is also found in roadside avenues, for which it makes an excellent tree, giving shade in the hot season. Banyan, pipal and tamarind are other village trees. The ber or wild plum (*Ziziphus jujuba*) is a common village tree, as is also the Bel (Aegle marmelos), the tree sacred to Lord Siva, the fruit of which is used as medicine. The pretty Mununga (Moringa pterygosperma) is largely cultivated in villages for its edible fruits. The best grazing grasses in the district are Musyal (*Iseilema laxum*) and Kel or Kuila (*Andropogon annulatus*). The leaves of kel are long and those of musyal are short the latter is a small grass which keeps fresh for a long time. Parwariya (*Heteropogon contortus*) is also a good grazing grass especially when young.

Plantaions of trees such as mango, mahua, jamun (*Syzygium cumini*), sissoo (*Dalbergia sissoo*), siris, amaltas (*Cassia fistula*), gulmohar (*Delonix regia*), pipal (*Ficus religiosa*), arjuna (*Terminalia arjuna*), kanji (*Pongamia pinnata*), bargad (*Ficus bengalensis*), and neem (*Azadirachta indica*) were raised along the PWD roads under the roadside avenuels scheme. List of plant species found in the region, are given in the following tables.

TableNo. 3.22 List of plant species that are commonly found in the area

Trees

Common name	Botanical name	Uses
Sagwan (Teak)	*Tectona grandis*	Used for house door and windows and furniture as a good timber -wood
Seja	*Lagerstroemia parviflora*	Best timber for house posts, rafts and agricultural implements
Aonia (Amla)	*Emblica officinalis*	Bark and leaves used tanning and as a medicure – fruit edible.
Mahua	*Madhuca longifolia*	For flower and fruit and to make country liquor
Neem	*Azadirachta indica*	Used as avenue trees, medicinal value and tooth brushing
Pipal	*Ficus religiosa*	Avenue tree for shade, religious value
Imli	*Tamarindus indica*	Avenue trees, fruit used for sour taste/ tartrees

Munga/ Sahjan	*Moringa olifera*	Cultivated in valleys for its fruit used as vegetables. Relieves knee pains
Karnoda	*Carissa carandas*	Used for fencing, fruits used in tarts and jam
Rusa	*Cymbopogon martinii*	Yields essential aromatic oil
Khus	*Vetiveria zizanioides*	Roots used for making khus, tati and aromatic oil

Table No. 3.23 Flora at the Study area-1 as per Forest data

Botanical name	Local name	Botanical name	Local name
Madhuca longifolia	Mahua	*Mitragyna parvifolia*	Kem
Albizia lebbeck	Kala siris	*Bauhinia variegata*	Kachnar

Buchanania lanzan	Chiraunji	*Azadirachta indica*	Neem
Bombax ceiba	Semal	*Butea monosperma*	Palash
Diospyros melanoxylon	Tendu	*Terminalia tomentosa*	Saaj
Carissa spinarum	Karonda	*Euphorbia hirta*	Dudhi
Feronia limonia	Kaitha	*Jatropha curcas*	Ratanjot
Lantana camara	Makoi	*Nymphaea nouchali*	Kumodini
Terminalia arjuna	Arjun	*Ficus glomerata*	Goolari

Syzygium cumini	Jamun	*Ziziphus mauritiana*	Ber
Sterculia urens	Kullu	*Emblica officinalis*	Amla
Terminalia bellirica	Bahera		

Among the flora given in the table above, some of the species are found at the Study area-1 while others are found within the 10 km radius of the Study area-1. Plant species found at project region and its surroundings are enlisted in the following tables:

Table No. 3.24 Flora at the Study area-1

Botanical Name	Family	Common Name
Tectona grandis	Lamiaceae	Sagoan

Terminalia tomentosa	Combretaceae	Saaj
Acacia nilotica	Fabaceae	Babool
Terminalia arjuna	Combrataceae	Arjuna/ koha
	Ebenaceae	Viraala

Ficus religiosa	Moraceae	Pipal
Acacia leucophloea	Fabaceae	Revanja
Dalbergia paniculata	Fabaceae	Dhoban

Terminalia bellirica	Combretaceae	Bahera
Mitragyna parvifolia	Rubiaceae	Kem
Ficus glomerata	Moraceae	Goolar
Diospyros melanoxylon	Ebenaceae	Tendu

Dodonaea viscosa	Dodonaea viscosa	Dodonaea viscosa
Sapindaceae	Sapindaceae	Sapindacea e
Cassia fistula	Caesalpiniaceae	Amaltas
Bauhinia racemosa	Caesalpiniaceae	Aashto

Sterculia urens	Sterculiaceae	Kullu
Lagerstroemia parviflora	Lythraceae	Sejah
Aegle marmelos	Rutaceae	Bel
Adina cordifolia	Rubaceae	Haldu

Azadirachta indica	Meliaceae	Neem
Ougeinia oojeinensis	Fabaceae	Teshta
Grewia tiliaefolia	Malvaceae	Dhaman
Dalbergia latifolia	Fabaceae	Black Seesam

Madhuca indica	Sapotaceae	Mahua
Tamarindus indica	Caesalpiniaceae	Imli
Holoptelea integrifolia	Ulmaceae	Chilbil
Ficus hispida	Moraceae	Katumar

Ziziphus xylopyrus	Rhaminaceae	Kathber
Holarrhena antidysenterica	Apocyanaceae	Doogi
Gardenia latifolia	Rubiaceae	Papada
Crataeva religiosa	Capparidaceae	Barnov

Limonia acidissima	Rutaceae	Belsona
Vitex negundo	Verbenaceae	Nerogudi/ sambhalu
Ipomoea pes-caprae	Convolvulaceae	Besarama
Cuscuta reflexa	Convolvulaceae	Amarbel

Ricinus communis	Euphorbiaceae	Arandi
Lantana camara	Verbenaceae	Vedaysini
Annona squamosa	Annonaceae	Sitaphal
Gardenia turgida	Rubiaceae	Fatara

Ziziphus jujuba	Rhaminaceae	Ber
Ziziphus oenoplia	Rhamnaceae	Makoar
Colebrookea oppositifolia	Labiatae	Kalabansa
Ixora arborea	Rubiaceae	Lokandi

Jatropha curcas	Euphorbiaceae	Ratanjyoti
Achyranthes aspera	Amaranthaceae	Aapamarga
Tribulus terrestris	Zygophyllaceae	Gokharu
Andrographis paniculata	Acanthaceae	Chirota

Ziziphus nummularia	Rhamnaceae	Jadaneri
Ocimum sanctum	Lamiaceae	Tulsi
Cassia tora	Caesalpiniaceae	Puvar
Thespesia lampas	Malvaceae	Banakapas

Embelia robusta	Myrsinaceae	Baivirang
Solanum nigrum	Solanaceae	Batakatiya
Grewia hirsuta	Tiliaceae	Gudasakari
Desmodium pulchellum	Leguminosae	Chipati

Cynodon dactylon	Poaceae	Doob grass
Euphorbia neriifolia	Euphorbiaceae	Thuwar
Indigofera pulchella	Fabaceae	Neela
Asparagus racemosus	Liliaceae	Satavari

Eclipta prostrata	Asteraceae	Bhrungraj
Vernonia indica	Asteraceae	Mohati

Table No. 3.25 Climbers & Grasses at the Study area-1

Botanical Name	Family	Common Name Name
Ventilago calyculata	Rhamnaceae	Kevto

Abrus precatorius	Leguminosae	Gunjha
Ichnocarpus frutescens	Apocynaceae	Demarbel
Acacia pennata	Leguminosae	Raini
Butea superba	Leguminosae	Palasbel
Bauhinia vahlii	Leguminosae	Mahul

Saccharum spontaneum	Poaceae	Kans
Dendrocalamus strictus	Poaceae	Baans
Iseilema laxum	Poaceae	Mushel
Desmostachya bipinnata	Poceae	Khus

Vetiveria zizanioides	Poaceae	Khas
Aristida setacea	Poaceae	Jhani

Table No. 3.23 Climbers & Grasses around the Study area-1

Botanical Name	Family	Common Name
Ventilago calyculata	Rhamnaceae	Kevto

Abrus precatorius	Leguminosae	Gunjha
Ichnocarpus frutescens	Apocynaceae	Demarbel
Butea superba	Leguminosae	Palasbel
Bauhinia vahlii	Leguminosae	Mahul
Saccharum spontaneum	Poaceae	Kans

Dendrocalamus strictus	Poaceae	Bhans
Iseilema laxum	Poaceae	Mushel
Andropogon annulatus	Poaceae	Karad
Woodfordia floribunda	Lythraceae	Dhataki
Desmostachya bipinnata	Poceae	Khus

Vetiveria zizanioides	Poaceae	Khas
Aristida setacea	Poaceae	Jhani
Cynodon dactylon	Poaceae	Dhoob grass
Dichanthium annulatum	Poaceae	Bhuravel
Eragrostis interrupta	Poaceae	Bhurabhusi choti

Medicinal plants

Lists of the medicinal plants found at Study area-1 and its surrounding regions.

Table No.3.27: List of medicinal plants used by the tribe

No.	Botanical Name of the plant	Local name of medicinal plant	Disorder	Part of the plant used	Mode of use
1	*Vitis quadrangularis*	Harjor/Haddij or	Bone fracture	Stem	Given internally and applied for fracture of bone
2	*Cleome gynandra*	Hurhur	Headache	Seeds	Paste is used externally for 3-7 days
3	*Litsea glutinosa*	Garbijaur	Vomiting	Bark	Powder used 2 dosage (Approx. 10gm's) in a day.
4	*Eclipta alba*	Vringraj	Inflammatory disorder	Seed/whole	Anti-inflammatory, digestive, hair tonic
5	*Vanda tessellata*	Banda/Rasana	Ear pain	Leaves	Decoction used orally
6	*Leucas aspera*	Drond pushpin	Eye pain	Leaves	The juice put into eyes for 2 or 3 times daily to relieve burning sensation and redness of eyes

Table No.3.28 RET Species of Study area-1

Sr. No.	Name of species	Status
1	*Abrus precatorius*	Near Threatened
2	*Acorus calamus*	Endangered
3	*Andrographis paniculata*	Vulnerable
4	*Aristolochia indica*	Near Threatened
5	*Asparagus racemosus*	Near Threatened
6	*Bacopa monnieri*	Vulnerable
7	*Butea monosperma var.lutea*	Endangered
8	*Caesalpinia bonduc*	Vulnerable
9	*Caesalpinia decapetala*	Vulnerable
10	*Capparis decidua*	Vulnerable
11	*Centella asiatica*	Vulnerable
12	*Ceropegia bulbosa*	Endangered
13	*Chlorophytum tuberosum*	Vulnerable
14	*Commiphora wightii*	Rare
15	*Costus speciosus*	Vulnerable
16	*Curculigo orchioides*	Endangered

17	*Curcuma amada*	Endangered
18	*Curcuma angustifolia*	Vulnerable
19	*Dioscorea bulbifera*	Vulnerable
20	*Gloriosa superba*	Vulnerable
21	*Gymnema sylvestre*	Under Threat
22	*Manilkara hexandra*	Near Threatened
23	*Mucuna pruriens*	Near Threatened
24	*Operculina petaloidea*	Endangered
25	*Oroxylum indicum*	Vulnerable
26	*Plumbago zeylanica*	Vulnerable
27	*Prosopis cineraria*	Endangered
28	*Psorelea corylifolia*	Vulnerable
29	*Rauvolfia serpentina*	Endangered
30	*Saraca asoca*	Endangered
31	*Spilanthes calva*	Vulnerable
32	*Tinospora cordifolia*	Vulnerable
33	*Tylophora indica*	Vulnerable
34	*Uraria picta*	Vulnerable
35	*Urginea indica*	Vulnerable

Biodiversity Assessment Method:

Transect/Quadrat method:

Quadrat size laid down is 10×10 m in project area. Quadrat data has been given inTableNo.3.26in which Frequency, Density and Abundance calculated as per formula:

Frequency:

Frequency, as introduced by Raunkiaer (1934), indicates the number of sampling units in which a given species occurs (Mishra, 1968). Frequency of mangrove vegetation refers to the degree of dispersion of individual species in an area and is usually expressed in terms of percentage of occurrence.

$$\text{Frequency} = \frac{No\ of\ occurrences\ of\ a\ species}{Total\ no\ of\ site\ samples\ taken} \text{ X } 100$$

$$\text{Relative Frequency} = \frac{No\ of\ occurrences\ of\ particular\ species}{Total\ no\ of\ occurrences\ of\ all\ the\ species} \text{ X } 100$$

Abundance:

The abundance and density represent the numerical strength of species in the community (Mishra, 1968). Abundance is described as the number of individuals occurring per sampling unit and density as the number of individuals per sampling unit. Abundance and density are calculated using the following formulae:

$$\text{Abundance (A)} = \frac{Total\ number\ of\ individuals}{Number\ of\ Sampling\ units\ of\ occurrence} \times 100$$

$$\text{Abundance (A)} = \frac{Total\ number\ of\ individuals}{Number\ of\ Sampling\ units\ of\ occurrence} \times 100$$

$$\text{Relative Abundance} = \frac{Abundance\ of\ a\ particular\ species}{Sum\ of\ the\ abundances\ of\ all\ species} \times 100$$

$$\text{Density} = \frac{Total\ no\ of\ individuals\ of\ a\ species\ in\ all\ quadrats}{Total\ no\ of\ quadrats\ sampled} \times 100$$

$$\text{Relative density} = \frac{Density\ of\ a\ particular\ species}{Sum\ of\ the\ densities\ of\ all\ species} \times 100$$

Importance Value Index (IVI):

The concept of 'Important Value Index (IVI)' has been developed for expressing the dominance and ecological success of any species, with a single value (Mishra, 1968). This index utilizes three characteristics, viz. relative frequency, relative density and relative abundance. The three characteristics are computed using frequency, density and abundance for all the species falling in all the transects by using the following formula.

IVI = Relative frequency + Relative abundance + Relative density

Importance Value is a measure of how dominant a species is in a given forest area. It is a standard tool used by foresters to inventory a forest related density, the number of individuals per area as a percent of the number of individuals of all species.

Therefore from the above Quadrat study it is observed that some species like *Salmalia malabarica, Annona squamosa* and *Terminalia chebula* are showing high Importance Value Index and in a given project area this species are dominant in nature.

Fauna

Among thr wildlife of the study area occasionally, wolf (*Canis luzus*) and hyena (*Hyenae hyena*) are found in the hills and ravines throughout the istrict. Jackal (*Cains aureus*) and fox (*Bulpas bengalensis*) occur everywhere but are less numerous than north of the Betwa, while pig (*Sus cristatusindicus*) abound and play havoc with the fields. The nilgai (*Boselophus tragocamalus*) and large herd of sambar (*Cervus unicolor*) frequent the wide cotton plains. Species of wild animals, birds and reptiles commonly found in and around the submerged area and the Study area-1 are as given below.

Animals (Mammals)

Carnivore: Indian Fox, Wild Dog.

Herbivore: Spotted deer, Nilgai, wild Boars, Rabbits, Black faced Monkeys, (Langoors), and Red faced Monkeys.

Table No. 3.30.Fauna at the Study area-1

Zoological	**Family**	**Common name**	**Schedule**
Animals			
Gazelle gazelle	Antilopinae	Indian gazelle	IV

Macaca mulatta	Cercopithecidae	Bandar	IV
Felis chaus	Felidae	Jungli billi	II
Sus scrofa	Suidae	Suwar	III
Bandicota bengalensis	Muridae	Field rat	V
Golunda ellioti	Muridae	The Indian bush rat	IV

Muntiacus muntjak	Cervidae	Indian muntjak	IV
Cervus unicolor	Cervidae	Sambhar	III
Axis axis	Cervidae	Cheetal	III
Boselaphus tragocamelus	Bovidae	Nilgai	IV
Lepus nigricollis	Leporidae	Kharghosh	IV
Hyaena hyaena	Hyaenidae	Lakadbagga	III

Rattus rattus	Muridae	Chuha	V
Bos indicus	Bovinae	Cow	V
Reptiles			
Bungarus caeruleus	Elapidae	Krait	IV
Naja naja	Elapidae	Naga	II
Ptyas mucosus	Colubridae	Dhaman	II
Varanus bengalensis	Varanidae	Godhi	II

Fishes			
Labeo rohita	Cyprinidae	Rohu	IV
Catla catla	Cyprinidae	Bhakur	IV
Cirrhinus cirrhosus	Cyprinidae	Mrigal	IV
Amphibians			
Bufo melanostictus	Bufonidae	Common toad	IV
Rana tigrina	Ranidae	Indian bull frog	IV

Table No. 3.30. Fauna around the Study area-1

Zoological name	**Family**	**Common**	**Schedule**

Animals			
Hemiechinus auritus	Erinaceidae	Hedgehog	IV
Suncus murinus	Soricidae	Musk-shrew	IV
Presbytis entellus	Colobinae	Langoor	IV
Macaca mulatta	Cercopithecidae	Bandar	IV
Cynopterus sphinx	Pteropodidae	Fruit bat	IV

Felis chaus	Felidae	Jungli billi	II
Panthera pardus	Felidae	Panther	III
Sus scrofa	Suidae	Suwar	III
Cuon alpinus	Canidae	Wild dog	II
Bandicota bengalensis	Muridae	Field rat	V
Mellivora capensis	Mustelidae	Honey badger	IV

Golunda ellioti	Muridae	The Indian bush rat	IV
Muntiacus muntjak	Cervidae	Indian muntjak	IV
Cervus unicolor	Cervidae	Sambhar	III
Axis axis	Cervidae	Cheetal	III
Herpestes hyaena	Hyaenidae	Spotted hyaena	IV
Boselaphus tragocamelus	Bovidae	Nilgai	IV

Rattus rattus	Muridae	Chuha	V
Bos indicus	Bovinae	Cow	V
Funambulus pennanti	Sciuridae	Squirrel	IV
Vulpes bengalensis	Canidae	Indian fox	IV
Gazelle gazelle	Antilopinae	Indian gazelle	IV
Reptiles			
Bungarus caeruleus	Elapidae	Krait	IV

Naja naja	Elapidae	Indian Cobra	II
Ptyas mucosus	Colubridae	Dhaman	II
Varanus bengalensis	Varanidae	Indian Bengal Monitor	II
Fishes			
Labeo rohita	Cyprinidae	Rohu	IV
Catla catla	Cyprinidae	Bhakur	IV
Cirrhinus cirrhosus	Cyprinidae	Mrigal	IV

Amphibians			
Bufo melanostictus	Bufonidae	Common toad	IV
Rana tigerina	Ranidae	Indian bull frog	IV

Birds:

About 125 species of birds are permanent resident of area under study. Pea fowl (*Pavo cristatus*), grey-partridge (*Francolins godicerianus*) and quail (*Coturnix cotornix*), the letter of the smaller variety called the button-quail are found throughout the district. The painted partridge (*Francolinus pictus*) is common in hilly tracts and the common dandgrouse, plovers, blue-rock (*Colubia livia*) and green pigeon (*Crocopus phoenlcopterus*) are found in most of the places. Of migratory waterfowl (*Anatidae*) various species of geese, duck and teal visit the district n cold season. In the same localities and in tanks the snipe (*Charadriidae*) is also common at the same season, while numerous varieties of cranes, storks and waders are found where water is found. The avi-fauna of the study area includes all the usual species of doves, shrikes, rollers, parrots and other passerine and non-passerine birds.These are listed below.

Table .No.3.32: Avifaunaat the Study area-1

Zoological	**Family**	**Common**	**Schedule**
BIRDS			

Phalacrocorax niger	Phalcrocoracodae	Little comorant	IV
Ardeola grayii	Phalcrocoracodae	Pond herone	IV
Bubulcus ibis	Ardeidae	Cattle egret	IV
Anastomus oscitans	Ciconiidae	Open billed stork	IV
Milvus migrans	Accipitridae	Common kite	IV
Perdicula asiatica	Phasianidae	Jungle bush quail	IV

Grus grus	Gruidae	Common crane	IV
Psittacula krameri	Psittacidae	Parrot	IV
Eudynamys scolopaceus	Cuculidae	Cukoo	IV
Halcyon smyrnensis	Halcyonidae	White brested kingfisher	IV
Acridotheres tristis	Sturnidae	Common myna	IV
Pycnonotus cafer	Pycnonotidae	Bulbul	IV

Apus affinis	Apodidae	Ababil	IV
Bubo bubo	Strigidae	Owl	IV
Columba livia	Collumbidae	Blue rock pigeon	IV
Streptopelia decaocto	Collumbidae	Indian ring dove	IV
Corvus splendens	Corvidae	House crow	IV
Corvus macrorhynchos	Corvidae	Jungle crow	IV

Passer domesticus	Ploeidae	House sparrow	IV

Table No3.32. Avifaunaaroundthe Study area-1

Zoological	Family	Common	Schedule
BIRDS			
Ardeola grayii	Phalcrocoracodae	Pond herone	IV
Anastomus oscitans	Ciconiidae	Open billed stork	IV
Milvus migrans	Accipitridae	Common kite	IV
Coturnix coturnix	Phasianidae	Common grey quail	IV

Perdicula asiatica	Phasianidae	Jungle bush quail	IV
Grus grus	Gruidae	Common crane	IV
Eudynamys scolopaceus	Cuculidae	Cukoo	IV
Alcedo atthis	Alcedinidae	Small blue king	IV
Halcyon smyrnensis	Halcyonidae	White brested kingfisher	IV
Acridotheres tristis	Sturnidae	Common myna	IV

Spilornis cheela	Accipitridae	Crested serpent eagle	
Accipiter badius	Accipitridae	Crested hawk	
Spizaetus cirrhatus	Accipitridae	Cheel	IV
Psittacula krameri	Psittacidae	Parrot	IV
Pycnonotus cafer	Pycnonotidae	Bulbul	IV
Centropus sinensis	Cuculidae	Mokha	IV
Eudynamys scolopaceus	Cuculidae	Cukoo	

Apus affinis	Apodidae	Ababil	IV
Bubo bubo	Strigidae	Owl	IV
Ploceus philippinus	Ploceidae	Baya	IV
Phalacrocorax niger	Phalcrocoracodae	Little comorant	IV
Columba livia	Collumbidae	Blue rock pigeon	IV
Streptopelia chinensis	Collumbidae	Spotted dove	IV

Coracias benghalensis	Coracidae	Blue jay	IV
Sturnus contra	Strunidae	Indian myna	IV
Corvus splendens	Corvidae	House crow	IV

The project area does not have dense forest cover and thus is not habitat of many animals. Monkey and Fox etc. are found in the forest area near the Study area-There is no endangered, threatened or rare species found.

Reptiles:

Snakes and scorpions are numerous and majority of snake species found in district are non-poisonous. Among the venomous snakes found in the district the chief are cobra (*Naja naja* or *Naja tripudian*), the krait (*Bungarus Caeruleus*) and the Russelli's Vipera (*Vipera russellii*) The crocodile of both varieties, gharial and magar are found in the Betwa and all the larger and sometimes even in smaller streams while the former rivers abounds in turtles or kachhua (*Trionnyx gangeticus*) and tortoises. The chameleon and house lizards are common everywhere the monitor lizard being found in the hilly tracts.

3.AQUATIC ECOLOGY

River Betwa is the right bank tributary of Yamuna river. It originates from the Northwards slope of the Vindhyan Mountains. The total length for which it flows is 590km. the average depth of the whole Betwa river ranges between 2.7-9.4 m. the river bed of Betwa river mostly aggregates stones, sand, riffle and pools; pebbles and cobble.

The study area has a wide range of biotic communities - Phytoplankton dominated by Chlorophyceae, Bacillariophyceae; and Myxophyceae, Zooplankton such as Copepods, Cladocerans Rotifers and Protozoans.The chief species found are mahseer, (*Barbus Tor*), rohu (*Labeo rohita*), Tengra or kantua (*Mystus seenghala*), parhin (*Wallagonia attu*), saul (*Opheocopholus sp.)* kalabanu (*Labeo colbasa)* and nain (*Cirrhina mrigala*). Other species such as moi (*Notopterus notopterus*), Bhakur (*catla catla*) and bam or eel (*Rhynchobdilla aculata*) are also found. Oil is extracted for medicinal purposes from the sus. Benthos is represented by insect larvae and nymphs, Oligochaeta, Nematods and Mollusca and a rich growth of Periphyton on submerged objects. However, the physico – chemical parameters will change after the construction is over and water is filled in the reservoir. This would result in high flushing in reservoir in the monsoon months.

1) Sampling collection method-

- Take plankton net with the mesh size of 0.32 mm aperture.
- Drop the net into the water from the bank and haul up vertically. Collect about 25 litres of water with Phytoplankton in it and sieve by using mesh.
- A flow meter can be attached with the net to measure the water flow.

2) Preservation techniques-

- Planktonic organisms are sensitive to temperature so should be collected in thermos flask.
- The samples should be examined within 24 hrs hours.
- Further preservation can be done by adding Lugol's solution to the samples.

3) Sample analyses-

Number of individuals can be found either visually or through the microscope. Large organisms are measured by visual count and the small organisms counted and recorded through binocular microscope. Results can be expressed in percentage as:

No. of individuals per cm3 = A/B

Where, A – No. of individuals counted visually or under microscope.

B – Volume of water taken in cm3.

Species Diversity Index – Species diversity index (H) for aquatic population was determined separately from the Shannon Wiener's information function (Shannon and Weaver, 1963).

$$H = -\sum (ni / N) \log_2 (ni / N)$$

Where: ni = importance value for each species, N = total of importance values

Pi = importance probability for each species = ni/N

Table No.3.33 Study of Phyto and Zooplankton's

Sp. Name	**Sp. Name**	**Sp. Name**	**Sp. Name**
Bacillariophyceae	**Chlorophyceae**	**Myxophyceae**	**Euglenophyceae**
Pinularia sp.	*Ankistrodesmus sp.*	*Merismopedia sp.,*	*Phacus sp.*
Navicula sp.	*Cosmarium sp.*	*Aphanezomenon*	
Nitzschia sp	*Coelestrum sp.*	*Lyngbya sp.*	
Synedra sp			
Cymbella sp,			
Fragillaria sp.			
Meridion sp.			

Sp. Name(Unit/Lt)	**March**	**April**	**May**
Protozoa			
Aracella sp.	++	++	+++
Ceratium sp.	+++	++	+++
Diffuzia sp.	+++++	++	+++
Euglypha sp.	++	++	+++
Paramecium sp.	++	++	+++

Vorticella sp.	++	++	+++
Rotifera			
Asplanchnopus sp.	**+**	**+++**	**+++**
Brachionus sp.	**++**	**++**	**+++**
Filinia sp.	**+**	**+++**	**++**
Keratella sp.	**-**	**++**	**+++**
Lecane sp.	**++**	**+++**	**++**
Monostylla sp.	**++**	**+++**	**+++**
Polyarthra sp.	**+**	**++**	**+++**
Trichocera sp.	**++**	**+++**	**+++**
Copepoda			
Bosmania sp.	*++*	*+++*	*+++*
Cerodaphnia sp.	*+*	*+++*	*+++*
Cyclops sp.	*++*	*+*	*+++*
Daphnia sp.	*++*	*++*	*+++*
Diaptomus sp.	*+++*	*++*	*+++*
Macrothrix sp.	*+++*	*+++*	*++*
Mesocyclops sp.	*++*	*+++*	*+++*
Nauplius sp.	*+++*	*+++*	*+++*

Table No. 3.34. Aquatic plants at the Study site

S.No	Botanical name	Habit	Family
1	*Alternanthera sessilis*	Herb	Amaranthaceae

2	*Bergia ammanioides*	Herb	Elatinaceae
3	*Caesulia axillaris*	Herb	Compositae
4	*Eriocaulon cinereum*	Sedge	Cyperaceae
5	*Limnophilla*	Herb	Scrophulariaceae

Fishery Development

Aquatic resources

Fish is of the most important species of the aquatic fauna as well as important source of protein in human food. Since, topographical and climatological condition of Betwa River varies from tropical to moderate temperature region; there are significant variations in the fish species observed at different elevations. Normally the varieties of fish Catla, Rohu, Bam, Padan are normally observed.

Pisciculture: A wide range of indigenous fishes are found in the Betwa River. The important commercial fish species in the river are *Cirrhinus mrigala, Catla catla,labeo rohita, Labeo calbasu* among major carps; *Tor tor* among mahseer; *Spereta seenghala. Spereta aor, Wallago attu* and *Rita rita* among catfishes; *Chitala chitala* among featherbacks. A number of species of lesser size and importance are available in the river are reported as miscellaneous fishes and comprise *Aspidoparia morar, Salmophasia bacaila, Oxygaster gora, Labeo boggut, Labeo bata, Cirrhinus reba, Gudusia chapra*.

The water bodies that would be created by dam provide ample opportunity to develop fresh water fishery and should be developed for food and sport.

3.9SOCIO-ECONOMIC ENVIRONMENT

The Uttar Pradesh state constitutes of 75 districts as per Census 2011. The study area comprises of three districts i.e. Hamirpur, Jalaun and Jhansi. In includes four sub-districts of Hamirpur namely Hamirpur, Rath, Sarila and Maudaha, similarly four sub-districts of Jalaun district Kalpi, Madhogarh, Jalaun and Konch, and one sub-districts of Jhansi namely Garautha. Total 220 villages fall under the area under study covering 3 districts. The detailed socio economic study is attached as Annexure XV

Table No.3.36. Total Number of all villages and towns within 10kn radius

District	Tehsil	No. of Villages	No. of Towns
Hamipur	Hamirpur	2	--
	Rath	14	--
	Sarila	56	
	Maudaha	1	--
Jalaun	Kalpi	36	--
	Madhogarh	4	--
	Jalaun	3	--
	Konch	5	--

Jhansi	Garautha	21	--
Total		**220**	--

3.9.1. Population Profile:

The study area has a total population of 359856, out of which major percent which is 63% from district Jalaun, 29% from Hamirpur and 8% from Jhansi. The percentage of population share among the districts is shown in in Fig.3.48

The total number of households within the study area are 63562 out of which Jalaun district contibutes the major portion (61%),percent share of other districts is represented in in Fig.3.49

The figures below represents the demographic profile of the area under study showing perecentages of Males, Females and the population below 6 years of age. The study area includes three districts namely Jalaun, Hamirpur and Jhansi, hence the demographic profile of the individual districts is also represented in the figures given below. Mine leases are only located in the two districts of the study area *viz.*Jalaun and Hamirpur, only a very small portion of Jhansi district lies within the 10 km buffer zone of the study area.

3.9.2. Literacy profile:

There are parts of four districts which are falling under this Regional EIA study namely Hamirpur, Jalaun, and Jhansi. Literacy profile of the study area is given below in Fig.3.51

3.9.3.Occupational profile:

The percentage of Worker and Non-Worker population out of the total population constituting the study area is given in Fig 3.52. number and percentage of Main worker, which work as worker for major part of the duration of the year and Marginal Workers, which work as Workers for less than 6 Months in the duration of a year. Here, As per Census Of India, 2011. Marginal Workers have been categorised into two Categories:

a) Marginal Workers who work for 3-6 Months

b) Marginal Workers who work for less than 3 Months

Category of workers as per their occupation for both Main and Marginal workers is defined as Cultivators, Agricultural Laborers, Household Industry Workers and Other Workers. Category wise percentage of Main and Marginal workers is given in in Fig. 3.53.

Details of Socio-economic status of villages in the study area is annexed as Annexure-XV

CHAPTER- IV

ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION METHODS

4. GENERAL

The mining projects along with other activities in vicinity may influence the existing physical, biological and social components of environment. In case of mining projects, impacts on biodiversity, air pollution, water pollution, waste management and social issues may be associated. These impacts could be minimized up to a significant level when scientific mining procedures, guidelines and rules are taken into account. The nature and characteristics of impacts are required to be taken into consideration while evaluating the magnitude of impacts. Open cast mining activities have different types of impacts on nearby environment with respect to both magnitude and significance. During the working life of mine, air, water, noise and land use are likely to be affected due to mining of minerals and associated activities. The various anticipated impacts and mitigation measures are discussed in this chapter.

Environmental factors ("impacts") associated with, or caused by, mining, as distinct from those associated with the subsequent use of the extracted minerals, are largely confined to relatively restricted areas in the vicinity of the appropriate geological formation and downstream in the catchment where the deposit is located. These impacts would normally be considered to be "direct" impacts that can be linked directly to the mining and ore processing operations.

In contrast, there are many other types of impacts that are associated with mining activities, but do not occur as a direct consequence of the mining activity itself. These would be considered to be "indirect" impacts. A typical example would be the variety of impacts caused by the activities of individuals and organizations that take place in areas peripheral to a mining operation. In several instances, these indirect impacts can exceed the total environmental impact of the original mining operation and thereby require a far greater degree of management attention.

The term "cumulative impacts" is generally applied to those situations where several impacts from different processes and activities combine to exert a greater set of (usually adverse) effects than those that would be predicted from the original activities. An example of this type of situation would be the combination of adverse effects that a community would experience if it were exposed simultaneously to atmospheric emissions of gases, wind blown dust and effluent discharged from a mining operation. A second example would be the situation where effluents and discharges from several mining operations or industries in a single catchment exerted a set of combined effects or impacts on the river system draining the basin. In some circumstances, there may be synergistic effects, where the combined (cumulative) effect of two different activities is greater than would be expected from a simple combination of the two isolated activities. Similarly, there are also certain circumstances where the impacts from two different activities effectivelyneutralize each other – this situation is often referred to as an "antagonistic" or "counteractive" interaction.Three typical wastes provide a simple example of this type of situation, namely: acid rock drainage, raw sewageand power station ash. Individually, these wastes exert serious adverse impacts on aquatic environments; in combination, however, they neutralize and offset each other so that their combined effect on the aquaticenvironment is often innocuous.

4.0.1. Regional Impacts

Regional impacts are those impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors in the proposed study area. Regional impacts are therefore generally impacts that act with others in such a way that the sum is greater than the parts. This is, however, not always the case – sometimes they will simply be the sum of the parts, but that sum becomes significant. Regional impacts arise from the environmental effects which ranges from simple additive impacts to complex interaction of the stresses anticipated because of the proposed project.It occur when

- impacts on the natural and social environments take place so frequently in time or so densely in space that the effects of individual "impact" cannot be assimilated;
- the impacts of one activity combine with those of another in a synergistic manner.

Causes of environmental change also include natural variability and anthropogenic climate change. Four types of impact of mining are identified which compined to create regional impact.

1. **Space Crowding**-occurs when a system is disturbed by several similar activities, or by different activities producing a similar effect, in an area small to assimilate the combined impacts. (Rees 1995)
2. **Time Crowding**-occurs when impacts are so close in time that the impact of one action are not dissipated before the next occurs.(CEARC 1986)
3. **Interactive effects**- can be additive or compounding, reflecting the interactive nature of ecosystems. Additive is the simple linear addition of one impact on another, whereas compounding is when two or more agents combine to cause an impact. Antagonistic effects can also occur, where the combined impact of more than one agent is less than the sum of the individual impacts. (Canter and Kamanth 1995)

4. **<u>Indirect effects</u>**- are secondary impacts arising as a result of the direct effect, and include the impacts of activities facilitated by a project, including reasonably foreseeable impacts from downstream users.

This Chapter considers the regional impacts that would result from the combination of the Project and other actual or proposed future developments in the study Area.

4.0.2. Shadow projection of impacts:

In addition to the proposed projects the study Area may experience impacts as a result to the following developments:

1. Other functional or proposed mining projects.

   Table No.4.1. List of Projected mine leases falling within the study area-1

S. Nos.	District	Village	Number of mine leases
1.	Hamirpur	RiruwaBasariya	01
2.		Chikasi	06
3.		ChandwariGhuroli	05
4.	Jalaun	Nandha	02
5.		Kharka	02
6.		Sikrivyas	01
7.		Bandhauli	03

   Given above are the numbers of leases (20 leases) which are falling within the Study Area-1, other than the exisiting leases for which EIA study has been done in this report. These leases (20-projected + 11-existing leases) would be included in the Regional EMP of Study Area-1, as these projected 20 leases will have impact on the leases located towards the downwind direction. The cumulative impact of all the leases will be assessed and will be addresses in the Regional EMP given in Chapter 10.

2. Development of new roads
3. Strengthening of existing roads
4. Construction of new bridges or other infrastructural facilities

These developments may worsen or enhance the impacts identified.Given the limited information available regarding such future developments, the assessment that follows is necessarily of a generic (qualitative) nature and focuses on key issues and sensitivities, and how these might be influenced by cumulative impacts with other planned developments.

4.0.3. Management and mitigation of regional impacts

Managing cumulative effects in a Environmental Impact Assessment requires, as a start, the same type of mitigation and monitoring that would be recommended in an Environmental Impact Assessment for a stand alone mining project. Mitigating a local effect as much as possible is the best way to reduce regional effects. Mitigating and managing an individual project's impacts as far as possible, even when the project itself does not result in significant impacts, is an appropriate way to reduce impacts across a region. It is generally unreasonable to expect a single proponent however to bear the burden of mitigating effects attributable to other actions in the region. Such an approach can significantly disadvantage later projects and be a disincentive to investment. Ultimately, when threshold level of regional impacts required a broader intervention and mitigation of impact, impact assessment and regional environmental management plan comes into the picture. This may result in increased regulation of activities contributing to these impacts and regional collaborative initiatives. Following are specific management measures for mitigate and manage all impacts.

4.0.4 Shared Infrastructure

Proposed project will discuss and decide between them where possible, to share infrastructure (viz. access roads and transportation routes inside their project areas) to reduce the potential disturbance caused by installing several similar infrastructure in close proximity to each other.

4.0.5.Undertaking a Strategic Regional Environmental and Social Impact Assessment

In the context of this study, these examples of cumulative impacts are highly relevant as the river basins evaluated in this study contain very large numbers of mining operations as well as other forms of land use. In combination, therefore, there is a large potential for the impacts of mining operations to add to, or possibly even counteract, some of the impacts from these other activities. Keeping in mind the Environment Impact Assessment (REIA) (due to numbers of leases (11) on Betwa river in district Jalaun and Hamirpur, the environmental baseline scenario as detailed in Chapter 3 and the proposed mining activity described in Chapter 2) is attempted to assess the likely impact and its extent on various environmental parameters and likely mitigation measures to be adopted. An impact matrix has also been made for the REIA considering all vital parameters of the physical & biological parameters if nearby environment in relation to their significance.

Table No. 4.2 Impact of Sand Mining and Consequences.

	Main Impact	Consequences
Air	Increase level of air pollutants concentration	Human health risks
Flora and fauna	Habitat loss	Alteration on fish population
		Increasing level of weed infestation
	Physical disturbance of the habitat	Degradation of aquatic biota
		Alter number of animal species
	Vegetation is destroyed	Reduction of farmlands and grazing lands
Water	Increase water turbidity	Decrease plants photosynthetic activity
		Changes in nutrient parameters

	Main Impact	Consequences
		Disturbing feeding activity for different aquatic animal species
		Reduce light penetration and oxygen levels that can affect aquatic animals activities and composition of phytoplankton
		Affect spawning and hatching
		Affect aquatic animals respiration (Cause respiratory distress)
		Negative changes in fish population diversity and trends (major decline in population)
		Increase infections and death risk for aquatic animals
		Redistribution of fine particles in the water
	Increase soil and coastal erosion	Seawater intrusion
		Affect infrastructure projects
	Water quality deterioration	Increase water salinity
		Alteration of water sources
		Increase water treatment cost
	Water pollution	Affects the biodiversity

	Main Impact	Consequences
	Sinking and deformation of riverbeds and banks	Drying up wells around the river
		Lateral channels erosion and instability
		Negative effect on groundwater
		Waterways siltation
		Influence the uncertainty of the slope and levee
	Affects hydrological function	Change in water flows, flood regulation and marine currents
Soil	Decrease soil quality	Increase dark areas (fertile land became unfertile due to lowering groundwater levels)
		Changes in soil geochemistry (increase concentration of lead, arsenic, mercury, etc.)
	Soil erosion	Watercourses, wetlands and lakes pollution
Land	Landscape disturbance	Dramatically change of the landscape
		Deforestation
		Loss of bathing beaches
		Decrease sand reserve for natural beach storm response
	Mine-Induced	

	Main Impact	Consequences
	Seismicity	
	Structures stability	Damage of the public and private property.

4.1. IMPACTS OF MORRUM MINING

On a large scale, to carry out a REIA impacts of morrum mining can be broadly classified as given below:

4.1.1. Physical

The large-scale extraction of streambed materials, mining below the existing stream bed and the alteration of channel-bed form and shape may lead to several impacts such as erosion of channel bed and banks, increase in channel slope, and change in channel morphology.

4.1.1.2.Mitigation Measures

- Ultimate working depth shall be up to 3.0 m from Riverbed level and not less than one meter from the water level of the River channel whichever is reached earlier.
- The River Bed Mining (RBM) will be done in unsaturated zone. Thus no loss to habitat is anticipated.
- Dredging will not be allowed. Mining activities will be done using bar scraper and loader.
- The mining procedure will also be made to conform to the recommendations of MoEF& CC's Standard Environmental Conditions for Sand Mining mentioned in SSMMG, 2016.
- The e-tendering of the leases were done by DM, Jalaun and Hamirpur keeping in view the points like availability of minor mineral reserves, sites specific problem like

flooding, submergence crop lands/ fields, need of excavation rate of sediment deposition etc.

- RBM will be done in responsible manner.
- Head cutting will not be done.
- The RBM will be done in unsaturated zone.
- As per SSMMG, 2016, the required safety distances will be maintained when mining will be carried out near important structure like bridges, dam and other infrastructures to prevent any damage & bar skimming.

4.1.2.Land Environment

Theimpactonthelandformorphysiography willbelimitedtothemodificationoftheslope.The landscapeandlandusewillundergoaradicalchangeduetoopencastmining.Theimpactduring next5yearislimitedasbencheswillbeformedandwillbereplenishedduringmonsoon. Besides thesebenches,roadswillalsomodifythePhysiography.

Miningactivitycausesimpactonfloraand faunaduetolanddegradation,deforestation, etc.However, asthemining isrestrictedtoverysmall areaintheriverbedindry condition. Thereisnolikelihood ofanylanddegradationordeforestation being caused.Theimpactonlandusewillalsobelimited.Themining activityisrestrictedalongthe riverbedonly.Sincethesiteisgovernment ownedwasteland,noimpactonexistinglanduseis anticipated;alsotheminedareawouldgetreplenishedonarrivalofmonsoon everyyearitself.The impacts of mining on land environment are predominantly governed by the area acquired and land use characteristics. The satellite imagery on land use, discussed in Chapter 3 of baseline information should form the basis of impact prediction on land. Cost- Benefit analysis is also carried out to see the overall benefits the project will bring and the economic benefits the land is providing to the area are to be estimated. The potential impacts of mining on land and their significance are compiled hereunder and summarized in table 4.4.

4.1.2.3. Anticipated impacts and evaluation

The proposed morrum mining operations will have both positive and negative changes on the pre mining environmental and ecological status of the area. All mining companies proposed/ operating in the study area will require the good quality water for drinking. The water demand for sprinkling and plantation, when projected on the regional basis will be greater.

a.Impact on quantity and characteristics of top soil

The current REIA identifies the impact of 11morrum mining projects(inclusive of upcoming projects of B1-sub-category for which Public Hearing is awaited and B2- sub-category projects for which EC is awaited) in a stretch of River Betwa between **25°46'12.48"N & 79°19'13.34"E to 25°52'2.99"N & 79°46'49.50"E**. The project will be restricted to scraping and loading of morrum deposit. The lease areas proposed in REIA are deficient of top soil, so no loss of top soil is anticipated and non-plastic and having many vertical tubular pores. It appears that due to the mixing of different soil horizons during mining, the soil profile changed to a great extent (Ghosh, 1989). The particle size analysis reveals that sand particles increased, and silt and clay decreased with respect to unmined soil. This trend may be due to increased erosion of aggregates and consequently a high rate of infiltration. The soil dumps were found to be sandy loam in texture, and gradually changed to loamy sand after that period. The high bulk density of the soil dumps may be attributed to the use of heavy machinery. This has the high bulk density of the soil dumps may be attributed to the use of heavy machinery. This has a serious implication for subsequent changes in soil properties, because gaseous diffusion is made moredifficult. Thus, restrictions on growth of deep-rooted plants may be one of the reasons for stagnation of plant succession at the shrub stage. However, if any layer of soil is found beneath the surface during mining it will be utilized for strengthening the haulage route as it is not biologically active/ fertile.

b.Impact on soil quality of the surrounding area

Since it is RBM project, absence of topsoil in mining lease areas is observed, so no mitigation measures required.However, the following mitigation measures will be taken to prevent any impact on soil quality of the nearby areas due to operational aspects of the project:

- It will be ensured that the scraper and front-end loader are properly maintained.
- Equipments will be regularly serviced and inspected to make sure there are no leaks of oil, diesel, fuel, detergents or hydraulic fluids.
- Servicing and maintenance of vehicles as far as possible will occur outside of the boundaries of mining lease area. If maintenance does occur on site due to breakdown, all steps will be undertaken to avoid hydrocarbon spills/leakages.
- Under no circumstances will oil or diesel to be stored and disposed of at the site.
- No night parking of vehicles in the mining lease area.
- Vendors of UPPCB will be contracted for collection of hazardous waste (used oil) & oil spill kit will be provided with each vehicle.

c. Impact On Existing Land Use

These impacts may cause: (1) the undercutting and collapse of river banks, (2) the loss of adjacent land and/or structures, (3) upstream erosion as a result of an increase in channel slope and changes in flow velocity, and (4) downstream erosion due to increased carrying capacity of the stream, downstream changes in patterns of deposition, and changes in channel bed and habitat type. The mining activities will be restricted to the river bed only. Since the site is government owned waste land, no impact on existing land use is anticipated. Also, the mined area would get replenished on arrival of monsoon every year.

d. Impact of siltation in the morrum pits

Since it is RBM project, no over burden or waste will be generated during mining activity. Impact of siltation will be very low to Nil as there will be no pit formation due to use of bar scraper.

e.Impact on natural course of river/diversion of water flow due to bank erosion

The mining activities will be confined to the river bed only, hence will help the river to remain channelized also avoiding natural hazards like erosion, flooding etc. thus the impact is positive and significant.

f.Impact on riverine ecology

In the current REIA, dredging or instream mining is not proposed in any of the 11 leases(inclusive of upcoming projects of B1-sub-category for which Public Hearing is awaited and B2- sub-category projects for which EC is awaited). Hence, the impact on riverine ecology would be negligible. However, it has been found that during site visit some part of the few lease areas was submerged in the active water channel. In such condition, the depth of the mining in contrast with LOI will be increased in the dry mining area to meet out the production from the respective leases. Ultimate mining depth will be kept at 03 m from surface limiting above 1 m above water level of the river.

Riparian ecology includes the vegetative cover on and adjacent to the river banks. The mining activity will be confined to the river bed only. No vegetation is adversely affected.

g.Erosion potential and terrain: stability of river banks (which may lead to loss of chunks of land and make area flood prone)

Kondolf (1993) reported that in stream mining resulted in channel degradation and erosion, head cutting, increased turbidity, stream bank erosion and sedimentation of riffle areas. All these changes adversely affect fish and other aquatic organisms either directly by damage to organisms or through habitat degradation or indirectly through disruption of food web. Further, effects on stream geomorphology (e.g., channel incision) can result in infrastructure damage such as undermining bridge piers and exposure of buried pipeline crossings and water supply intake (Kondolf, 1997). The mining activity will be confined to the river bed only, hence will help the river to remain channelized also avoiding natural hazards like erosion, flooding etc. Thus, the impact is positive and significant.

4.1.3.Waste Dumps

This is RBM project, no drilling; blasting is proposed thus not involving any waste generation. The excavated material will be loaded and transported directly to the potential markets, not leaving any waste dumps behind. There may be incidental waste due to activities of mine workers which will be insignificant and provisions for dustbins will be available on site to collect the incidental waste.

4.1.3.1 .Mitigation Measures

- The Mineable reserves will be limited by
    a) Free space of 3 m or 10% of the channel width of the river from riparian zone.
    b) Bench height will be kept at max. of 0.6 m and width of minimum 10 m.
    c) Bench slope not more than of 30° from vertical axis.
    d) safety margins from civil structures for each site.
- The main stream will not be diverted to form inactive channels from mining.
- Mining below subterranean water will not be done.
- Riverbed mining will be carried out where maximum sedimentation occurs.
- Segments of breaded river will be used preferably for mining.
- Mining at the concave side of the river channel will not be done so that the bank erosion may not occur.
- Mining will be carried out at places where sediment aggregations are maximum.
- Mining will be restricted during the monsoon season and at the time of floods.
- Mining schedule will be synchronized with the river flow direction and the gradient of the land.
- Care will be taken to ensure that ponds are not formed in the river bed.
- Access roads from public roads and up to river bank will be selected in such a way that it would cause least environmental damage.

- Productive land will not be utilized for storage and other purpose.
- Siltation on agriculture land will be prevented.

4.1.4 Air Environment

4.1.4.1. Anticipated Impacts and Evaluation

Air pollution is likely to be caused at various stages of morrum mining operations such as excavation, loading, transportation and screening of material. If we look at regional level, dust generated during loading, unloading and transportation of morrum is the main pollutants of morrum mining operations of which cumulative impacts would be very significant. Most of the dust will be generated from loading, screening and transportation operations. This dust becomes air borne and gets carried away to surrounding areas. The impact on air is mainly localized in nature as the dust particles are not carried to longer distances due to larger size and the effect is felt within the core zone of the all 06 mining leases. But combined impact of air borne dust from the mining lease areas will definitely give a relatively larger picture of fugitive dust emission in the area. Also, loading, transportation and unloading operations may cause deterioration in air quality due to handling dry materials.

In the present case, only wet materials will be handled by suitable water sprinkling during loading & on haulage routes, thus eliminating problems of fugitive dust. Also, the collection and lifting of minerals will be done manually without any blasting. Therefore the dust generated is insignificant as compared to mining process of other hard minerals like the process of drilling, blasting, mechanized loading etc.

4.1.4.3. Air Modeling

In general, mining operations may generate airborne respirable dust, which leads to the development of respirable diseases in mine workers. The increasing trend of mining leads to release of huge amount of dust. These air borne dust particles, generally below 10 micron in size, are nuisance particulates and cause health hazards as an ill effect of mining activities. Mining activities like drilling, blasting, material handling and transport are a potential source of air pollution. Therefore, a detailed study on emission sources and quantification of pollutant concentration by means of dispersion modeling is required to access the environmental impact of a mine. On the basis of the predicted increments to air pollutant concentrations, an effective mitigation and environmental plan can be devised for sensitive areas. In case of river bed morrum mining, as there are no blasting and drilling activities, the impacts are caused by material handling and transportation activities of mostly wet morrum and are minimal.

4.1.4.4. Fugitive dust- modeling

Concentration of the fugitive dust was calculated using the empirical equations for unpaved roads published by USEPA- AP42. The Concentration of the fugitive Dust is given below:

$$\mathbf{C = (2/\pi)^{1/2} \ (E / \sigma z\ \upsilon)\ Exp\text{-}\ [(h^2) / (2\ \sigma z^2)] \times 10^6} \text{ --------------------------- } \mathbf{(2)}$$

Where

C = Concentration in microgram/ m3

E = Emission Rate = 0.012 g/sec/m

υ = Wind Speed =1 m/s

h = 1m

Modelling was done for an infinite line source assuming unpaved road. For conservative calculation wind was assumed to blow at a velocity of 1 m/s perpendicular to the road. For fugitive emission control, the uncontrolled emissions from various source ranges from 1,00,000 to 4,00,000 μg/m3 . As control efficiency of 95% could reduce this level to 5,000 to 20,000 μg/m3, close to source, measured at maximum 1 M distance. By applying Gaussian Model for neutral atmospheric conditions, the effect of SPM at different distance would be as mentioned below

For an average achievable SPM concentration value at source (<1Meter) of 10,000 microgram per cubic meter would have a projected SPM concentration in the range of 150 microgram per cubic meter at 30 Meter distance.

4.1.4.5. Mitigation Measures

During operational phase of mining, the only air pollution sources are fugitive dust emission due to movement, loading, unloading and transportation of minor minerals as drilling, blasting, crushing, DG Set/furnace or storage is not proposed at site. The following mitigation measures are suggested:

- Dust suppression measures like spraying/sprinkling of water on haulage route to keep the surface wet as well as during loading/ unloading of minor mineral.
- No overloading of the trucks/trolleys.
- Transportation of material in covered vehicles to prevent dust emission in case of long haulage or if the road passes through in close proximity to habitation.
- Provision of water spray on the dumper and roads to arrest fine dust before transportation.
- Suitable dust barriers in the form of green nylon curtains near excavation site.

4.1.5. Water Environment

4.1.5.1. Baseline Status

The source of water in the area is generally the ground water and rainwater. The River Betwa is one of the major flowing rivers of the district.Betwa River during its course from the source is joined by a number of sub-tributaries. As the proposed activity is a process involving scraping of morrum from the river bed & hence intersection of ground water does not arise.

4.1.5.2. Anticipated impacts and evaluation

During the mining operations, there will be no wastewater discharges to water bodies from the lease areas. The inflow of sewage or effluents from the surrounding locality is also considered nil as no temporary or permanent housing is proposed at mine sites. The only water contaminant is rainwater run-off during the monsoon season. There will be no impact due to the proposed mining on the water environment and the water flow pattern does not disturb the turbidity and velocity, hence no mitigation measures are suggested. There is no noticeable effect on surrounding ground water resource due to mining as the mining activity does not require ground water extraction. The collection of morrum is done on the river bed where excessive sedimentation has been noticed up to the required depth only. Excessivemining will reduce the thickness of the natural filter materials (sediments) through which the groundwater is recharged. The pollutants due to mining, such as washing ofmining materials, wastes disposal, diesel and vehicular oil lubricants and other human activities may pollute the groundwater. Dumping of fine material, compaction of filter zone due to movement heavy machinery and vehicles formining purposes may reduce the permeability and porosity of the filter material through which the groundwater is recharging, thus resulting in steady decrease of ground water resources.Deposition of silt on river bed can smother diatoms, benthic algae, macro-invertebrates and fish eggs. Composition of benthic and fish communities affected by changes in sediment texture and habitat loss arising from selective removal of fine aggregates from the river bed deposit. Many aquatic organisms, especially the benthos, are affected severely by sand mining. The organisms include different species of mayfly, dragonfly, chironomids, eaddisfly and other insects of the order Diptera. Sand mining can also negatively affect the survival and dispersal of benthic organisms belonging to the groups Polychaeta, Crustacea and Mollusca. Dispersal of eggs and larvae is an important aspect of the biological processes of aquatic organisms. In the fisheries point of view, loss of food in the form of benthic invertebrates is a major negative impact which will ultimately end up in the decline of inland fishery resource of the area.

The impact on the aquatic flora & fauna due to the proposed opencast mining is insignificant as mining involves only scraping of morrum from the river bed which will not disturb the aquatic life present in the river. The detrimental effects to biota resulting from bed material mining are caused by three main processes:

i. alteration of flow patterns resulting from modification of the river bed
ii. an excess of suspended sediment

iii. damage to riparian vegetation and in stream habitat

4.1.5.3. Impact on water level:-When mining is done in the sand pits above the ground water level, pit is not dewatered , no significant impact on ground water is observed. However when the mining is done from mining pit below the water table, mine altered the ground water flow direction in the sand and gravel deposits affecting the nearby ground water source for the area. Sand and gravel operations are found in deposits formed during the advance and retreat of glaciers and in alluvial floodplain deposits formed by streams. Both types of deposits often are critical ground-water aquifers and recharge areas in upland settings; they often are focused discharge zones in stream and river valleys where wetlands and springs depend on continued groundwater flows through the sand and gravel. Because sand and gravel deposits allow comparatively high infiltration rates and relatively rapid rates of water transfer within an aquifer, activities and land uses within and above granular aggregate can have negative effects on groundwater quantity and quality within aquifers. Excess esive dewatering in mines as shown in figure create the cone of depression surrounding the pit and the mergingof Aquifer 1 and Aquifer 2 water surfaces due to dewatering. The red arrows represent the ground-water flow under these conditions and approximate the hydraulic gradient, or water surface slope, of Aquifer 1. Because the potentiometric surface of Aquifer 2 has been reduced, the hydraulic gradient of Aquifer 1 is steeply sloping toward the pit. Groundwater flow paths, water table elevations, groundwater gradients and both surface- and ground-water basins can be altered by mining below the water table. Excavation of the pit below the water table can cause water levels to decline near the mine and downgradient of the mine. The effect is due to redirection of ground-water flow to the pond and then to the ditch system and is due to evaporation from the pond surface. The greatest potential for alteration of water levels and flow patterns occurs where mines intersect a water-yielding zone. The magnitude and arial extent of changes in water levels and flow patterns are dependent on many variables including

1. The arial extent of the flow system penetrated by the mine,
2. The thickness of the saturated interval penetrated by the mine,
3. The hydraulic head at the mine site,

4. the horizontal and vertical dtstnbution and magnitude of hydraulic conductivity and storage coefficient surroundmg the mine site,
5. the distance to and types of hydrologic boundaries,
6. the stze and shape of the mine cut,
7. the length of time the mine is in operation

4.1.5.3. **Increase in turbidity :-**Turbidity is the cloudiness or murkiness of water, which is an expression of the optical properties of water, which cause the light to be scattered and absorbed rather than transmitted in straight lines. It is therefore commonly regarded as the opposite of clarity (Wass*et al*., 1997). Turbidity impairs the suitability of the water for many purposes. High levels of mean turbidity in the mining and downstream sites is due to increased riverbed and bank erosion associated with sand mining which increases suspended solids in the water at the mining and downstream sites. Mining operation also release fine sand and small silt particles that are present in the stream. Silt particles (< 63 μm) can be transported over large distances by the river because of their small settling velocity (Kondolf,1994). Although water turbidity does not pose a serious problem to ground water since it is unable to migrate beyondthe immediate infiltration site, the continual infiltration of the turbid water does raise the potential for other sources of contaminant to migrate to the aquifer because it decreases the distance between the ground water table and land surface. In some cases, the excavation actually penetrates the shallow aquifers, leading a direct access to ground water (Despreze, 2000) mean depth of 3- 4 meters. Any chemical contaminants that are allowed to enter wash water or spills in the area would have quicker access to the aquifer. Once in the ground water, a chemical substance would be free tomove with the water in the aquifer. It should also be recognized that although it does not pose a threat to the health of water users, the impact of turbidity are many and include, its being as primary agent causing biological stresses; source of introduction ofabnormal volumes of organic material and nutrients and reintroduction of toxic substances uncovered by miningactivities thus increasing the biological oxygen demand (BOD), which in turn reduces oxygen levels. Also it hasbeen observed that sand mining operations reduce the buffering capacity of subsurface materials by removing thesoil layer from an area. The reduction in buffering capacity makes the groundwater sensitive to pH change (Borges, *et,al,*2002) . Other impact of turbidity is discoloration of water which more than anything renders goodwater appear bad.

4.1.5.6. Mitigation Measures

No mitigation measures are required as the project activity is carried out in the meandering part of the river bed; none of the project activities will affect the water environment or riparian habitats. In the projects, it is not proposed to divert or truncate any stream. No proposal is envisaged for pumping of water either from the river or tapping the ground water. Project Proponent will adhere to all guidelines and rules for proper and scientific method of mining during the period of extracting the morrum. Thus, the project activities shall not have any adverse effect on the physical components of the environment and therefore may not have any effect on the recharge of ground waters or affect the water quality.

4.1.6. Noise Environment

The proposed RBM project is predominantly semi-mechanized/OTFM, thus will generate very less noise, that too by the movement of vehicles as drilling blasting etc. are not proposed.

4.1.6.1. Anticipated impacts and evaluation

As there will be no heavy earth moving machinery hence there will not be any major impact on noise level due to the mining and other associated activities. A detailed noise survey has been carried out and results are discussed in Chapter 3. Drilling & Blasting technique is not required for morrum lifting, hence no possibility of land vibration. It is found that the mining activity will not have any significant impact on the noise environment of the region. The only impact will be due to transportation of materials by trucks/trolleys.

4.1.6.3.Traffic during operations

It is likely that mining companies will use the same main haul road to transport product out of the study area and through road networks. Although this will result in an increase in the number of trucks utilising the road, the actual predicted noise level will not increase; rather, the predicted road noise levels will become less intermittent.

4.1.6.4.Mitigation Measures

As the only impact is due to transportation of morrum though village roads, emphasis will be given on the following points:

- Haulage route for transportation of the excavated minor mineral will be opted & constructed away from the habitation, schools, hospitals & other social areas.
- Trucks which are newer or less than 15 years old having fitness certificate will be deployed for transportation of minor minerals after obtaining pollution under control certificate.
- Minimum use of horns in the village area will be promoted and silence zone (if any) will be marked as applicable.
- Care will be taken to produce minimum sound during loading.
- Labourers will be provided with personal hearing protection device i.e. ear plugs or ear muffs if required.

4.1.6.5.Traffic analysis of regional impact of additional traffic because of proposed projects

Significant cumulative impacts can arise due to emissions from vehicle exhausts and from dust dispersion lifted from unpaved road surfaces. Impacts at roadside sensitive receptors caused by the vehicles associated with the proposed projects are however predicted to be of negligible negative significance (post-mitigation). On this basis, where air quality standards are to be approached or exceeded, these impacts would likely arise from vehicles other than trucks from the proposed mining projects. Where unpaved access roads are used however, major adverse impacts associated with dispersion of dust and PM 10/PM2.5 can potentially occur. These effects can be especially significant if the same unpaved road is used by various mining company traffic.

The vehicular movement within the site is inevitable. However, during operation phase, this activity would not cause any significant impact on the ambient air quality. To ensure this traffic analysis is carried out by:

- visiting each and every mine site & finalizing the opted haulage route away from the habitation, schools, hospitals & other social areas.
- categorizing the paved & unpaved length & width of the haulage route for each mine site in the region.
- identifying the common haulage route for two or more leases in the stretch.
- calculating the no. of trucks to be deployed for transportation of excavated minor mineral.
- understanding the existing carrying capacity of the roads near to the project site and the connecting main roads in the area. Then depending on the capacity of the mine, the number of trucks that will be added to the present scenario will be compared to the carrying capacity.

The details regarding length of haulage route, daily production and no. of trucks to be deployed per day is given in the Table 4.1 below:

Table 4.2. Haulage route analysis & details of vehicular movement of leases falling in stretch of REIA

Project Proponent (s) & Name of Company (if any) & Residential Address	Gata No (s)/ Khand No (s) ,Village Tehsil/ District	Details of Production		Haulage Route Length (km)			
		Daily Production (cum/day)	No. of Trucks to be deployed for transportation/day	Description	Unpaved Length	Paved Length	Total Length
M/s Sanevin Infrastructure Private Limited	Khand No. 26/7, ChandwariGhurauli Sarila/ Hamirpur (36.437 ha)	2650	176	>8m wide road connected to SH 21 (Orai-Rath)	1	7.98	8.98

M/s Sanevin Infrastructure Private Limited	Khand No. 22/15, RiruaBasariya Sarila/ Hamirpur (24.291 ha)	1413	94	>7m wide road connected to MDR(Kalpi-DgawaRatha road) which is further connected to SH-21 (Orai-Rath)	2.4(SW) & 0.44(S)	1.19(SW) & 4.55 (S)	3.59 (SW) & 4.99 (S)
M/s Sanevin Infrastructure Private Limited	Gata No(s). 864/320, 865/320, Simiriya Orai/ Jalaun (27.53 ha)	1,502	100	>10m wide road connected to SH 21(Orai-Rath) which is further connected to NH 25(Kanpur-Jhanshi-Highway)	0.59	14.5	15.09
ShriAtikurRahman	Khand No. 22/14, RiruaBasariya Sarila/ Hamirpur (24.291 ha)	1413	94	>7m wide road connected to MDR(Kalpi-DgawaRatha road) which is further connected to SH-21 (Orai-Rath)	2.60 (NW) & 0.44 (S)	1.19 (NW) 4.55 (S)	3.79 (NW) & 4.99 (S)
M/s New Eoan Associates	Khand No. 26/3 ChandwariGhurauli Sarila/ Hamirpur (24.291 ha)	1766	117	>9m wide road connected to Pucca road which is further connected to SH-21 (Orai-Rath)	0.73	5.98	6.71
M/s Satyam Constructions*	Khand No.- 24/9, Chikasi Sarila/ Hamirpur (36.437 ha)	2649	176	>8m wide road connected to Pucca road which is further connected to SH-21 (Orai-Rath)	1.47	5.23	6.7
M/s Disha enterprises*	Khand No.- 24/14 ,Chikasi Sarila/ Hamirpur (36.437 ha)	2649	176	>7m wide road connected to Pucca road which is further connected to SH-21 (Orai-Rath)	0.65	2.4	3.05

M/s ShriShrikant Gupta*	Khand No. 24/13, Chikasi Sarila/Hamirpur (36.437 ha)	2649	176	>6m wide road connected to Pucca road which is further connected to SH-21 (Orai-Rath)	1.31	2.4	3.71
08 Leases		**16691**	**1109**		**11.63**	**49.97**	**61.60**
M/s HSM Holdings Private Limited	Khand No. 22/10, RiruaBasariya Sarila/ Hamirpur (24.291 ha)	1413	94	>8m wide road connected to MDR (Kalpi-DgawaRatha Road) which is further connected to SH 21 (Orai-Rath)	0.77	4.38	5.15
M/s Kanhaiyalal And Sons	Khand No. 03, Gata No. 1782, 1783, Muhana Orai/ Jalaun (8.906 ha)	324	22	>8m wide road connected to SH 21(Orai-Rath) which is further connected to NH 25 (Kanpur-Jhanshi-Hwy)	0.36	0.89	1.25
M/s Pratap Corporation*	Khand No. 9, BaderaKhalsa Sarila/Hamirpur (24.291ha)	1413	94	>6m wide road connected to SH 21(Orai-Rath)	1.57	6.76	8.33
Total **03 Leases-B2**		**3150**	**210**		**2.70**	**12.03**	**14.73**
Grand Total **11Leases-(B1+B2)****		**19841**	**1319**		**14.33**	**62.0**	**76.33**

***Upcoming B1- sub-category Projects for which Public Hearing is awaited and EC from SEAC for B2-sub-category projects is also awaited & granted.**

****(inclusive of upcoming projects of B1-sub-category for which Public Hearing is awaited and B2-sub-category projects for which EC is awaited)**

Table 4.3 : Existing Traffic Scenario & LOS

Road	V	C	Existing V/C Ratio	LOS
Near project site	60*	500	0.12	A
SH	306*	1500	0.20	B

NH	364*	2400	0.15	A

* Source: local survey

V= Volume in PCU's/hr C= Capacity in PCU's/ hr LOS- level of service

The existing Level of Service for State Highway-21 is "**B**" i.e. Very Good and for National Highway-25 is "**A**" i.e Excellent.

V/C	**LOS**	**Performance**
0.0 - 0.2	A	Excellent
0.2 - 0.4	B	Very Good
0.4 - 0.6	C	Good / Average / Fair
0.6 - 0.8	D	Poor
0.8 - 1.0	E	Very Poor

Note: As per the IRC standard- IRC: 106-1990, the capacity of SH and NH given on page no. 11 table-2 for arterial road/ Highways:

The State and National which will be used for carrying sand/morrum from mine lease sites to the nearest market are:

SH-21- Two Lane (2 way)

NH-25- Two lane (1 way);

4.1.6.6.During mine operation

Total extraction of morrum : 5456724 cum (as estimated in LOI)*

No. of working days in a year : 275

Total extraction/day : 19,842.6 cum

Truck Capacity : 15 cum

No. of trucks deployed/day : 1322.8 trucks (say 1323 trucks)

Working Hours per day : 12 hours

No. of trucks deployed/hr : 110.25 say 111 trucks

Increase in PCU/ hr : 222 (to and fro)

*(extraction inclusive of upcoming projects of B1-sub-category for which Public Hearing is awaited and B2- sub-category projects for which EC is awaited)

Table 4.4: Modified Traffic Scenario & LOS

Road	V	C	Existing V/C Ratio	LOS
Near project site	262	500	0.56	C
SH	572	1500	0.35	B
NH	630	2400	0.24	B

4.1.6.7.Results

From the above analysis it can be seen that the V/C ratio will be modified to 0.56 on roads nearby project sites/ village roads with LOS being "C" which is good. While for National Highway V/C ratio and State Highways will slightly be modified to 0.35and 0.24, respectively with unchanged LOS being "B" which is Very Good. So, the additional load on the carrying capacity will be affecting to a significant level.

4.1.6.8 Anticipated impacts and evaluation

Mining companies proposed in the area should collaborate and participate in a forum together with local authority, regional government and other key authorities so as to establish agreements regarding the use and maintenance of unpaved haul roads, the proposal of maximum plantation in the project area and in keeping the speed of all traffic using unpaved roads to below 20 kph.

4.1.6.9. Mitigation Measures

As such, there is the potential for cumulative noise impacts to arise as a result of potential noise contour overlap during the operational phases of all the proposed project and already functional mining projects in the study area. In this respect, proposed project proponent should collaborate with one another and participate in a forum so as to ensure that impacts (viz. overlapping noise impacts) are discussed and agreed and that (if necessary) appropriate mitigation implemented.

4.1.7. Biological environment

4.1.7.1. Anticipated impacts and evaluation

The mining activity will have insignificant effect on the existing flora and fauna. Data have been collected from various Government Departments such as forests, agriculture, fisheries, animal husbandry and various offices to establish the pre-project biological environmental conditions. There are no endangered species, wildlife sanctuary, wildlife corridors or eco-sensitive area near the core zone. The purpose of the project itself is to save the flora around the project area from river widening, excessive erosion and floods. It is found that the morrum mining activity will not have any significant impact on the biological environment of the region.

4.1.7.2.Impact On Biological Environment

Mining of River bed material will not cause any significant impact on the ecosystem of Betwa River. Given below are the expected impacts can be arise due to proposed project:

- Disturbance to avifauna migratory routes/nesting grounds/wild fauna, birds, reptiles
- Damage to Riparian ecosystem/wetlands
- Micro flora and fauna in upstream and downstream water
- Impact on route of domesticated fauna viz. cow , buffalo etc. of nearby villages
- Disturbance to Fisheries found in natural river water

4.1.7.3.Increased Habitat Loss and Disturbance of Wildlife

The proposed projects are in the river bed of River Betwa. While mining activities are largely restricted to dry river bed, the location of offices and accommodation are focussed in safety zone of mining lease. The area is alredy is under habitation and fragmentation in various places along its limited extent. The mining leases at these places were functional in past. Most of the faunal species present in the area are not listed as sensitive. No wildlife is reported or observed in the study area.

4.1.7.4.Widespread Human Influx

Each mining operation is expected to result in a large in-migration of people brought in to work there or attracted by potential opportunities there especially for peripheral employment oppertunities. An influx of people will lead to pressures on the environment in the form of fuel wood harvesting, increased demands for water, increased pressure on ecosystem services such as the harvesting of fruits and vegetables, and greater disturbance effects on existing faunal species. There may also be an increase in numbers of livestock. The environment has a very limited grazing capacity and has a slow recovery following degradation through overuse.

4.1.7.5.Mitigation Measure

The mining operation will have positive and long term impact on river environment. In order to prevent flooding or related natural hazards, the operation will result in excavation of excessive morrum deposits from points where the maximum sedimentation occurs.

Since the project site is a river bank, mining activities will not have any major impact on environment and since the deposits are replenished naturally no reclamation is proposed. There is no migratory route of birds or grazing route of domesticated animal is reported on or near mining lease, hence there will be no impact anticipated. Mining activity will be confined upto a required depth of 3m from ground level or 1m above river water level whichever is less. No mining activity will be carried out in river stream. Since it is a RBM project and mining will be done along the river bed only leaving the free spaces as specified. No impact on fisheries, spawning ground or riparian ecosystem is anticipated

Project proponent along with local/ regional government will workout the solutions to adverse impacts originated as a result of increased pressure on the environment.

4.1.7.6.Impact On Ecology Of The Area

Mining which leads to the removal of channel substrate, re-suspension of streambed sediment, clearance of vegetation, and stockpiling on the streambed, will have ecological impacts. These impacts may have an effect on the direct loss of stream reserve habitat, disturbances of species attached to streambed deposits, reduced light penetration, reduced primary production, and reduced feeding opportunities.

For thousands of years, morrum has been used in the construction of roads and buildings. Today, demand for morrum continues to increase. Mining operators, in conjunction with cognizant resource agencies, must work to ensure that morrum mining is conducted in a responsible manner.

Excessive and unscientific Riverbed morrum mining causes the degradation of rivers. Riverbed mining lowers the stream bottom, which may lead to bank erosion. Depletion of morrum in the streambed causes the deepening of rivers, and the enlargement of river mouths. Any volume of morrum exported from streambeds is a loss to a system.

It may also be a threat to bridges, river banks and nearby structures. Morrum mining also affects the adjoining groundwater system and the uses that local people make of the river and sometimes result in destruction of aquatic and riparian habitat through large changes in the channel morphology. Impacts include bed degradation, bed coarsening, lowered water tables near the streambed, and channel instability. These physical impacts cause degradation of riparian and aquatic biota and may lead to the undermining of bridges and other structures. Continued extraction may also cause the entire streambed to degrade to the depth of excavation.

Morrum mining generates extra vehicular traffic, which negatively impairs the environment. Where access roads cross riparian areas, the local environment may be impacted.

4.1.7.7. Mitigation measures

As the present mining will be done in a scientific manner as mentioned before, significant adverse impacts are not predicted; however the following mitigation measure will be taken to further minimize it.

- Re-suspension, turbulence, stream flow, channel substrate and associated species will be disturbed and could be lost due to mining. This loss of species is negligible in case of river bed mining as mining will be restricted to river bed only leaving the free space as per mining law.
- No mining will be done near to important structure like bridges, dam and others structures as per mining law. Safety distance as per SSMMG, 2016 will be maintained.
- No mining will be carried out during monsoons. This will minimize impact on aquatic life.
- Since it is a RBM project, it has no vegetation, therefore clearance of vegetation is not required.
- The mining activity will employ many vehicles (tractors/ trollies) to transport the morrum outside the mine to desired destination. Safe site/routes having less impact will be selected for transportation, all the vehicles will be employed for transportation purpose will be PUC certified.

4.1.7.8. Flora and fauna of riparian habitat

If morrum mining is done in an unscientific way, i.e. beyond the replenishment capacity, riverbed mining can have adverse effects at the mine sites. The fertile streamside land will be lost gradually and the wildlife in the riparian areas may start vanishing. Degraded stream habitats will result in loss of fisheries productivity, biodiversity, and recreational potential. Thus the severely degraded channels may lower the aesthetic value too.

All species require specific habitat conditions to ensure long-term survival. Native species in streams are uniquely adapted to the habitat conditions that existed before human began alterations. These have caused major habitat disruptions that favouredsome species over others and caused overall declines in biological diversity and productivity. In most streams and rivers, habitat quality is strongly linked to the stability of channel bed and banks. Unstable stream channels are inhospitable to most aquatic species. No dredging is proposed and hence there will be no possibility of sediments altering water quality.

Factors that increase or decrease sediment supplies often destabilize bed and banks and result in dramatic channel readjustment. For example, human activities that accelerate stream bank erosion, such as riparian forest clearing/ Riverbed mining cause stream banks to become net sources of sediment that often have severe consequences for aquatic species. Anthropogenic activities that artificially lower stream bed elevation cause bed instabilities that result in a net release of sediment in the local vicinity. Unstable sediments simplify and, therefore, degrade stream habitats for many aquatic species.

The most important effects of excessive and unscientific Riverbed morrum mining on aquatic habitats are bed degradation and sedimentation, which can have substantial negative effects on aquatic life. The stability of morrum -bed and morrum-bed streams depends on a delicate balance between stream flow, sediment supplied from the watershed, and channel form. Mining- induced changes in sediment supply and channel form disrupt channel and habitat development processes. Furthermore, movement of unstable substrates results in downstream sedimentation of habitats. The affected distance depends on the intensity of mining, particle sizes, stream flows, and channel morphology. Channel widening causes swallowing of the streambed, producing braided flow or subsurface inter gravel flow in riffle areas, hindering movement of fishes between pools. All such impacts can be reduced by following scientific mining practices and mitigation measures. All such impacts can be reduced by following scientific mining practices and mitigation measures.

4.1.7.9. Environmental Management Plan (Biological Environment)

Proper environmental management plan is proposed for “River Bed Material” mining project to mitigate the impact during the mining operation:

- Mining operation will be suspended during monsoon season.
- Mining operation will be carried out during day time only.
- No labour camps will be allowed on river bed.
- Prior to mining, short awareness program will be conducted for labours to make them aware about the finer nuances related to mining.
- If some casualty or injury to animal occurs, proper treatment should be given.
- No tree cutting, chopping, lumbering, uprooting of shrubs and herbs should be allowed.
- Corridor movement of wild mammals (If exists) should be avoided
- Care should be taken that noise produced during vehicles movement for carrying RBM materials are within the permissible noise level.
- No piling of RBM material should be done in agricultural areas.
- Care should be taken that no hunting of animals or collections of medicinal plant are carried out by labours.
- If wild animals are noticed crossing the river bed, it should not be disturbed or chased away, instead the labours should move away from their path.

4.1.8. Socio-Economic Environment

The proposed project will have direct and positive impact on socio-economic environment. The field survey conducted based on a social survey to understand the knowledge and the perception of the people living around the project area, gives a clear idea about the need for the project.

The project activities shall not have any adverse impacts on any of the common property resources of the village communities, as the morrum mine lease area is not being used for any purpose by any section of the society in this region. There is no R & R involvement in this project. There is no land acquisition in this project.

This activity will help raise the socio-economic status of the people who are directly and indirectly involved through primary direct employment of local workers to secondary employment through transportation. It has also come to light that if this activity is not activated, then the affected groups will tend to participate in other illegal activities. This project will provide employment to the people residing in vicinity people will to be benefited directly or indirectly by the project. Only local labour will be used for the proposed mining operation and no will be approximately 729 for all the mining leases in the riverbed of Betwariver in District Jalaun and Hamirpur.

4.1.8.1.Project induced in-migration

The proposed Project is expected to cause some in-migration into the study area and surrounds related to the arrival of opportunistic economic migrants and migrant labour. Other potential mining operations in the vicinity of the proposed Project may increase the scale and likelihood of this in-migration due to a perception that more benefits are available in the area. The presence of several mining Projects in the region is likely to increase the perceived desirability of the area for visitors, increasing the scale of in-migration. This increased in-migration is likely to contribute to in-migration related impacts.

4.1.8.2.Mitigation Measure

Capacity Building: Local administration along with the Project proponent will discuss and agree on a holistic approach to provide government with support and build the capacity of its staff to plan effectively for future development. Administrative capacity building could include training, provision of equipment and the provision of technical support (e.g. information technology support). The potential benefits may include improved local governance and greater efficiency in capacity development initiatives.

Increasing Human Capital among the Local Population: The residents of the study area will have access many of the potential benefits from economic activity related to the study area and other proposed mining developments. Increasing the capacity of the local population will allow for increased local benefits and increase the local resilience to potential in-migration related impacts. Early efforts to increase human resource capital through training and capacity building would assist in putting local inhabitants in a position to be employed or start business enterprises to service future developments.

Recruitment Alignment: Mining companies should agree a holistic approach to aligning recruitment strategies. This will help to ensure that there is a viable labour pool of local employees for companies and help to build the skills and experience of local people. Combined efforts to align the approach to recruitment will help to reduce or avoid potential inmigration.

The factors related to in-migration will be enhanced by the presence of mining projects in the area therefore collaboration in implementing measures to avoid and manage in-migration will boost the potential for successful implementation. This may include:

- Collaboration with the regional and local Government and other operators in the developing and implementation of a shared Environmental Management Plan
- Developing a shared approach to monitoring changes in specific baseline conditions related to in-migration. This would require the establishment of a shared monitoring capability to consider price inflation, demographics, changes in land cover and land use etc.

4.1.9. Increased risk of road traffic accidents

4.1.9.1. Impact

Existing vehicle traffic is not significant in the study area; local people tend to walk or use there personal vehicles to their destinations to transport their goods. Settlements tend to be located close to existing roads and children and livestock roam freely and are unsupervised. The proposed Projects will increase light and heavy vehicles using the local roads throughout the duration of the project period and during the life of mine. During operations, there will be 222 heavy vehicle movements per day related to YaraDallol BV leaving the processing site and travelling along the transport corridor to the market place, as well as returning. The anticipated number of light and heavy vehicles movements related to these other proposed mines is also taken into consideration; however, it can be assumed to be a significant number. The combined volumes of road traffic will place both human and livestock in danger of being injured or killed throughout the life of mine.

4.1.9.2. Mitigation Measures

Following are the proposed mitigate measures for potential cumulative impacts from other mining developers related to traffic accidents. A specialist and integrated Road Traffic Risk Assessment is considered to understand the cumulative risks related to proposed projects using the transport corridor to the market place. This assessment will assist in planning and coordination of road traffic reducing risks related to traffic accidents. Where possible all operators should consider the use of shared access roads that join a shared transport corridor.

4.1.10. Decreased Availability Of Water And Livelihood Impacts

4.1.10.1. Impact

Fresh water is a resource, which has a livelihood impact on resident of study area. If the ground water is being withdrawl, decrease in available groundwater resources may be observed. This could have adverse impacts on local communities. Without systematic management the unplanned and uncoordinatedabstraction of groundwater resources could contribute to water shortages andlivelihood impacts. The unmanaged cumulative effect of these operators could exacerbate the impacts on natural resources assessed for the proposed Projects.

4.1.10.2.Mitigation Measures

The measures described in the assessment of cumulative groundwater impacts will help to avoid or mitigate these impacts. Specifically establishing a regional water committee will help to manage the abstraction of groundwater.

4.1.11 Cultural heritage

4.1.11.1. Impact

In terms of cumulative impacts, the main concern for cultural heritage is the potential for a substantial increase in population within the larger region as people from neighbouring regions move into the study area in search of work. Increased population is usually accompanied by the expansion of existing settlements or the establishment of new settlements. As settlements expand or are established, new areas are impacted by building activity and it is likely that archaeological resources will be impacted by this increased activity. Population growth may also prompt the development of roads and other civil infrastructure with ground disturbing components, which will also likely impact archaeological sites. Increased traffic resulting from higher population density or other mining projects in the area could also generate additional vibration impacts.

4.1.11.2.Mitigation Measure

It is proposed that the residents of the study area will be educated about the region's important local heritage and what areas should be avoided when choosing new places to build or expand communities.

4.1.12 Visual and landscape character

4.1.12.1. Impact

Proposed mining leases and the leaseswhich will be come up in future increase will caused impacts on the surrounding landscape and visual receptors/amenity during the operational phases, including:

- Landscape Impacts – the presence of additional development will increase the impact on the open desolate character of the surrounding landscape.
- Visual Impacts – the presence of additional infrastructure along with other mining leases in the area will increase the visual impact from receptors in relative proximity, and will also experience a greater visual impact although this is unlikely to result in significant cumulative effects.

4.1.12.2. Mitigation Measure

Project proponents of the study area will collaborate the potential to share infrastructure is discussed (*viz.* access roads and transportation routes).

4.1.13. Occupational health

There is no environmental pollution due to the proposed mining as it is proposed to be a mainly semi-mechanized/OTFM mining for extraction of morrum on the banks of River Betwa. Hence there will be no major occupational health hazards. The villagers avail medical facilities from the nearest public health centre locally and for specific treatments & health assistance they avail facilities from Govt. hospital located at district level.

4.1.13.1. Anticipated Health Impact

A health survey showed that the effect on public health will be primarily due to emanation of dust & smoke from the haulage of transport vehicles in the buffer zone. On continuous exposure to the proposed activities certain occupational health hazards are anticipated:

- Fungal infection of the hands and legs due to constant contact with the wet morrum.
- Due to lack of personal hygiene water borne diseases are also envisaged to the workers.
- Continuous exposure to morrum dust can lead to silicosis, Silica tuberculosis other pulmonary diseases.

Proposed mining activity may not pose any adverse health hazard to the people in & around the area as healthy mining practices are carried out during the course of mining and the activities are restricted to excavation of permitted volume in Environmental clearance. Further no one is residing in the core zone and regulatory restriction for the inhabitation will be maintained.

4.1.13.2Mitigation Measures

An inventory of the risks involved during the proposed project would be delineated with the measures to mitigate the same and the same would be ensured to the people by conducting an awareness program in the surrounding areas. Other mitigation measures are given below:

- Mining activities will be carried out semi-mechanized/ OTFM using bar scraper and loader only.
- Laborers will have access to basic first aid (first aid box) facility on site.
- Awareness on safety and ensure using of personal protective equipments (PPE) by workers like gloves, helmets, boots ear plugs and ear muff etc. to avoid injuries.

- The workers will be trained on using personal protective equipments as a precautionary measure & thereby preventing any infectious diseases.
- Workers will be periodically made aware of health & safety and various other risks.
- Special emphasis to the women health regarding the pre-natal and post-natal care will be looked into which is very much neglected in the rural areas.

Table. No. 4.5. Anticipated Impacts and proposed Mitigation measures

Source: Consultant Analysis/ Findings

SL. NO.	IMPACTS	POSSIBLE IMPACTS						PROJECT SPECIFIC IMPACTS	MITIGATION MEASURES
		TYPE	NATURE	MAAGNITUDE	TIMING/DURATION	SIGNIFICANCE	REVERSIBILITY	SIGNIFICANCE	
OPERATIONAL PHASE									
LAND ENVIRONMENT									

1.	Impact on existing land use	+ve	Direct	High	Short term/temporary	Significant	Reversible	Long Term	Mining will be done as per the mining plan in the designated lease area from government for a period of five years up to the required depth only and will be confined along the river bed only. Thus, there will be no impact on existing land use as the mined area gets replenished every year during monsoon season
2.	Quantity and characteristics of top soil	Nil	Nil	Nil	Nil	Nil	Nil	No impact	Since it is a RBM project, does not involve removal of Top soil.
3.	Erosion potential and terrain	Nil	Nil	Nil	Nil	Insignificant	Nil	Least significant	Mining activities will be confined along the river bed.
4.	Excavation of Pits in mine lease area	Nil	Nil	Nil	Nil	Nil	Nil	Least significant	There will be no pits.Sand will be scrapped. The mine section will be backfilled on arrival of Monsoon every year itself.
5.	Waste dumps	NA	NA	NA	NA	Insignificant	NA	Significant	It is a morrum mining project, no waste generation is anticipated. Workers will also be hired locally to avoid permanent housing at site, thus the MSW waste generation is also Nil.
6.	Agricultural land and productivity	-ve	Indirect	NA	NA	NA	NA	Insignificant	Productive land will not be utilized for storage and other proposes. Siltation on agriculture Land will be prevented. Garland drain system will be provided to prevent excessive runoff from mine site.

AIR ENVIRONMENT									
1.	Fugitive dust emission due to movement, loading , unloading and transportation of minor minerals	-ve	direct	mode rate	Short term/tem porary	Significant	Irreversibl e	Short Term/ Insignificant	Dust suppression measures like spraying/sprinkling of water to keep the surface wet and provision of the dust barriers. Overloading of the trucks/trolleys will not be done. Transportation of sand/ morrum will be in covered vehicles to prevent fugitive dust emission. The road will be properly maintained.
2.	Blasting and Drilling	NA	NA	NA	NA	NA	NA	No Impact	Not proposed
3.	Boiler/DG Set/furnace	NA	NA	NA	NA	NA	NA	No Impact	Not proposed
WATER ENVIRONMENT									
1.	Interruption in natural Drain	+ve	direct	hig h	Long term/tem porary	Significant	Reversibl e	Positive Direct Impact	RBM mining will maintain the natural course of River. In this project it is not proposed to truncate or divert any stream.
2.	Impact on surface water source	+ve	direct	hig h	Long term/tem porary	Significant	reversibl e	Positive Direct Impact	The main stream will not be diverted to form inactive channels from mining. Mining will remove excess deposits and deepen river bed which will prevent flooding and related problems.
3.	Impact on ground water source	Nil	Nil	Nil	Nil	Nil	Nil	No Impact; ground water extraction is not proposed	The workers will be hired locally, drinking water demand will be met by providing earthen pots or private tankers at site for 50-52 labourers. Thus there will be no extraction of ground water. Mining will be restricted to

									max.depth of 3 m from the ground level or/ 1m above water level whichever is less.
4.	Impacts on Riparian vegetation and stream habitat	+ve	Direct	Low	Short term/temporary	significant	Irreversible	Insignificant with proposed mitigation measures	Project activity will be carried out along the river bed only leaving free space as specified, thus do not affect water environment and riparian habitat.
NOISE ENVIRONMENT									
1.	Movement of vehicles	-ve	Indirect	low	Short term/temporary	Significant	-	Insignificant with proposed mitigation measures	Newer vehicles less than 15 year old will be used for transportation. PUC certificates shall be obtained. Labourers will be provided with personal hearing protection device. Noise & dust barriers among areas of heavy vehicular movement and excavation site.
BIOLOGICAL ENVIRONMENT									
1.	Disturbance to avifauna migratory routes/nesting grounds/wild fauna, birds, reptiles	-ve	Indirect	low	Nil	Insignificant	Nil	No Impact	Mining activities will be restricted to daytime only and along the riverbed. No Migratory routes are identified within the stretch.
2.	Damage to Riparian ecosystem/wetlands	-ve	Indirect	Low	Nil	Significant	Nil	No Impact	Mining activities will be restricted along the riverbed and mining will be done upto the 3m/ 1m above water level

									whichever is lesser.
3.	Micro flora and fauna in upstream and downstream water	-ve	indirect	High	Short term/Temporary	Significant	Nil	Insignificant	The main stream will not be diverted to form inactive channels from mining. Mining below subterranean water will not be done.
4.	Impact on route of fauna	Nil	Nil	Nil	Nil	Nil	Nil	No Impact	It is river bed plain thus do not serve any grazing land for grazing animals.
5.	Disturbance to Fisheries found in natural river water	-ve	indirect	Moderate	Short term/Temporary	Significant	Nil	Insignificant	Mining will be confined along the river bed. Main river course will not be disturbed.
SOCIOECONOMIC ENVIRONMENT									
1.	Generation of employment opportunities	+ve	direct	high	Short term/temporary	Significant	Reversible	Positive significant	The proposed project will generate employment opportunities to all the section of people, locally.
2.	Increase in aesthetic conditions	+ve	direct	high	Long term/ permanent	Significant	Reversible	Positive significant	Will improve the livelihood condition of the nearby areas by providing employment opportunities.
3.	Occupational Health	-ve	direct	Moderate	Short term/temporary	Significant	-	Insignificant with proposed mitigation measures	Mining activities will be carried out semi-mechanized/ OTFM using bar scraper and loader only. Laborers will be provided with onsite basic first aid (first aid box) facility on site. Awareness on safety and ensure using of personal protective equipments (PPE) by workers

									like mask and glasses.
4.	R & R	-	-	-	-	-	-	No Impact	NA

Table. No. 4.6 . EMP for General Project Impacts

Activity	Issue	Duration / Extent	Magnitude	Action with Key Riders	Responsibility
Laborers activity	Consumption of water and discharge of sewage	Temporary	Low	labourers will be required, which will be hired locally, rest shelters and portacabins are proposed.. Drinking Water supply will be provided by way of Private tankers and earthen pots at site.	Contractor
	Generation of solid waste	Temporary	Low	It is a morrum mining project, no mine waste generation is anticipated. Workers will also be hired locally. Uncontrolled dumping will be discouraged. Dustbins shall be provided onsite to collect domestic waste generated. MSW management is given due consideration.	Contractor
	Risks to occupational health and safety	Temporary	Moderate	Mining activities will be carried out semi-mechanized/ OTFM using bar scraper and loader only. Onsite first-aid and primary medical facilities will be provided during operation period. Personal protective equipments will be used. Training and awareness programs related to significance and use of protective gear will be imparted to the	Contractor

Activity	Issue	Duration / Extent	Magnitude	Action with Key Riders	Responsibility
				workers.	
	Possible transmigration	Temporary	Moderate	The contractor will be encouraged to give preference to local labour in the region.	Contractor
Earth Movement	Induced soil erosion, loosing of productive top soil.	Nil	Nil	Mining will be done as per the mining plan in the designated lease area from government for a period of five years upto the required depth only and will be confined along the river bed only. No impact as the mined area gets replenished every year during monsoon season. Since it is a RBM project, availability of top soil is very rare. Precautionary measures as the covering of vehicles will be taken to avoid spillage during transport of borrow materials. The unpaved surfaces used for the haulage of borrow materials will be maintained properly. The haul roads and borrow areas will be managed and maintained by the contractor. Since dust is the only impact along the haul roads, sprinkling of water will be carried at least once or twice a day depending upon the weather.	
Onsite activity	Extraction of natural resources such as morrum	5 years	Negligible	No impact as the mined area gets replenished every year during monsoon season.	Contractor
	Noise generation due to the movement of Vehicles	Temporary	Moderate	No heavy machinery is proposed for the extraction of morrum, mining activities will be carried out semi-mechanized/ OTFM using bar scraper and loader only.	Contractor

Activity	Issue	Duration / Extent	Magnitude	Action with Key Riders	Responsibility
				Noise generated due to movement of vehicles will be managed by the use of vehicles which are less than 15 years old and after obtaining the pollution under control certificate. Also silence zones will be demarcated and noise barriers will be put accordingly. Labourers should be provided with personal hearing protection device (if required).	
	Air emissions	Temporary/ Short Term	Moderate	The dust emissions will be minimized by following the good practices, for example, water sprinkling, provision of noise barriers, etc. Overloading of the trucks/trolleys should not be done. Suitable dust barriers shall be proposed.	Contractor

CHAPTER- V

ANALYSES OF ALTERNATIVES

S. NO.	CONTENTS
5.1	EXCAVATION METHODS AS PER SUSTAINABLE SAND MINING GUIDELINES 2016
5.2	OTHER POPULAR METHODS
5.3	ACCEPTIBILITY OF VARIOUS MINING METHODS FOR SUSTAINABLE MINING
5.4	WHY BAR SKIMMING/SCALPING
5.5	ANALYSIS OF ALTERNATIVE SITE

5.1 EXCAVATION METHODS AS PER SUSTAINABLE SAND MINING GUIDELINES 2016

The important methods of sand and gravel mining operations are as below:

a) Bar scalping or skimming

Bar scalping or skimming is extraction of sand and gravel from the surface of bars. This method generally requires that surface irregularities be smoothed out and that the extracted material be limited to what could be taken above an imaginary line sloping upwards and away from the water from a specified level above the river's water surface at the time of extraction (typically 0.3 - 0.6 m (1-2 ft). Bar scalping is commonly repeated year after year. To maintain the hydraulic control provided to upstream by the Riffle head, the preferred method of bar scalping is now generally to leave the top one third (approximately) of the bar undisturbed, mining only from the downstream two-thirds.Bar skimming involves scraping off the top layer (of variable thickness) from a gravel bar without excavating below the summer water level (Kondolf, 1994b). Bars are temporary storage features in which sand and gravel pass through. Controlled bar skimming is a recommended sand extraction method in most of the developing countries as a means for achieving stream resource conservation while sustaining the extraction industry. Bar skimming is somewhat a controlled type of sand extraction. Usually, bar skimming would be done above the water table and within a minimum width buffer that separates the excavation site from the low flow channel and the adjacent active channel bank. bar skimming consisting of removing all the material in a gravel bar, to which must be added floodplain pit mining. However, some authors recognise this practice as a benefit in aggrading channels . Bar scalping (or “skimming”) is extraction of gravel from the surface of gravel bars. Historical scalping commonly removed most of the gravel bar above the low flow water level, leaving an irregular topography. It is typically require that the bar, which originally would typically have a steep margin and relatively flat top, be left after scalping with a smooth slope upwards from the edge of the low water channel at a 2 percent gradient) to avoid stranding fish in shallow holes after high flows that inundate the bar. Bar scalping is commonly repeated year after year. To maintain the hydraulic control provided to upstream by the riffle head, the preferred method of bar scalping is now generally to leave the top one-third (approximately) of the bar undisturbed, mining only from the downstream two-thirds.Bars are temporary storage features in which sand and gravel pass through. Controlled bar skimming is a recommended sand extraction method in most of the developing countries as a means for achieving stream resource conservation while sustaining the extraction industry. Bar skimming is somewhat a controlled type of sand extraction Usually, bar skimming would be done above the water table and within a minimum width buffer that separates the excavation site from the low flow channel and the adjacent active channel bank.Sand and gravel mining 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 (Sreebha, 2008).Bar skimming or scalping requires scraping off the top layer from a gravel bar without excavating below the summer water level. Bar skimming or "scalping" should only be allowed under restricted conditions:

- Sand/gravel should be removed only during low flows and from above the low-flow water level.
- Berms and buffer strips must be used to control stream flow away from the site (Hill & Kleynhans, 1999).

In-stream gravel mining involves the direct removal of streambed sediments by heavy equipment, usually conducted during low water, resulting in a local depression in bed profile.

During subsequent high flows, bed material transported from upstream is deposited in this pit, depriving downstream reaches of bedload sediment supply, potentially inducing incision downstream of the gravel mine. In addition, the upstream end of the pit is a knickpoint in the bed profile, and this knickpoint typically migrates upstream, inducing incision upstream of the gravel mine as well (Kondolf 1993) In bar skimming, there is need for strictly limiting gravel removal quantities so that recruitment and accumulation rates are sufficient to avoid extended impacts on channel morphology and fish habitats (Kondolf, 2007). Lawal (2011) recommended the use of abandoned stream channels on terraces, inactive floodplains and deltas as the best sources of gravel and sand. He noted that gravel pits on floodplain should not go deeper than water table. Bar scalping are viewed as less deleterious to the aquatic environment since they do not cause immediate turbidity impacts or direct egg mortality.

Sand and gravel mining could be extracted from the downstream of the sand bar atriver bends. Retaining the upstream one to two thirds of the bar and riparian vegetation is accepted as a method to promote channel stability. Retaining the upstream one to two thirds of the bar and riparian vegetation whileexcavating from the downstream third of the bar is accepted as a method to promotechannel stability and protect the narrow width of the low flow channel necessary forfish. Sand and gravel would be re-deposited in the excavated downstream one to twothirds of the bar (or downstream of the widest point of the bar) where an eddy would
Form during sediment transporting flows. Riparian vegetation performs several functions essential to the proper maintenance of geomorphic and biological processes in rivers. It shields river banks and bars from erosion.

TableNo.5.1. Comparative study of various mining methods:

S.No.	Method	Advantages	Disadvantages
Trenching			• Potential introduction offines. • Potential low flowchannel diversion. • Potential fishstranding. • Poor fish habitatvalue. • Potential bed loadsink. • In non-

			aggradedchannels, can resultin head cutting,bank erosion,turbidity.
Bar skimming		Ideally, self-replenishing If within replenishment capacity following impacts can be negate 1. Channel Confinement 2. Channel widening and swallowing 3. Potential braiding 5. Potential channel Degradation 6. Increased bank heights. 7. Lowering of groundwater table. 8. Loss of riparian vegetation.	
Pit mining			• Stream capture. • Fish stranding.
Extraction from meander scars, high terraces		potentially limited direct impacts on fish	Channel shifts may result in streamcapture. Potential fishstranding. "Permanent" land use change.

b) Dry-Pit Channel Mining

Dry-pit channel mines are pits excavated within the active channel on dry intermittent or ephemeral stream beds. Dry pits are often left with abrupt upstream margins, from which head cuts are likely to propagate upstream.

c) Wet-Pit Channel Mining

Wet-pit mining involves excavation of a pit in the active channel below the surface water in a perennial stream or below the alluvial groundwater table.

d) Bar Excavation

A pit is excavated at the downstream end of the bar as a source of aggregate and as a site to trap sand and gravel. Upon completion, the pit may be connected to the channel at its downstream end to provide side channel habitat.

e) Channel-wide River bed Mining

In rivers with a highly variable flow regime, sand and gravel are commonly extracted across the entire active channel during the dry season. The bed is evened out and uniformly (or nearly so) lowered.

5.2OTHER POPULAR METHODS

5.2.1 Bucket-Plow Method Of Sand Mining

One of the most popular methods of riverbed sand mining is extraction of the sand with help of hydraulic excavators which operates with an assembly of a steel bucket which is driven by hydraulic pressure. This method of mining is sometimes also used to lifting up the instream bottom sediments which is referred as dredging. In other words, dredging is an excavation activity usually carried out underwater, in shallow seas or freshwater areas with the purpose of gathering up bottom sediments and widening with help of a bucket. This technique is often used to keep waterways navigable and creates an anti-sludge pathway for boats.

A bucket (also called a scoop to qualify shallower designs of tools) is a specialized container attached to a machine, as compared to a bucket adapted for manual use by a human being. It is a bulk material handling component.

The bucket has an inner volume as compared to other types of machine attachments like blades or shovels.The bucket could be attached to the lifting hook of a crane, at the end of the arm of an excavating machine, to the wires of a dragline excavator, to the arms of a power shovel or atractor equipped with a backhoe loader or to a loader, or to a dredge. The name "bucket" may have been coined from buckets used in water wheels, or used in water turbines or in similar-looking devices.

5.2.2 Trenching Method of Mining

Trenches are usually employed to expose steep dipping bedrock buried below shallow overburden, and are normally dug across the strike of the rocks or mineral zone being tested. Excavation can be either by hand, mechanical digger, or by bulldozer on sloping ground. Excavated depths of up to 3.0 m are common.

5.2.3 Pitting Method of Mining

Pitting is usually employed to test shallow, extensive, flat-lying bodies of mineralization. An ideal example of this would be a buried heavy mineral placer. The main advantage of pitting over a pattern-drill programme on the same deposit is that pits are capable of providing a very large volume sample. Large sample sizes are necessary to overcome problems of variable grade distribution, which are a characteristic feature of such deposits. In areas where the ground is wet, or labour is expensive, pits are best dug with amechanical excavator. Pits dug to depths of 3 m are common and with large equipment excavation to 6 m can be achieved. In wet, soft ground any pit deeper than 1 m is dangerous and boarding must be used. Diggers excavate rapidly and pits 3 m deep can be dug, logged, sampled, and re-filled within an hour. In tropical regions, thick lateritic soil forms ideal conditions for pitting and, provided the soil is dry, vertical pits to 30 m depth can be safely excavated.

5.3 Acceptibility of various mining methods for Sustainable Mining:

Table No. 5.2.Acceptibility of Mining Method for sand

METHODS	Acceptibility of method
Bar Skimming	√
Dry Pit Channel Mining	X
Wet Pit Channel Mining	X
Bucket Plow method	X
Trenching Method	X
Pitting Method	X

Bars are temporary storage features in which sand and gravel pass through. Controlled bar skimming is a recommended sand extraction method in most of the developing countries as a means for achieving stream resource conservation while sustaining the extraction industry. Bar skimming is somewhat a controlled type of sand extraction Usually, bar skimming would be done above the water table and within a minimum width buffer that separates the excavation site from the low flow channel and the adjacent active channel bank. Sand and gravel mining 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 .Bar skimming or scalping requires scraping off the top layer from a gravel bar without excavating below the summer water level. Bar skimming or "scalping" should only be allowed under restricted conditions.

5.4 WHY BAR SKIMMING/SCALPING

- Sand/gravel should be removed only during low flows and from above the low-flow water level.
- Berms and buffer strips must be used to control stream flow away from the site

Instream gravel mining involves the direct removal of streambed sediments by heavy equipment, usually conducted during low water, resulting in a local depression in bed profile. During subsequent high flows, bed material transported from upstream is deposited in this pit, depriving downstream reaches of bedload sediment supply, potentially inducing incision downstream of the gravel mine. In addition, the upstream end of the pit is a knickpoint in the bed profile, and this knick point typically migrates upstream, inducing incision upstream of the gravel mine as well In bar skimming, there is need for strictly limiting gravel removal quantities so that recruitment and accumulation rates are sufficient to avoid extended impacts on channel morphology and fish habitats. . Bar scalping are viewed as less deleterious to the aquatic environment since they do not cause immediate turbidity impacts or direct egg mortality.

Sand and gravel mining could be extracted from the downstream of the sand bar atriver bends. Retaining the upstream one to two thirds of the bar and riparian vegetation is accepted as a method to promote channel stability. Retaining the upstream one to two thirds of the bar and riparian vegetation whileexcavating from the downstream third of the bar is accepted as a method to promotechannel stability and protect the narrow width of the low flow channel necessary forfish. Sand and gravel would be redeposited in the excavated downstream one to twothirds of the bar (or downstream of the widest point of the bar) where an eddy would
form during sediment transporting flows. Riparian vegetation performs several functions essential to the proper maintenance of geomorphic and biological processes in rivers. It shields river banks and bars from erosion.

5.5 **ANALYSIS OF ALTERNATIVE SITE**

The site selection is based on the following points :

Appropriate extraction sites are locations chosen based on knowledge of the local rate of aggradation or scour, a site-specific determination of channel stability and bank erosion and evaluation of riparian resources.

Site-specific evaluation is needed to evaluate each proposed operation to minimize disturbance and maximise stability of channel.

In-stream extraction sites should be located where the channel loses gradient or increases in width, and deposition occurs unrelated to regular bar-pool spacing in channel. Particular sites may include sites upstream of a bedrock constriction or backwater, or at deltas created near confluences.

Identification of sand mining blocks:-

Identification of sand block is one of the important activities in sand mining. The department should estimate the demand of the particular district and State and hence come out with the requirement of further allotment. Based on the requirement, the process of identification of sand reaches should be taken up by the relevant department responsible for sand mining in the State. The relevant department/ person needs to obtain the Khasra map of the area and conduct a spot inspection and confirm from other departments regarding availability of area to check if the area is not reserved for some other purpose and can be allotted for sand mining. Further, if the inspector finds that the block is not lying in the restricted zone based on the above parameters and that the area is available for sand extraction, the area should be presented for e-auction. The sand mining area is allotted only through e-auction process, so alternative site analysis is not opted and no other NOCs are required.

It is not applicable because the lease area is e-auctioned and granted to lessee for sand excavation by District Magistrate. So no alternative site is analysed for the project.

CHAPTER- VI

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6.1	INTRODUCTON
6.2	MONITORING SCHEDULE & PARAMETERS
6.3	MEASUREMENT METHODOLOGY
6.4	IMPLEMENTATION OF ENVIRONMENT MONITORING PLAN
6.5	ENVIRONMENTAL POLICY
6.6	STANDARD OPERATING PROCEDURES FOR REPORTING OF NON-COMPLIANCE OF EIA CONDITIONS:
6.7	CO-ORDINATION WITH DISTRICT MAGISTRATE & RO, UPPCB FOR MONITORING PLAN.

ENVIRONMENTAL MONITORING PROGRAMME

6.1 INTRODUCTON

Regular monitoring of environmental parameters is of immense importance to assess the status of environment during project operation. The knowledge of baseline conditions & the monitoring program will serve as an indicator for any deterioration in environmental conditions due to operation of the project. A proper prior monitoring plan will lead to better understanding of impacts of project on environment and thus a sound mitigation plan can be furnished. This Environmental monitoring programe will be done through NABL accrediated lab.

6.2 MONITORING SCHEDULE & PARAMETERS

Table No. 6.1. Monitoring Schedule

S.N.	POTENTIAL IMPACT	PARAMETERS	FREQUENCY OF MONITORING	LOCATION
1.	Air Emission	PM10, PM2.5, SOx, NOx, CO & SIO2	As per CPCB/MoEF&CC requirements i.e. 24 hourly monitoring for one month in each season except monsoon.	Total 15 Monitoring Stations in and around Core Zone.

2.	Noise	Spot Noise level recording Leq (day), Leq (night)	periodic/As per CPCB norms i.e. quarterly	Total 15 Monitoring Stations in and around Core Zone.
3.	Water Quality	Ground Water Surface Water	once in each season except monsoon	Total 16 sampling sites including 09 GW & 07 SW (Upstream & Downstream)
4.	Soil Quality	Physical & Chemical Parameters	once in each season except monsoon	Total 09 Sampling Sites in and around Core Zone.
5.	Traffic	No. of vehicles	For all 10 mining leases.	
6.	Health	Total Health Parameters	Initial Medical Examination & Periodic Medical Examination	All employees

<u>Table No 6.2. Total no. of monitoring stations.</u>

S.N.	**POTENTIAL IMPACT**	**Total Monitoring Stations**
1.	Air Emission	15
2.	Noise	15
3.	Water Quality Surface Ground	 07 09
4.	Soil Quality	09
Total Monitoring Stations		**55**

TOTAL MONITORING STATIONS = 55

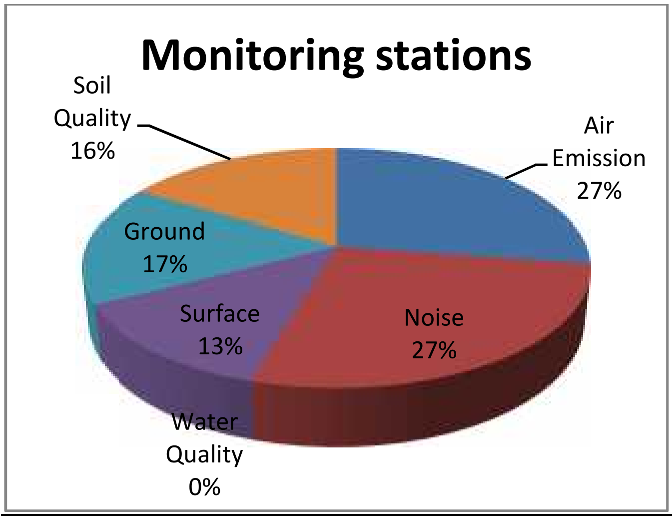


Fig 6.1 Distribution of Monitoring locations.

JUSTIFICATION OF MONITORING STATIONS

Monitoring stations for ambient air quality have been placed keeping in mind the prominent downwind direction of wind blow and for water sampling locations (surafece+ ground) according to any point sources of effluents/discharges into the river and aquifers, if any.

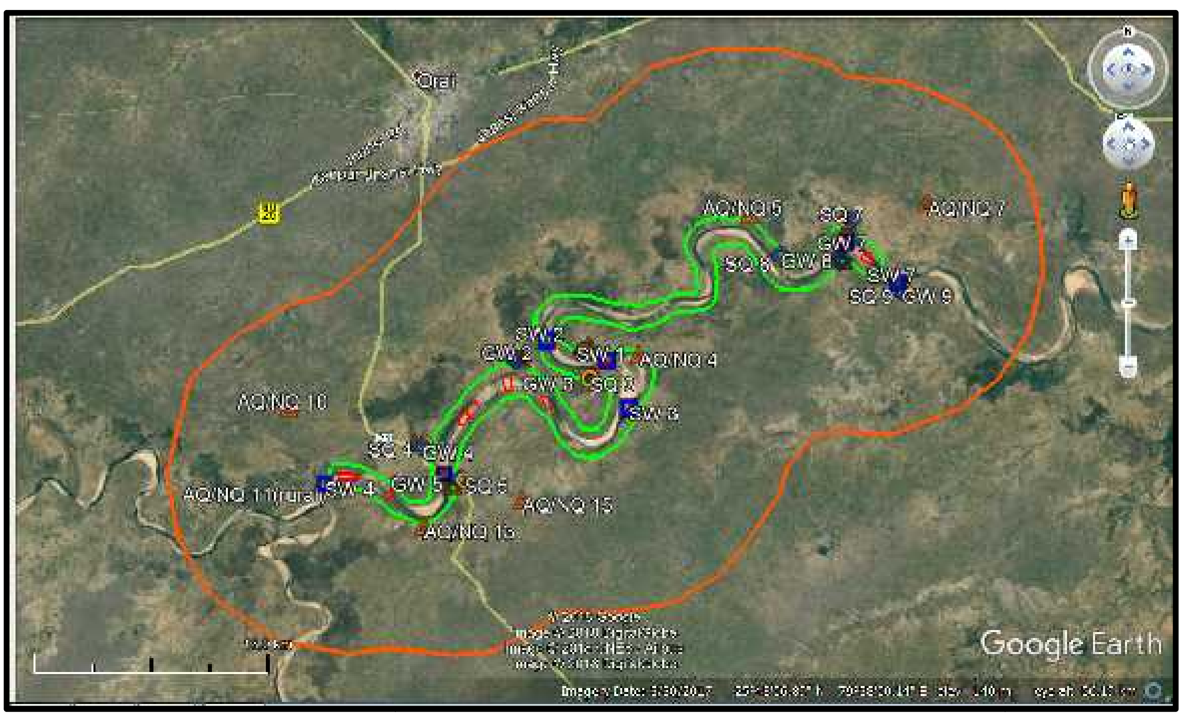


Fig 6.2. Monitoring Stations for Study Area-1

(AIR & NOISE MONITORING STATIONS)

S. No.	Station Code	Location	Remarks	Project Area	Category
1.	AQ10/NQ 10	Barsar	Upwind	Buffer Zone	Rural
2.	AQ11/NQ 11	Chandwari Danda	Downwind within 500m	Impact Zone	Rural
3.	AQ13/NQ 13	Magrauth	Downwind	Buffer Zone	Rural
4.	AQ12/NQ 12	Mohana	Crosswind	Buffer Zone	Rural

(GROUNDWATER SAMPLING STATIONS)

S. No.	Station Code	Location	Project Area	Category
1.	GW 4	Mohana	Buffer Zone	Rural
2.	GW 5	Chikasi	Buffer Zone	Rural

(SURFACE WATER SAMPLING STATIONS)

S. No.	Station Code	Location	Distance & Direction from the Project Site	Project Area	Category
1.	SW 4	Chadwari Danda	Upstream	Impact Zone	Rural
2.	SW 5	Muhana	Downstream	Impact Zone	Rural

(SOIL SAMPLING STATIONS)

S. No.	Station Code	Location	Project Area	Category
1.	SQ 4	Mohana	Buffer Zone	Rural
2.	SQ 5	Chikasi	Buffer Zone	Rural

M/s Sanewin Infrastructure Pvt. Ltd. & M/s New Eoan Associates are located at village Chandwari Ghuroli in Sarila Tehsil of Hamirpur district. During the months of baseline monitoring viz. March to May, 2018, the prominent wind direction in the Hamirpur district is towards South and South-east direction. Hence, in the upwind direction AQ 10 (in village Barsar) monitoring station has been placed which is about 4.50km towards NW direction from the nearest mine lease site and AQ11 and AQ13 monitoring stations have been located in villages Chandwari Danda (within 500m) and Magrauthtowards the downwind direction and AQ 12 located in village Mohana which is also the crosswind direction of the wind.

Sampling locations for Groundwater samples and soil samples are collected from the different villages in Buffer zone. Groundwater samples are collected from Borewells and handpumps marked as GW 4 & GW 5 located in villages Mohana and Chikasi respectively. Similarly, Soil samples were also collected from the agricultural fields marked as SQ 4 and SQ 5 from the same villages viz.Mohana and Chikasi respectively. These villages have been selected as they represent that area since all the villages fall within the 5kms radius of the all the mine lease sites mentioned in this group. The represent the ground water Quality and soil Quality and the impact of mining activity on the villages found in the vicinity of the mine leases.

Surface Water samples were collected from Sampling station SW 4 which is located along the Village Mohana in the river Stream of Betwa River. Since the Betwa river flows from west to east direction, SW 4 sampling station is the upstream for these leases and sampling station SW 5 which is along the village Chikasi is the downstream for these leases.

6.3 MEASUREMENT METHODOLOGY

6.3.1 Air

The quality of the air that we breathe affects our health and quality of life. It can also have major impacts on the ecosystem. Measuring and understanding air pollution provides a sound scientific basis for its management and control.

The criteria pollutants measured are Particulate Matter $_{10}$ (PM_{10}), Particulate matter $_{2.5}$ ($PM_{2.5}$), Sulphur dioxide (SO_2), Oxides of Nitrogen (NO_x), and Carbon Monoxide (CO) etc. concentration in downwind direction considering predominant wind direction, at a distance of 500 metres from the following dust generating sources shall be measured in the manner indicated below:

Table No. 6.3 Measurement Methodology

S.N.	PARAMETERS	CODE OF PRACTICE	SAMPLER	INSTRUMENT USED FOR ANALYSIS
1.	PM_{10}	IS: 5182 Part 23:2006	RDS Sampler	Balance, Desicator
2.	$PM_{2.5}$	NAAQS Monitoring	Fine Dust	Balance, Desicator

		&Analysis Guidelines volume- 1, 2011 CPCB	Sampler	
3.	SO_2	IS: 5182 (Part-V)	RDS Sampler	Spectrophotometer
4.	NO_2	IS: 5182 (Part-IV)	RDS Sampler	Spectrophotometer
5.	SiO_2	Molybdosilicate method.	………....	------------
6.	CO	EPA Method 13	CO Analyzer	--------------

6.3.2 Water

Water quality monitoring is an important aspect of overall water quality management and water resources development. A well planned and well managed water quality monitoring system is required to signal, control or predict changes or trends of changes in the quality of a particular water body, so that curative or preventive measures can be taken to restore and maintain ecological balance in the water body.

Two liters of representative water samples will be collected in plastic container and transported to laboratory for physic-chemical analysis. For determination of BOD and bacteriological analysis, 250 ml pre-sterilized bottles will be used and care will be taken to maintain cool temperature by keeping the bottles in ice boxes during transportation to the laboratory for analysis.

Table No. 6.4. Code of practice for water analysis

S.N.	PARAMETERS	CODE OF PRACTICE
1	Colour	IS 3025 Part 4:1983
2	Odour	IS 3025 Part 5:1983
3	pH Value at 25°C	IS 3025 Part 11:1984
4	Total Dissolve Solids	IS 3025 Part 16:1984
5	Total Suspended Solids	IS 3025 Part 18:1984
6	Total Solids	IS 3025 Part 9:1984
7	Temperature	IS 3025 Part 14:1984

8	Conductivity at 25°C	IS 3025 Part 17:1984
9	Calcium (as Ca)	IS 3025 Part 40:1991
10	Ammonical Nitrogen	IS 3025 Part 34:1988
11	Chloride (as Cl)	IS 3025 Part 32:1988
12	Iron (as Fe)	IS 3025 Part 53:2003
13	Magnesium (as Mg)	IS 3025 Part 46:1994
14	Nitrate (as NO_3)	IS 3025 Part 34:1988
15	Potassium (as K)	IS 3025 Part 45: 1993
16	Phosphate (as PO_4)	IS 3025 Part 31:1988
17	Sodium (as Na)	IS 3025 Part 45:1993
18	Sulphate (as SO_4)	IS 3025 Part 24:1986
19	Total Alkalinity (as $CaCO_3$)	IS 3025 Part 23:1986
20	Total Hardness (as $CaCO_3$)	IS 3025 Part 21:2009
21	Biochemical Oxygen Demand	IS 3025 Part 44:1993
22	Chemical Oxygen Demand	IS 3025 Part 58: 2006
23	Dissolved Oxygen	IS 3025 Part
24	Faecal Coliform	IS 1622:1981

6.3.3 Noise

Noise levels in the work zone environment shall be monitored. The frequency will be once in three months in the work zone. Similarly, ambient noise levels near habitations will also be monitored once in three months. Audiometric tests will be conducted periodically for the employees working close to the high noise sources.

As there will movement of trucks, the Noise level may be high in the area and after the accurate monitoring results; we can provide the suitable mitigation measures.

Noise Monitoring will be done in Day & Night Time quarterly. Day time shall mean from 6 AM to 10 PM & Night time shall mean from 10 PM to 6 AM

6.3.4 Soil

The main concern of soil monitoring is measurement of fertility of the area and impact of sand mining process on it. Composite Soil samples will be collected from surrounding agriculture fields that are likely to be impacted from the project.

Table No. 6.5. Code of practice for soil analyses

S.N.	PARAMETERS	CODE OF PRACTICE
1	pH Value at 25°C	IS 2720 (P-26)-1987, Reaff- 2007
2	Conductivity at 25°C	IS 2720 (P-21)-1977, Reaff- 2006
3	Moisture	IS 2720 (P-2)-2002
4	Sodium (as Na)	RIMSLAB/SOP/ENV/010-D
5	Potassium (as K)	RIMSLAB/SOP/ENV/010-D
6	Total Kjeldhal Nitrogen	RIMSLAB/SOP/ENV/010-C
7	Phosphorus	RIMSLAB/SOP/ENV/010-G
8	Organic Matter	IS 2720 (P-22)-1972, Reaf:2005
9	Magnesium (as Mg)	RIMSLAB/SOP/ENV/010-B
10	Cation Exchange Capacity	IS 2720 (P-24)-1976, Reaf:2005
11	Water Holding Capacity	RIMSLAB/SOP/ENV/010-H
12	Bulk Density	-
13	Porosity	-
14	Soil Grain Size Analysis	IS 2720 (P-4)-1985, Reaf:2001

6.3.5 Traffic

Given in chapter 7 in additional studies

6.3.6 Health

Health checkups and Health camps will be organized as per The Mines Rules 1955.

6.3.7 Flora Fauna Study

Table No. 6.6 .Mode of data collection & parameters considered during the survey

ASPECT	DATA	MODE OF DATA COLLECTION	PARAMETERS MONITORED
Terrestrial Ecology & Aquatic Ecology	Primary Data Collection	By field survey	Floral & Faunal diversity
	Secondary Data Collection	From authentic sources like Forest Department of U.P., District Forest Officer, Hamirpur and Jalaun and other Literatures	Floral & Faunal diversity and study of vegetation, forest type, importance etc.

6.3.8. Biodiversity Study

Given in chapter 3 in baseline data generation

6.4 Implementation of Environment Monitoring Plan

With the knowledge of initial parameters, deviations in environmental conditions due to operation of the mine will be assessed and suitable mitigation steps will be taken to safeguard the environment. The routine monitoring program will be implemented under the project monitoring as per CPCB & MoEF & CC guidelines. The core responsibilities of the project proponetwill be authorizing a person for:

- Organization and interpretation of the environmental monitoring data to establish a record of change associated with the implementation of a project or the operation of an organization.
- The process of verification that all or selected parameters measured by Environmental Monitoring Program are in compliance with regulatory

requirements, internal policies and standards, and established environmental quality performance limits.

- The assessment of the effectiveness of the environmental management system, practices and procedures.
- The environmental monitoring and audit work will be carried out by qualified personnel by NABL accredited lab and/or NABET accredited consultant.
- A summary of non-compliance of the environmental quality performance limits.
- To implement and monitor the control and protective measures based on the EMP.
- To coordinate the environment related activities to the top management within as well as with outside concerned agencies.
- To provide of health check up of workers and the people living in nearby villages.
- To develop greenbelt at transportation routes.

6.5 ENVIRONMENTAL POLICY

1. We are committed for the protection & improvement of Environment.
2. We will follow all the applicable Environment & Pollution laws and practice scientific mining as per the statutory guidelines.
3. We will not operate without Environment Clearance and follow the conditions mentioned in it. If any difficulty is found in the implementation of condition, it will be discussed with SEAC/SEIAA.
4. Efforts will be made so as to reduce Noise Pollution.
5. Promote Environment Management plan as per prescribed Guidelines.
6. Enhance environmental awareness amongst employees.
7. Encourage our associates to adopt right approach for environmental protection

NAME OF RESPOSIBLE PERSON	
POST	
SIGN	

PHONE NUMBER	

8. Following information will be displayed in hindi at various places for contact in emergency situation.

Reporting Structure:

- Mine manager will be responsible for compliance management.
- Before the start of mining operation and during the mining , we will follow Air Act, Water Act, MSW Rules as applicable and also retain the copy of guidelines on site.
- Mine manager will report to proponent every month about compliance.
- The management will ensure that the Name, Contact number of Mine Manager will be shared and posted on Site.
- If any discrepancy in compliance found, Mine manager will be responsible for it.
- Safe and Clean drinking water for all the persons working at Mine site
- Use of dustbin will be promoted.
- He will be responsible for-
  - ✓ Environment Management
  - ✓ Worker Safety
  - ✓ Social Responsibility
  - ✓ Mine Management

6.6. STANDARD OPERATING PROCEDURES FOR REPORTING OF NON-COMPLIANCE OF EIACONDITIONS:

Proposed system will be described to Mines Manager.

↓

The conditions of EIA to be followed will be displayed at rest shelters in Hindi and will be explained to the workers weekly.

↓

When any unwarranted condition arises, work will be stopped immediately.

↓

The information will be communicated to Board of Directors.

↓

Further notification of the conditions will be responsibility of the Board of Directors.

↓

A written report about the situation, responsible person and conditions due to which the problem arise will be submitted by Mines Manager to the Board of Directors in next 48 hours.

6.7CO-ORDINATION WITH DISTRICT MAGISTRATE & RO, UPPCB FOR MONITORING PLAN.

The letters regarding pre monsoon monitoring plan has been sent to Regional Officers, UPPCB & District Magistrates of Hamirpur and Jalaun. Copy of letter is annexed as **ANNEXURE-III**. However the schedule of compliance monitoring will be sent to RO, UPPCB in advance and results will be submitted as annexure of six monthly compliance report.

CHAPTER VII

S. NO.	CONTENTS
7.1	PUBLIC CONSULTATION
7.2	RISK ASSESSMENT
7.3	IDENTIFICATION OF HAZARDS
7.4	MITIGATION OF HAZARDS
7.5	SEDIMENT INFLUX RATE
7.6	SOCIAL IMPCT ASSESSMENT
7.7	RESSETLEMENT & REHABILITATION PLAN
7.8	DISASTER MANAGEMENT
7.9	TRANSPORTATIONAL ROUTE ANALYSIS
7.10	INCREAMENTAL NOISE IN THE STUDY AREA-1
7.11	GREEN BELT DEVELOPMENT

ADDITIONAL STUDIES

7.1 PUBLIC CONSULTATION

The public hearing process is an important part of the EC process. Public hearings mandate the EAC and MoEF to consider recorded public concerns. As a component of public consultation, a public hearing provides a “decentralised democratic space” (Utkarsh Mandal v Union of India 2009) in the clearance process where members of the public are given an opportunity to participate in the regulatory process. It is meant to give assurance to people by the government, through face-to-face interactions, to raise their concerns and provide them with all the information regarding the project, while seeking their opinions and hearing their grievances. At the same time, the opinions of the project proponents are also considered before a final decision is made. These face-to-face interactions fulfi l the government’s commitment towards “sustainable development,” “environmental justice” (Bowen 2001 and US EPA), “empowered participatory governance” (Fung and Erik 2003) and “principles of natural justice” (S Nandkumar v State of Tamil Nadu 2010).The addressing of these issues by proponents ensures that authorities are aware of ground realities and the pros and cons of the project, which would contribute to effective decision-making (M P Patil v Union of India 2012).

7.1.1 Procedural Guidelines

- Online submission of project proposal.
- Preparation of draft report on the basis of TOR issued/standard TOR.
- The draft REIA is prepared by TOR issued by SEAC or on the basis of standard TOR issued by MoEF as presecribed in EIA notification 2006 amended on 10th April 2015, is submitted to SPCB.
- After submission of draft REIA State Pollution Control Board gave the advertisement for public hearing, which will be conducted between 30-45 days.

- At the day of the public heariong Regional office made all the arrangements for public hearing.
- The presentation based on the draft EIA was presented in the presence of all the people assembled for the public hearing, item-wise.
- No person was be allowed to enter the pandal/hall where the public hearing is being conducted holding party fl ags and they shall not be allowed to raise party slogans.
- No irrelevant issues were discussed and the public hearing was strictly confined to the issues that arise from the draft REIA report and ancillary thereto, and nothing more.
- The persons who wanted to speak in the public hearing were asked to give their names in a prescribed form indicating details such as name, father/husband's name, name of the village, taluk/tehsil, and the subject on which he or she wants to speak, etc. Those people were periodically given the mike
- Consultants were present with the proponent in the presence of the public and submit views, on the subject.
- At the end, all the views, whether for or against the project, were addressed subject-wise/issue-wise and be responded to by the project proponent or consultants.
- The authority conducting the public hearing took an active part in following each and every minute procedure required for conducting the public hearing. Regional Office prepared minutes of the proceedings in accordance with the EIA notification, 2006 and show it to the public.
- All the concerned issues are mentioned and incorporated in Regional Environemntal Impact Assessment.

  Point wise public hearing compliances were given in PH compliances.

  Minutes of public hearing, clippings of news paper were attached as **annexure-VIII**

7.2 RISK ASSESSMENT

Mining and allied activities are associated with several potential hazards to both the employees and the public at large. A worker in a mine should be able to work under conditions, which are adequately safe and healthy. At the same time the environmental conditions should be such as not to be impair his working efficiency. This is possible only when there is adequate safety in mines.

7.3 IDENTIFICATION OF HAZARDS

There are various factors, which can create unsafe working conditions in mining of minor minerals from river bed. These hazards are as follows:

a) Inundation / Flooding.

b) Quick Morrum Condition.

c) Drowning.

d) Accident due to vehicular movement.

e) Accident during morrum loading, transporting and dumping.

7.3.1. Mineral loading

a. The minerals are loaded in the trucks using loader. There is no possibility of injury during loading with loaders.
b. There is possibility that the workers standing on the other side while loading may get injury due to over thrown morrum with pebbles.
c. There is possibility of workers getting injured during opening of side covers to facilitate loading.
d. There is possibility of riverbank collapse.
e. There is a chance of falling of cattle/children into pits in river bed.

7.3.2. Transport

The minerals loaded in trucks (almost 1319) are being sent to through public roads.

a. Possibilities of road accidents.
b. Accident may also occur during movement in the mine.
c. There are possibilities that due to overloading, pebbles or boulders may injure the passersby.

7.3.3. Inundation/flooding

a. The possibility of inundation/flooding of the mines are very high during monsoon or during heavy rains as the mine area lies in the riverbed.

b. There is danger to the trucks and other machineries due to flooding.

c. There is danger to the workers working in the mines.

Inundation or flooding is expected and beneficial for these mines as during this time only the mineral reserve gets replenished.

7.3.4. Quick sand condition

Quickmorrum is a colloidhydrogel consisting of fine granular material (such as morrum or silt), clay, and water.

Quickmorrum forms in saturated loose morrum when the morrum is suddenly agitated. When water in the morrum cannot escape, it creates liquefied soil that loses strength and cannot support weight.This condition occurs when the permeability of the strata is very high. This condition occurs when the effective stress in the morrum becomes zero due to influx of water i.e.

$i = \quad i_{cr} = y'/y_{W}$-;

where i = Hydraulic gradient,

i_{cr} = Critical Hydraulic gradient,

y' = submerged unit weight,

y_w = unit weight of water.

This creates danger condition to the trucks and other machineries plying over the morrum dunes on the river banks.

7.3.5. Drowning

There are no possibilities of drowning in the river, since mining operations are carried out only in the dry seasons. All mining activities will be stopped during the monsoon season.

7.4. MITIGATION OF HAZARDS

7.4.1. Measures to prevent accidents during loading

Loading will be done by using fron end loader in general. In case of manual loading following precautions will be taken

1. The truck will be brought to a lower level so that the loading operation suits to the ergonomic condition of the workers.

2. The loading will be done from one side of the truck only.
3. The workers will be provided with gloves and safety shoes during loading.
4. Opening of the side covers (pattas) will be done carefully and with warning to prevent injury to the loaders.
5. Operations during daylight only.
6. No foreign material will be allowed to remain/spill in river bed and catchment area, or no pits/pockets are allowed to be filled with such material.
7. Stockpiling of harvested material on the river bank will be avoided.

7.4.2. Measures to prevent accidents during transportation

1. All transportation within the main working will be carried out directly under the supervision and control of the management.
2. The Vehicles will be maintained in good repairs and checked thoroughly at least once a week by the competent person authorized for the purpose by the Management.
3. To avoid danger while reversing the trackless vehicles especially at the embankment and tipping points, all areas for reversing of lorries will as far as possible be made man free, and.
4. A statutory provision of the fences, constant education, training etc. will go a long way in reducing the incidents of such accidents.
5. Generally, overloading will not be permitted.
6. The truck will be covered and maintained to prevent any spillage.
7. The maximum permissible speed limit will be ensured.
8. The truck drivers will have proper driving license.

7.4.3. MEASURES TO PREVENT DANGEROUS INCIDENTS DUE TO INUNDATION/FLOODING

Inundation of flooding is expected and beneficial for these mines as during this time only the mineral reserve gets replenished.

1. During monsoon months and heavy rains the mining operations are ceased.
2. There will be mechanism/warning system of heavy rains and discharges from the upstream dams.

7.4.4. Measures to prevent quick sand condition

1. The only way to avoid quick morrum condition is by avoiding mineral lifting below water table.
2. The critical hydraulic gradient (i_{cr}) will be maintained at less than 1 to prevent high artesian pressure in a coarse morrum area.
3. 1/3rd of sand will be left in Mine Lease Area as the provision of Bar scalping.

7.4.5. Measures to prevent drowning

1. The mining will be done under strict supervision and only during the dry season.
2. Mining will be done in dry bed zone.
3. No go zones will be clearly marked and made aware to the mine workers.

7.4.6. Natural resource conservation

Marking of mining lease at the concave side of the river channel is avoided by Directerate of Geology and mining to prevent bank erosion. Similarly meandering segment of a river are be selected for mining in such a way as to avoid natural eroding banks and to promote mining on naturally building (aggrading) meander components.These precations are taken at the time of lease markation.

7.5 SEDIMENT INFLUX RATE

Sediment influx in Ephemeral streams is generally confined to the beginning of the rainy season as velocity of the water washes down medium to fine sand and silt depending on the velocity and gradient of land. Cobbles, pebbles and boulders will be transported buy only over short distance. Boulders are normally 256 mm and above are normally transported either by dragging action or by siltation.As waters flow from high elevation to sea level, their potential energy is converted to other forms as they sculpt the landscape, developing complex channel networks and a variety of associated habitats. Rivers accomplish their geomorphic work using excess energy above that required to simply move water from one point on the landscape to another. In natural channels, the excess energy of rivers is dissipated in many ways: in turbulence at steps in the river profile, in the frictional resistance of cobbles and boulders, vegetation along the bank, in bends, in irregularities of the channel bed and banks, and in sediment transport. The transport of sand- and gravel-sized sediment is particularly important in determining channel form, and a reduction in the supply of these sediments may induce channel changes. Supply of sand and gravel is influenced by many factors, including changes in land use, vegetation, climate, and tectonic activity. Sediment is transported mostly as suspended load. Whereas clay, silt, and sand held aloft in the water column by turbulence, in contrast to bedload, sand, gravel, cobbles, and boulders transported by rolling, sliding, and bouncing along the bed . The idealized watershed can be divided into three zones: that of erosion or sediment production (steep, rapidly eroding headwaters), transport (through which sediment is moved more or less without net gain or loss), and deposition . The size of sediment typically changes along the length of the river system from gravel, cobbles, and boulders in steep upper reaches to sands and silts in low gradient downstream reaches, reflecting diminution in size by weathering and abrasion, as well as sorting of sizes by flowing water. Over time scales of centuries, the river channel in the transport reach can be likened to a "conveyor belt", which transports the erosional products downstream to the ultimate depositional sites below sea level. Transport of sediment is highly flow dependent, an "event-based" process that varies widely from year to year. At time scales of years to decades, the transport of sediment tends to be episodic, in contrast to the continuous transport implied by the conveyor belt analogy. Moreover, individual grains may not move very far per flood – often jumping just from one bar to the next bar downstream, and material transport is heterogeneous spatially within the channel Transport of sediment through the catchment and along the length of the river system is continuous (on geologic time scales). Increased erosion in upper reaches of the catchment can affect the river environment many miles downstream (and for years or decades) as the increased sediment loads propagate downstream through the river network. Rivers and streams draining the western slope of the Cascade Mountains in Western Washington typically transition abruptly from steep, eroding uplands to relatively flat coastal plains. Gravel mining activities are typically situated near urban areas in these transitions, where the coarse portion of the sediment delivered from steep uplands during floods is deposited. These are also typically zones of naturally pronounced channel activity. Along the river channel "conveyor belt", channel forms (such as gravel bars) may appear stable but the grains of which they are composed may be replaced annually or biannually by new sediment from upstream. Similarly, the sediments that make up the river floodplain (the valley flat adjacent to the channel) are typically mobile on a time scale of decades or centuries. The floodplain acts as a storage reservoir for sediments transported in the channel, alternately storing sediments, by deposition, and releasing sediment to the channel, by bank erosion. Downstream, water released from the dam possesses the energy to move sediment, but so long as the reservoir continues to trap more sediment, the water released has little or no sediment load. This “clear water” released from the dam is often referred to as hungry water, because the excess energy is typically expended on erosion of the channel bed and banks for some years following dam construction, resulting in incision (downcutting of the bed) and coarsening of the bed material (termed armoring in fluvial geomorphology) until equilibrium is reached and the material cannot be moved by the flows (Kondolf 1997). The reduced sediment supply below dams has profound implications for the siting of sand and gravel mines, because mines located in sediment starved reaches below a dam are not replenished by sediment yield from the basin, only by downstream tributaries and channel erosion In many cases, reduction of flood peaks can more than offset reduced sediment availability, causing net aggradation of the river channel below the dam . By removing sediment from the active channel bed, instream mines interrupt the continuity of sediment transport through the river system, disrupting the sediment mass balance in the river downstream and inducing channel adjustments (usually incision) extending considerable distances (commonly 1 km (0.6 mi) or more) beyond the mine site itself. Instream gravel mining directly alters the channel geometry and bed elevation and may involve extensive clearing of vegetation, flow diversion, sediment stockpiling, and excavation of deep pits . Regardless of the mining technique, the preexisting channel morphology is disrupted and a local sediment deficit is produced.Recharge is in two forms, one general deposition of coarse, medium and fine sand when the velocity of the river water decreases below the carrying capacity. However, flash floods due to heavy rains in the upper reaches often causes rapid transportation of boulder, sand etc., along with silt which can never deposit.

Recharge Rate: It is dependent upon the following 4 factors

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

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

The numerical sedimentation rate varies from 50cm medium sand to as much as 3m of medium and fine sand where the slope of the river bed is less than 10^0 slope per season. For silt and clay, these only be deposited in the flood area and normally varies between 1-5m over 6 months period.To maintain sediment transport continuity, Extraction rates should be less than the amount estimated to be transported to the site from upstream on an annual average basis. Recognizing the large variability in annual sediment transport (actual sediment transport to the site in any given year is typically much less than or much more than the annual average rate), and site-specific considerations, The cumulative effects of gravel mining over time and upstream/downstream, and the cumulative effects of multiple mines on one river system, have rarely been addressed. As discussed above, the real impacts of gravel mining are cumulative – additive effects of extractions on the sediment budget, increasing extent of floodplain pits, multiple captured pits, etc.Small extractions are often viewed as having only small, insignificant impacts. However, a small extraction on a small stream can take a large fraction of the annual load, and multiple small extractions on a larger stream can add up to be equivalent to a large proportion of total load. In some cases, small extractions may be practiced to avoid scrutiny entailed by fewer, larger extractions. A large timber company in northern California had 42 small extractions in one county in 1992, each declared at less than 764 m3 (1000 yd3) and thus exempt from most requirements of the state's surface mine reclamation act. Even when the extractions are all legitimately small, they can add up to have a significant cumulative effect on channel form, especially in small channels, where the sediment load would be naturally low Instream mining results in removal of mass (gravel) from the reach, thereby lowering the average elevation, and in that sense making future deposition more likely. Even using environmentally preferred extraction techniques from bars, leaving the head of the bar and in some cases the stream margin in place, and lowering the interior of the downstream part of the bar surface, mining creates a site for deposition of gravel and sand. Thus, at a minimum bar scalping represents a loss term in the sediment budget. Because "…bars are temporary storage sites through which sand and gravel pass, most bars are in approximate equilibrium so that the influx and downstream transport of material are equal when averaged over a number of years. If all of the sand and gravel reaching such a bar is removed, the supply to bars downstream will diminish. Since sand and gravel will continue to be transported from these downstream bars by the river, their size will decrease." (Dunne et al. 1981:89) The magnitude of this impact basically depends on the magnitude of the extraction relative to bedload sediment supply and transport through the reach. Erosion from the bed has made up the difference in volume. Gauge and cross-section data indicate that the beds in reaches of each river with intensive gravel extraction have been lowering at the rate of 30 mm/yr (0.1 ft/yr) (Collins and Dunne 1986). As described below, incision can reduce overbank flooding, increase in-channel shear stress and sediment transport potential, destabilize bed and banks, lower the alluvial water table, and change the distribution and structure of riparian vegetation While individually many of these pits would be considered relatively insignificant, the net effect of multiple pits in one reach results in cumulative, off-site impacts. Bank protection constructed to protect these pits has reduced the potential channel migration zone, resulting in reduced riparian habitat values on a large percentage of the Yakima's active floodplain. Numerous pits also change hyporheic zone dynamics and groundwater flow patterns, effects that remain largely undocumented. Approach to managing gravel mining is to estimate the annual bedload sediment supply from upstream, the "replenishment rate", and to limit annual extraction to that value or some fraction thereof, considered the "safe yield". The replenishment rate approach has the virtue of scaling extraction to the river load in a general way, but bedload 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 bedload yields. More fundamentally, however, the popular notion that one can extract at the replenishment rate without affecting the channel ignores the continuity of sediment transport through the river system. 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. Dunne et al. (1981) stressed because actual bedload transport is variable from year to year, estimated average annual bedload inflow rates may not be applicable in most years. Replenishment can be estimated year-to-year, either riverwide (based on sediment rating curves), or based on site-specific deposition. The latter approach is **applied here in this study, where a team of experts visited the sites in post monsoon season and taken the readings of the sampling mast planted in pre-monsoon season, thus** estimates the amount of deposition over the flow season, and recommends an extraction amount, location,. In estimating annual (or annual average) replenishment rates, it is important to recognize that using sediment transport equations yields an estimate of theoretical bedload sediment transport capacity, which is commonly less than actual load, as the latter is limited by actual sediment supply from the basin. **To avoid this problem method of physical verification is applied here.**

Components of Replenishment study:

7.5.1.River description

Betwa: River Betwa enters in Hamirpur in Chandawari Danda reserved forest. and subsequently passes through Ghuraull and Mangrauth villages. In Chandwari Danda, river Dhasan meets with river Betwa. In between village Baragaon and Sultanpur, Betwa joins Yamuna river.

Table 4: List of Villages through which River Betwa passes in Hamirpur

S.No.	Name of Place/Village	S.No.	Name of Place/Village
1.	Chandrawari	2.	Kherma
3.	Ghuraull	4.	Raniganj P.F.
5.	Manrauth	6.	Bajetha
7.	Chikasi P.F	8.	Tiknipur
9.	Sulgawan	10.	Mamhenpur
11.	Hardua	12.	Parsaul
13.	Barera Khalsa	14.	Kumhaupur
15.	Birhat	16.	Harehata
17.	Jampur	18.	Kewaura
19.	Barera P.F.	20.	Suharapur
21.	Barera Muafi	22.	Pauthiya buzurg
23.	Bindhauli	24.	Nethi
25.	Benda	26.	Kiratpur
27.	Jitkari	28.	Sahijan
29.	Chaura	30.	Bangiyaon
31.	Jitkari P.F.	32.	Gimhur
33.	Chandaurt P.F.	34.	Badanpur R.F.
35.	Basaria R.F.	36.	Sankari Tipar
37.	Rirua Buzurg	38.	Sindra
39.	Harsudi P.F.	40.	Jarali Madaiya
41.	Khandaut	42.	Surauli Khurd
43.	Jalalpur P.F.	44.	Baragaon

Betwa River enters in Jalaun District at village Kanjusa situated 120 m elevation. It further passes through Marhepura and Shivganj. Subsequently river flows through various villages and the exit from district, near village Ikauna.

Table 3: List of Villages through which River Betwa passes in Jalaun.

S.No.	Name of Place/Village	S.No.	Name of Place/Village
1.	Dhera R.F.	2.	Kahta
3.	Maruna-ke-khod	4.	Makrechha P.F.
5.	Sala R.F.	6.	Airpatti R.F.
7.	Thurat R.F.	8.	Mohana
9.	Rukhana R.F.	10.	Haidalpur P.F.
11.	Rukhana	12.	Bindaula R.F.
13.	Amror R.F.	14.	Gurha
15.	Rajapur	16.	Simhariya
17.	Saidnagar	18.	Tikua
19.	Sudhauli R.F.	20.	Kharka
21.	Karthara R.F.	22.	Kuruana
23.	Kishor R.F.	24.	Dadri
25.	Kotra	26.	Sonahata
27.	Sati	28.	Kahta Hamirpur
29.	Nandha R.F.	30.	Parason
31.	Sikri R.F.	32.	Almari
33.	Kamtha	34.	Purwa Kunheta
35.	Shri Kahta P.F.	36.	

Table : Drainage System of River Betwa in study area-1

S.No.	Name of District	Length in the district	Area Covered (sq km)	% Area Covered
1.	**Jalaun**	28	20	0.5%
2.	**Hamirpur**	132	94.6	2.42 %

The Betwa river is a tributary of Yamuna River. Its basin extends from longitude 77^0 to 81^0E and latitude $23^0$8' to $26^0$0N. The Betwa River originates at an elevation of 470m in Bhopal district in M.P. After traversing a distance of 590m, the river joins the Yamuna River near

Hamirpur at an elevation of 106.68m The total catchment area of the Betwa River is 46580 sq. km of which 31,971 sq. km (68.64%) lies in M.P. and 14,609 sq. km (31.36%) lies in U.P. The basin is saucer shaped with sandstone hills around the perimeter. The Dhasan River is the important tributaries of the Batwa River.

Betwa River plays vital role in the formation of Alluvium in the Bundelkhand region. Alluvium deposit is the main source of morrum, which plays very important role in economy of the Bundelkhand region.

Betwa River flows from south west to north east in Jhansi. Jalaun and Hamirpur district, forming a large meanders. The deposition of sediments occur as point bars and channel bars Geologically the catchment area of Betwa river comprises rocks of Bundelkhand Granitic complex of Archean to Proterozoic age and Alluvium of quaternary period.

Dhasan River flows from south to north and meet with river Betwa on the right bank of Betwa river in Jhansi district. The catchment of Dhasan river is occupied by Bundelkhand Granitic Complex which is overlain by alluvium of quaternary age.

7.5.2. Geology

Betwa river,flows on Bundelkhand Granitic Complex in Jhansi, Jalaun and Hamirpur District.
The regional geological succession of the area is as follows:

Geological Unit	Lithologic Composition	Group	Age
Channel Alluvium	Red and quartzofeld -spathic sand	Newer Alluvium	Holocene
Terrace Alluvium	Red and quartzofeld -spathic sand		
Varanasi Alluvium	Brownish yellow silt, clay with kankar	Older Alluvium	Early to late Pleistocene
Banda Alluvium	Red to deep brown sand with gravel lenses ,silt and clay		

	with kankar		
Bundelkhand Granitic Complex	Granite and gneisses and outcrops of granitoid , metasedimentaries and basites, dolerite and quartz reef	B.G.C.	Archean To Proterozoic

Betwa river in Jhansi, Hamirpur and Jalaun District comprises rocks of Bundelkhand Granitic Complex. Bundelkhand Granitic complex consists of granite of different types , gneiss and migmatite intruded by dolerite and quartz dykes. Metamorphosed rocks occur as enclaves. Granites are porphyritic to fine grained, non foliated and jointed. Quartz dykes commonly known as (quartz reef) trend NE-SW and extends several km. around Jaitpur,Kulpahar , Charkhari and south of Gorahari.

The Alluvium unconformably overlying Bundelkhand Granitic Complex is divisible into Older Alluvium and Newer Alluvium. Older Alluvium contains oxidized (brown , yellow khaki color) sediments and Newer Alluvium comprises unoxidised (grey and khaki color) sediments. Banda Alluvium and Varanasi Alluvium of Pleistocene period represent older Alluvium. The Banda Alluvium consist of brownish silt – clay with kankar, red-quartzofeldspathic and gravel .The Varanasi Alluvium overlies Banda Alluvium and contains polycyclic sequence of micaceous sand , silt and clay with Kankar.

The Newer Alluvium of Holocene age , consist of Terrace Alluvium and Channel Alluvium. Terrace Alluvium consisting of 8-15 m. thick sequence of sand, silt and clay occupies terraces of Betwa river . Loose sand of point and channel bars constitute Channel Alluvium of Betwa river. However over the years the construction of dams changed the mineralogical specialities of depositional sediments.

7.5.3 Local Geology

The morrum occur all along with the Betwa River in Jhansi, Jalaun and Hamirpur District, which is red in color. The red color sediments is the product of weathering and disintegration of granitic gneisses of Bundelkhand Complex

Morrum in this belt are gravelly in nature and mineralogically comprises of quartz, feldspar and other accessory minerals and is coarse to very coarse grained.

7.5.4.Topography of the study area-1

The present mining geological study area lies between the coordinates **25°46'12.48"N &79°19'13.34"E to 25°52'2.99"N & 79°46'49.50"E** in which River Betwa flows, has a major area covered by **Banda Alluvium** which has developed over the basement of **Bundelkhand Granitoid Complex (BGC)** which comes under the Group of Older Alluvium.

Banda Alluvium is spread all over the part of Jalaun, Hamirpur and Jhansi districts falling within the study area. Banda Alluvium is of Red to deep brown sand due to the presence of red-quartzofeldspathic with gravel lenses, of brownish silt and clay with kankar. The **Bundelkhand Granitoid Complex** (BGC) which forms the base of **Banda Alluvium** mainly consists of Granite and Gneiss with the origin of Archean to Proterozoic age.

Within the area of study of this particular study area, in the beginning only Dhasan river joins the betwa river (25°47'31.99"N 79°23'43.85"E) around the point of confluence of two rivers is the low lying area. On river Betwa patches of **Channel alluvium** found near and around Villages Kamtha (25°47'45.63"N79°22'40.62"E), Makrechha, Patti Air (25°47'51.20"N79°26'57.56"E), Bandhauli, Gurha, Simiriya (25°50'47.88"N79°32'39.53"E) and around Karwi Buzurg(25°53'41.15"N79°31'2.53"E) in Jalaun district which is mostly partially or wholly submerged during monsoons. Channel bars and point bars are formed within the channel of the river and these sediment deposits are called as Channel alluvium. Rest part of the district falling within the study area is covered with **Banda Alluvium**and **Terrace Alluvium**.

Terrace Alluvium is found all along the river stream flowing from south-west to east direction and is mostly deposited on the older flood plains which are low lying and this sediment deposition is younger in nature and mostly preserved by the incision of rivers as it keeps on getting deposited in the forms of terrace. In this particular stretch, the deposition of alluvium is mainly Morrum in nature which are coarse to very coarse in texture having red colour due to presence of quartzofeldspathic sand.

As the river Betwa enters the Jalaun district and till the point where it joins the Dhasan river the deposition of sediments varies in depth within the 10km buffer zone of our study area around Kamtha (25°47'45.63"N79°22'40.62"E) the thickness of sediment deposit varies from 30m-07m from the water level in the river which is on average 114m on the concave side of the river.

The course river Betwa is meandered through out this stretch and just after the river Dhasan joins it around villages Chandwari & Dhuroli (25°47'54.24"N79°24'30.27"E) towards the concave side the sediment deposit are found of thickness of approx. 18m-7m from the average water level of the river which is approx. 110m.

The water level/zero level of the river Betwa around the the Bandhauli, Gurha, Simiriya (25°50'47.88"N79°32'39.53"E) along the steep bend in the water channel is approx. 107m and the thickness of sediment deposition is approx. 35m- 12m.

The meandering of the river facilitates the deposition of sediments further down the course around villages Idhora and Benda Dariya (25°52'32.53"N79°32'59.12"E) with the thickness of 28m-12m from the average water level in the river which is approx. 106m. futher down the stream around the villages Jitkari, Kahata, Parsan etc.(25°54'41.34"N79°38'12.22"E) the thickness of sediment deposits varies 30m- 10m from the water level which is approx. 102m. **Terrace Alluvium** is found all along the river Betwa in both the Jalaun and Hamirpur districts within the study area on the older flood lowland plains which has got high permeability and low compressive strength and is suitable for monocrop cultivation. The water table level along the Yamuna river within this study area varies from 10-20m bgl. The whole stretch of this particular cluster has average slope of 0.9% with maximum slope of 3.8%.

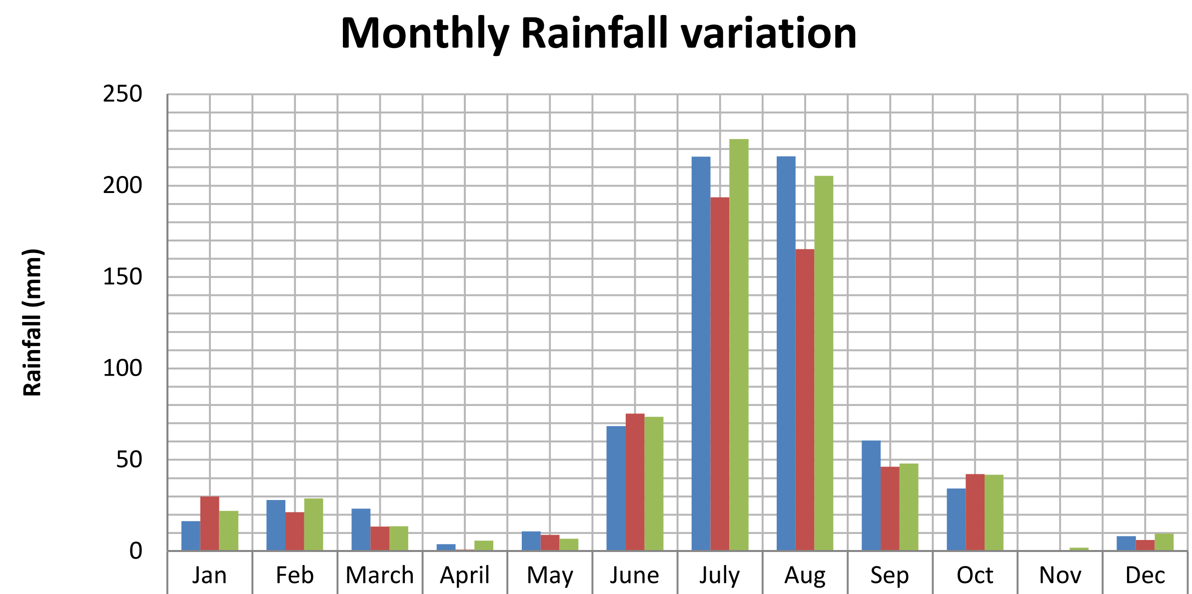
Betwa in Jalaun: The Betwa forms the boundary with Jhansi along the southern border from a point a few kilometers east of the town of Erichh to its junction with Dhasan. Its course, which up to the junction runs due east tends then somewhat to the north-east and it meanders along the south-eastern side of tahsil Orai and Kalpi, separating them from Hamirpur. Like the Yamuna it leaves the district on Baoni border. It flows in a tortuous channel with many loops and bends. Its total length along the district border is approximately 96 kilometers, but from point to point it does not exceed 64 kilometers. Both the banks are fringed for some distance inland by uncultureable ravines.

Betwa in Hamirpur: This river flows along the north-eastern border of the district form the point where Dhasan joins Betwa separating tehsil Rath from district Jalaun. It Joins Yamuna at 10 km east of Hamirpur. The total distance of river is almost 65 km but it is almost doubled due to numerous loops formed in tortuous course. After joining Yamuna its channel curves gently from north to south. The banks except at the end of its course are precipitous and very little alluvial soil is formed between the ricer and cliff. In the upper reaches rocks and boulders occur in a few places in its bed , but for the most part the bed is sandy. The banks except in the last few km are usually scoured with ravines. The river brings down large volume of water in the rains and for the rest of the year, the river shrinks to a narrow stream.

Table No.7.1 Drainage status in study area-1

<table>
<tr><th>S.No.</th><th>Name of water body</th><th colspan="2">Merges with</th></tr>
<tr><td>1.</td><td>Amwala Nala</td><td rowspan="2">Birma River</td><td rowspan="6">Betwa River</td></tr>
<tr><td>2.</td><td>Arjun Nala</td></tr>
<tr><td>3.</td><td>Parwaha River</td><td rowspan="4"></td></tr>
<tr><td>4.</td><td>Urmel River</td></tr>
<tr><td>5.</td><td>Kulaho Nala</td></tr>
<tr><td>6.</td><td>Mahila Nala</td></tr>
</table>

7.5.5. Rainfall: The variation in rainfall during the duration of environmental monitoring is shown below in Fig.7.2 . The graph represents the mean monthly variation in the rain fall annually. The rainfall data has been gathered from the IMD monitoring stations in each district of the past 5 years.



	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Hamirpur	16.5	28	23.3	3.9	10.8	68.4	215.9	216.1	60.5	34.4	0.4	8.2
Jalaun	30	21.3	13.4	0.8	9	75.2	193.6	165.3	46.3	42.2	0	6.1
Jhansi	22	28.9	13.6	5.8	6.9	73.5	225.5	205.4	47.9	41.9	2	9.7

Fig 7.2. Mean monthly Rainfall variation in the study area

7.5.6. Soil

In this region mainly four types of soils are found

1. Clay loam to sandy
2. Loam & Sandy Loam
3. Sandy loam to sodic soil
4. Sandy loam & clay are dominant

Different morphological units have different types of soil. The soil ranges from pure sand to stiff clays and including all combination of the two extreme litho units. The pure sand is called Bhur and clay is called Matiar when the sand is mixed with clay in equal proportion, the soil may be termed as Dumat or Loam – a good agricultural soil. illustrate different soil types in different geomorphic setting in Hamirpur and Jalaun district, Uttar Pradesh. The soil found in the area under study shows different variations-

Hamirpur district comes under the doab region of Ken and Betwa rivers covered by the recent alluvium. Different erosion and depositional agencies contribute to the diversity of soil types. Different morphological unit have different type of soil ranges from pure to stiff clay and included all combinations of the two extreme litho units. The pure sand is called BHUR and clay is MATIAR. The soils consist of the well-known Bundelkhand varieties- **Mar, Kabar, Parua and Rakar**.

Mar is often called black cotton soil, containing soil lumps of kankar and varies greatly in colour.

Kabar ranges from a rich dark balck to light brown and due to extreme adhesiveness, hard blocks are formed.

Parua is a light coloured sandy soil, found in many forms. It is usually less rich in organic matter but its finer texture makes it more responsive to manure and irrigation.

Rakar is a refuse soil which occurs on sloping ground, where the action of water has trended to denude the earth of all its better qualities.

Soil of the district **Jalaun** can be grouped into four types that commonly occur in Bundelkhand region, which are **Mar, Kabar, Parwa and Rakar**.

Mar is a dark coloured clay soil mixed with calcareous nodules (Kankar) with swelling and shrinking character. The soil is friable in dry state, moisture retentive and highly fertile.

Kabar is also a fertile soil but contains fewer amounts of clay and lighter in colour than Mar. **Kabar** and **Mar** soils are commonly known as black cotton soil and occur in the area of central parts.

Parwa generally occurs in the northern parts of area. This is a loamy soil, usually having grey colour.

Rakar soil is coarse grained red soil, strewn with Kankar. It has less fertility and occurs on ravine slopes.

In **Jhansi**,the soil found may be classified into two group on the basis of colour and topography i.e. red (upland soils) and black (low land soils). On the basis of texture, the red soil is further divided into 'Rakar' and 'Parwa' and the black soil group into 'Kabar' and 'Mar'.

7.5.6. Land Use/Land cover

Table no.7.2. Land use of 500 m radius

Land use types	Area ha	% Area
River and water bodies	1085.41	13.20368
Land with or without scrub	1835.97	22.33402
Crop land (Horticulture)	911.82	11.09201
Sand	4387.31	53.37029

Table 7.3.Land use of 10 km radius

Land use types	Area ha	% Area
River and water bodies	1587.23	1.486124
Forest	14044.6	13.14996
Land with or without scrub	34793.1	32.57678
Crop land	48340.1	45.26084
Fallow land	1058.55	0.99112
Built-up land	1325.56	1.241122
Waste land	5327.26	4.987914
Sand	326.97	0.306142

Description of Land use/land cover

The buffer zone of study area-1 is almost 45 % crop land and 32% of land area is scrub land or with no scrub.The total builtup area in 10 km radius is 1.24 % and waste land is 4.89 or almost 5 % of the total area covered in the buffer zone of study area-1.

7.5.7.Process of deposition

Sediment transport is critical to understanding how rivers work because it is the set of processes that mediates between the flowing water and the channel boundary. Erosion involves removal and transport of sediment (mainly from the boundary) and deposition involves the transport and placement of sediment on the boundary. Erosion and deposition are what form the channel of any alluvial river as well as the floodplain through which it moves. The amount and size of sediment moving through a river channel are determined by three fundamental controls: competence, capacity and sediment supply. Competence refers to the largest size (diameter) of sediment particle or grain that the flow is capable of moving; it is a hydraulic limitation. If a river is sluggish and moving very slowly it simply may not have the power to mobilize and transport sediment of a given size even though such sediment is available to transport. So a river may be competent or incompetent with respect to a given grain size. If it is incompetent it will not transport sediment of the given size. If it is competent it may transport sediment of that size if such sediment is available (that is, the river is not supply-limited). Capacity refers to the maximum amount of sediment of a given size that a stream can transport in traction as bedload. Given a supply of sediment, capacity depends on channel gradient, discharge and the calibre of the load (the presence of fines may increase fluid density and increase capacity; the presence of large particles may obstruct the flow and reduce capacity). Capacity transport is the competence-limited sediment transport (mass per unit time) predicted by all sediment-transport equations, examples of which we will examine below. Capacity transport only occurs when sediment supply is abundant (non-limiting). Sediment supply refers to the amount and size of sediment available for sediment transport. Capacity transport for a given grain size is only achieved if the supply of that calibre of sediment is not limiting (that is, the maximum amount of sediment a stream is capable of transporting is actually available). Because of these two different potential constraints (hydraulics and sediment supply) distinction is often made between supply-limited and capacity-limited transport.

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

7.5.9. Modes of Sediment Transport

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

1. Dissolved load

2. Suspended load

3. Intermittent suspension (saltation) load

4. Wash load

5. Bed load

7.5.10.Sediment Transport in Rivers

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. A dynamic equilibrium state of the boundary may be expected when a steady and uniform flow has developed (Nalluri & Featherstone, 2009). 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.

Sediment Influx Rate

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

Recharge is in two forms, one general deposition of coarse, medium and fine sand when the velocity of the river water decreases below the carrying capacity.

However, flash floods due to heavy rains in the upper reaches often causes rapid transportation of boulder, sand etc., along with silt which can never deposit.

Recharge Rate: It is dependent upon the following 4 factors

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

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

The numerical sedimentation rate varies from 50cm medium sand to as much as 3m of medium and fine sand where the slope of the river bed is less than 100 slope per season. For silt and clay, these only be deposited in the flood area and normally varies between 1-5m over 6 months period.

7.5.11. Estimation of Sedimentation

The sedimentation rate in India is estimated using empirical formula, actual observed data and reservoir sedimentation survey. In addition the sediment data is also collected by the state governments on river systems in their respective territories. Thus there is enough data to estimate both the average annual sediment yield and also the distribution of annual sediment yields. There are also situations where the gauging stations provide nested systems of catchments. In these situations data can be used to identify the contribution to the total sediment yield from individual sub-catchments. Though this data is extremely useful and is recommended to be fully used for estimation of sediment rate, the data need to be interpreted with care. The sediment measurements are, in general, based on bottle sample taken from near the water surface. In general, the suspended sediment concentration varies with depth, with the sediment concentration being greatest at the lower levels. This means that the measurement may under estimate the suspended sediment concentrations. The sediment yield depends on catchment area, the average catchment slope, the lithology of the catchment, the land use, the drainage density, the annual/seasonal precipitation and storm events etc. There are a number of empirical methods developed in USA and still used worldwide to assess sediment erosion, including the Universal Soil Loss Equation (USLE), MUSLE, and Revised Universal Soil Loss Equation (RUSLE). Some work has been done in India and certain empirical relations have been developed linking annual sediment yield with some of these parameters .
Estimation of sediment yield from the catchment area above the reservoir is usually made using river sediment observation data or more commonly from the experience of sedimentation cf existing reservoirs with similar characteristics. On adopting the first procedure, it is usually necessary (though often not complied within practice) to evolve

proper sediment water discharge rating curve and combine it with flow duration (or stage duration curve) based on uniformly spaced daily or shorter time units in case of smaller river basins. Where observed stage/flow data is available for only shorter periods, these have to be suitably extended with the help of longer data on rainfall to eliminate, as far as possible, the sampling errors due to shortness of records. The sediment discharge rating curves may also be prepared from hydraulic considerations using sediment load formulae, that is, modified Einstein's procedure but this has not yet become popular. It is also necessary to account for the bed load which may not have been measured. While bed load measurement is preferable; when it is not possible, it is often estimated as a percentage generally ranging from 5 to 20 percent of the suspended load. However, practical means of measuring bed load of sediment needs to be undertaken particularly in cases where high bed loads are anticipated. To assess the volume of sediment that would deposit in the reservoir, it is further necessary to make estimates of average trap efficiency for the reservoir in question and the likely unit weight of sediment deposits, time averaged over the period selected. The trap efficiency would depend mainly on the capacity inflow ratio but would also vary with location of controlling outlets and reservoir operating procedures. The density of deposited sediment would vary with the composition of the deposits, the location of the deposit within the reservoir, the flocculation characteristics of clay and water, and the age of the deposit. For coarse material (0.0625 mm and above), variation of density with location and age may be unimportant. For silt and clay, this may be significant. Normally, a time and space average density of these fractions, applicable for the period under study is required for finding the overall volume of deposits. For this purpose, the trapped sediment for the period under study would have to be classified in fractions by corrections in inflow estimates of the fractions by trap efficiency. Most of the sediment removed from the reservoir should be from the silt and clay fraction. In some special cases, local estimates of densities at a point in the reservoir may be required instead of average density over the reservoir. Estimates of annual sediment yield/sedimentation rate assessed from past data are further required to be suitably interpreted and where necessary, the unit rates which would apply to the future period are computed by analysing data for trends or by making subjective adjustments for the likely future changes. Where the contributing drainage area is likely to be reduced by upstream future storages, only such of the projects as are under construction or which have the same priority of being taken up and completed as the project in question are considered for assessing the total sediment yield. Sediment observation data (is necessary if the yield is being assessed from hydrometric data. If observational methods are inadequate, the possibility of large errors should be considered. For drawing conclusions from reservoir re-surveys, it is important that reduction of at least 10 percent or more has been observed in the capacities of the two successive surveys; if this is not done, inaccuracies in the successive surveys will distort the estimation of the capacity reduction between the surveys. If the loss of capacity is small, useful conclusions may not be forthcoming, and in such cases, river sediment measurements with its large observational errors may still provide a better estimate. It is essential to make a proper assessment of sediment yield for reservoir under study taking relevant factors into account.

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

Erosion of catchments The most significant agent for eroding sediments from land is running water. Other agents of land erosion include wind, ice, and gravity. The processes by which water degrades the soil are complicated and depend upon the rainfall properties, soil properties, land slope, vegetation, agricultural methods, and urbanization process. The last two factors account for the most important effects of man's activities on erosion. Empirical equations have been developed for the determination of soil loss (sheet erosion) from agricultural lands. One of them, developed by Musgrave for conditions prevailing in the United States , is given as an example: E = IRS1.35 l0.35 p1.75 (59.1) where E is the mean annual soil loss, in millimetres, I is the inherent erodibility of the soil, in millimetres, R is a land-cover factor, S is the land slope, in per cent, l is the length of the slope, in metres, and p is the 30-minute, two-year rainfall depth, in millimetres. The values of the parameters I and R are determined empirically from regional studies.

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

Transportation of sediments in channels Fine (suspended) sediments transported in rivers originate mainly from the topsoil of the catchment and from the banks of the channels. However, fine sediments also originate from sewage and other return flows, e.g., such sediments comprise about onethird of the suspended-sediment load in the lower Rhine river. A large portion of the transported material comes to rest on flood plains especially upstream from hydraulic structures. The settled material undergoes compaction and other physical and chemical changes that can sometimes prevent its re-erosion by flows that would have carried it previously. A decrease is usually found in the mean annual sediment transported per unit area of the catchment as the area of the catchment increases. The concentration of suspended sediment in runoff is described by formulae such as : $\log c_s = C \log Q + B$ (59.2) in which c_s is the concentration expressed in weight per unit volume of water, Q is the water discharge, C is a dimensionless coefficient, and B is a function of the rainfall depth, of the antecedent discharge, or of other meteorological and hydrological variables. The concentration of suspended sediment varies within the channel crosssection. It is relatively high in the lower portion and may also be non-uniform laterally . so that its sampling at several points or along several verticals of the cross-section is often necessary for obtaining its mean. The mean concentration should be evaluated to yield the total sediment weight per unit time when multiplied by the water discharge. The graph of suspended sediment against time usually has a peak that does not occur simultaneously with the peak discharge. This lag is a result of the specific conditions in a watershed, and no generalization has yet been formulated for the evaluation of this difference.

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

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

Some of the famous sediment transport equations are:-

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

7.5.12. Study of Replenishment of the stretch

Objective

A realistic estimation of the sand resource in a lease area.

Estimation of replenished sand by measuring pre and post monsoon sand level in the mining area.

Drawing and overall picture of sand budgeting in the study area.

Review of literature

The transport of sediment by rivers has been studied extensively by engineers and earth scientists or more than a century. The use of Bed load transport is a famous one for this analytical type of approach. Recent studies on bed load transport incorporated the stochastic nature of the river sand inflow. Several such studies related to river sand mining have been reported for the rivers of Kerala also. For a clear direction for the local bodies, for the limit for safe sand mining from different stretches, an analytical study based on bed load transport model combined with actual sand flow measurement is necessary. This study develops a reach wise assessment of actual sand inflow and the optimal removal from rivers.

- Methodology and data collection
- Field mapping using cadastral scale map
- Local survey
- Sand survey by sample mining

The scientific solution for the crisis of sand mining needs an optimization of sand removal.Knowledge of sand inflow is the key part of determination of optimal sand removal. To determinethis sand inflow an analytical study is carried out by using bed load transport model. The bed loadtransport can be estimated using different analytical model such as Meyer-Peter's, Einstein'sModel, Shield's Formula, Du-Boy's Formula etc. However, in the present study, the most practical approach is used for estimation of bed load transport.

Table No7.4. Popular methods for Replenishment Study

Sediment Transport Equations	• Yang Equation • Engelund-Hansen Equation
River Modeling	• River Modelling Using HEC-RAS

Sediment Rating Curve Determination	• Flow Discharge based on Surveyed Cross Section • Sediment Distribution Curve • Total Bed Material Load Computation • Historical Flood Hydrograph • Extraction Volume Determination
Site Visits and Estimation of Actual Amount	• Visits to extraction site annually, reviews cross section survey data & estimates the actual amount of replenishment over the flood season.

The monsoon in the Uttar Pradesh is regular. Thus, the actual observation of flow and siltwhich is essential for determination of replenishment is utilized for the study purpose. With this situation in mind, a twostage sand replenishment study, described hereunder, was undertaken. In stage one;preliminary study with field data collection was done. During the field visit, theinstallation of marked observation rods was undertaken in every leasehold area in the pre-monsoonperiod. The rise of river bed level in the post monsoon season was then ascertained. Whileinstalling the marked observation rods, it was also kept in mind that depending upon the rainfallintensity and duration. The second stage includesobservation of level of sand at the end of the monsoon season. The difference obtained between the pre and post monsoon level of sand is the actual amount of sand replenished during the rainy season.**The actual results will be collected after rainy season and same will be given in first compliance report.**

7.6 SOCIAL IMPCT ASSESSMENT

Detail Social Impact Assessment study has been done and given in Chapter-3.

7.7 RESSETLEMENT & REHABILITATION PLAN

Not applicable.

7.8 DISASTER MANAGEMENT

All types of industries face certain types of hazards which can disrupt normal activities abruptly and to disaster like fires, inundation, failure of machinery, explosion, to name a few. Similarly Sand mines also have impending dangers or risk which need be addressed for which a disaster management plan has been formulated with an aim of taking precautionary steps to avert disasters and also to take such action after the disaster which limits the damage to the minimum. Nevertheless, the following natural/industrial problems may be encountered during the mining operation.

1. Inundation- filling of the mine pit due to excessive rains.
2. Slope failures at the mine faces or stacks.
3. Accident due to storage of explosive and blasting.
4. Accident due to fire.

As per proposal made under the mining plan, during proposed working the area will be developed by means of opencast and OTFM mining method. Exploitation and transportation of minerals are to be carried out by manual means. Water table will not be touched during processed working. No high risk accidents like landslides, subsidence flood etc. have been apprehended. But, possibility of accidental disaster is also not ruled out. Therefore, all the statutory precautions should be taken for quick evacuation as per; the Mines Act 1952, the Mines Rules 1955, MMR-1961 and MCDR-1988. There will be no storage of explosives or blasters as it is not required in River bed Mining.

7.8.1. Risk Assessment and Disaster Management Plan

The possible risks in the case of river bed mining project are bank erosion, floods, accidents due to transportation etc. Mining and allied activities are associated with several potential hazards to both the employees and the public at large. A worker in a mine should be able to work under condition, which are adequately safe and healthy. At the same time, the environment should be such as not to impair his working efficiency. This is possible only when there is adequate safety in mines. Hence, safety at the mine of all the employees is taken care of by the mining rules & regulations, which are well defined with laid down procedure for safety, which when scrupulously followed safety is ensured not only to manpower but also to machines & working environment.

Possible Risks Due To Inundation & Its Control

Mining will be done during the non monsoon periods; therefore, problem of inundation is not likely to happen.

Dewatering

Depth of mine is limited to 3m/ water level whichever less is whereas the ground water flows far below the bed level. Fig 3.15 in chapter 3 depicted pre and post monsoon water level and depth of mining.

Hence, no dewatering is required.

Possible Risks Due To Failure Of Pit Slope & Its Control

Pit will be created of limited depth only i.e. 3 m water level whichever is less thus the chance of failure of pit slope does not exist.

Possible Risks Due To Failure Of Waste Dump & Its Control

No waste dump is created; therefore the question of failure of waste dump does not exist.

Possible Risks Due To Fire & Its Control

The operation does not anticipate any fire disaster.

7.8.2 Measures to Prevent Accidents Due to Trucks and Dumpers

- ❖ All transportation within mining lease working should be carried out directly under the supervision and control of the management.
- ❖ The vehicles will be maintained in good condition and checked thoroughly at least once a month by the competent person authorized for the purpose by the management.
- ❖ Road signs will be provided at each and every turning point up to the main road (wherever required).
- ❖ To avoid danger while reversing the equipments/ vehicles especially at the working place / loading points, stopper should be posted to properly guide reversing/ spotting operating, otherwise no person should be there within 10 m radius of machine.

- A statutory provision of the fences, constant education, and training etc.will go a long way in reducing the incidents of such accidents.

7.8.3. Other Possible Measures to Avoid Risks/ Disaster Due to River Bed Mining.

- Unwanted material including mineral or spillage (if any) should not be stacked on the banks as it will hinder the flow of water in monsoon season.
- Mining of minerals / working shall be started from the centre from dip to rise and then laterally in 0.6 Meter slice so that the river course could not get affected.
- The minerals will be mined out in a uniform way so that the river flow/ course shall not get disturbed.
- River banks will not be excavated to from access ramps. Only excavated river gravel should be used to deposit against the river bank to form access ramps.

7.9 TRANSPORTATIONAL ROUTE ANALYSIS

The table given below is the basis for calculation of additional load of air pollutants due to the transportation of excavated sand in the region. The contribution of different factors like emission due to unpaved length, paved length and tail pipe are calculated and represented in graphs.

Table No. 7.1 Transportational Route analysis

Project Proponent (s) & Name of Company (if any) & Residential Address	Gata No (s)/ Khand No (s) ,Village Tehsil/ District	Details of Production		Haulage Route Length (km)			
		Daily Production (cum/day)	No. of Trucks to be deployed for transportation	Description	Unpaved Length	Paved Length	Total Length
M/s Sanevin Infrastructure Private Limited	Khand No. 26/7, Chandwari Ghurauli Sarila/ Hamirpur (36.437 ha)	2650	176	>8m wide road connected to SH 21 (Orai-Rath)	1	7.98	8.98
M/s Sanevin Infrastructure Private Limited	Khand No. 22/15, Rirua Basariya Sarila/ Hamirpur (24.291 ha)	1413	94	>7m wide road connected to MDR(Kalpi-Dgawa Ratha road) which is further connected to SH-21 (Orai-Rath)	2.4(SW) & 0.44(S)	1.19(SW) & 4.55 (S)	3.59 (SW) & 4.99 (S)

M/s Sanevin Infrastructure Private Limited	Gata No(s). 864/320, 865/320, Simiriya Orai/ Jalaun (27.53 ha)	1,502	100	>10m wide road connected to SH 21(Orai-Rath) which is further connected to NH 25(Kanpur-Jhanshi- Highway)	0.59	14.5	15.09
Shri Atikur Rahman	Khand No. 22/14, Rirua Basariya Sarila/ Hamirpur (24.291 ha)	1413	94	>7m wide road connected to MDR(Kalpi-Dgawa Ratha road) which is further connected to SH-21 (Orai-Rath)	2.60 (NW) & 0.44 (S)	1.19 (NW) 4.55 (S)	3.79 (NW) & 4.99 (S)
M/s New Eoan Associates	Khand No. 26/3 Chandwari Ghurauli Sarila/ Hamirpur (24.291 ha)	1766	117	>9m wide road connected to Pucca road which is further connected to SH-21 (Orai-Rath)	0.73	5.98	6.71
M/s Satyam Constructions*	Khand No.- 24/9, Chikasi Sarila/ Hamirpur (36.437 ha)	2649	176	>8m wide road connected to Pucca road which is further connected to SH-21 (Orai-Rath)	1.47	5.23	6.7
M/s Disha enterprises*	Khand No.- 24/14 ,Chikasi Sarila/ Hamirpur (36.437 ha)	2649	176	>7m wide road connected to Pucca road which is further connected to SH-21 (Orai-Rath)	0.65	2.4	3.05
M/s Shri Shrikant Gupta*	Khand No. 24/13, Chikasi Sarila/Hamirpur (36.437 ha)	2649	176	>6m wide road connected to Pucca road which is further connected to SH-21 (Orai-Rath)	1.31	2.4	3.71
08 Leases		**16691**	**1109**		**11.63**	**49.97**	**61.60**
M/s HSM Holdings Private Limited	Khand No. 22/10, Rirua Basariya Sarila/ Hamirpur (24.291 ha)	1413	94	>8m wide road connected to MDR (Kalpi-Dgawa Ratha Road) which is further connected to SH 21 (Orai-Rath)	0.77	4.38	5.15

M/s Kanhaiyalal And Sons		Khand No. 03, Gata No. 1782, 1783, Muhana Orai/ Jalaun (8.906 ha)	324	22	>8m wide road connected to SH 21(Orai-Rath) which is further connected to NH 25 (Kanpur-Jhanshi-Hwy)	0.36	0.89	1.25
M/s Pratap Corporation*		Khand No. 9, Badera Khalsa Sarila/Hamirpur (24.291ha)	1413	94	>6m wide road connected to SH 21(Orai-Rath)	1.57	6.76	8.33
Total	**03 Leases-B2**		**3150**	**210**		**2.70**	**12.03**	**14.73**
Grand Total	**11Leases-(B1+B2)****		**19841**	**1319**		**14.33**	**62.0**	**76.33**

*Upcoming B1- sub-category Projects for which Public Hearing is awaited and EC from SEAC for B2-sub-category projects is also awaited & granted.

**(inclusive of upcoming projects of B1-sub-category for which Public Hearing is awaited and B2- sub-category projects for which EC is awaited)

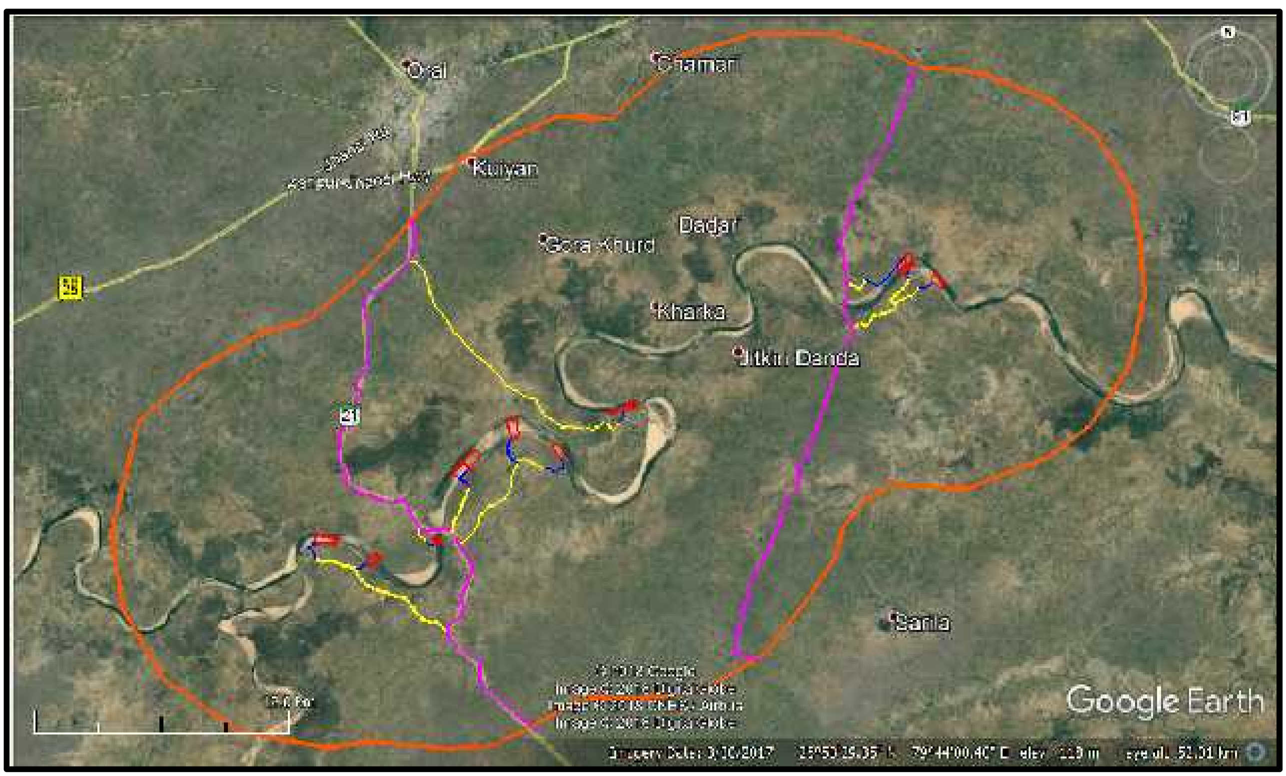


Fig 7.9. Google Map showing Tranportational Route of Study Area-1

In the above figure, the transportational route of Study area -1 is represented, in which Blue path represents the unpaved road, Yellow path represents the paved road and violet path represents the main roads like SH and NHs.

Details of transportational routes are given in Chapter-2 under lease wise details.

7.9.1.Air pollutants level prediction using modeling for worst case scenerio (Incremental +baseline data) in study area

Additional emission load of air pollutant emission from heavy vehicles using sand/morrum transportation in sand mining project surrounding, Betwa River District Jalaun/ Hamirpur

Sand/morrum mining minerals have been transported through roads using motor vehicles. Motor vehicles have been producing various air pollutants through exhaust such as PM, CO, NO_2, and SO_2. Dusts are also released from vehicle tires while play on unpaved (haulage road) and paved road. This dust is well known as suspended dust.

The ambient air quality might get degraded of sand/morrum mining project site surroundings from vehicular emissions through transportation of sand/morrum. Vehicular emissions and resuspension of road dust which may lead to respirable diseases of human beings at project sites and surroundings. The emission load contribution at the receptor sites in atmosphere depends upon multitude of factors such as local meteorology, location, height of release and atmospheric removal processes.

The incremental air pollutant level for worst case scenerio was predicted using modeling in study area. The methods have been discussed in the next section.

Methodology

Air Quality Modeling is a method used to predict air quality in study area for sand/morrum. The emission factor one of input parameter for modeling. The emission factor of vehicles has taken from “The Automotive Research Association of India (ARAI)”, Pune (ARAI, 2016). The heavy vehicle populations have been count daily movements up and down trip for transportation of sand/morrum. Emission factor from paved and unpaved road has been calculated using USEPA AP-42 method. Air quality modeling was done using line source model as published by USEPA for transportation through roads and the empirical emission factor equations from article, "Emission Factor Equations for Haul roads: The Indian Perspective" (Singh et al., 2006). Concentration of the fugitive dust was calculated by using empirical equations for unpaved roads. Gaussian plume a model has been predicted the downwind air pollutants (CO, SO2, NO2, and Particulates) concentrations from line source through exhaust (Goyal, P. 2007; Demirarslan et al. 2017).

Air Quality Index (AQI) is a tool for effective communication of air quality status to people in terms, which are easy to understand. It transforms complex air quality data of various pollutants into a single number (index value), nomenclature and colour. There are six AQI categories, namely Good, Satisfactory, Moderately polluted, Poor, Very Poor, and Severe. Each of these categories is decided based on ambient concentration values of air pollutants and their likely health impacts (known as health breakpoints) (CPCB 2014). AQI range is also associated with possible health impacts and presented in Table 1 as prescribed by CPCB, 2014. Air pollutants concentration and air quality index (AQI) has been plotted using GIS tool. GIS mapping was done in this study using spatial interpolation technique by inverse distance weighted (IDW) (Jha et al., 2011; Wong et al. 2004). Contour map was also plotted using ArcGIS tool for distribution of air pollutants and AQI value in the study area.

Table No. 7.6. AQI category, ranges and their associated health impacts (Source: CPCB, 2014)

AQI	Color Code	Associated Health Impacts
Good (0-50)		Minimal Impact
Satisfactory (51-100)		May cause minor breathing discomfort to sensitive people
Moderately polluted		May cause breathing discomfort to the people with lung disease such as asthma and discomfort to people with heart disease, children and

(101-200)		older adults
Poor (201-300)		May cause breathing discomfort to people on prolonged exposure and discomfort to people with heart disease
Very poor (301-400)		May cause respiratory illness to the people on prolonged exposure. The effect may be more pronounced in people with lung and heart diseases
Severe (>401)		May cause respiratory effects even on healthy people and serious health impacts on people with lung/heart diseases. The health impacts may be experienced light physical activity even during

Analysis of emission load of air pollutants from heavy trucks.

Projects production: 15780 cum/day)

Table No.7.7Emission load of $PM_{2.5}$from heavy capacity truck employed at sand mining project siteson Betwa River area

Monitoring stations	Baseline concentration of $PM_{2.5}$	Incremental value in concentration of $PM_{2.5}$	Total (Baseline +Incremental) concentration of $PM_{2.5}$	Increase in % of $PM_{2.5}$
AQ 1	52.3	5.7	58.0	10%
AQ 2	50.9	6.2	57.0	11%
AQ 3	52.5	0.5	53.0	1%
AQ 4	51.8	1.0	52.8	2%
AQ 5	52.8	0.0	52.8	Negligible
AQ 6	52.7	9.5	62.1	15%
AQ 7	51.4	1.0	52.4	2%
AQ 8	52.5	1.0	53.5	2%
AQ 9	52.1	2.3	54.4	4%
AQ 10	51.5	0.0	51.5	Negligible
AQ 11	54.4	3.0	57.4	5%
AQ 12	50.2	1.6	51.8	3%
AQ 13	50.5	3.5	54.0	7%
AQ 14	50.6	3.5	54.1	7%
AQ 15	51.4	1.0	52.5	2%

Ambient Air Quality Monitoring stations at Villages Kutra and Barsar with Station Code AQ 5 & AQ 10 respectively shows negligible % increase in $PM_{2.5}$because of the distance from the nearest mine site. Since, AQ 5 is situated at approximately more than 5.0kms and AQ 10 is situated at approximately more than 9.50kms pollutant gets dispersed. Hence, the percent increment is negligible.

TableNo.7.8Emission load of PM_{10} from heavy capacity truck employed at sand mining project sites on Betwa River area

Monitoring stations	Baseline concentration of PM_{10}	Incremental value in concentration of PM_{10}	Total (Baseline +Incremental) concentration of PM_{10}	Increase in % of PM_{10}
AQ 1	88.6	13.8	102.4	13%
AQ 2	88.8	12.2	101.0	12%
AQ 3	90.3	1.3	91.6	1%
AQ 4	89.1	0.0	89.1	Negligible
AQ 5	85.6	0.0	85.6	Negligible
AQ 6	91.5	16.3	107.8	15%
AQ 7	86.8	0.0	86.8	Negligible
AQ 8	87.7	0.0	87.7	Negligible
AQ 9	89.3	4.9	94.2	5%
AQ 10	89.0	0.0	89.0	Negligible
AQ 11	91.0	5.3	96.2	5%
AQ 12	86.5	5.76	92.3	6%
AQ 13	86.9	6.3	93.2	7%
AQ 14	88.8	6.3	95.1	7%
AQ 15	92.5	0.0	92.5	Negligible

Ambient Air Quality Monitoring stations at Villages Kutra, Benda Dariya, Dhamni Khurd, Basariya, Barsarand Atra with Station Code AQ 4, AQ 5, AQ 7, AQ 8, AQ 10& AQ 15 respectively shows negligible % increase in PM_{10} because of the distance from the nearest mine site. AQ 5, AQ 7, AQ 8 & AQ 15are situated at approximately more than 4.50 kms, AQ 4 is situated at approximately 1.80kms from the nearest mine site and AQ 10 is situated at approximately more than 9.50kms pollutant gets dispersed. Hence, the percent increment is negligible.

Table No.7.9Emission load of $SO_2$from heavy capacity truck employed at sand mining project sites on Betwa River area

Monitoring stations	Baseline concentration of SO_2	Incremental value in concentration of SO_2	Total (Baseline +Incremental) concentration of SO_2	Increase in % of SO_2
AQ 1	8.4	0.1	8.5	1.2%
AQ 2	7.7	0.0	7.8	0.6%
AQ 3	8.4	0.0	8.4	0.3%
AQ 4	8.1	0.0	8.1	Negligible
AQ 5	7.9	0.0	7.9	Negligible
AQ 6	8.0	0.2	8.2	2%
AQ 7	8.1	0.0	8.1	Negligible
AQ 8	7.8	0.0	7.8	Negligible
AQ 9	8.0	0.1	8.1	1.2%
AQ 10	7.7	0.0	7.7	Negligible
AQ 11	8.1	0.2	8.3	2.4%
AQ 12	7.6	0.0	7.6	0.4%
AQ 13	8.1	0.0	8.1	0.4%
AQ 14	7.6	0.0	7.7	0.4%
AQ 15	8.4	0.0	8.4	Negligible

Ambient Air Quality Monitoring stations at Villages Kutra, Benda Dariya, Dhamni Khurd, Basariya, Barsarand Atra with Station Code AQ 4, AQ 5, AQ 7, AQ 8, AQ 10 & AQ 15 respectively shows negligible % increase in SO_2because of the distance from the nearest mine site. AQ 5, AQ 7, AQ 8 & AQ 15 are situated at approximately more than 4.50 kms, AQ 4 is situated at approximately 1.80kms from the nearest mine site and AQ 10 is situated at approximately more than 9.50kms pollutant gets dispersed. Hence, the percent increment is negligible.

Table No.7.10 Emission load of $NO_2$from heavy capacity truck employed at sand mining project sites on Betwa River area

Monitoring stations	Baseline concentration of NO_2	Incremental value in concentration of NO_2	Total (Baseline +Incremental) concentration of NO_2	Increase in % of NO_2
AQ 1	11.4	4.2	15.6	27%
AQ 2	10.1	4.2	14.3	29%
AQ 3	10.5	1.5	12.0	12%
AQ 4	10.4	0.0	10.4	Negligible
AQ 5	10.4	0.0	10.4	Negligible
AQ 6	10.3	5.3	15.5	34%
AQ 7	10.4	0.0	10.4	Negligible
AQ 8	10.4	0.0	10.4	Negligible
AQ 9	10.2	3.8	14.0	27%
AQ 10	9.9	0.0	9.9	Negligible
AQ 11	10.5	4.2	14.7	29%

AQ 12	10.5	3.0	13.5	22%
AQ 13	10.9	3.0	13.9	22%
AQ 14	10.2	3.0	13.2	23%
AQ 15	10.4	0.0	10.4	Negligible

Ambient Air Quality Monitoring stations at Villages Kutra, Benda Dariya, Dhamni Khurd, Basariya, Barsarand Atra with Station Code AQ 4, AQ 5, AQ 7, AQ 8, AQ 10 & AQ 15 respectively shows negligible % increase in NO_2because of the distance from the nearest mine site. AQ 5, AQ 7, AQ 8 & AQ 15 are situated at approximately more than 4.50 kms, AQ 4 is situated at approximately 1.80kms from the nearest mine site and AQ 10 is situated at approximately more than 9.50kms pollutant gets dispersed. Hence, the percent increment is negligible.

Table No. 7.11 Emission load of CO from heavy capacity truck employed at sand mining project sites on Betwa River area

Monitoring stations	Baseline Air pollutants concentration	Incremental value of Air pollutants concentration	Total Air pollutants concentration
AQ 1	BDL	0.0	0.03%
AQ 2	BDL	0.0	0.03%
AQ 3	BDL	0.0	0.03%
AQ 4	BDL	0.0	Negligible
AQ 5	BDL	0.0	Negligible
AQ 6	BDL	0.2	0.16%
AQ 7	BDL	0.0	Negligible
AQ 8	BDL	0.0	Negligible
AQ 9	BDL	0.0	0.02%
AQ 10	BDL	0.0	Negligible
AQ 11	BDL	0.1	0.08%
AQ 12	BDL	0.0	0.01%
AQ 13	BDL	0.1	0.08%
AQ 14	BDL	0.0	0.04%
AQ 15	BDL	0.0	Negligible

Ambient Air Quality Monitoring stations at Villages Kutra, Benda Dariya, Dhamni Khurd, Basariya, Barsarand Atra with Station Code AQ 4, AQ 5, AQ 7, AQ 8, AQ 10 & AQ 15 respectively shows negligible % increase in NO_2because of the distance from the nearest mine site. AQ 5, AQ 7, AQ 8 & AQ 15 are situated at approximately more than 4.50 kms, AQ 4 is situated at approximately 1.80kms from the nearest mine site and AQ 10 is situated at approximately more than 9.50kms pollutant gets dispersed. Hence, the percent increment is negligible.

Table 7.12: Air quality index of AAQ monitoring locations.

Location/AQI	Sub-index of air pollutant					AQI	Health statements for AQI
	IPM10	IPM2.5	ISO2	INO2	ICO		
AQ 1	101.9	96.7	10.7	19.5	1.4	101.9	Moderately polluted
AQ 2	101.0	95.0	9.7	17.9	1.4	101.0	Moderately polluted
AQ 3	91.6	88.2	10.5	15.0	1.4	91.6	Satisfactory
AQ 4	89.1	87.9	10.1	13.0	0.0	89.1	Satisfactory
AQ 5	85.6	87.9	9.9	13.0	0.0	87.9	Satisfactory
AQ 6	105.5	104.8	10.2	19.4	8.0	105.5	Moderately polluted
AQ 7	86.8	87.2	10.2	13.0	0.0	87.2	Satisfactory
AQ 8	87.7	89.0	9.7	13.0	0.0	89.0	Satisfactory
AQ 9	94.2	90.5	10.2	17.5	1.2	94.2	Satisfactory
AQ 10	89.0	85.6	9.6	12.4	0.0	89.0	Satisfactory
AQ 11	96.2	95.6	10.4	18.4	4.0	96.2	Satisfactory
AQ 12	92.3	86.1	9.7	16.9	4.0	92.3	Satisfactory
AQ 13	93.2	89.9	10.2	17.4	4.0	93.2	Satisfactory
AQ 14	95.1	90.0	9.6	16.5	1.9	95.1	Satisfactory
AQ 15	92.5	87.3	10.5	13.1	0.0	92.5	Satisfactory

- Air Quality status at three monitoring stations (AQ1, AQ2 and AQ6) of Study Area-1 on Betwa river are moderately polluted due to vicinity of haulage route, paved road and Sand/Morrum mine projects.
- Air quality at other twelve stations out of above mentioned stations (AQ3, AQ4, AQ5, AQ 7etc.) are satisfactory condition due to more distance from haulage road, being situated in upwind direction of wind and existing forest area.

Table 7.13: IND-AQI category, ranges and their associated health impacts (Source: www.cpcb.nic.in)

AQI	Color Code	Associated Health Impacts
Good (0-50)		Minimal Impact
Satisfactory (51-100)		May cause minor breathing discomfort to sensitive people
Moderately pollute (101-200)		May cause breathing discomfort to the people with lung disease such as asthma and discomfort to people with heart disease, children and older adults
Poor (201-300)		May cause breathing discomfort to people on prolonged exposure and discomfort to people with heart disease.
Very poor (301-400)		May cause respiratory illness to the people on prolonged exposure. The effect may be more pronounced in people with lung and heart diseases
Severe (>401)		May cause respiratory effects even on healthy people and serious health impacts on people with lung/heart diseases. The health impacts may be experienced light physical activity even during

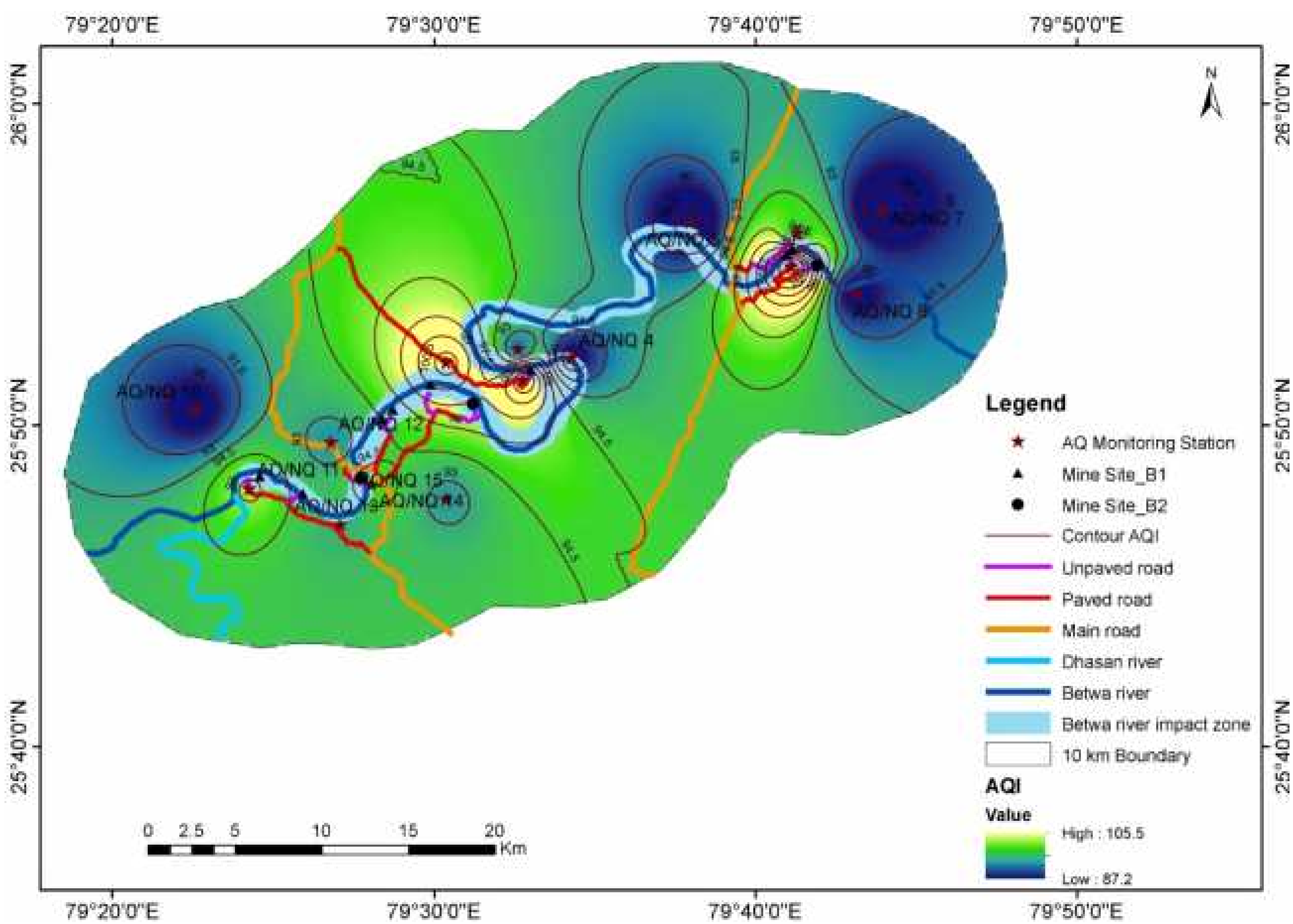


Fig 7.18: Air quality index of monitoring locations.

Betwa River study area 1 :Air quality status fall in Moderate and Satisfactory condition

7.10 INCREAMENTAL NOISE IN THE STUDY AREA-1

In opencast mines most of the mining machineries produce noise levels in the range of 90-115 dBA, exposure to which may affect the general health of human beings in accordance with the WHO definition of health.

Many machines do not operate constantly or at a constant noise level. Exposure to noise varies due to mobility of workers, mobility of noise sources, variations in noise levels or a combination of these factors. If the survey indicates that worker is exposed to noise > 115 db (A) then he should be provided with hearing protection.

7.10.1.Work Place Noise Standards:

DGMS Circular No.18 (Tech), 1975 A warning limit of 85-dB (A) may be set as the level below which very little risk to an unprotected ear of hearing impairment exists for an eight-hour exposure.

- The danger limit value shall be **90-dB (A)** above which the danger of hearing impairment and deafness may result from an unprotected ear.
- A worker should not be allowed to enter, without appropriate ear protection, an area in which the noise level is **115-dB (A)** or more.
- Personal protective equipment shall be worn, if there are single isolated outbursts of noise, which can go above **130-dB (A)** "Impulse", or **120-dB (A)** "Fast". ¨ No worker shall be allowed to enter an area where noise level exceeds **140-dB (A).**

7.10.2.Noise Generation, Transmission and Reception

Before steps are taken to develop noise control solutions, the problem should be analyzed in terms of; the source of the noise, the pathway of transmission and the receivers being exposed.

- **Identify the Source** - Frequently, a single piece of mining equipment will combine several individual sources of noise.
- **Determine the Transmission Pathways** - Sound can be propagated over long distances through structures and noise from individual sources may reach the receiver through different pathways.
- **Consider the Receivers -** Consider options on the amount of exposure to the noise rather than the noise itself
- **Distance Considerations –** Sound, which propagates from a point source in free air, attenuates (reduces by) **6 dB** for each doubling of the distance from the source. Sound propagating in an enclosed space is attenuated less than this value, because of contributions to the sound level brought about by reflection from walls and ceilings.
- **Addition of Noise from Several Sources** - Noises from different sources combine to produce a sound level higher than that from any individual source. Two equally intense sources operating together produce a sound level that is 3 dB higher than one alone. It is also noticeable that decibels cannot be directly added, as they are logarithmic values.
- **Sound Insulation** - When a sound meets a wall or partition, only a small proportion of the sound energy passes through as most is reflected.
- **Sound Absorption** - Sound energy is absorbed whenever it meets a porous material. Porous materials that are intended to absorb sound are called sound absorbents and they absorb between 50 to 90% of the incident sound energy.

Table No. 7.14. Equipment Types, and Their Noise Levels.

EQUIPMENT TYPE	USAGE FACTOR	Lmax at 50 feet (dBA)	Leq at 50 feet (dBA)
Air Compressor	40%	78	74
Blackhoe	40%	78	74
Blasting	1%	94	74
Compactor	20%	83	76
Concrete Mixer Truck	40%	79	75
Concrete Pump Truck	20%	81	74
Crane	16%	81	73
Dozers	40%	81	77

Dump truck	40%	77	73
Excavator	40%	81	77
Front end Loader	40%	80	76
Generator	50%	81	78
Generator (<25 kVA)	50%	73	70
Grader	40%	85	81
Jackhammer	20%	81	74
Mounted Impact Hammer	20%	90	83
Pickup Truck	40%	75	71
Pumps	50%	77	74
Scrapper	40%	84	80
Tractor	40%	81	77

Source: FHWA, 2006. Siskiyou, 1978.

7.10.2. Sound Level Variation VS Distance:

Distance variation of sound level calculated by using below equation-

Sound level L and Distance r

$$L_2 = L_1 - \left|20 \cdot \log\left(\frac{r_1}{r_2}\right)\right| \qquad L_2 = L_1 - \left|10 \cdot \log\left(\frac{r_1}{r_2}\right)^2\right|$$

$$r_2 = r_1 \cdot 10^{\left(\frac{|L_1 - L_2|}{20}\right)} \qquad r_1 = \frac{r_2}{10^{\left(\frac{|L_1 - L_2|}{20}\right)}}$$

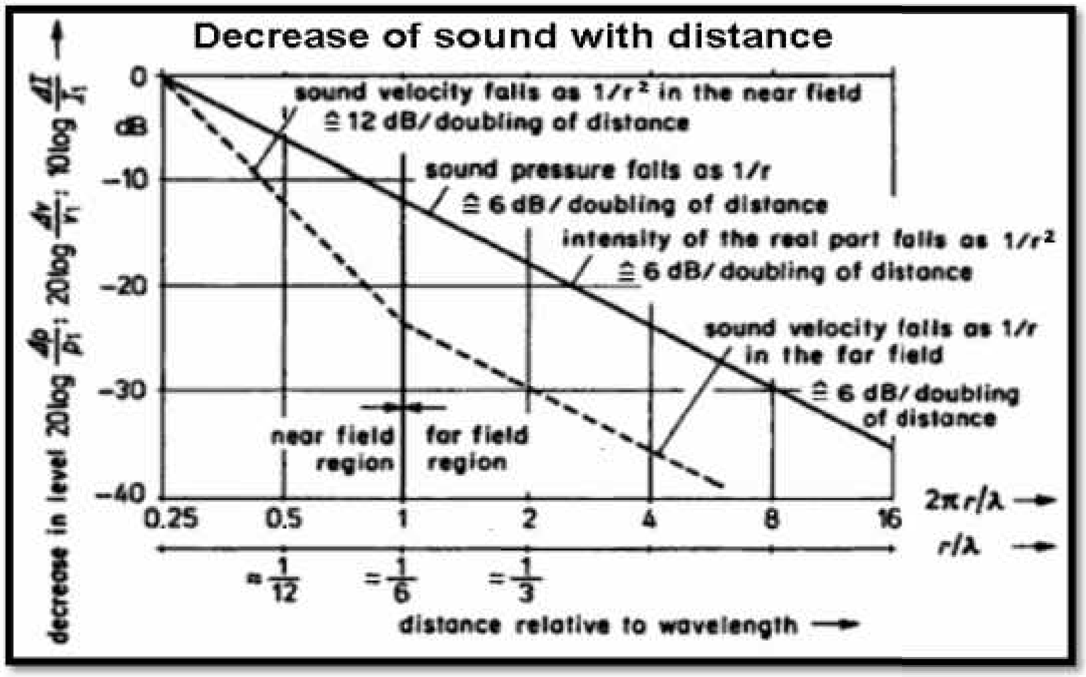


Fig 7.21: Decrease of Sound with Distance

For a spherical wave of a point source we get:

- The sound pressure level (SPL) decreases with doubling of distance by (-) 6 dB.
- The sound intensity level decreases with doubling of distance by (-) 6 dB.

Based on the above calculations and formula, L_{D}, L_N & L_{DN} have been calculated depending upon the Noise source and distance from it. As the distance increases from source, the Noise level decreases. The projection of Noise levels during mine operations is derived from Baseline Monitoring data of Noise. Depending upon the number of trucks and Machineries on each lease area, the Noise levels were calculated and shown in figure NoFig.11 the propagation of Noise along the stretch of Study area.

Table No. 7.15. Noise emission(Baseline +Incremental) at different monitoring Locations

NQ stn.	Baseline(dBA)	Final base+ incremental(dBA)	% incremental
NQ1	52.2	52.5	0.6
NQ2	52.8	53.3	0.9
NQ3	52.2	52.2	0.1

NQ4	53.7	53.7	0.1
NQ5	53.7	53.7	0.0
NQ6	53.7	55.2	2.7
NQ7	53.7	53.7	0.0
NQ8	53.7	53.7	0.0
NQ9	53.7	53.8	0.3
NQ10	53.7	53.7	0.0
NQ11	53.7	53.8	0.1
NQ12	53.7	53.8	0.2
NQ13	53.7	53.7	0.1
NQ14	53.7	53.9	0.3
NQ15	53.7	53.7	0.0

- Noise Quality status at one monitoring station (NQ 6) of Study Area-1 on Betwa riverhave increment of 2.7% as three noise sources are present within the 500m radius of the monitoring station.
- Noise quality at other thirteen stations out of above mentioned stations (AQ3, AQ4, AQ5, AQ 7etc.) are satisfactory condition due to more distance from haulage road, being situated in upwind direction of wind and existing forest area.

7.11 GREEN BELT DEVELOPMENT

The proposed green belt for the cluster on river Betwa extending between (**25°46'12.48"N & 79°19'13.34"E to 25°52'2.99"N & 79°46'49.50"E**) is to be developed taking into consideration the availability of area as the efficiency of green belt in pollution control mainly depends on tree species, its width, distance from pollution sources, side of the habitat from mining sites and tree height. The proposed green belt has been designed to control PM, gaseous pollutants, noise, surface run off and soil erosion etc. While considering the above aspects due care will be taken for selecting the suitable characteristics of plant species such as fast growing, locally adoptable plant species, resistant to specific pollutant and those which would maintain the regional ecological balance, soil and hydrological conditions.

As plants are universal sink for air pollutants, they trap the carbon dioxide and store it within them as reserve food material. Plants being the initial acceptors of air pollutants act as a scavenger to the pollutants. Leaves provide surface area for impingement, absorption and adsorption of air pollutants as well settlement for dust particles in the atmosphere equally.

Few plants are sensitive to certain air pollutants while others are tolerant. The plants sensitive to pollutants act as pollution indicators while the plants tolerant to pollutants act as sink. While selecting the species for pollution control the following are the important characteristics could be considered. Plants should be evergreen, large leaved, rough bark, indigenous, ecologically compatible, low water requirement, minimum care, high absorption of pollutants, resistant pollutants, agro-climatic suitability, height and spread, canopy architecture, growth rate and habit (straight undivided trunk), aesthetic effect (foliage, conspicuous and attractive flower colour), pollution tolerance and dust scavenging capacity. Hence, plantation needs to be done on haul routes to curb air pollution in respect to dust emission.

For sand mining projects, there is one more important function of plantation along the river bank is river bank protection from water erosion. As the vegetation along river bank contributes to bank stability by retarding water speeds and tractive forces near the soil surface. Following are the various functions of river bank protection by plantation:

7.11.1.Function of vegetation in river bank protection

a) **Catching:** Loose materials have a tendency to roll down a slope because of gravity and erosion, and this can be controlled by planting vegetation. The stems and fine roots can catch and hold loose material.

b) **Armoring:** Some slopes are very water sensitive. They start moving and/or are easily liquefied when water falls on them. Vegetation can protect the surface runoff and promotes water infiltration and control erosion by rain splash.

c) **Reinforcing:** The shear strength of the soil can be increased by planting vegetation. The roots bind the particles of soil. The level of reinforcement depends on the nature of the roots.Species having more adventitious roots aremore suitable then the surface of top roots forms

d) **Supporting:** Lateral earth pressure causes a lateral and outward movement of slope materials. Large and mature plants can provide support and prevent movement.

e) **Anchoring:** Layers with a tendency to slip over each other can be pinned to each other and the stable underlying layer by penetration of and ramification roots from the vegetation functions as anchors.

f) **Draining:** Water is the most common triggering factor for slope instability. Surface water drains away more easily in areas with sparse rooted vegetation. Thus, draining can be managed by planting small and dense rooted vegetation such as durva grass.

Under the afforestation plan, plantation in nearby villages and connecting roads will be done. The implementation for development of greenbelt will be of paramount importance as it will not only add up as an aesthetic feature but will also act as a pollution sink. The species to be grown in the areas will be dust tolerant and fast growing species so that a permanent greenbelt is created. Plantation in the barrier zone and roads is necessary as these areas will contain fine particulates resulting from mining operation and vehicle movement Plantation will also be carried out as social forestry program in village, school and the areas allocated by the Panchayat/State authorities. Native plants like Neem, Peepal, and other local species will be planted. A suitable combination of trees that can grow fast and also have good leaf cover shall be adopted to develop the greenbelt. It is proposed to plant almost 2200 Nos of native species along with some fruit bearing and medicinal trees during the plan period. The greenbelt development program is given in Table below:

Table No.7.16. Green belt development Plan for 5 years

Year	**Saplings to be planted (Survival rate (@ 100 %))**	**Species**	**Place of Plantation**
I	1518	Local species found in the region after consultation with DFO Jalaun and Hamirpur	• Along the Haul routes which will be used by empty and loaded vehicles (especially bushes) • Plantation in nearby villages towards Prominent downwind direction from the mine lease sites
II	190*		
III	190*		

IV	190*		• Plantation along the river bank for its protection • Plantation in the vacant places in the region(transition region between the Dariya and Danda regions)
V	190*		

7.11.2. Guidelines for plantation:

The plant species identified for greenbelt development shall be planted using pitting technique. The pit size will be of 60 cm x 60 cm x 60 cm. bigger pit size will be considered at marginal and poor quality soil. Soil used for filling the pit should be mixed with well decomposed farm yard manure or sewage sludge at the rate of 2.5 kg (on dry weight basis) and 3.6 kg (on dry weight basis) for 60 cm x 60 cm x 60 cm size pits respectively. The filling of soil should be completed at least 5-10 days before the onset of monsoon. Healthy sapling of identified species should be planted in each pit with the commencement of monsoon. Provision for regular and liberal watering during the summer period during the commissioning stage of the plant will be arranged from the local available resources. The authorities responsible for plantation will also make adequate measures for the protection of the saplings. While making choices of plant species for plantation in green belt, weightage has been given to the native species, bio climatic condition, plants which can be grown as per normal silvicultural practices. Plant species are identified for greenbelt development, considering the bioclimatic and soil condition.

7.11.3.Selection of Plants for Greenbelts:

The main limitation for plants to function as scavenger of pollutants are, plant's interaction to air pollutants, sensitivity to pollutants, climatic conditions and soil characteristics. While making choice of plants species for plantation in green belts, due consideration has to be given to the natural factor of bio-climate. Xerophyte plants are not necessarily good for greenbelts; they with their sunken stomata can withstand pollution by avoidance but are poor absorber of pollutants. Character of plants mainly considered for affecting absorption of pollutant gases and removal of dust particle are as follows.

a.For absorption of gases:

- Tolerance towards pollutants in question, at concentration, that are not too high to be instantaneously lethal
- Longer duration of foliage
- Freely exposed foliage
- Adequate height of crown
- Openness of foliage in canopy
- Big leaves (long and broad laminar surface)
- Large number of stomatal apertures

b.For Removal of Suspended Particular matter:

- Height and spread of crown.
- Leaves supported on firm petiole
- Abundance of surface on bark and foliage
- Roughness of bark
- Abundance of axillaries hairs
- Hairs or scales on laminar surface
- Protected Stomata

c.Main objectives of plantation: The main purpose of developing green belt is to meet with specific purposes by the completion of the lease period:

1. For aesthetic enhancement of the project corridors and places of importance by planting selective ornamental trees, landscaping and turfing with grasses and ornamental shrubs.
2. To reduce the impacts of air pollution and dust as trees and shrubs are known to be natural sink for air pollutants.
3. To provide much needed shade on glaring hot roads during summer.
4. To reduce the impact of ever increasing noise pollution caused due to increase in number of vehicles.

5. To arrest soil erosion and dust emission.
6. Moderating the effect of wind and incoming radiation.

As envisaged in the Official issue vide letter No. **H16405/220/2018/02** on subject- **"Green belt development for the carbon offsetting and Air Pollution control"** by **Uttar Pradesh Pollution Control Board** issued on 16.02.2018, protocol for Green Belt Development has been given; the total area which should be under green cover to maintain ecological balance in the region. The species proposed should be long rotation, ornamental, evergreen, hardy, wind firm and also have the capacity to combat pollution(air and noise).

c. Model of Green Belt Development:

- Spacing between plants : 3m X 3m
- Plantation Pattern : Staggered rows
- Spacing between plantation of trees and bushes : 1m X 1m

d. Plantation Program

The present cluster includes the river bed mining projects, so the dense plantation will be done along the haul routes, any land earmarked by Gram Panchayats in Schools and other village lands. Details of plantation are given below in the table:

Total Mine leases	11*
Mine Area(in ha)	303.64 ha**
Total Number of plants/saplings(@ 5 sapling per hectare)	1518
Total Lease Period	5 Years
Total length of haul road(in km)	76.33km

e. Plantation pattern:

- ➢ The first row along the highways will be of small to medium size ornamental trees
- ➢ Subsequent rows depending on the availability of width will comprise of ornamental and/or shade bearing species of medium height more than those in the first row.
- ➢ In rural sections the last row shall always be shade bearing tall trees.

➢ Plantation shall be done in a staggered (zigzag) manner.

Table No. 7.17. Details of row Plantation pattern

Specification	**I row**	**II row**	**III row**
Distance from embankment	3.3 ft away from the toe of embankment	20.3 ft	37.3 ft
Spacing between plant to plant	10 ft	10 ft	20 ft
Canopy Shape & Size	Cylindrical/oblong with small CSA	Round/oblong with medium CSA	Spreading with medium CSA
Spacing between rows	-	15 ft	15 ft
Size of the pits	60 X 60 X 60 cm	60 X 60 X 60 cm	60 X 60 X 60 cm
Height of the plant	1.5 m to 2 m	More than 2m	More than 3m

Table No.7.18.Varieties and species of plants and bushes to be planted on the basis of Major Air Pollutants:

Major Pollutants	Varieties of Trees	Varieties of Bushes	Varieties of Grasses
Particulate Matter	Cassia siamea, Siris, Chitwan, Kadamb, Neem, Sheesham, Mahua, Amaltas, Ficus	Kadi Patta, Croton, Tecoma stans, Cassia glauca, Dhak	Beard Grass, Bluestem, Buffalo Grass, Anjan. Birdwood Grass, Durwa Grass(Bermuda Grass), Guriya Grass
Sulphur oxides	Siris, Arroo, Chitwan, Kadamb, Neem, Bamboo, Mahuli, Semal, Mahua,	Amla, Dhak, Subabool, Lantana camara	Beard Grass, Bluestem, Buffalo Grass, Anjan. Birdwood Grass, Durwa Grass(Bermuda Grass),

	Tamarind, Ficus		Guriya Grass
Nitrogen oxides	Chilbil,Mangifera indica, Siris, Mahua, Jamun, Neem, Sheesham	Mahuli, Subabool, Dhak, Lantana Camara	Beard Grass, Bluestem, Buffalo Grass, Anjan. Birdwood Grass, Durwa Grass(Bermuda Grass), Guriya Grass

f. Operation Model for Plantation Species Matrix:

To develop a plantation matrix various characteristics of plant species are taken into considerations like tolerance factor, ecologically compatible, growth rate of plant species, canopy surface area, leaf area, stomatal index, canopy shape, flowering seasonality and utility etc. as per the geographical features of the cluster of all mine lease sites and score obtained by varieties of species of trees and bushes naturally found in that region. The species which scored high are preferred over the species scored less for the plantation to curb air pollution.

Table No. 7.19. Matrix for plant selection.

S.No.	Characteristic	Score	Remarks
1.	Tolerance/stressed	1/0	Any species which have shown tolerance for primary pollutants of vehicular emission will be rated tolerant and given a fixed score of 1 mark and sensitive species are given 0 mark.
2.		1/0.5/0	Evergreen tree/shrubs have been given 1 marks, semi deciduous have been given 0.5 marks and deciduous have got 0 mark.
3.	Growth rate	1/0.5/0	Growth rate of trees/ shrubs have been classified in to three categories. Fast- 1 mark for the trees which grow in a very short span of time. Quick 0.5 mark for the trees which grow in a very short span of time. Slow-0 mark for the trees which grow in

			a very short span of time.
4.	Canopy surface	1	Trees/ shrubs with highest canopy surface have been given 1 mark and others have been rated relative to the tree /shrubs with highest CS.
5.	Leaf area	1	Trees/ shrubs with highest leaf area have been given 1 mark and others have been rated relative to the tree /shrubs with highest LA.
6.	Stomatal index.	1	Trees/ shrubs with highest stomatal index have been given 1 mark and others have been rated relative to the tree /shrubs with highest SI.
7.	Canopy shape-Spreading/Round /oblong/Flat crown/Conical	1/0.75/0.5/0.25/0	Spreading-1 mark Round -0.75 mark Oblong-0.5 mark Flat crown-0.25 mark Conical-0 mark
8.	Flowering seasonality	0.5	Tree/shrubs having the round year flowering season have been given 0.5 marks and others have been rated relative to them.
9.	Utility	1	Trees with highest recorded uses have been given 1 mark and others have been rated relative to the tree /shrubs with highest uses.
10.	Total	8.5	

Table No.7.20 Suitability of plant species for plantation throughout the country.

Scientific name	**Comman name**	**Type**	**Stressed/ Tolerent**	**Growth rate**	**Evergreen/ Deciduous**	**Score**
Azadirachta indica	Neem	Tree	Tolerent	Quick	Evergreen	5.71
Tamarindus indica	Tamarind	Tree	Tolerent	Quick	Evergreen	5.46
Cocos nucifera	Coconut	Tree	Tolerent	Slow	Evergreen	5.1
Bombusa arundinacia	Bomboo	Tree	Tolerent	Fast	Evergreen	4.92
Ficus benghalensis	Banyan	Tree	Tolerent	Quick	Evergreen	4.79
Zizyphus marutiana	Ber	Tree	Tolerent	Quick	Evergreen	4.71
Caesalpinia pulcherrima	White gold mahur	Tree	Tolerent	Quick	Evergreen	4.56

Trema orentalis	Charcoal	Tree	Tolerent	Quick	Evergreen	4.53
Alstonia scholaris	Devil tree	Tree	Tolerent	Quick	Evergreen	4.51
Peitophorum pterocarpum	Copper pod tree	Tree	Tolerent	Quick	Evergreen	4.45
Samanea saman	Rain tree	Tree	Tolerent	Quick	Evergreen	4.45
Duranta repens	Duranta	Tree	Tolerent	Quick	Evergreen	4.4
Anona squamosa	Custard Apple	Tree	Tolerent	Fast	Evergreen	4.4
Dendrocalamus strictus	Lathi bans	Shrubs	Tolerent	Fast	Evergreen	4.4
Thespesia populnea	Umbrela tree	Tree	Tolerent	Quick	Evergreen	4.39
Cassia siamea	Iron wood tree	Tree	Tolerent	Fast	Evergreen	4.37
Anthocephalus chinensis	Kadam	Tree	Tolerent	Fast	Deciduous	4.34
Prosopis cineraris	Khejari	Tree	Tolerent	Quick	Evergreen	4.32
Acacia nilotica	Babul	Tree	Tolerent	Quick	Evergreen	4.29

g. Recommended Species for Various Soil Types:

Uttar Pradesh is the fourth largest state of the country and is been drained by one of the major river of India Ganga and its biggest tributary Yamuna and several other distributaries. Hence, across the state all along the rivers sediment gets deposited according the flow of the river which somehow defines the soil of that region. Selection of suitable plant species for the plantation on haul routes, river bank protection and also in the transition region between Khadar and Bangar region is the key of successful plantation programme. Given below are the few species suitable for plantation according the soil types found in that region.

Table No.7.21 Suitable species for different soil types.

Soil Type	Suitable Species
Clay Soil	Azadirachata indica, Pongamia pinnata, Swietenia mahagoni, Pterocarpus marsupium, Terminalia tomentosa, Melia dubia, Delbergia latifolia, Delbergia sissoo
Red soil with 10 ft minimum soil depth	Swietenia mahagoni, Pterocarpus marsupium, Terminalia tomentosa, Melia dubia, Delbergia latifolia, Azadirachata indica, Pongamia pinnata, Ailanthus exceisa
Red soil with 5 ft minimum soil depth	Tectona grandis, Swietenia mahagoni, Santalum album, Pterocarpus marsupium, Delbergia latifolia, Azadirachata indica, Melia dubia, Ailanthus exceisa

Alluvial soil	Tectona grandis, Swietenia mahagoni,Pterocarpus marsupium, , Melia dubia,Delbergia latifolia, Neolamarckia cadamba, Pongamia pinnata
Uncultivable soil	Azadirachata indica, Albezia lebbeck, Delbergia sissoo, Ailanthus exceisa, Pterocarpus santanalius
	Terminalia arjuna, Casurina junghuniana, Pongamia pinnata

Plants experience physiological changes before getting damaged when the leaves are exposed to air pollutants. The tolerant species are preferred over the sensitive species for plantation. To analyze the species, various variables are used like Air Pollution Tolerance Index (APTI) which is based on biochemical parameters, Anticipated Performance Index (API) which is based on biological and socio-economic aspect of a plant. The carbon trapping and dust accumulating potential also varies from species to species.

Table No. 7.22 APTI score of different trees and their efficacy in Pollution control.

S.Nos.	Botanical Name	Family	Common Name	APTI	Effective in Control
1.	*Cassia siamea*	Caesalpiniodeae	Kassod tree	10.41	Dust
2.	*Albizia lebbeck*	Fabaceae	Siris tree	15.9	Air pollution
3.	*Alstonia scholaris*	Apocynaceae	Chitwan tree(Blackboard tree)	6.6	Dust
4.	*Neolamarckia cadamba*	Rubiaceae	Kadamb tree(Burflower tree)	15.5	Dust
5.	Azadirachta indica	Meliaceae	Neem tree	18.73	Dust, air pollution and Noise pollution
6.	*Dalbergia sissoo*	Papilionaceae	Sheesham	16.59	Air pollution , noise pollution
7.	*Madhuca indica*	Sapotaceae	Mahua	22.57	Air pollution
8.	*Mangifera indica*	Anacardiaceae	Mango	20.80	Air pollution

9.	*Bougainvillea spectabilis*	Nyctaginaceae	Booganbel	20.32	Air pollution
10.	*Nerium indicum*	Apocynaceae	Kaner	18.94	Air pollution
11.	*Ficus benghalensis*	Moraceae	Banyan	15.92	Air pollution, noise pollution
12.	*Ficus religiosa*	Moraceae	Peepal	12.41	Air pollution , noise pollution

Table No. 7.23 APTI score of different shrubs.

S.Nos.	Botanical Name	Family	Common Name	APTI
1.	*Murraya koenigii*	Rutaceae	Kadi Patta	8.47
2.	*Codiaeum variegatum*	Euphorbiaceae	Croton	10.91
3.	*Tecoma stans*	Bignoniaceae	Yellow trumpetbush, Yellow Bells(Pilia)	10.60
4.	*Cassia glauca*	Fabaceae	Scrambled Egg Bush(Pila Amaltas)	8.43
5.	*Butea frondosa*	Leguminoceae	Dhak	13.40
6.	*Phyllanthus emblica*	Phyllanthaceae	Amla	40.93
7.	*Lantana camara*	Verbenaceae	Raimuniya	10.95

Table No. 7.24 APTI score of grass species.

S.Nos.	Botanical Name	Family	Common Name
1.	*Polypogon*	Poaceae	Beard Grass
2.	*Andropogon*	Poaceae	Bluestem Grass
3.	*Bouteloua dactyloides*	Poaceae	Buffalo grass
4.	*Pennisteum purpureum*	Poaceae	Anjan
5.	*Cenchrus setiger*	Poaceae	Birdwood grass
6.	*Cynodon dactylon*		Durva(Bermuda grass)

Table No. 7.25. Plan of plantation for green belt development:

S. Nos.	Lease Details	Number of saplings to be planted	Description (saplings to be planted for all leases included in Study Area-1)
1.	I	1518	First year plantation for all leases included in Study Area-1
2.	II	190*	Recurring Plantation to maintain 100% survival rate
3.	III	190*	Recurring Plantation to maintain 100% survival rate
4.	IV	190*	Recurring Plantation to maintain 100% survival rate
5.	V	190*	Recurring Plantation to maintain 100% survival rate

Total Cost of projects included in Cluster = Rs. 1,92,21,64,772*

Cost for Green Belt Development for five year = Rs. 4,69,42,184

Other Maintenance Charges(Fencing/Tree guards) = Rs. 30,36,390

Annual Irrigation = Rs. 156,564

*(inclusive of upcoming projects of B1-sub-category for which Public Hearing is awaited and B2- sub-category projects for which Ec is awaited)

Table No. 7.26. List of plants, shrubs and herbs found in Bundelkhand Region:

Bundelkhand Region		
Dillenia indica	*Butea superba*	*Wendlandia heynei*
Dillenia pentagyna	*Dalbergia lanceolaria*	*Ardisia solanacea*
Miliusa tomentosa	*Dalbergia sissoo*	*Madhuca longifolia*
Miliusa velutina	*Erythrina stricta*	*Diospyros exsculpta*
Capparis decidua	*Pongamia pinnata*	*Diospyros malabarica*
Cochlospermum religiosum	*Pterocarpus marsupium*	*Diospyros melanoxylon*
Casearia graveolens	*Bauhinia purpurea*	*Nyctanthes arbor-tristis*
Casearia tomentosa	*Bauhinia racemosa*	*Schrebera swietenioides*

Flacourtia indica	*Bauhinia variegata*	*Salvadora oleoides*
Tamarix indica	*Bauhinia tomentosa*	*Carissa spinarum*
Shorea robusta	*Cassia fistula*	*Holarrhena pubescens*
Kydia calycina	*Acacia catechu*	*Wrightia tinctoria*
Bombax ceiba	*Acacia leucophloea*	*Calotropis gigantean*
Eriolaena hookeriana	*Acacia nilotica*	*Cordia dichotoma*
Helicteres isora	*Acacia tomentosa*	*Cordia sinensis*
Pterospermum acerifolium	*Albizia lebbeck*	*Ehretia laevis*
Sterculia urens	*Albizia odoratissima*	*Solanum incanum*
Sterculia villosa	*Albizia procera*	*Dolichandrone falcate*
Grewia abutilifolia	*Dichrostachys cinerea*	*Millingtonia hortensis*
Grewia asiatica	*Pithecellobium dulce*	*Oroxylum indicum*
Grewia flavescens	*Prosopis cineraria*	*Pajanelia longifolia*
Grewia helicterifolia	*Prosopis juliflora*	*Stereospermum chelonoides*
Grewia hirsuta	*Anogeissus latifolia*	*Tecomella undulate*
Grewia orbiculata	*Terminalia elliptica*	*Tecoma stans*
Grewia tiliifolia	*Terminalia arjuna*	*Clerodendrum phlomidis*
Balanites roxburghii	*Terminalia bellirica*	*Gmelina arborea*
Murraya koenigii	*Terminalia chebula*	*Premna barbata*
Murraya paniculata	*Syzygium cumini*	*Tectona grandis*
Ailanthus excelsa	*Syzygium heyneanum*	*Litsea chinensis*
Boswellia serrata	*Careya arborea*	*Litsea glutinosa*
Azadirachta indica	*Lagerstroemia parviflora*	*Antidesma ghaesembilla*
Melia azedarach	*Lawsonia inermis*	*Bridelia retusa*
Soymida febrifuga	*Alangium salviifolium*	*Bridelia squamosal*
Elaeodendron glaucum	*Catunaregam spinosa*	*Mimusops elengi*
Gymnosporia senegalensis	*Ceriscoides turgida*	*Drypetes roxburghii*
Ziziphus mauritiana	*Gardenia latifolia*	*Flueggea virosa*
Ziziphus rugosa	*Haldina cordifolia*	*Mallotus philippensis*
Ziziphus xylopyrus	*Hymenodictyon orixense*	*Trewia nudiflora*

Buchanania lanzan	*Mitragyna parvifolia*	*Holoptelea integrifolia*
Lannea coromandelica	*Morinda pubescens*	*Trema orientalis*
Semecarpus anacardium	*Neolamarckia cadamba*	*Artocarpus lakoocha*
Butea monosperma	*Tamilnadia uliginosa*	*Ficus arnottiana*
Ficus benghalensis	*Ficus racemosa*	*Ficus rumphii*
Ficus hispida	*Ficus religiosa*	*Ficus tomentosa*
Ficus virens	*Streblus asper*	

h. Recommended species for haulage route plantation:

The species of shrubs & bushes recommended for plantation at on haulage route have the high dust tolerant tendency, fast growing and heavy canopy. List of the recommended species of shrubs are given below:

Table No.7.27 List recommended species for haulage route plantation

S.Nos.	Botanical Name	Family	Common Name	APTI
1.	*Tecoma stans*	Bignoniaceae	Yellow trumpetbush, Yellow Bells(Pilia)	10.60
2.	*Butea frondosa*	Leguminoceae	Dhak	13.40
3.	*Phyllanthus emblica*	Phyllanthaceae	Amla	40.93
4.	*Lantana camara*	Verbenaceae	Raimuniya	10.95

Species of grasses recommended for plantation on river bank for its protection have the dense root system which binds the soil of the river banks. List of the recommended species of trees are given below:

S.Nos.	Botanical Name	Family	Common Name

1.	*Polypogon monspeliensis*	Poaceae	Beard Grass
2.	*Andropogon geradi*	Poaceae	Bluestem Grass
3.	*Bouteloua dactyloides*	Poaceae	Buffalo grass
4.	*Pennisteum purpureum*	Poaceae	Anjan
5.	*Cenchrus setiger*	Poaceae	Birdwood grass
6.	*Cynodon dactylon*	Poaceae	Durva(Bermuda grass)

Table No. 7.29. Recommended species for downwind wind direction:

The species of trees recommended for plantation at the places or villages situated in the downwind direction of the wind blow have the highest APTI, which indicates that they are highly tolerant to dust and air pollutants. List of the recommended species of trees are given below:

S.Nos.	Botanical Name	Family	Common Name	APTI
1.	*Azadirachta indica*	Meliaceae	Neem tree	18.73
2.	*Madhuca indica*	Sapotaceae	Mahua	22.57
3.	*Mangifera indica*	Anacardiaceae	Mango	20.80
4.	*Bougainvillea spectabilis*	Nyctaginaceae	Booganbel	20.32
5.	*Nerium indicum*	Apocynaceae	Kaner	18.94

CHAPTER VIII

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8.1	BENEFITS OF SUSTAINABLE/SCIENTIFIC MINING
8.2	ROAD MAINTAINANCE
8.3	EMPLOYMENT POTENTIAL- SKILLED, SEMISKILLED AND UNSKILLED
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8.6	SUMMARY

PROJECT BENEFITS

Nature has given us morrum as a natural resource. The man has to use it wisely for the larger benefit of the society and sustainable development. The extraction of minerals not only provides the building materials but also generate employment to the locals engaged directly in extraction of morrum as well as indirectly transportation and sale of mineral. It also earns huge sum of revenue in the form of mineralroyalty for the State Exchequer.

8.1BENEFITS OF SUSTAINABLE/SCIENTIFIC MINING

- Channelize and maintain the natural course of River
- Protection of banks
- Reducing excessive sedimentation
- Maintains and controls the natural flow or river.
- Generates employment opportunity
- Revenue generation to Government.
- Improves the socio-economic condition and add beautification
- Prevent natural hazards i.e. flooding, bank erosion, subsidence etc.
- Prevention of Illegal Mining

8.1.1 Environmental Benefits

a It controls river bank erosion by deepening of river channel, thus prevents flooding and other natural hazards.

b It helps in Regeneration &Establishment of Pioneer Species like Shisham&Khair on the banks of rivers besides saving agricultural land & land cutting.

c It regulates & maintains the existing course of the river, and improves the water holding capacity of channels.

8.1.2 Improvement in physical infrastructure

Mining and agriculture are the only industries from which the mankind receives directly. In the fast growing economics of vibrant India, both the sectors play important role, one in developing infrastructure and the other in maintaining food securities. Morrum is an integral part of soil. When present in common in right proportions it imparts favourable properties and improves soil productivity. Similarly, morrum is an important aggregate used in bulk in construction industry. Beginning 21st century, India is witnessing a spurt in infrastructure sector. Construction of high rise group housing and commercial complexes, growth of new private townships, lanes to highways, expressways, flyovers, and bridges, modernization of airports, metros, game villages, stadiums and construction of abodes by ordinary people has given ample impetus for mining. Rivers are the major sources of morrum as they replenish themselves every year during monsoons.

8.1.3 Improvement in social infrastructure

Nearby villages shall be benefited in several ways like, protected water supply, basic health camps, improved infrastructure facilities, employment opportunities etc., besides enhancing the local economy through the benefits from the project activities and personnel.

Now the royalty received from mining activites are now used in PradhanMantriKhanijKshetraKalyanYojana (PMKKKY) is a programme launched on 17 September 2015 to provide for the welfare of areas and people affected by mining related operations. PMKKKY is implemented by the District Mineral Foundations (DMFs) of the respective districts using the funds accruing to the DMF from miners. (Khanij means

Mineral and Kshetra means area or field in Hindi. Kalyan stands for welfare and Yojana stands for a Plan or project). District Mineral Foundation (DMF) is a trust set up under Mines and Minerals (Development & Regulation) Amendment Act, (MMDRA) 2015 as a non-profit body in those districts affected by the mining works to work for the interest and benefit of persons and areas affected by mining related operations, in such manner as prescribed by the relevant State Government. At least 60% of the funds under the PMKKKY has to be used for high priority areas such as drinking water supply, environment preservation and pollution control measures, primary / secondary health care, education, welfare of women, children, aged and disabled people, skill development & sanitation**.** Up to 40% of the funds can be used for infrastructure projects such as physical infrastructure, irrigation, energy and watershed development and any other measures for enhancing environmental quality in mining district.Not more than 5% of the funds can be used for administrative expenses. Save for the base minimum contractual posts, creation of posts, purchase of vehicles etc. would require prior permission.The DMFs have also been directed to take all major decision in a participatory mode, in consultation with the '*gram sabhas'* of the respective villages. They are expected to maintain utmost transparency in their functioning and provide periodic reports on the various projects and schemes taken up by them.Efforts are made to achieve convergence with the State and the District Plans so that the activities taken up by the DMF supplement/complement the development and welfare activities already being carried out. However, activities meant to be taken up under the 'polluter pays principle' cannot be taken up under the PMKKKY.

Of the total funds that DMF would receive in a year, no less than 20 per cent should be deposited in an account for future use (when mining operations are closed) as well as for emergency situations, such as natural calamities.

- ✓ Of the total funds that DMF would receive in a year, no more than 80 per. cent should be spent in the year.
- ✓ Of the total money that DMF has to spend in a year:
- ✓ No less than 65 per cent should be spent on directly affected areas.

- ✓ No less than 50 per cent should be used for the upliftment of directly affected persons.
- ✓ No more than 20 per cent should be spent on indirectly affected areas.
- ✓ No more than 10 per cent should be spent for the development of the district, excluding directly and indirectly affected areas.
- ✓ No more than 5 per cent should be used as administrative expenses of the DMF.

a.Benefit-sharing

- ✓ Every directly affected family should be entitled to equal monetary benefit, which could either be paid monthly or annually. The directly affected family could include widows, single mothers and old people without family support.
- ✓ The amount of monetary benefit should be decided by the Governing Council of the DMF at the beginning of each financial year. However, such amount of monetary benefit shall not be less than the amount a family may be entitled to under the provisions of the Mahatma Gandhi National Rural Employment Guarantee Act, 2005.
- ✓ In fact the need to provide at least the minimum wage has also been mentioned under the Mineral Concession Rules, 1960 (Rule 27p and q). It specifies that such monetary benefit must be given to tribals and persons displaced due to mining if they are employed by mining-lease holders.
- ✓ It is important that a part of the DMF money be used to secure livelihoods of directly affected persons. The second priority, therefore, should be given for education scholarships, health insurance, livelihood trainings, loans to establish small businesses, etc. Priority should be given to support businesses of women.
- ✓ The DMF funds can be used as an 'add-on' (to supplement the funds that district/blocks/ villages would receive normally) for developing local infrastructure, including healthcare facilities, schools, water supply, sanitation and sewerage, electricity, roads, etc. For such developmental purposes, there should be mechanisms in place to transfer DMF funds to other concerned government

departments that can implement and maintain these assets. However, the DMF must have a system to verify and audit its contributions.

- ✓ A part of the DMF money used for administrative expenses must be used for capacity building of the affected communities to run the DMF, including fiscal training. Investing in the future
- ✓ A part of the money should be invested for the future. This money should be kept to revive the economy of the area when mining finishes to avoid the issue of 'ghost towns' as is commonly observed in mining areas. DMF funds to be used for the socio-economic upliftment of the community must not be compromised by its administrative expense requirements. Similarly, district entitlements from state coffers must not be affected.

However all the decisions regarding DMF are responsibilities of district administration.

Activities that may be shared in the study area by administration and project proponent:

- Road strengthening.
- Road widening
- Road creation
- School building renovation.
- Medical assistance to the beneficiaries
- Educational assistance
- Plantation
- Creation of new drinking water facilities
- Repairing of existing drinking water facilities
- Creation of public toilets for public use
- Support to existing facilities in the area

8.2. ROAD MAINTAINANCE

Access roads are maintained during the period of time they are required. The level of maintenance on an access road varies depending on its use at any given time. For example, during wood extraction operations, when numerous heavily loaded trucks are using a road, it is maintained to keep the riding surface very smooth. Later, if the road is no longer used for timber management, the road use may change. It caneither be maintained at minimal levels for light recreational and other traffic uses . The operations carried out for road maintenance can be broken into two main groups: routine and non-routine. Routine operations include those day-today activities necessary tomaintain the road for the traffic using it. These may include grading and the maintenance of drainage by cleaning out blocked ditches and culverts. Non-routine maintenance includes major repairs and restoration. Since roads gradually deteriorate with time, there is a periodic need to restore the condition of roads serving a long-term need. These roads may require major maintenance or re-construction to restore their original condition every ten to twenty years. Example operations falling into this category include: brush control with mechanical and chemical methods; replacement of gravel surfacing material; repair of major flood damage, and, replacement of substandard bridges.Remove roadside vegetation that shades the road, for safety (visibility) and for drying of the road. In erodible soils, do not expose the mineral soil during the brushing operation. Special mitigative techniques such as sediment traps and check dams should receive regular maintenance as long as they are needed.

8.2.1Construction of motarable roads

The construction of access roads will cause significant disturbance to the natural environment, if not properly maitained. Construction of access road activities will be subdivided into a series of operations that take place in a chronological sequence. Using this sequence, the good practices have been grouped into the following components:

• ***Road planning and location***-This phase comprises finalization of route that will have the minimal environmental and social effect. the preconstruction components of the route study, road location and road design. The level of technical evaluation, layout and design required on a particular road depends on the geometric standard, the terrain through which the road will be built and the method of construction. At this stage, the final route is selected. Decisions about the location of a particular road have an important influence on the impact the road will have on the natural environment. For environmental as well as practical considerations, road alignments will follow the contours of the land. Gentle grades (1-4%) for proper drainage and economical construction will be taken into consideration • Construction of a road to a higher standard than necessary increases costs and has the potential for more environmental damage. Landings, loading areas and turnarounds will be located when the road is being laid out

• ***A clearing-***To avoid any vegetation clearing the existing haulage route.If the need arise the normal practice will be to specify a minimum width of clearing. This will be done for several reasons: to allow space for construction equipment to operate without knocking down standing trees; to provide safe sight lines around curves; and, to allow drying of the roadway in wet weather and spring break-up. Maximum widths should also be specified to minimize the areal extent of disturbance caused by road construction.However in the study area clearing is not required as path for haulage route is already decided.

• ***Grubbing-***Grubbing, or stripping, consists of the removal and disposal of stumps, roots, brush, small trees, embedded logs and organic material overlying the mineral soil. Grubbing is done to expose the mineral soil for three reasons: • To prepare for earth grading operations. • To improve roadway performance by eliminating weak organic material in the zone carrying wheel loads; and • To minimize future sight distance problems that roadside vegetation could cause.

• ***Earth Grading-***Earth grading reshapes the original ground contours to the shape of the road, in profile and cross-section. The operation includes the excavation of earth cuts and the construction of earth fills. Lower standard roads tend to follow the original ground contours more closely, because their geometric requirements are less critical; this means that cut and fill depths will be less than those for a higher- standard road constructed along the same route.

• ***Graveling-***This operation refers to the placing of sand and gravel materials to form the structural road sub-base and surface that supports the wheel loads. A sand cushion may be used as a sub-base under the gravel surface if the underlying earth cut or fill materials are poor and of low strength. The operation generally involves importing select material from a gravel pit nearby. The equipment normally used includes front-end loaders, dump trucks, bulldozers, graders and back- hoes. Occasionally, crushing units, compaction equipment and water trucks are also used.

• ***Road Maintenance-***Access roads are maintained during the period of time they are required. The level of maintenance on an access road varies depending on its use at any given time. For example, during wood extraction operations, when numerous heavily loaded trucks are using a road, it is maintained to keep the riding surface very smooth.

• ***Road Abandonment-***Physical Abandonment occurs when there is a deliberate act to render a road unusable by vehicular traffic. Physical abandonment could include taking steps which will minimize the environmental impacts of non-maintenance. Natural Abandonment occurs when road maintenance has ceased, yet steps are not taken to prevent the use of the road by vehicles. With natural abandonment, no physical changes are made to the road.

8.3 EMPLOYMENT POTENTIAL- SKILLED, SEMISKILLED AND UNSKILLED

Morrum mining and agriculture is the basic sector of employment for the local people in this area. This project will lead to indirect employment opportunity. Employment is expected during morrum excavation, morrum transportation, in trade and other ancillary services. Employment in these sectors will be primarily temporary or contractual and involvement of unskilled labour will be more. A major part of this labour force will be mainly from local villagers who are expected to engage themselves both in agriculture and project activities. This will enhance their income and lead to overall economic growth of the area.

8.4 ECONOMICAL BENEFITS

- Extraction of minerals provides the building materials.
- Generates employment to the locals engaged directly in extraction of morrum as well as indirectly transportation and sale of mineral.
- Earns huge sum of revenue in the form of mineralroyalty or dead rent for the State Exchequer.

8.5 Positive Aspects of Mining

- ***Employment generation***Any mine in the area creat opportunities for employment. Besides of direct employment in mine, satellite occupation in surrounding areas florish at the time of mining operations. As a part of the social responsibilities mine owners provide vocational training in various streams, training for rural enterprises, self help group , alternative livlyhood opportunity project and income generation programme for women.

- ***Afforestation***During and/or post mining operations is themajor and most common after-use sanctioned through reclamation. Wherespecificusefulness oflandcouldbedecided, afforestation isnormally planned through thesite couldhavebeenconsidered forbetterpossibilities oflanduse.
- ***Agriculture*** Someformofagriculturalusemay bepossible insitesthatareadjacent tofarmland providedthesoiland topography arefavorable. Agricultural andhorticultural crops canbegrown ina varietyofmaterials. Therangeofpossibilities includearablecropping,grazing ineitherproductive lowlandoroveruplandpasture. Theonlyconstraint apart from the site is that there must be some integration intothelocal rural agricultural pattern. Butitwouldbeinappropriate toestablish pasturein anareaofarablecropping,eventhoughthegrazed pasture would recreate thesoil structure more rapidly.
- ***Housing and Industry***Manyquarries specially ofbuilding materialsare the basis of development forresidential accommodation, infrastructure and industrial activities.

Sl. No.	Project/ Owner	Village/ Tehsil/ District	Total Project Cost (Rs.)	CER Cost (Rs.) (2% of Total Project Cost)
1.	**M/s Sanewin Infrastructure Pvt. Ltd.**	Simiriya/ Orai/ Jalaun	16,11,42,928/-	**32,22,858/-**
2.	**M/s Sanewin Infrastructure Pvt. Ltd.**	ChandwariGhurouli Sarila / Hamirpur	23,70,65,105/-	**47,41,302/-**
3.	**ShriAtikurrahman**	RiruaBasaria/Sarila / Hamirpur	16,03,11,050/-	**32,06,221/-**

4.	**M/s Senvin Infrastructure Pvt. Ltd.**	RiruaBasaria/ Sarila / Hamirpur	17,68,99,104/-	**35,37,982/-**
5.	**M/s New Eoan Associates**	ChandwariGhurauliSarila/ Hamirpur	17,68,99,104/-	**35,37,982/-**
6.	**M/s Disha Enterprises Proprietor**	Chikasi/ Sarila/ Hamirpur	23,61,16,355/-	**47,22,327/-**
7.	**M/s Satyam Construction Proprietor**	Chikasi/ Sarila/ Hamirpur	23,80,99,105/-	**47,61,982/-**
8.	**ShriShrikant Gupta S/o ShriShriPrakash Seth**	Chikasi/ Sarila/ Hamirpur	23,70,26,605/-	**47,40,532/-**
9.	**M/s H.S.M Holdings**	RiruaBasaria/Sarila/ Hamirpur	15,09,56,350 /-	**30,19,126/-**
10.	**M/s KanhaiyaLal And Sons**	Muhana/Orai/ Jalaun	7,54,24,504/-	**15,08,490/-**
11.	**M/s Pratap Corporation**	BaderaKhalsa/ Sarila/ Hamirpur	8,17,27,850/-	**16,34,556/-**

8.6 SUMMARY

The in situ mining activity in any area is on one hand bring revenue and employment (Primary and secondary) and on other hand if not done properly potential pollution and ecological imbalance increases. The ability of the ecosystem to fix nitrogen can also be reduced. Particulate matter transported by the wind as a result of excavations, blasting, transportation of materials, wind erosion (more frequent in open-pit mining), fugitive dust from tailings facilities, stockpiles, waste dumps, and haul roads. Exhaust emissions from mobile sources (cars, trucks, heavy equipment) raise these particulate levels; and Gas emissions from the combustion of fuels in stationary and mobile sources, explosions, and mineral processing. The direct impact of activities will be from mining and transportation. The indirect impacts comprises adjacent areas affected through mining activities and changes in the landscape that can propagate ecological changes for various distances; this includes such items as fragmentation, changes in forest type within the direct effect, changes in wildlife migration and habitat use patterns, noise, light, windblown dust, dispersal of invasive species established on the mine site, and watershed areas affected by water withdrawals and mine drainage.Mining will directly displace forests and potentially change the composition of any forest. Certain species require large tracts of unfragmented forest, Wildlife species living within the primary mining footprint would be directly displaced, due to loss of forest and other vegetation. Employment generation and social upliftment alongstrenghed infrastructure will be the beneficial aspects. The mining activity along with precaution and mitigation measure will be beneficial.

CHAPTER-IX

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9.1	INTRODUCTION
9.2	ANALYSIS OF PROJECT COMPONENTS
9.3	QUANTITATIVE ANALYSIS
9.4	QUALITATIVE ANALYSIS
9.5	INFERENCE
9.6	COST BENEFIT ANALYSIS OF THE PROJECTS IN THE STUDY AREA:

ENVIRONMENTAL COST BENEFIT ANALYSIS

9.1 INTRODUCTION

Since sand/ morrum are the basic requirements in construction industry and due to the recent boom in the sector, indiscriminate river sand mining has created a number of environmental and social problems. Within this context, this chapter attempts to identify environmentally safe options for sustainable river sand mining that minimize environmental degradation while meeting the requirements of the construction industry and local people. It is essential to have a cost benefit impact analysis of a project. It lies in a range of project and plan appraisal methods that seek to apply monetary value to cost and benefits. It is more compressive in scope. It takes long view of the project (further as well as nearer future) and a wide view (in the sense of allowing for side effect). It is the comparison of any positive or negative changes in the value of mine environment amenities with costs (or benefits) of implementing the proposed change. It is based in welfare, economics and seeks to include all the relevant cost and benefits to evaluate the net social benefits of a project. In proposal for de-reservation or diversion of forest use, it is essential that ecological and environmental losses and sufferance cause to the people, who are displaced are weighted against the economic and social gain. It contains simply the worknecessary to present a decision taken with the information, which require in order to make a decision.

9.1.1General Application of Costs-Benefits Analysis

1. In calculation of environmental impact of a proposed mining activity
2. In transportation
3. In evaluating alternative planning policy,
4. In optimum allocation of resource to activities,
5. In water resource planning,

9.1.2 Types of Impact of Mining

Three distinctive process of mining can be isolated as causative agents of environmental deterioration. Possible impacts may be siltation, impact on aquiflora and aquifauna, siltation, change in flow and current pattern, alteration of the sand budget, change in

erosion and deposition rates, change in ground water level. Loading process may creates clouds or plumes of sand. A bottom plume will be created at the point of excavation and asurface plume will be created from the loading itself.

9.1.3 Benefits of Mining

Methodology

There are various methodologies to calculate the CBA

- Project definition
- Identification
- Enumeration of cost and benefits
- Evaluation of cost and benefits
- Discounting and presentation of result

Cost - benefit analysis typically involves reducing an innumerable of com-plex physical and social-economic variable to simple, quantifiable categories of costs and benefits.

The mine environment can be structured in several ways- include components, scale, space and time. A narrow definition of mine environmental component would focus primarily on all media susceptible to mine pollution, including air, water, soil; flora and fauna, and human being; landscape, urban and rural conservation and the built heritage.

The net benefits of sand mining are analyzed from a social (cost-benefit analysis) and a private (financial analysis) perspective. Sand mining of the riverbeds has huge social and environment impacts on the rivers and communities depending on the rivers.

One of the most important concepts in residual management is costs and benefits involvement in term of mine environmental pollution and waste minimization. Proper decision making involves a comparison of total project cost and benefit in order to choose an alternative that returns the appropriate benefit for the least cost, thereby allocating resources in the most efficient way. The ultimate goal of residual management is to provide the level of protection necessary for the prevention of significant damage to ecological and social system at a minimum cost.

Pollution because development cannot took place free of cost. However, as sharply minimize the losses of crops and forests, improve the life system etc. It reduces protection cost of buildings attested by pollutant; minimize expenditure on imports of energy and raw materials. Mine environmental quality controls can offer more suitable benefits. Mine Environmental controls reduce the need for defensive products, such as medical care health and life insurance burglar alarms and soon by improving the health and living condition of the general populate. The economic, health, physical, and social benefits of mine environmental quality controls clearly outweigh the costs. In true economics sense, mine environmental controls provide a valuable service to citizens by promoting health, safety, welfare, peace, and permanence.

After the system's capacity to assimilate mine pollution has been exceeded. The cost benefit analysis is a useful tool to predict the damage caused by the mining in term of its impact of cost which can help management to take precautionary measure to minimize the damage and reduce the cost. It will heavily reduce the costs of health service, improved productivity, minimize the losses of crops and forests, improve the life system etc. It reduce s protection cost of buildings attested by pollutant, minimize expenditure on imports of energy and raw materials. Mine environmental quality controls can offer more suitable benefits. Mine Environmental controls reduce the need for defensive products, such as medical care health and life insurance burglar alarms and soon by improving the health and living condition of the general populate. The economic, health, physical, and social benefits of mine environmental quality controls clearly outweigh the costs. In true economics sense, mine environmental controls provide a valuable service to citizens by promoting health, safety, welfare, peace, and permanence. The cost benefit analysis is a useful tool to predict the damage caused by the mining in term of its impact of cost which can help management to take precautionary measure to minimize the damage and reduce the cost. It will heavily reduce the costs of health service, improved productivity,

9.2 ANALYSIS OF PROJECT COMPONENTS (ECONOMIC AND FINANCIAL ANALYSIS)

An **Economic analysis** is conducted from the perspective of the community as a whole. It focuses on "real" resource costs and benefits, including any "external" environmental costs and benefits that affect the broader community.

In **Financial analysis,** from a private perspective, similar concepts apply as in the economic analysis, but the benefits and costs are estimated in terms of the financial benefits received and costs borne by private producers. Because the financial analysis focused only on the project proponent's private financial prospects and did not take into account externalities or external environmental costs, it is inadequate in determining the efficiency of resource allocation.

9.3 QUANTITATIVE ANALYSIS

9.3.1 Financial analysis: The total profit per year that a project proponent can receive from sand mining is calculated as follows:

Total Profit = Unit Profit x Sand Extract Volume

Unit Profit = Market Value of 100 $m^3$of Extracted Sand – Total Costs of Extraction of 100 m^3

The market value of sand was calculated based on the market price of sand; the cost of sand extraction includes cost of labour, fuels, equipment depreciation, and other costs. However some measure cost components are

1. **Cost of Labour**
   - **a** Unskilled
   - **b** Semi skilled
2. **Cost of Equipments**

a	**Scraping and Loading**
i	Bar scraper and Light Earth Mover
ii	Fuel and Contigency Charges
iii	Manual Hand equipments
3.	**Environment Management Plan (EMP)**
	Plantation
a	No of plants Tree Guard
	Water Demand for plantation
b	**Air Pollution Control**
	Sprinkling on haulage route for dust suppression
c	**Environmental Monitoring**
4.	**Site Services**
a	Portable toilets
b	PPE for Health and Safety of labours
c	Drinking water for site workers
5.	**Miscellaneous**
a	Site Development (Pole Marking, soil & debris removal etc.)
b	Training and Awareness Camps for labours
c	River bank plantation
d	Channel flow conservation (Hume pipe)
e	Road maintainance
f	Installation of waste water treatment.

Above components will include for the Total Cost of project. Suppose this cost is ‘X’ for current production ‘P’ per annum.

Now equation is –

Production P per annum = Rs. X

So, cost of production per cum = Rs. X/ P

Now, Selling Cost per cum = Rs. S

(which can be calculated on the basis of Cost per truck, say it 15 cum)

We can clearly compare the values of S & X

9.3.2 Economic analysis: The net benefit that a society receives from sand mining was calculated as follows:

$$NPV = \sum_{i=0}^{n} \frac{Bi-Ci}{(1+r)^{i}}$$

Where *NPV* is net social benefit from sand mining;
Bi is the financial benefits of sand mining for society through the years;
Ci is the cost of sand mining through the years, including the financial cost (cost of labour, fuel, and equipment that the dredgers have to pay), external costs of riverbank erosion, dike breakage and degradation, agricultural loss, and aqua-resource degradation; and *r* is the discount rate.

9.4 QUALITATIVE ANALYSIS

The analysis is expected to show if the external cost of current sand mining does outweigh the combined gains/profits of all the individuals involved in sand mining. It is out of the scope of the report to quantify the Environmental Cost Benefits resulting from the proposed mining activity, thus a general quantitative description is discussed as under:

9.4. 1. Environmental Costs

Expenditures incurred to prevent, contain, mitigate or remove environmental contamination throughout the life cycle of a product or an activity. These costs include remediation or restoration costs, waste management costs or other compliance and environmental management costs. The various environmental costs identified, qualitatively for the proposed sand / morrum mining in riverbed are:

- On-site effects such as the erosion of riverbanks
- Lowering of water tables in the adjoining areas
- Dust and air pollution due to fugitive air emissions of free silica
- Noise pollution due to movement of heavy machinery and transporting vehicles
- Riverbank erosion, soil quality deterioration due to movement of heavy vehicles
- Spillage of diesel oil from machines and vehicles, which may pollute the soil and may leach to pollute the ground water.
- Damage to Riparian biodiversity
- Reduced vegetative bank cover.
- Loss of habitat of the aquatic population
- Alteration of flow patterns due to the modification of riverbeds, overloading of suspended sediment
- Damage to the channel beds due to the use of heavy equipment
- Disturbance of the natural hydrology of the riparian zone because of infrequent elevated flow levels
- Drying up of irrigation channels, thus reduced flooding of paddy fields with nutrient-laden water
- Presence of water puddles in lease vicinity and haulage road, thus increase in mosquito-related health problems
- Breakout of epidemics leading to loss of life. Expenditure on control of these breakouts, vaccines, medicines, scientific research and quarantining the area.
- Off-site effects include the impairment of rural roads, causing damage to the road infrastructure due to heavy loads carried on weak rural roads.

Sand mining is a global activity in both developed and developing countries. Exploiting sand from different sources has both multiple benefits (poverty reduction, economic growth, new habitats for plants and animals, new water reservoirs are created, and a series of negative impacts on the environment. Based on the studies, several factors must be taken into account when the environmental impact of sand mining is analyzed:

- location of sand mine;
- size of mining area;
- time of exploitation;

- secondary mineralogy;
- habitats and vegetation diversity across the mining area; and
- Technical conditions for exploitation.

9.4.2 Environmental Benefits

Expenditures saved on safeguard, management or upkeep of environment, through direct or indirect practices, implemented during the course of life cycle of a product or an activity. In the case of sand mining for the Proposed Sand / Morrum mining projects the environmental benefits are:

The proposition is to mine morrum from the riverbeds to cater to the increasing demands of the construction industry. This can help desilt the riverbeds that have been silted up over the years. This in turns has a number of benefits:

- Prevention of floods due to channelization of river. Restoring of banks and safety, if and when undertaken, will cost in crores to Govt.
- Prevention of losses due to flooding.
- Prevention of Loss of life
- Prevention of Loss of homes or other items of utility
- Prevention of Agricultural losses
- Prevention of loss of cattle and aquatic resources.

1. Prevention of Change of Course of river

As the yearly deposition of morrum is excavated, the change in course of river, which might have occurred in absence of such extraction, is prevented. It thus has following benefits:

- Continual use of infrastructure along the course of the river such as bridges, dams, hydro-electric power plants, sewer lines, purification units or other industrial units.
- Continued access to river resources to those dependent on it, involving activities like fishing, washing, fisheries unit and other associated industries such as freezing units etc.
- Natural irrigation through canals, along the agricultural field, orchards along the river course.

2. Social Benefits and Associated Environmental Benefits

The proposed mining will generate revenue for the government and for the lease holder. It will generate direct employment for almost 800 people, who will work as manual labours on site. Employment will also be generated for machine operators and truck drivers. The benefits of these are as:

- Generation of employment, thus improvement in life style and increase in standard of living.
- Paradigm shift from environment polluting activities such as burning of woods or coal to cleaner or less polluting fuels such as LPG or electricity, resulting in reduced dust, smoke and GHG emissions.
- Education of masses instils the importance and need of preservation of environment, which in long run, will improve the environmental conditions.
- Revenue generation to Government gives them the opportunity to carry out researches on new improved scientific methods for environmental preservation and sustainable development.

Table No. 9.1: Qualitative Environment Cost Benefit Analysis of Mining in Different Scenarios

S. No.	Evaluation Criteria	Complete ban	Restrict/access to vulnerable sites	Make allowance For environmental trust fund	Illegal Mining	Introduce community based sand mining
A	**Social**					
1	Effect on livelihood	--	0	+	+ +	+ +
2	Effect on health	+ +	+ +	+	--	+
3	Loss of residences	-	+	+	+	0
4	Water for	+	+	+	-	+

	cattle rearing					
5	Loss of domestic utility water	+ +	+ +	+	-	+
6	Pollution of drinking water	+	+	+	-	0
B	**Economic**					
7	Cost of repairing infrastructure	+ +	+ + +	+	-	0
8	Effect on crop production	+	+ +	0	-	+ +
9	Income of mine owners	---	- -	-	+ +	0
10	Income of labourers	---	- -	0	+ +	+
11	Income of sand transporters	---	- -	0	+ +	0
12	Income building material suppliers (alternatives to sand)	+ + +	+ +	0	-	0
13	Income of building material suppliers	- - -	-	0	+ + +	-

	(except alternatives to sand)					
14	Cost of river bank conservation	+ +	+	+	-	0
15	Effect on inland fisheries	+ +	+	0	-	0
16	Price of sand	- -	-	0	+ +	0
C	**Environmental**					
17	Loss of biodiversity	+ +	+ +	+	- -	0
18	Loss of riverine vegetation	+ +	+ +	+	- -	0
19	Decline in ground water levels	0	+ +	0	-	0
20	Imbalance In the natural flow system of rivers	- -	+	+	-	0
21	Quality of soil	+ +	+ +	0	-	0
D	**Technical**					
22	Use of technology	0	0	- -	-	+
23	Scale of mining	+ +	+ +	- -	-	+

9.5 INFERENCE

The analysis done for study area indicates the balance in favour of Environmental Benefits. That is to say, the financial expenditures incurred in preventing, containing, mitigating or removing environmental contaminations occurring as a result of the proposed mining activity are superseded by the expenditures saved (on environment, both short and long term) as a result of project activity.

9.6 COST BENEFIT ANALYSIS OF THE PROJECTS IN THE STUDY AREA:

The expenditure here will include relevant operation, maintainance and replacement costs. So far no other activities are recorded from the river stretch of project area. The specific purpose of the CBA is to express measure of impact from an activity. Beneficial effects from a plans implementation may be result of management, preservation, restoration etc. Regional income appears similar to that of national economic development. It represents a scheduled influx of money in form of salaries of localy employed people for next five years. This would be regardless of the alternative eventually employed persons. As adverse effect the cost of scrapping is taken in to consideration. The stretch is not used for fish catch or navigation, so adverse effect will be limited to cost of scrapping only. The amount (DMF + taxes + CER) funded by the government and project proponents when utilized on regional basis will create a positive scenario.

Table No. 9.2.- Beneficial and adverse effects : ***Regional development***

S.No.	Componenets	Measures of Effects
1. Regional Income		
	Beneficial Effects	
a.	Value of Sand produced	It may vary from place to place
b.	External components (Other river based activities like fishing)	Nil
	Adverse Effects	

a.	Cost of Excavation	Cost of labour and machines project wise given in chapter 2a.
b.	Additional cost	
c.	Lack of other activities	Nil
	Total Net benefit	
2. Regional Employement		
	Beneficial Effects	
a.	Increase in number of employed person (Direct and Indirect)	**Almost 4000**
	Adverse Effects	
b.	None	**-**
	Total Net benefit	
3. Population Distribution		
a.	Beneficial and adverse Effects	Incoming of people for satellite ioccupation can deplete the livelihood resources.
	Total Net benefit	None
4. Reginal Economic Base and Stability		
	Beneficial Effects	**Yes**
a.	Provide a source of Economic stability and economic diversification.	
b.	Provide for regional mining capability	**Yes**
	Total Net benefit	
5. Regional Environmental Concerns		
	Adverse Effects	
a.	Areas of natural beauty	Visual impacts from mining
b.	Natural resources and ecological systems	Impact on aquiflora and aquifauna, Impact of fugitive emission from loading sites, Impact of tailpipe emission.
c.	The quality of air, water and land	Change in sand budget,

	resources	Creates turbid water, Impact of fugitive emission from loading sites, Impaact of tailpipe emission.
d.	Deterioation of Environment	Proper Implication of mitigation measures for anticipated impacts.
	Total Net benefit	

Table no. 9.3.- Beneficial and adverse effects : ***Social well being***

S.No.	Componenets	Measures of Effects
1. Regional Income Distribution		
	Beneficial Effects	
a.	Gross Earnings from Excavated sand	
b.	Beneficiaries Primary a.Project proponent b. Local people who are employed c. Government Secondary Contractors and allied industries Tertiary Consumers Peripheral workers	 **11** **800** **-** **2500 aprox** **700 aprox.**
	Adverse Effects	
a.	Loss of income from other allied activities dependent on river	**-**
2. Life Health and Safety		
a.	Possible health impacts due to mining	**fugitive dust and noise**

	activity	
3.	**Educational, cultural and recreational**	
a.	Possible detriment to recreational interests.	-
4.	**Emergency Preparedness**	
a.	Total independence of sand supplies route	New road construction and maintainace is envisaged by local administration.

Table No. 9.4. Total benefits from the implementation of proposed plans in study area

Regional Economic Development	
Environmental Quality	Data for future regulation formulation.
Regional Income from sand	**It may vary from place to place**
Regional Employment	**Almost 4000**
Population Distribution	None
Economic Base and stability	Economic diversification, sand extraction capacity of area
Environmental concerns	Real impact, visual impact change in sand budget
Social well being	
Real Income Distribution	Reduced cost of sand, Creation of new jobs (direct and indirect employment),
Life Health Safety	Possible health impacts due to mining activity
Educational, cultural and recreational opertunities	Possible detriment to recreational interests.
Emergency Preparedness	Total independence of sand supplies route

Table No. 9.5 Benefits-Adverse effects for Proposed Plan Implementation

Regional Economic Development	***Environmental Quality***	***Regional Consideration***	
		Development	***Social well being***
Value of increased outputs	Areas of natural beauty	Income	Real Income Distribution
	Natural resources and ecological systems	Employment	Life, health, safety
Values of output results	The quality of air, water and land resources	Population Distribution	Education, culture, recreation
	Deterioation of Environment	Economic base and stability	Emergency preparedness
		Environmental concerns	

CHAPTER-IX

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REGIONAL ENVIRONMENTAL MANAGEMENT PLAN

10.1.INTRODUCTION

On 1st July 2016 wide S.O. 2269 (E), directions have been given on environmental clearance for minor minerals and environment clearance for leases in group of leases and concept of Regional Environment Management Plan (REMP) has been introduced. Generic guidance on Regional Environment Impact Assessment (REIA)/ Regional Environment Assessment (REA) was introduced in the World Bank in 1989 with the adoption of an Operational Directive on environmental assessment (amended in 1996 as OP/BP/GP 4.01). The emerging experiences of regional pollution has revealed that this tool can improve regional development planning by helping to formulate more sustainable investment strategies and to build environmental management capacity at the regional level.

10.2. REGIONAL ENVIRONMENT MANAGEMENT PLAN (REMP)EMP is one of the crucial parts of any EIA study wherein detail description is needed for proper implementation of the same. However, for large projects, it is often difficult to provide a detailed description. For example, the greenbelt development is one of the mitigation measures to reduce the adverse impact of pollution on the environment but it is often quite challenging to mention in the EIA report the type of plants to be planted considering the type of soil, agro climatic region and the type of pollutant emitted by the industry. Also, the total cost for implementing the mitigation plan is often hard to work out.

Causes of environmental change also include natural variability and anthropogenic climate change. Four types of impact of mining are identified which compined to create regional impact.

1. **Space Crowding**-occurs when a system is disturbed by several similar activities, or by different activities producing a similar effect, in an area small to assimilate the combined impacts. (Rees 1995)
2. **Time Crowding**-occurs when impacts are so close in time that the impact of one action are not dissipated before the next occurs.(CEARC 1986)
3. **Interactive effects**- can be additive or compounding, reflecting the interactive nature of ecosystems. Additive is the simple linear addition of one impact on another, whereas compounding is when two or more agents combine to cause an impact. Antagonistic effects can also occur, where the combined impact of more than one agent is less than the sum of the individual impacts. (Canter and Kamanth 1995)
4. **Indirect effects**- are secondary impacts arising as a result of the direct effect, and include the impacts of activities facilitated by a project, including reasonably foreseeable impacts from downstream users.
5. **Regional issues** When preparing theRegional Envieonmental management plan the first step is the identification of regional issues. Some of them are given below:

Water abstraction

Direct abstraction from within the specified river/river reach as well as upstream (including tributaries) must be considered. This excludes indirect abstraction, for example by exotic vegetation. The presence of any of the following can be used as an indication of abstraction: cultivated lands, water pumps, canals, pipelines, cities, towns, settlements, mines, impoundments, weirs and industries. Water abstraction has a direct impact on habitat type, abundance and size; is implicated in flow, bed, channel and water quality characteristics; and riparian vegetation may be influenced by a decrease in water quantity.

Inundation

Destruction of instream habitat (*e.g*. riffle, rapid) and riparian zone habitat through submerging with water by, for example, construction of an on-channel impoundment such as a dam or weir. This leads to a reduction in habitat available to aquatic fauna and may obstruct movement of aquatic fauna; in addition it influences water quality and sediment transport.

Water quality

The following aspects should be considered: untreated sewage, urban and industrial runoff, agricultural runoff, mining effluent and effects of impoundments. Ranking may be based on direct measurements or indirectly via observation of agricultural activities, human settlements and industrial activities in the area. Water quality is aggravated by a decrease in the volume of water during low or no flow conditions.

Flow modification

This relates to the consequence of abstraction or regulation by impoundments. Changes in temporal and spatial characteristics of flow such as an increase in duration of low flow season can have an impact on habitat attributes. This results in low availability of certain habitat types or water at the start of the breeding, flowering or growing season. Effects of flow regulation of floods and low flows are assessed separately.

Bed modifications

This is regarded as the result of increased input of sediment from the catchment or a decrease in the ability of the river to transport sediment. Indirect indications of sedimentation are stream bank and catchment erosion. Purposeful alteration of the stream bed, *e.g*. the removal of rapids for navigation is also included.

Channel modifications

This may be the result of a change in flow, which alters channel characteristics causing a

change in marginal instream and riparian habitat. Purposeful channel modification to improve drainage is also included.

***Presence of exotic aquatic fauna** (e.g. fish)*

The disturbance of the stream bottom during feeding may influence, for example, the water quality and lead to an increase in turbidity. Predation on indigenous fish is also a factor. The extent of the effect is dependant upon the species involved and their abundance.

Presence of exotic macrophytes

Exotic macrophytes may alter habitat by obstruction of flow and may influence water quality. The extent of infestation over instream area by exotic macrophytes, the species involved, and its invasive abilities should be considered.

Solid waste disposal

The amount and type of waste present in and on the banks of a river,*e.g*. litter and building rubble is an obvious indicator of external influences on stream and a general indication of the misuse and mismanagement of the river.

Bank erosion

A decrease in bank stability will cause sedimentation and possible collapse of the river bank resulting in a loss or modification of both instream and riparian habitats. Increased erosion can be the result of natural vegetation removal, overgrazing or encroachment of exotic vegetation. Siltation is the process whereby fine solid particles build up on the bed of a river or lake and is the result of an excessive load of suspended solids in a river or rivers. Mining operations produce large quantities of dust and finely powdered rock, with much rock having been ground to particle sizes below 0.2 mm. Though the materials that are dumped after removal of the commodity being mined have fine particle size and reasonable physical characteristics that could permit plant growth and retain adequate amounts of water, these materials have been formed from hard unweathered material and so may not contain much of the finest clay material and lack organic or microbial activity. The result is that mine dumps may be very unstable, easily blown by wind when they are dry and eroded by heavy rain when wet. The action of rain and wind thus removes fine particles into nearby water systems, leading to a build up of suspended solids and ultimately siltation.

Ground water movement

Many so-called sandstone aquifers are actually multiple-aquifer systems consisting of discontinuous sand bodies distributed complexly in a matrix of lower-permeability silts and clays. The arrangement and Interconnectedness of these various lithofacies strongly influence spatial patterns of hydraulic conductivity (K) and, in turn, groundwater flow and mass transport. The aquifer system, which is consists of multiple, elongate sand bodies and silts and clays deposited in a fluvial environment and is similar to many other systems found in the sedimentary basins. The resulting deterministic-conceptual flow model demonstrates the importance and methods of incorporating geologic information in groundwater models. Flow in the aquifer is controlled not so much by hydraulic conductivity of the sands as by their continuity and Interconnectedness. Much of the aquifer system consists of large zones in which the fluvial channel-fill sands are sparse and apparently disconnected, resulting in groundwater flow rates lower by a factor of 101 to 103 than in adjacent, well-interconnected belts of fluvial channel-fill sand belts.. Though sand body Interconnectedness is critically important, it is also very difficult to estimate. One or two well-connected sands among a system of otherwise disconnected sands can completely alter a velocity field. This is particularly true if the sands are connected vertically and nonzero vertical hydraulic gradients exist, which yield reasonably accurate hydraulic heads (Fogg, 1986).

Change in particle size:

It appears that due to the mixing of different soil horizons during mining, the soil profile changed to a great extent (Ghosh, 2002). The particle size analysis reveals that sand particles increased, and silt and clay decreased with respect to unmined soil. This trend may be due to increased erosion of aggregates and consequently a high rate of infiltration.Studies reveal that indiscriminate and continued mining of sand from the alluvial reaches of river systems could impose marked changes in the grain size characteristics of river beds, in the long run (Scott, 1973; Sandecki, 1989; Stevens et al., I990). It is now we understood that the physical composition and stability of substrate are changed significantly as a result of instream sand mining. And. most of these physical effects exacerbate sediment entrainment in the channel. The deep pits created in the channel as a result of pit excavation method of sand mining act as sediment traps and the hungry water leaving the pits could selectively entrain sand particles in the finer entities and deposit further downstream. Continuation of this process, in the long run could result in bed coarsening with high percent content of coarser particles in the upstream. Indiscriminate extraction of sand from the lower reaches could impose marked changes in the sediment distribution pattern in thi s fluvial environment. The sand mining ac tivates the selective removal of medium to very fine sands from the upstream and their deposition in the subsequent downst ream stations. This processes of selective sorting based on grain size aggravated many folds by indiscriminate sand mining, is responsible for bed coarsening in the upstream reaches of the rivers.

Lowering of ground water:

Due to the connectivity of aquifer with the river channel. The aquifer lithology of alluvial sand and alluvial clay consists of thick ferruginous fine sand, underlain successively by fine sand, 2-3 m of unconsolidated clay and the weathered zone with open fractures and boulders of basement. This unique lithological assemblage has some advantages to areas with thick vermicular laterite upslope. When the river is in flood, the water level rises above the sand-clay interface. A major part of the sand thickness gets saturated. When the water saturated sand is in contact with vermicular laterite upslope, the water potential of the latter increases. However, when the floodwatcrs recede and reach its level of January to May virtually the entire sand is drained of its water and escapes as baseflow to the river leaving the wells along the river bank virtually dry. However, the water table in the vermicular laterite does not get lowered correspondingly. Continuous removal of sand from river bed increases velocity of flowing water which erodes beds and banks. Kondolf (2007) noted that as the velocity increases, the river bed can propagate both upstream and downstream for many kilometres. This can lower alluvial water tables. Stebbins (2006) added that in stream sand mining causes destruction of aquatic and riparian habitat through large changes in channel morphology, lowered water table, instability and sedimentation at mining sites due to stock piling and dumping of excess mining materials. There is environmental degradation on open land and rivers as well as high evaporation from exposed river beds leading to dry rivers and shortage of water for domestic purposes and animals. Sand act as a reservoir to charge ground water wells, so when removed, wells have to be dug deeper which increases water costs (Pereira, 2012). Generally, there is loss of employment to farm workers as agricultural land is destroyed to pave way for mining while there is human rights violation to farmers. When sand bed water is exposed by mining to dry atmosphere, there is a lot of evaporation. This leads to a micro disturbance of ground water. Continuous movement of heavy machines on rivers weaken riverbeds, causing water table to be nearer the surface where water is forming a pool from underground. Raised water table and formation of pools on riverbeds increases evaporation rate in summer such that exposed water is lost to atmosphere, and will not be useful to livestock and crops. (MADYISE, 2013) The water table along the river bank plunges steeply to the riverbed.Channel incision due to sand mining, typically lowers the alluvial water table as the channel itself determines the level down to which the alluvial groundwater drains (Galay, 1983; Creuz des Chatelliers and Reygrobellet, I990; Mas-Pla et al., 1999). This results in loss of groundwater storage and influences alluvial groundwater-surface water exchanges along the river system.Typical mining impact management and mitigation measures include the adherence to the Best Practice Guidelines that have been developed for a range of mining activities (for example, water quality management), investigating alternative locations for infrastructure and waste disposal sites, the adoption of different mining and beneficiation technologies, the use of cleaner production technologies, recycling of water and specific materials, pollution control measures, rehabilitation and landscaping, and the acquisition of additional property to compensate for habitat loss.

10.2.1. The area was divided into three zonesas per the sensitivity of the area on the basis of different environmental issues.

1. Area of high sensitivity

   Area of high sensitivity is near the project site where impact is highest.
2. Area of medium sensitivity

   Area of medium sensitivity is near the project site where impact is lesser.
3. Area of Low sensitivity

   Area of low sensitivity is farthest from the project site where impact is least.

10.2.1.1.Future scenario

The economic activitie which areexpected grow in the future are sand extraction.Because of these incoming population for permanent and satellite occupoation and increased transportation will enhance. The stretgy for for future scenario will include

1. Identification of present scenario.
2. Need for additional control measures for air quality deterioration because of the upcoming project.
3. Need for planning for additional solid waste due to incoming population.

10.2.1.2. Cost estimation for the different stretgies.

Identification of the problems because of the upcoming projects include the fugitive dust control measures will entail the cost of dust suppression by water spraying, improvement of PWD roads , paving of unpaved road. This will constitute bulk of investment.

10.2.1.3. Study area

Out of total 11 sand/moram mine leases, 02 leases are granted by District Magistrate,Jalaun while 09 leases are granted by District Magistrate Hamirpur through e-tenderingforexcavation of S a n d / Moram f r o m R i v e r b e d o f B e t w a R i v e r . The total area of mining lease is **303.64 ha** and the annual production will be **5456724 cum/annum**. These lease are situated on the river Betwa in two districts namely Hamirpur and Jalaunbetween **- 25°46'12.48"N & 79°19'13.34"E to 25°52'2.99"N & 79°46'49.50"E** in the river bed of BetwaThe plan period of the entire lease is 05 years.Area wise only four projects “two of M/s Sanewin Infrastructure Pvt. Ltd, M/s Disha Enterprises M/s Satyam Construction and M/s ShriShrikant Gupta(for which PH is awaited)” are falling under category B1 having area of more then 25 ha. All other projects are below 25 ha but some of them are being treated as B1category because of group of leases situation. The spirit of EIA notification is the cumulative impact assessment of two small mines which individually are believed to cause less impact. The buffer zones of various mines on the stretch of river Betwa are overlapping each other, that is the need for impact assessment on the large scale and REIA is undertaken.

10.3. PRESENT ENVIRONMENTAL CONDITION

pH of the ground water samples ranges from 7.13 to 7.39 . The ground water sample from Idhora village shows lowest pH i.e. 7.13 whereas from Gurha village shows the highest pH

7.39, which is in permissible limit of standards given by CPCB. Fluoride concentration is lowest in Basariya and highest in Idhora village, however lowest Iron concentration is found in Kahata Village and highest fluoride concentaration is found in Parsan village .The concentration of iron and fluoride is far below the standards specified by CPCB for drinking water. Total hardness of ground water samples are well within the limits.For Fugitive dust emission at any site, the most prevalent particulate sources, such as unpaved roads, bare ground, and loading. The upwind and downwind concentrations of TSP, PM_{10}, and $PM_{2.5}$ were measured. Emission of fugitive dust are influenced by moisture content, silt content, wind speed, and vehicle activity on unpaved roads, which includes vehicle speed and vehicle counts. The value of $PM_{2.5}$ is higher on all the monitoring locationsthan the NAAQS, 2009 (Attached as annexure-) standards with exception of AQ 5 i.e. Kutra. PM_{10} is also higher on all the monitoring stations except AQ 5 i.e. Kutra Higher $PM_{2.5}$ levels may be contributed due to traditional ways of cooking along with vehicular emission. PM_{10} in the area may be formed by physical processes of abrasion of surfaces and agricultural activities. The anthropogenic source are coarse particles are produced by the mechanical break-up of larger solid particles, wind blown dust such as road dust,soot, agricultural processes, combustion of fossil fuel . It also causes visibility reduction Almost all the monitoring locations are having higher PM_{10}. SO_2 and NO_2 are far below standards. Noise level at all the location below the standard.

10.4. FUTURE SCENARIO

It is expected that the economic growth in the study area would continue to be dominated by mining and associated activities. So environmental quality will be affected the environmental so there are number of strategies are in pipeline.

10.4.1. Management Stratgies

This stretgy confirms the need for additional abatement.

Improvement of roads

Improvement of quality of life.

10.4.2. Combined Planning

A combined strategy incorporating elements from all the components will be used for integrated environmental management plan. It will imply the integrated approach from the point of entry to closure of mines. However the local administration will play an important role in regional planning and how to proceed.

10.4.3. Cost estimates

The cost estimation of all the components of environmental protection will be account for all the projects proposed in the area.

10.5 REGIONAL ENVIRONMENTAL MANANGEMENT PLAN

10.5.1. Aims and objectives

The general aims and objectives of this plan are as follows:

(a) to maintain and improve the water quality and river flows and its tributaries and ensure that development is managed in a manner that is in keeping with the national, state, regional and local significance of the Catchment,

(b) to protect and enhance the environmental quality of the Catchment for the benefit of all users through the management and use of the resources in the Catchment in an ecologically sustainable manner,

(c) to ensure consistency with local environmental plans and also in the delivery of the principles of ecologically sustainable development in the assessment of development within the Catchment where there is potential to impact adversely on ground water and on the water quality and river flows

(d) to establish a consistent and coordinated approach to environmental planning and assessment for land along the river to promote integrated catchment management policies and programs in the planning and management of the Catchment,

(e) to encourage more effective consultation between local government and State Government agencies in executing the responsibility for environmental planning within the Catchment,

10.5.2. REMP application

General principles When this Plan applies the following must be taken into account:

(a) the aims, objectives and planning principles of this plan,

(b) the likely effect of the proposed plan, development or activity on adjacent or downstream local government areas

, (c) the cumulative impact of the proposed development or activity on the River or its tributaries,

(d) any relevant plans of management including any River and Water Management Plans approved by the Minister for Environment and the Minister for Land and Water Conservation and best practice guidelines approved by MoEF&CC

(e) all relevant State Government policies, manuals and guidelines of which the council, consent authority, public authority or person has notice,

(f) whether there are any feasible alternatives to the development or other proposal concerned.

10.5.3. Specific issues

- River quality and river flows
- On-site sewage management
- River-related uses.
- Bank disturbance
- Flooding
- Land degradation

10.6 ENVIRONMENTAL MANAGEMENT ACTIVITIES.

Table No. 10.1 Environmental management activities

Activity	Issue	Action with Key Riders	Responsibility
Labourers activity	Consumption of water and discharge of sewage	Workers are proposed for operation of scrappers and loaders) labours will be required, which will be hired locally. Drinking Water supply will be provided by way of Private tankers and earthen pots at site. A portable treatment plant is proposed at site and and water from that will be used for plantation.	Project Proponent
	Generation of solid waste	It is a sand mining project, no waste generation is anticipated. Workers will also be hired locally to avoid permanent housing at site.	Project Proponent

Activity	Issue	Action with Key Riders	Responsibility
		Uncontrolled dumping will be discouraged. Dustbins shall be provided onsite to collect domestic waste generated.	
	Risks to occupational health and safety	Mining activities will be open cast and semi-mechanized/OTFM (Other Than Fully Mechanized) i.e. using light earth Movers eg. Bar scraper and Loaders to avoid accidental hazards. Onsite first-aid and primary medical facilities will be provided during operation period. Protective equipments will be used. Training and awareness programs related to significance and use of protective gear will be imparted to the workers.	Project Proponent
	Possible transmigration	The contractor will be encouraged to give preference to local labour in the region.	Project Proponent
Earth Movement	Induced soil erosion, loosing of productive top soil.	Mining will be done as per the mining plan in the designated lease area from government for a period of five years up to the required depth only and will be confined along the river bed only. No impact is anticipated however replenishment activity is under process for actual volume estimation.as the mined area gets replenished every year during monsoon season. Top soil either absent or find in pockets and removal of Top soil is not required.	

Activity	Issue	Action with Key Riders	Responsibility
		Precautionary measures as the covering of vehicles will be taken to avoid spillage during transport of borrow materials. The unpaved surfaces used for the haulage of borrow materials will be maintained properly. The haul roads and borrow areas will be managed and maintained by the contractor. Since dust is the only impact along the haul roads, sprinkling of water will be carried at least twice a day	
Onsite activity	Extraction of natural resources such as sand, morrum	No impact as the mined area gets replenished every year during monsoon season however replenishment activity is under process for actual volume estimation.as the mined area gets replenished every year during monsoon season.	Project Proponent
	Noise generation due to the movement of Vehicles	No heavy machinery is proposed for the extraction of sand, operational is semi-mechnaized/OTFM (Other Than Fully Mechanized) using LEMM eg. Bar scrapper and loaders Noise generated due to movement of transportation vehicles will be managed by the use of vehicles which are less than 15 years old and after obtaining the pollution under control certificate. Also silence zones will be demarcated and noise barriers will be put accordingly. Labourers should be provided with personal hearing protection device (if required).	Project Proponent

Activity	Issue	Action with Key Riders	Responsibility
	Air emissions	The dust emissions will be minimized by following the good practices, for example, water sprinkling, provision of noise barriers, etc. Overloading of the trucks/trolleys should not be done. Suitable dust barriers shall be proposed.	Project Proponent

10.7 ENVIRONMENTAL MANAGEMENT PLAN

Proper environmental management plan are proposed for "River Bed Material" mining project to mitigate the impact during the mining operation.

- Mining operation will be suspended during monsoon season.
- Mining operation will be carried out during day time only.
- Prior to mining, short awareness program will be conducted for labours to make them aware about the finer nuances related to mining.
- If some casualty or injury to animal or human being occurs, proper treatment should be given.
- No tree cutting, chopping, lumbering, uprooting of shrubs and herbs should be allowed.
- Corridor movement of wild mammals (If exists) should be avoided
- Care should be taken that noise produced during vehicles movement for carrying mine materials are within the permissible noise level.
- No piling of mine material should be done in agricultural areas.
- Care should be taken that no hunting of animals or collections of medicinal plant are carried out by labours.
- If wild animals are noticed crossing the river bed, it should not be disturbed or chased away, instead the labours should move away from their path.

Table no. 10.2 Yearly plan for Environmental management Plan

S.No	Name of the project	Water requirement for plantation (KLD)	Air pollution control (Sprinkling) (KLD)	Environmental Monitoring Cost	No of plants
B1					
1	M/s Sanewin Infrastructure Pvt. Ltd.	0.069	11.80	2,70,000	138
2	M/s Sanewin Infrastructure Pvt. Ltd.	0.091	16.00	2,70,000	182
3	ShriAtikurrahman	0.061	42.56	2,70,000	121
4	M/s Sanewin Infrastructure Pvt. Ltd	0.061	39.76	2,70,000	121
5	M/s New Eoan Associates	0.061	13.14	2,70,000	121
6	M/s Satyam Constructions	0.091	23.52	2,70,000	182
7	M/s Disha enterprises	0.091	9.10	2,70,000	182
8	M/s Shrikant	0.091	15.72	2,70,000	182
B2					
9	M/s HSM Holdings Private Limited	0.061	12.32	2,70,000	121
10	M/s Kanhaiyalal And Sons	0.022	5.76	2,70,000	45
11	M/s Pratap Corporation	0.061	18.84	2,70,000	121

10.7.1. Progressive Green Belt Development Plan

- The lease area is designated aswasteland. Plantation will be carried out on:
- Riparian fringe-All along the river bank
- Sapling shall be planted along the approach roads and in the nearby villages i.e. all along the way from mine to nearest village in consultation with the Gram Panchayats

- Trees growing up to 5m.or more in height will be planted within the riparian fringe, such that there is no impediment to movement of water and general hydrodynamics.
- Plantations of adequate density serve as vertical screen of Biomass, screening the dispersion of air borne pollutants and attenuating noise as well.
- Local species will be planted as per the CPCB guidelines and in consultation with local forest office.Species to be planted will be the trees like Arjuna, Akashmoni, Kachnar, Jamun, Kaner, Bahera, Neem, Amaltas ,GulMohar, etc.
- Fast growing trees with thick perennial foliage will be grown,as otherwise it may take many years for trees to grow to their full height.
- Planting should be done in large sized 90cm x 90cm.due in advance and filled about 50 days before planting. The plantation raised earlier should be carefully maintained. Mortalities should be replaced by fresh planting.

10.7.2. Green Belt Development in the study area.

Same has been given in Chapter-07 under section 7.10.

10.7.3.Environmental Monitoring Plan

An Environmental monitoring programme has been prepared for the proposed project for periodical assessment of effectiveness of implementation of Environment Management Plan and to take corrective measures in case of any degradation in the surrounding environment.For assessing the prevailing quality of air, water, noise, land etc., regular monitoring of parameters are necessary. The data assessed will be helpful in predicting the impact and planning suitable measures to improve / protect the environment. In the study area, the lessee will carry out monitoring studies for ambient air quality, fugitive dust, water quality, noise levels and soil quality as per the standard procedures and schedules. The monitoring system will include:

1. Monitoring stations in the buffer zone remain the same as selected in this study for Air, water, Soil, Noise etc.
2. Implementation of the planned mitigating measures.
3. Monitoring the programme of implementation.

The Environmental parameters will be monitored & samples will be analyzed as per the stipulations of Indian Bureau of Mines & UP Pollution Control Board and as per MOEF

Guidelines. The above monitoring proposals shall be adhered to and the results shall be intimated to the appropriate authorities for their perusal and records. A typical environmental monitoring plan is given below in Chapter-06

Table No. 10.3: Frequancy of Monitoring

S.No.	Monitoring parameters	Frequency of Monitoring
1	**Ambient Air Quality** Ambient air monitoring at appropriate location for Particulate matter (PM_{10}, $PM_{2.5}$), SO_2,NO_2	**Half-yearly**
2	**Water** Surface and Ground Water	**Yearly**
3	**Noise** Day and night level of noise	**Half-yearly**
4	**Soil** Soil sampling	**Yearly**

10.7.4 .Organizational setup for Environmental Monitoring

Major attributes of environment are not confined to the mining site alone. Implementation ofproposed control measures and monitoring programme has an implication on the surrounding area aswell as for the region. Therefore, mine management should strengthen the existing control measuresas elaborated earlier in this report and monitor the efficacy of the control measures implementedwithin the mining area relating to the following specific areas for eco-friendly mining:

1. Collection of air and water samples at strategic locations with frequency suggested and byanalyzing thereof. If the parameters exceed the permissible tolerance limits, corrective regulationmeasure will be taken.
2. Collection of soil samples at strategic locations once in every year and analysis thereof withregard to deleterious constituents, if any.
3. The effectiveness of drainage system depends upon proper cleaning of all drains provided in thesurrounding of mine area. Any blockage due to siltation or loose material will be checked at leastonce in a month.
4. Measurement of water level fluctuations in the nearby ponds, dug wells and bore wells.
5. Regular visual examination will be carried out to look for erosion of river banks. Any abnormal condition, if observed will be taken care of.

6. Measurement of noise levels at mine site, stationary and mobile sources, and adjacent villages will be done in every quarter of the year.

7. Monitoring Ground Vibrations: Ground vibrations studies or monitoring is not required as there is no proposal of drilling / blasting for scooping operations.

10.7.5. Implementation Of EMP

As the major environment attributes will continue to be around the project area alone, Implementation of the proposed control measures and monitoring thereof will be undertaken on aregional basis. The project proponent will ensure the implementation of the measures within themine area and carryout efficient monitoring through outsourcing to competent certified consultantsand laboratories.In order to implement the measures suggested for mitigating the adverse impacts on theenvironment, it is suggested to monitor the environmental parameters regularly.

10. 7.6. Environment Management Mechanism

No cell is proposed to form; the plan will be implemented through outsourcing suitable andaccredited consultants and experts.Environmental Monitoring will be directly coordinated by the Supervisor / Owner. Competentoutsourced certified organization/lab personnel will conduct the monitoring operations. A full-fledged laboratory is not essential; part of the work will be given to competent consultants toundertake these jobs. Regular semi skilled manpower will be required for supervision, assistance in reclamation worksfollowed by trained unskilled labourers to carry out other necessary operations.

10.7.7 . Functions of the EMP Implementation Team

1. Implementation of the mitigation measures.
2. Maintain Records of the operation.
3. Monitoring the programme of implementation.
4. To estimate the efficiency of measures taken.
5. To bring out any other unforeseen effect on environment not covered under the report.
6. Inspection and regular maintenance of mining equipments and transport vehicles.

10.7.8. Budget For Environmental Management

Annual budget for EMP is very essential for successful implementation of EMP. The fund allocated will not be diverted for any other purposes and the top management will be responsible for this. The budget will take into consideration of capital and recurring expenses:

Table no. 10.4 Environmental Expanditure (Lease wise)

Name of the project	Sprinkling+ Water demand for plantation EMP (Recurring Cost)	Cost (sapling + tree guards+monitoring) EMP (Capital Cost)	EMP (Recurring Cost) Per Year
B1			
M/s Sanewin Infrastructure Pvt. Ltd.	1636695	1645948	327339
M/s Sanewin Infrastructure Pvt. Ltd.	2218788	1741698	443758
ShriAtikurrahman	5864525	1611128	1172905
M/s Sanewin Infrastructure Pvt. Ltd	5479525	1611128	1095905
M/s New Eoan Associates	1819275	1611128	363855
M/s Satyam Constructions	3252788	1741698	650558
M/s Disha enterprises	1270038	254008	1741698
M/s Shrikant	2180288	436058	1741698
B2			
M/s HSM Holdings Private Limited	1706525	1611128	341305
M/s Kanhaiyalal And Sons	796592	1445740	159318
M/s Pratap Corporation	2603025	1611128	520605

CHAPTER- XI

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11.1	SUMMARY OF REIA
11.2	PROJECTS
11.3	PROJECT DESCRIPTION
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11.5	RECOMMENDED MANAGEMENT PRACTICES
11.6	EXPLANATION OF HOW ADVERSE EFFECTS HAVE BEEN MITIGATED

SUMMARY & CONCLUSION

11.1 SUMMARY OF REIA

In district Hamirpur and Jalaun, river Betwa covers a distance more than 160 m as stated in District survey report of Sand of District Hamirpur and Jalaun. Across the river Betwa in its river bed many minable areas are identified and leased for morrum scrapping from the area under the guidelines issued in SSMMG, 2016 by MoEF& CC, GOI. The contiguous leases on the river stretch make the area more susceptible to Environmental degradation. A project level impact assessment is limited to a specific area and it does not ask whether the proposed undertaking is the most appropriate form of development or whether the cumulative effects of such development are in conflict with broader environmental goals or desired future conditions. It disregards the cumulative impacts i.e. deforestation, depletion of the ozone layer, biodiversity decline etc. No single project can be considered responsible for the problems; however they do occur due to the combination of several impact sources. When projects are assessed individually, not much attention is paid to other developments (existing or planned) affecting the same area, consequently the decision makers are masked the true nature of the problem under analysis and are asked to assess the acceptability of individual impacts. Such impacts often appear negligible despite their potentially harmful cumulative effect Thus, for such a large area containing different land uses Regional EIA is needed for assessing the cumulative impact of the proposed industries on the region as a whole. Regional EIA is more than expanding the boundaries of EIA “up” to a higher tier or “out” to encompass a broader geographic area, rather it represents a different way of approaching the relationship between environment and development decision making at a regional scale. These leases (B1-08 and B2-03)*(inclusive of upcoming projects of B1-sub-category for which Public Hearing is awaited and B2- sub-category projects for which EC is awaited)have their individual buffer area but when plot together their buffer area is overlapping each other. This study show how over some areas the environmental impact of projects is increased as those areas are having cumulative impact of both. To meet the objective of cumulative impacts on the environmental condition of the region containing multiple leases on the river stretch of Betwa in Hamirpur and Jalaun District, Environmental Impact Assessment (REIA) is being carried out. However the proposed project is situated in Khand No. 26/3 ,ChandwariGhurauli, Sarila, Hamirpur. Proposed mine leases has been sanctioned over for period of five years. Only morrum will be excavated. It has been proposed that 3,88,608 cum/ yearof morrum will be excavated. Although the area of the project is only 24.291 ha and it is B2 category project, but according to the cluster certificate another mine in 500 m radius of the proposed project form a cluster of 48.582 ha. So it also becomes a B1 category project.

11.2 PROJECTS

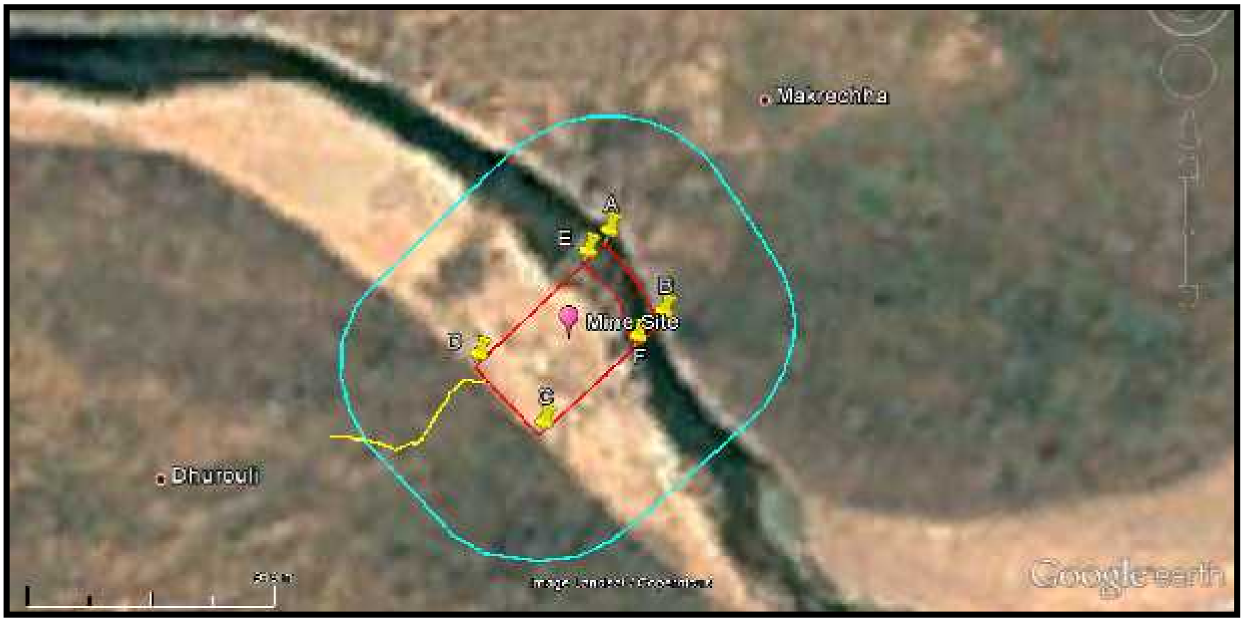

Fig 11.1 Google map of the Project

Table No.11.1 Details of the leases in the riverbed Betwa in District Hamirpur

11.2.1. Project Description:

Project Proponent(s) & Name of Company (if any) & Residential Address	M/s New Eoan Associates Proprietor ShriDharmendra Singh Tomar S/o Shri Krishna Kumar Tomar R/o House No. 101, Tansen Nagar, Gwalior (M.P.)
Gata No (s)/ Araji No (s)/ Khand No (s)	Khand No. 26/3
Village	ChandwariGhurauli
Tehsil/ District	Sarila/ Hamirpur
Area (ha)	24
Date of issue of Letter of Intent (LOI)	18.07.2018
MP approved on	Yes on 13.08.2018
Date of submission of EC application to MoEF's Portal with acknowledgement number & File	23/07/2018, SIA/UP/MIN/28363/2018; File No. 4404

No.	
Report Submission date	27.08.2018
Date of presentation/ Agenda No. /Sl. No.	TOR- 30.08.2018, 354, 02
Date of submission of draft EIA for Public Hearing	27.08.2018
Date of grant of TOR/EC	25-07-2018
Public hearing conductance	PH on 19-09-2018

11.2.2. Leasehold area

TOTAL MINE LEASE AREA (ha)	WORK ABLE AREA (ha)	NON-WORKABLE AREA (ha)	UNUSED AREA (ha)	AREA USED FOR AMENITIES (ha)	AREA LEFT AS SAFETY ZONE (ha)	MINEABLE AREA (ha)
24.291	20.290	4.0	0.7	0.2	0.9	14.4

11.2.3. Estimation of the reserve

MINE LEASE AREA (Ha)	WORK ABLE AREA (Ha)	GEOLOGICAL RESERVE (m3)	PROPOSED PRODUCTION AS PER LOI (m3/annum)
24.291	21.191	655476	4,85,747

11.3.PROJECT DESCRIPTION (Technology & Process)

The proposed project is to mine morrum from river bed sustainably and scientifically. Mining will be opencast, semi- mechanized/ OTFM (Other Than Fully Mechanized) using scraper and loaders along the river bed keeping bank unaffected. Following geo-scientific methods are proposed to carry out the activity:

- Mining will be confined to extraction of Morrum from the river bed only.

- Mining of gravelly morrum from the river bed will be restricted to a maximum depth of 3m from the surface.
- No drilling, blasting and beneficiation is proposed.
- Approximately 3,88,608 cum/annum(production inclusive of upcoming projects of B1-sub-category for which Public Hearing is awaited and B2- sub-category projects for which EC is awaited) minor mineral will be extracted.
- No mining activity will be undertaken during the monsoon season. So the river bed material will be replenished during the monsoon season every year.
- The mining activity will be restricted to daytime only in order to avoid environmental pollution or any accidental hazards.
- The operation will be done using OTFM (Other Than Fully Mechanized) method using Bar scraper and Loaders.
- During the lease period, the deposit will be worked from the top surface of the river bed to 3 m bgl or 1 m above water level whichever is less.

11.3.1Water Supply

The requirement of water is anticipated to carry out operations as it will be done in semi-mechanized manner. The water will be required either for drinking purposes or for dust suppression and in Plantation. It is projected that approx 800 workers will be required for the proposed project The water requirement will be met by nearby existing dugwells/borewells or by private water tankers.

Water Demand (KLD) for Sprinkling on Unpaved haulage road	Water Requirement for plantation (KLD)	Drinking water - Day worker (KLD)	Drinking water - Floting population(KLD)	Drinking water - Fixed population(KLD)	Stored water (KLD)	Total Water
13.14	0.061	0.56	0.51	0.58	4.10	18.95

11.3.2.Man Power Requirement

UNSKILLED LABOUR	SKILLED LABOUR	OTHERS	FLOATING POPULATION
47	9	13	254

11.4 OVERALL JUSTIFICATION FOR THE IMPLEMENTATION OF THE PROJECT

11.4.1.Sustainable Mining

All the measures to make the mining activity sustainable will be taken in to the consideration. The masures will include OTFM method using Scrapers and loaders, no mining in the concave areas of the rivers, 7.5 m safety zones inside of the either banks inside the river bed in the lateral form. Ultimate working depth will be upto 3.0m from Riverbed level and not less than one meter from the water level of the River channel whichever is reached earlier and suitable slopes not more than a gradient of 30° will be maintained. No mining in Monsoon season and in night time.

No mining below the water table and no mining and within 200-500 meter of bridge, 200 meter upstream and downstream of water supply / irrigation scheme, 100 meters from the edge of National Highway and railway line, 50 meters from a reservoir, canal or building, 25 meter from the edge of State Highway and 10 meters from the edge of other roads. Use of PUC certified vehicles will be allowed for the transportation of minor mineral.

11.4.2. Environmental Benefits

- This activity promotes a piscicultural operation extremely important for maintaining ecology and environment of the area.
- It controls river bank erosion by deepening of river channel, thus prevents flooding and other natural hazards.
- It helps in Regeneration & Establishment of Pioneer Species like Shisham&Khair on the banks of rivers besides saving agricultural land & land cutting.
- It regulates & maintains the existing course of the river, and improves the water holding capacity of channels.

11.4.3Social Benefits

- Generates employment to the locals engaged directly in extraction of morrum as well as indirectly transportation and sale of mineral.
- Leads to improvement in lifestyle and standard of living.
- Earns huge sum of revenue in the form of mineral royalty or dead rent for the State Exchequer.

11.5 RECOMMENDED MANAGEMENT PRACTICES

It outlines best management practices and addresses good operational elements to minimise impacts for the following aspects in sand mining operations:

- ❖ Operational practices;
- ❖ Processing Site/Maintenance yards;
- ❖ Appropriate Transportation Methods;
- ❖ Fuel storage/solid waste; and
- ❖ Practical BMPs and their effective implementation.

a.Operational practices

- ❖ The use of river reserve as dumping area will be prohibited; the river itself will not be used as dumping area;
- ❖ Machinery and transportation vehicles used in the operations must be maintained well and be free of any leakages;
- ❖ Mining activities will be avoided at night times;
- ❖ Vehicles transporting sand will maintain speed to not more than 20km/hr, be covered to avoid spilling on public roads and should travel on non-peak hours;
- ❖ Site office and workers quarters will be equipped with proper sanitation facilities. No direct discharge of sewage or sullage will be allowed into the river course;
- ❖ Proper waste collection bins will be provided; and
- ❖ Working areas will be made good after operations.

b.Processing site and maintenance yard

- ❖ No discharge of oily wastewater directly into the river;

- ❖ Wherever skid tank is used for fuel storage, it should be surrounded by a bund and underlain with concrete flooring to prevent any spillages reaching the river;
- ❖ Equipment, machinery and transportation leaving the site should always be clean and if applicable, provision made for a wheel washing facility to clean tyre prior to entering public roads;
- ❖ A maintenance yard should be concreted with perimeter drainage to collect oily waste; and
- ❖ Overburden from mining activities is not allowed to be dumped on the riverbank or riverine reserve

c.Appropriate transportation methods

Sand from the project site will be transported mainly via land and possibly by land transportation. Land transportation involves dumpers. Impact of this type of transportation will be fugitive dust from the sand itself and the gravel road on which the dumpers travel. Appropriate measures such as covering the dumpers with canvas or plastic sheets can prevent dust nuisance to road users and local residents.

d.Modifying operational practices working time

Environmental impacts can be minimized by improvement and improvisation in the working time. By operating at certain particular times, impact on the environment can be minimized. The following can be used as guidelines for mining operations. There will not be any mining activities during breeding periods of fish and other aquatic inhabitants (the operator should verify with the Fisheries Department).

11.6 EXPLANATION OF HOW ADVERSE EFFECTS HAVE BEEN MITIGATED

A brief description of mitigation of adverse effects is discussed as under, however, a detailed discussion on the same is done in Chapter 4 of REIA of Study Area 1.

- The mining activity is restricted to the dry river bed only. Since the site is government owned waste land, no impact on existing land use is anticipated. Also the mined area would get replenished on arrival of monsoon every year.

- Mining will be done as per the mining plan in the designated lease area from government for a period of five years up to the required depth only (3m below river bed/ or 1 m above the water level/ water table whichever is less) and should be confined to the dry river bed only.
- The only air pollution sources are fugitive dust emission due to movement, loading, unloading and transportation of minor minerals, as drilling, blasting, crushing, DG Set/furnace or storage is not proposed at site.
- There are no wastewater discharges to water bodies from the mining operations. The only water contaminant is rainwater run-off during the monsoon season. There will be almost negligible impact due to the proposed mining on the water environment and the water flow pattern does not disturb the turbidity and velocity, hence no mitigation measures are suggested.
- There is no noticeable effect on surrounding ground water resource due to mining as the mining activity does not require ground water extraction.
- As there will be no heavy earth moving machinery involved in the mining operations, there will not be any major impact on noise level due to the mining and other association activities. A detailed noise survey has been carried out and results are discussed in Chapter 3.
- Blasting technique is not used for morrum lifting, hence no possibility of land vibration.
- The mining operation will have positive and long term impact on river environment as the operation will result in extraction of excessive morrum deposits from points where the maximum sedimentation occurs, in order to prevent flooding or related natural hazards, which in turn will save the existing agricultural practices of nearby areas.
- No mining will be carried out during monsoons. This will minimize impact on aquatic life.
- It is a river bed mineral mining project which has no vegetation, therefore clearance of vegetation is not required

- An inventory of the risks involved during the proposed project would be delineated with the measures to mitigate the same and the same would be ensured to the people by conducting an awareness program in the surrounding areas.