Report on Damage Assessment Due to Illegal Mining of Limestone in the Districts of Junagadh & Gir-Somnath

CNS/GPCB/EH/P0237/2021/0014

FINAL PROJECT REPORT

Submitted to:

M/S. GUJARAT POLLUTION CONTROL BOARD (GPCB)

PARYAVARAN BHAVAN, SECTOR-10A,

GANDHINAGAR – 382 010.

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GANDHINAGAR

GUJARAT – 382 355

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For and on behalf of Indian Institute of Technology Gandhinagar		
Prepared By	:	**Dr. Manish Kumar**
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Year	:	March – 2021

Acknowledgement

I owe this project to the hard-working lime-stone diggers of all the 14 leased mines, dedicated staffs at Gujarat Pollution Control Board (GPCB), magnificent members of Water Environment Technology Laboratory at IIT Gandhinagar and untiring support from the staff at the Dean, Research and Development office at IIT Gn.

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Abbreviations

Abbreviations	Description
APHA	American Public Health Association
CGWB	Central Groundwater Board
DO	Dissolved Oxygen
EC	Environmental Clearance
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GEE	Google Earth Engine
GIS	Geographical Information System
GPCB	Gujarat Pollution Control Board
GPS	Global Positioning System
IDE	Integrated Development Environment
IIT–Gn	Indian Institute of Technology Gandhinagar
LST	Land Surface Temperature
LULC	Land Use and Land Cover
MCL	Maximum Contaminant Level
MODIS	Moderate Resolution Imaging Spectro-Radiometer
MoEF&CC	Ministry of Environment Forest and Climate Change
NDVI	Normalised Difference Vegetation Index
NGT	National Green Tribunal
ORP	Oxidation-Reduction potential
RQP	Recognized Qualified Person
RS	Remote Sensing
SEAC	State Expert Appraisal Committee
SEIAA	State Environment Impact Assessment Authority
TDS	Total Dissolved
WHO	World Health Organization

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Executive Summary

Background

In the case of O.A. No.: 58/2018 Hon'ble NGT has directed to a committee consisting of Gujarat Pollution Control Board (GPCB), State Environment Impact Assessment Authority (SEIAA), and Geologist Department to prepare damage assessment reports due to illegal limestone mining activity in Junagadh and Gir Somnath District. The committee has prepared a report and submitted to Hon'ble NGT. In the said report the committee observed to need "To evaluate the detailed assessment by the expert institution/organization of the national repute". Following the Hon'ble NGT order dated 01/05/2019 and 15/06/2020 in the matter of O.A. 58/2018, Protection of Environment and Public Service Committee Vs. Union of India & Ors.it was mandatory for the Board to carry out detailed assessment. In this context, the Gujarat Pollution Control Board (GPCB) take the professional services of IIT-Gn for the aforementioned work. The project was started on 1st January, 2021, with the objectives that are given below.

The objective

- Preliminary site/incident location characterization through proper documentation of the preliminary information.
- Computation of the net present value of ecological services foregone forever,
- To evaluate the overall cost of damage to the pristine ecology and
- To identify the actual cost of mitigation and restitution of environment in Junagadh and Gir Somnath mining areas.

Action Taken

Upon receiving the work order from GPCB, IIT-Gn project team had prepared the questionnaire/checklists before the field visit commenced between 18th to 23rd January, 2021. Before this field visit, we carried out several remote-sensing-based investigations to understand the field situation through several timeline impression images. The dynamics of land use/land cover (LULC) changes, the effect of mining on the LU/LC changes are studied and discussed in detail. The different land use classes mainly water body, mining area, forest cover, built-up area, barren land and agriculture land in Junagadh and Gir-Somnath districts are identified in order to understand the impact of LU/LC change on the environment. A detailed survey on various aspects of mining status, stakeholder's perceptions, vegetation status, and other environmental indicators were carried out during that six days in the field. The preliminary survey included the collection of local geological data for the Junagadh district in order to understand the soil characteristics. Besides, samples were taken for hydro-geochemical analyses. During our visit to the mining sites, the soil/sediment, surface water, groundwater, open-well water, pit water samples (wherever available) were collected in order to ascertain the water quality in the region as well as to trace the effect of mining activities on the potable water resources.

The collected samples are undergone investigation for various water quality parameters. In total, thirteen (n=13) open-well/bore-well and four (n=4) pit water samples were collected from the vicinity of mines. The physicochemical analyses (hydrogeochemical parameters, cations, anions, and trace metal ions) of the collected samples were carried out for the proper identification of their composition, suitability for drinking purpose, and the potential effect of mining pollution.

In addition to these, we had collected all the first-hand data and details from the lease holders, which included several pertinent issues of mining activities (refer sub-section 2.1.3 for detailed checklist). Based on the available guidelines, we have considered three methodology dependent formulas for the overall damage assessment, i.e., (i) CPCB

guidelines/methodology for assessing environmental compensation, (ii) SEAC, Gujarat proposed formula/guideline for assessment of ecological damage and (iii) Industries and Mines Department, Govt. of Gujarat resolution for imposing environmental compensation in cases of illegal mining, transportation and storage causing damage to the environment.

Key Findings

- The present status of environmental, ecological scenario and overall socio-economic impact in the core zone and buffer zone of limestone mining area of Junagadh and Gir Somnath District put together seems to have positive effects.
- The most critical findings of two-decade change (20 years i.e., from the year 2001 to 2021) in the land use/land cover change in the Junagadh and Gir Somnath district has been the significant reduction of barren land (-36.3 %) and increase of vegetation. Precisely speaking, our remote-sensing analyses suggests that even in the last decade i.e. the period between 2011-21, there has been a 23.4% of decrease in the barren land with a corresponding increase of 19.6% in vegetation and 32% in the human settlement. The main driver of these changes is the mining activities.
- A primary investigation including survey of local people reveals that in all the 14 mines, the open cast mining is done either manually or through surface miners/other mechanized means but without blasting. It implies that mining could not cause the damage to the extent that will create visible impacts on the surroundings and nearby people.
- A detailed questionnaire survey discloses the environmental, societal, biodiversity and climatic impacts of all the mines. However, the positive impacts are overwhelming the negative ones considering the proper management such as, the green belt development along the roads, providing work and shelter to people who live hand-to-mouth in the rural area of the district, less impact on the biodiversity and climate (owing to non-usage of blasting type of mining process).
- The physico-chemical analysis results suggested that for all the collected open-well/bore-well samples (n=13) the values of pH were ranged from 6.90 to 7.83 with an average value

of 7.29, signifying that the surface and groundwater present in the vicinity of mining area is neutral in nature with negligible impact from the mining activity.

- 77.8% of the collected water samples exceeded the IS standard limit for fluoride (F^-) in drinking water, implying that the open limestone quarries are somewhere directly/indirectly accountable for such higher content of F^- which can cause dental fluorosis as well as adversely affect the central nervous system, bones and joints at high (>1.5 mg L^{-1}) concentrations. However, the water samples collected from the quarry pit were of superior quality as compared to the open-well or the bore-well water samples.
- The penalty for the environmental damage calculated in the previous report was corroborated through our detailed exercise. However as is the case, final recommendation was based on the highest damage amount deduced from any of three methods used, which seems arbitrary, and unpractical for the following reasons:
    - Absence of consistent thumb rule for methodology opted for the damage obligation. The maximum financial penalty seems to be harsh and sporadic, which may lead to unsatisfaction among the stakeholders. It may not be also right from the social justice perspective.
    - Some of the lease holders had witnessed very less mineral production for a very small duration of one to two years. However, the levied penalty, following the highest financial calculation principle, turns out to be four to five times of their earned values.
    - There are significant statistical differences among the outcomes of three methods (i.e. CPCB, Industries and Mines, GoG and SEIAA/SEAC, GoG) used for financial obligations.
    - Environmental damages on the ground have been less obvious than the beneficial impacts of this open scrap mining leading to lake or water body creation, or agricultural land formations, positively affecting the basic human needs like drinking water and food.

- Overall, with proper functioning of these mines is likely to be beneficial or the local people by getting direct employment in the mining project and indirect employment opportunities in the associated services. The project will provide livelihood to the poorest section of the society who are economically and socially backward. It will provide employment to the people residing in the vicinity of mining area directly or indirectly. The mine management will also help the people in the nearby villages by providing financial aid to schools, conducting medical and social awareness campaigns, help in the formation of self-help groups, etc. Thus, the project will bring socio-economic development of the area, which is much needed.
- Under the light of above consideration, the average value for total damage assessment cost calculated through three different methods (i.e. CPCB, Industries and Mines, GoG and SEIAA/SEAC, GoG) should be levied to the proprietors.

Key Recommendations

- Thick plantation is recommended along the mine boundary within lease area to reduce noise and vibration although it is not the major problem since blasting has not been performed for mining process.
- The management should provide ear muffs and helmets to the workers in the mine and stress on its utilization.
- The regular medical check-up of workers is to be carried out. Green belt development is to be stressed and workers must be motivated for plantation care. The general environmental awareness is given to the local workers. Regular maintenance of vehicle is carried out. Slogans of environment, health and safety are recommended for display.
- The monitoring program weight or Parameter Importance Unit (PIU) by the experts will help in observing the improvements of various environmental parameters; and will provide timely guidelines for taking remedial measures for the present and future development activities. We recommend adaptation of environmental friendly

measures like modern technological processes for excavation, installation of pollution control equipment for pollution load reduction, and community scale afforestation, that could reduce the mining impact on our environment.

Limitations

- The damage to the ecology cannot be determined because assessment of environmental damage compensation particularly loss of ecological damage is very complex and required substantial time as well as resources.
- The environmental attributes such as, air pollution, water pollution, hazardous waste generation, noise & vibration, cannot be precisely identified due to non-operational condition of all the mines.
- The ongoing pandemic (COVID-19) restricted the IIT-Gn team members to carry out detailed door-to-door survey which would certainly help in understanding the impact on the mining activity on individuals.
- The assigned project was only for four months hence, it cannot be possible to carry out continuous water (groundwater/surface water) monitoring for all three seasons (monsoon, pre-monsoon, and post-monsoon), which may be required to understand the seasonal fluctuations on the water quality due to mining activity

Chapter 1. Introduction and Background

1.1. Background of the study

A Miscellaneous application was filed by Protection of Environment & Public Service Committee before the Hon'ble NGT and it was submitted that mining is being done in the districts of Junagadh and Gir-Somnath without any prior Environmental Clearance from SEIAA, Gujarat and 14 mining leases have been named in violation of EIA Notification 2006. It was further submitted that the miners do not have valid Consent to Operate from GPCB under the Air Act, 1981 and Water Act, 1974.

Vide order of Hon'ble NGT dated 15/02/2019, a Joint Inspection was ordered to be carried out by SEIAA Gujarat, CPCB & MoEF&CC, particularly with reference to the grant of EC, Consent under the Air & Water Act, which includes action, prosecution and recovery of damage & asked to submit the report within one month. Accordingly, the Joint Inspection Committee carried out inspection of all the 14 leases and submitted its report to the Hon'ble NGT on 19/03/2019.

The matter was further considered by Hon'ble NGT on 01/05/2019 and ordered that damages on the account of (i) Net present value (NPV) of the ecological services forgone forever (ii) cost of damage to environment and pristine ecology (iii) cost of mitigation and restitution of environment & (iv) deterrent environmental compensation distinct from earlier three heads, be assessed and a report submitted with regard to assessment made before 24.07.2019. To comply the order of Hon'ble NGT regarding assessment of damage caused due to illegal mining by the 14 limestone mining units in Junagadh & Gir

Somnath districts, a committee was formed by the GPCB and carried out joint inspection during 26-27 June 2019 and assessed the scenario in and around the vicinity of the 14 mine leases. The committee has prepared a report and submitted to Hon'ble NGT. In the said report the committee observed to need "To evaluate the detailed assessment by the expert institution/organization of the national repute". Hence, it was mandatory for the Board to carry out detailed assessment. In this context, the Gujarat Pollution Control Board (GPCB) take the professional services of IIT-Gn for the aforementioned work.

1.2. Introduction to the Limestone Mines

Referring to the work-order received from GPCB, following 14 limestone mines located in the districts of Junagadh and Gir Somnath were inspected by the experts from IIT-Gn on 18-22 January 2021. All the mines were observed to be non-operative. The details of each mines are mentioned in Table 1.

Table 1: *Details regarding the investigated total 14 Mine Leases located at Junagadh Gir-Somnath district.*

Sr. No.	Name of the Mining Company	Survey No.	Mine address	Latitude	Longitude	Lease Area (Ha)
1.	M/s Gopalsinh Himmatsinh Chauhan	64 P	Village Ghusiya, Taluka - Talala, Dist. – Gir Somnath	21°1'47.13''	70°31'1.39''	2.00
2.	M/s Vajesinh Dansinh Mori	152	Village Jasadhar, Taluka - Talala, Dist. – Gir Somnath	20°59'28.35''	70°37'16.1''	2.00
3.	M/s R. J. Trivedi & Co.	65, 70	Village Umba, Taluka - Veraval, Dist. – Gir Somnath	20°59'40.71''	70°24'15.55''	7.69
4.	M/s Aher Bhagwan Bhimsinh	389/1	Village Ajotha, Taluka - Veraval, Dist. – Gir Somnath	20°54'7.9''	70°29'19.56''	6.47
5.	M/s Somnath Hydrated Lime & Chemicals Industries Pvt. Ltd.	42/1	Village Kherali, Taluka - Veraval, Dist. – Gir Somnath	21°0'30.48''	70°24'37.29''	15.1352
6.	M/s Noormahamad Kalubhai Patani	49	Village Kherali, Taluka - Veraval, Dist. – Gir Somnath	21°0'56.76''	70°24'35.04''	4.2593
7.	M/s Vikram Chemical Company	110P	Village Damasa, Taluka - Una, Dist. – Gir Somnath	20°50'52.87''	70°57'43.18''	2.00
8.	M/s Dhirajlal Panchabhai Vachhani	49 P	Village Undari, Taluka - Una, Dist. – Gir Somnath	20°51'50.33''	70°56'52.79''	4.00

9.	M/s Somnath Hydrated Chemicals	Meghal riverbed	Meghal riverbed, at near Village Zadaka, Taluka - Maliya, Dist. – Junagadh	21°4'41.6''	70°17'42.3''	10.00
10.	M/s Dinesh Kumar & Company	2P	Village Khorasa, Taluka - Maliya, Dist. – Junagadh	21°2'49.82''	70°19'28.42''	5.00
11.	M/s Rajsi Rana Jotava Limestone Mine	29 P	Village Khorasa, Taluka - Maliya, Dist. – Junagadh	21°2'51''	70°19'19.84''	4.00
12.	M/s GHCL Ltd.	408/6P	Village Gorakhmadhi, Taluka - Sutrapada, Dist. – Gir Somnath	20°54'39''	70°31'16.95''	8.73
13.	M/s GHCL Ltd.	81P	Village Kodidra, Taluka - Veraval, Dist. – Gir Somnath	20°57'57.91''	70°31'12.97''	4.70
14.	M/s S. J. Trivedi Limestone Mine	123	Village Dari, Taluka - Veraval, Dist. – Gir Somnath	20°55'43.05''	70°19'47.13''	9.35

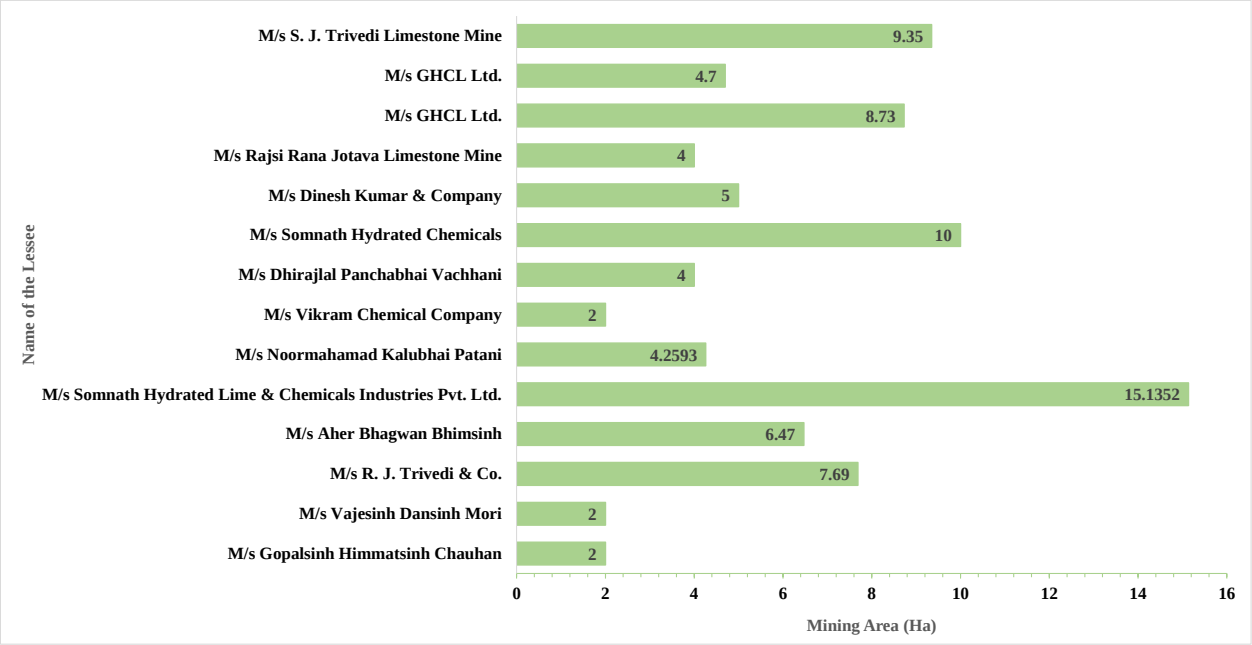

Figure 1: *Bar diagram representing the Total available Lease Area (Ha) for all the 14 lessees.*

Figure 1 represents the total available lease area (in Ha) for all the 14 lessees. From the figure it is clear that except two mines of M/s. Somnath Hydrated Lime and Chemical Industries Pvt Ltd, rest mines are of < 10 Ha area. The more details pertaining to each mine are mentioned below for further information.

(i) **Limestone Mine of M/s Gopalsinh Himmatsinh Chauhan**

This is an existing Limestone Mine located in 2.0 Ha mine lease area. During inspection, mining activity was observed to be stopped. No mining machinery was observed at site. Existing mining was observed to be carried out up to about 15 m depth in the work area. Water is accumulated in the Mine pit from which one water sample is collected. Noany river, school, village habitation etc are located in 500 m radius of this mine. Mine is surrounded from three sides by agriculture land and one side by village road. Ghusiya village and Hiran-2 Dam is around 2 km and 2.5 km away from the mine, respectively.

(ii) **Limestone Mine of M/s Vajesinh Dansinh Mori**

This is an existing Limestone Mine located in 2.0 Ha lease area. During inspection, mine was not in operation. Not any machinery was observed at site. Average depth of the minepit is about 1.5 to 2.0 m in the work out area. No any river, school, residential area etc. are there in 500 m radius of this mine. Mine is surrounded from two sides by agriculture land and two sides by other mine leases. Village Jasadhar is around 1.5 km away from mine.The mine lease area is located in proposed eco-sensitive zone around Gir Sanctuary. However, no vegetation is observed in the mine lease area. Surrounding area comprisedof horticulture plantation and agriculture land. As such, no impact is observed on the pristine ecology of the area.

(iii) **Limestone Mine of M/s R. J. Trivedi & Co.**

This is an existing Limestone Mine located in 7.69 Ha lease area. During inspection, mining activity was observed stopped. Existing mine pit is having about 0.5 to 1.0 m depth in the work out area. No mining machinery was observed at site. No any river, school, residential area etc are there in 500 m radius of this mine. Mine is surrounded from four sides by agriculture land. Village Umba is around 0.6 km away from mine.

(iv) **Limestone Mine of M/s Aher Bhagwan Bhimsinh**

This is an existing Limestone Mine with lease area of 6.47 Ha. During inspection, mining activity was observed to be stopped. No mining machinery was observed at site. A mine pit of about 1.5 m average depth was observed in work out area of the mine. No any river, school, village habitation is located in 500 m radius of this mine. Few houses are constructed in agriculture land near the mine lease area. Mine is surrounded from three sides by agriculture land and one side by village road. Village Ajotha is around 2.0 km away from mine.

(v) **Limestone Mine of M/s Somnath Hydrated Lime & Chemicals Industries Pvt. Ltd.**

This is an existing Limestone Mine located in 15.1352 Ha lease area. During inspection,mining activity was observed to be stopped. Average depth of mine working was observed to be about 1.5 to 2.0 m in the work out area. No mining machinery was observed at site. Babool plantation was carried on the lease boundary facing village road. No any river, school, residential area is observed in 500 m radius of this mine. Mine is surrounded from three sides by agriculture land and one side by barren land.

(vi) **Limestone Mine of M/s Noormahamed Kalubhai Patani**

This is an existing Limestone Mine with lease area of 4.2593 Ha. During inspection, mining activity was observed to be stopped. A small quarry pit with average depth of about 0.5 m was observed in work out area. No mining machinery is observed at site. No any river, school, residential area etc. are located in 500 m radius of this mine. Mine is surrounded from two sides by agriculture land and two sides by barren land. Village Kherali is around 1.0 km away from mine.

(vii) **Limestone Mine of M/s Vikram Chemical Company**

This is an existing Limestone Mine spread in 2.0 Ha lease area. During inspection, mining activity was observed to be stopped. Average depth of mining is about 2.5m in the workout

area. No any river, school, village habitation etc. are observed in 500 m radius of thismine. Few houses are located adjacent to the mine lease area. Mine is surrounded fromtwo sides by agriculture land and two sides by barren land. Village Damasa is around 0.7 km away from mine.

(viii) **Limestone Mine of M/s Dhirjalal Panchabhai Vachhani**

This is an existing Limestone Mine having 4.0 Ha lease area. During inspection, miningactivity was observed to be stopped. Average depth of mine pit was about 2.0 to 2.5m inwork out area. No mining machinery is observed at site. No any river, school, residentialarea etc. are there in 500 m radius of this mine. Mine is surrounded from three sides byagriculture land and one side by barren land. Village Undri is located at around 1.0 kmaway from mine.

(ix) **Limestone Mine of M/s Somnath Hydrated Chemicals**

This is an existing Limestone Mine spread over 10.0 Ha lease area located in Meghal river bed. During inspection, mining activity was observed to be stopped. No mining machinery is observed at site. Nearest human habitation is around 200 meter away from this mine.Mine lease area is surrounded from four sides by barren land. Village Zadka is around 0.3 km away from mine.

(x) **Limestone Mine of M/s Dineshkumar & Company**

This is an existing Limestone Mine spread over 5.0 Ha lease area. During inspection, mining activity was observed to be stopped. No mining machinery is observed at site. Nearest human habitation is around 200 meter away from this mine. Mine is surrounded from one side by agriculture land and three sides by barren land. Village Khorasa is around 0.5 km away from mine.

(xi) **Limestone Mine of M/s Rajsi Rana Jotava**

This is an existing Limestone Mine spread over 4.0 Ha lease area. During inspection, mining activity was observed to be stopped. No mining machinery is observed at site. Nearest human habitation is around 200 m away from this mine. Mine is surrounded from one side by agriculture land and three sides by barren land. Village Khorasa is around 0.5 km away from mine.

(xii)**Limestone Mine of M/s GHCL**

This is an existing Limestone Mine spread over 8.73 Ha lease area. During inspection, mining activity was observed to be stopped. Average depth of the mine pit was observed as 3.0 m. No mining machinery is observed at site. Mining area is properly fenced and some plantation has been carried out on the backfilled area in the mine lease. No any river, school, residential area etc. are there in 500 m radius of this mine. Mine is surrounded from three sides by agriculture land and one side by internal road. Village Gorakhmadhi is around 1.5 km away from mine.

(xiii) **Limestone Mine of M/s GHCL**

This is an existing Limestone Mine in 4.7 Ha lease area. During inspection, mining activity was observed to be stopped. Average depth of the mine was observed as 2.0 to 2.5 m. Nomining machinery is observed at site. Fencing has been carried out around the mine pit. No any river, school, residential area etc. are there in 500 m radius of this mine. Mine issurrounded from two sides by agriculture land and two sides by barren land. Village Kodidra is around 1.0 km away from mine.

(xiv) **Limestone Mine of M/s S. J. Trivedi**

This is an existing Limestone Mine spread over 9.35 Ha lease area. During inspection, mining activity is observed to be stopped. No mining machinery is observed at site. No any

river, school, residential area etc are there in 500 m radius of this mine. Mine is surrounded from one side by agriculture land and three sides by barren land. Village Veraval is around 3.0 km away from mine. Arabian Sea is located at about 0.47 km fromthe lease area. Hence, CRZ clearance may be required for this mine.

1.3. The objectives

Indian Institute of Technology Gandhinagar (IIT-Gn) has accepted the work with the following agreed objectives among the two parties i.e. GPCB and IIT-GN:

- Preliminary site/incident location characterization through proper documentation of the preliminary information.
- Computation of the net present value of ecological services foregone forever,
- To evaluate the overall cost of damage to the pristine ecology and
- To identify the actual cost of mitigation and restitution of environment in Junagadh and Gir Somnath mining areas.

1.4. Study Area

Junagadh district with the total geographical area of 8,831 sq.km is situated on the Kathiawar peninsula in western part of Gujarat at a longitude of 20°47’ to 21°45’ N and a latitude of 70°15’ to 70°55’E (Fig. 2(a, b)). It is surrounded by Rajkot District (North), Porbandar District (North-West), Amreli District (East) and to the South and West is the Arabian Sea. The district is divided into 10 talukas and is famous for the Gir Sanctuary, the only abode to Asiatic lions and mountain range of Girnar which is a major pilgrimage destination. As per census 2011, total population of the district is 27,43,082.

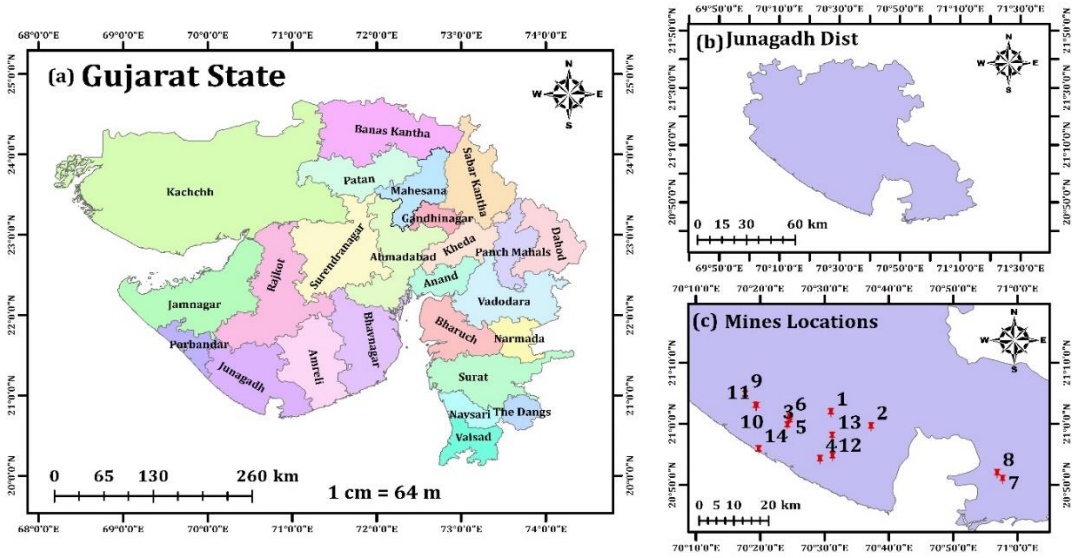

Figure 2: *Location Map of Gujarat (a), Junagadh district (b) and locations of 14 Mines (c).*

1.4.1. Geology study of the Junagadh district

The soils in the Junagadh district are formed from sedimentary rocks and partly from volcanic rocks. They are generally calcareous, rich in potassium content but comparatively deficient in nitrogen and humus. The main types of soils occurring in the district are Black soil, Medium black soil, Alluvial soil and in low-lying and coastal area, calcareous and brackish soils. The black soils are found in parts of Vanthli, Manavadar and Keshod talukas excepting the Ghed areas. Most of the villages of Jnagadh, Bhesan, Una, Kodinar, Talala, Malia and Visavadar talukas have medium black soil. The alluvial soil is found in the low-lying areas popularly known as “Ghed” in parts of Keshod and Mangrol talukas, these areas remain inundated during monsoon. Though the soil of this tract is fertile, water logging conditions prevent effective utilization of the land. In parts of Mangrol, Veraval and Sutrepada talukas the soil is alluvial and calcareous. The brackish soils are mostly found near the coastal belt of Mangrol, Maliya, Veraval, Sutrapada, Kodinar and Una talukas are representing the generation of the coastal alluvial soil due to ingress of the sea water. The area popularly known as “Lili Nagher” is the tract of fertile soil extending from Veraval – Patan to Una. Fig. 3 represents the soil properties of the Junagadh district.

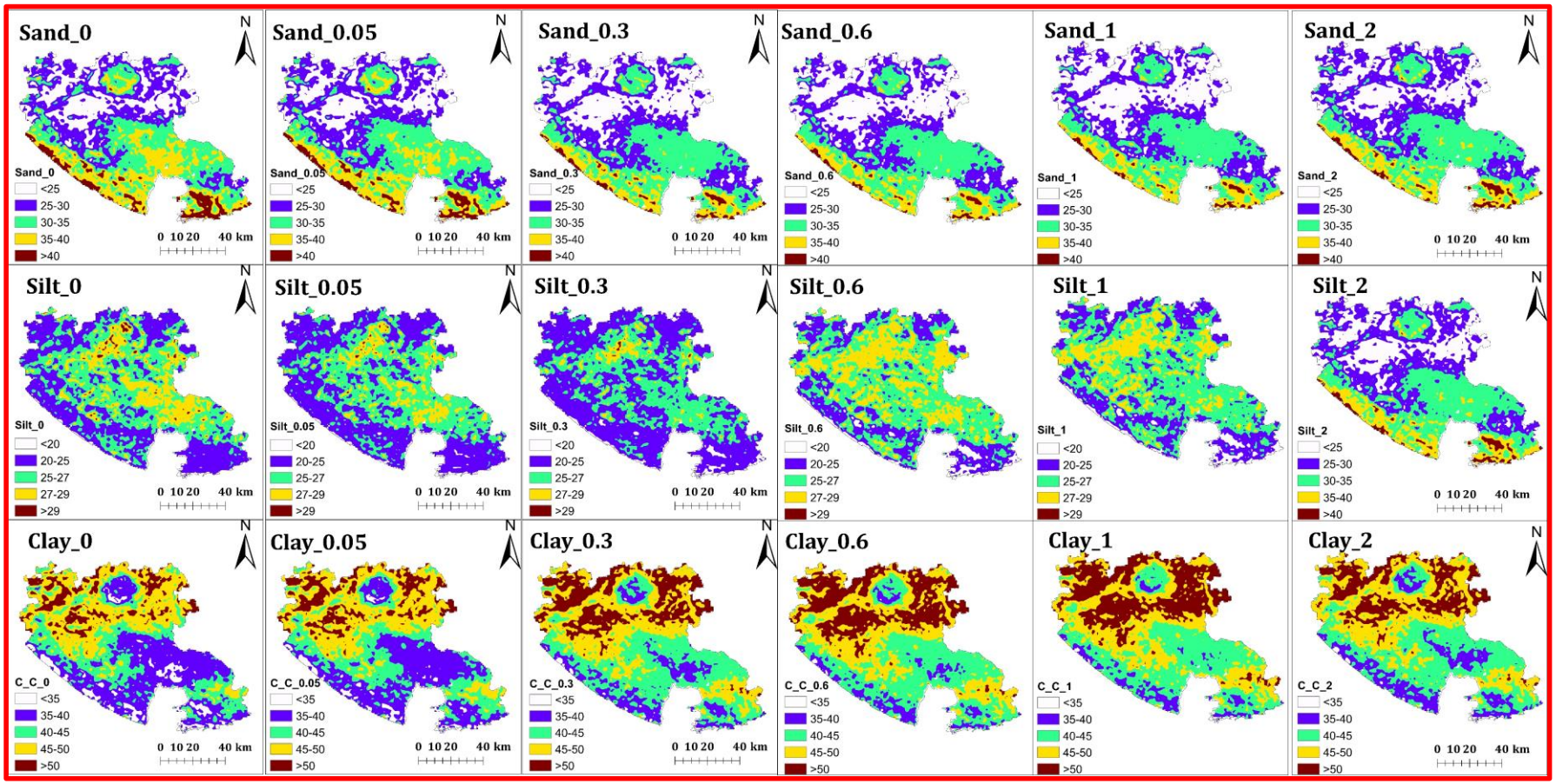

Figure 3: *Depth-wise sand, silt and clay content of the soil at the Junagadh district.*

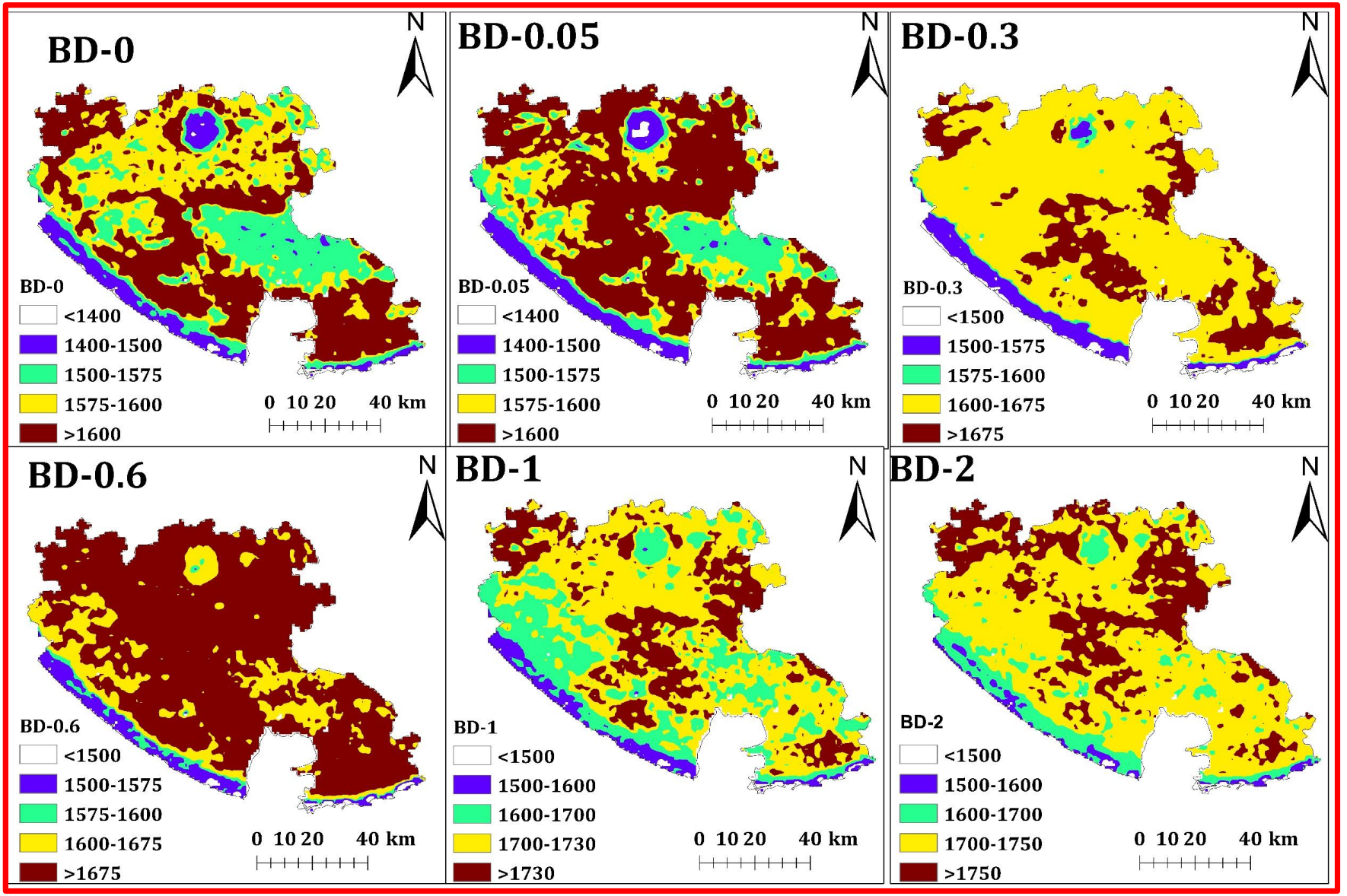

Figure 4: *Soil bulk density with respect to the different depths for the Junagadh district.*

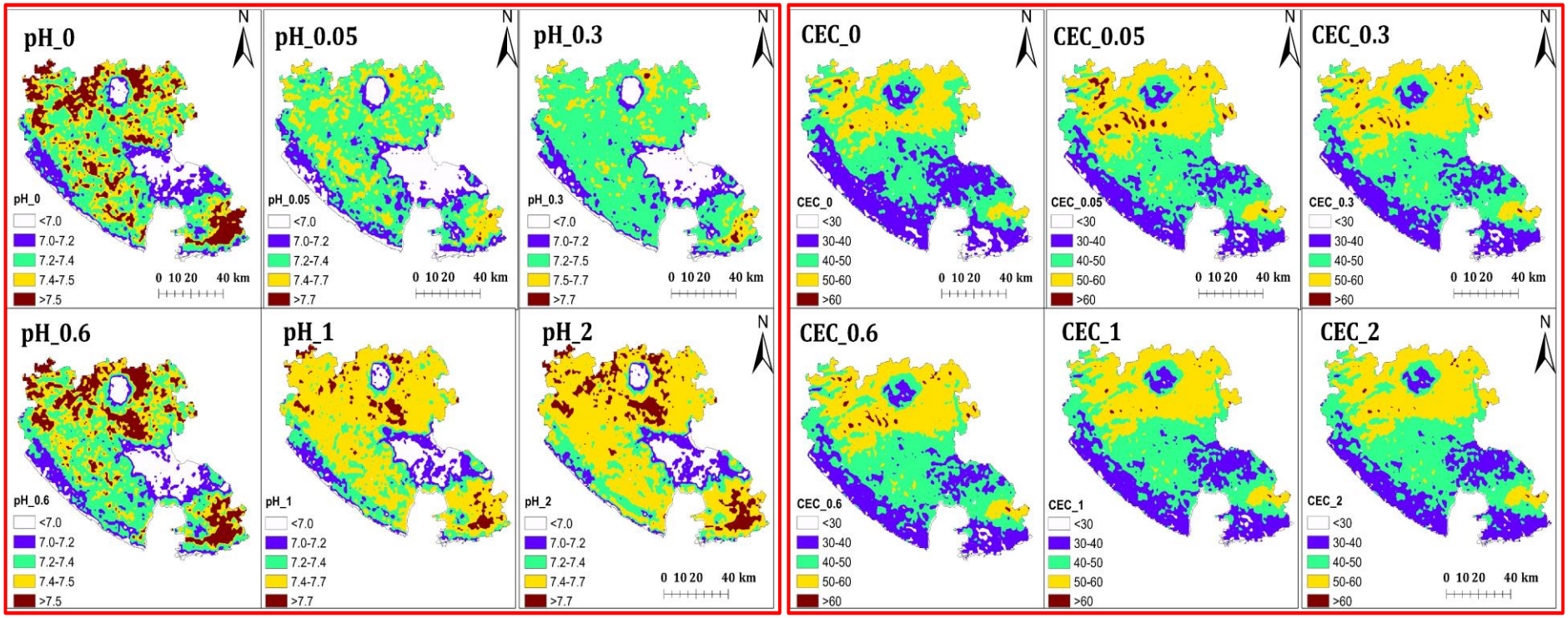

Figure 5: *Soil pH and Cation Exchange Capacity (CEC) with respect to the different depths for the Junagadh district.*

1.4.2. LULC study for Junagadh district

Land Use and Land Cover (LULC) change have become an essential and basic component in the current situation for monitoring environmental changes and natural resource management. Increasing anthropogenic interventions around the globe are causing large-scale alterations of the Earth's land surface, which affects the whole global system. LULC has been used for the social, cultural, spiritual, and material needs of humans, while, in the process, humans have caused several changes for his convenience. The tremendous changes of LULC, particularly in developing nations have resulted in the reduction of different essential resources including water, vegetation, and soil. Furthermore, the actions of human beings leading to LULC changes have a local cause. However, because of their extension, intensity and speed they have caused numerous and critical global implications, particularly on natural resources. The rapid change is alarming and can significantly impact the local, regional, national, and worldwide environment.

Researchers, policymakers, and urban and regional planners utilize LULC information to determine changes in natural resources, including evaluating growth patterns and also evaluates the growth rate. For a better understanding of land dynamics, it requires the detection of LULC change. Empirical studies by researchers from various disciplines proved that changes in LULC are key to the diverse applications such as hydrology, marine, and atmosphere, urban and regional planning, agriculture, forest, environment, geology, and ecology. Studies on LULC change detection have always attracted the attention of scientists and researchers. Many scientists argue that LULC change could result in ecosystem imbalance and its impacts on the environment caused by humans and their role in climate change. Furthermore, their significant findings yield arguments that could be focused on interventions, which emphasize more evidence on the impacts and rates of LULC change and the distribution of these changes in time and space as a fundamental and essential factor in present strategies for environmental monitoring of changes and natural resource management. The LULC classification is perhaps among the most well-known techniques of geospatial application.

Remote sensing (RS) and Geographical Information System (GIS) have long been acknowledged as essential and robust tools in determining LULC changes at different spatial scales. Several change detection techniques and digital image analyses have been used to uproot evidence from remotely sensed datasets. GIS, on the other hand, integrate information derived from remote sensing to develop a direct understanding of LULC modeling. RS and GIS have been proved to be very useful for the monitoring of LULC patterns. Moreover, the integrated use of satellite datasets, RS, and GIS has proved to be a powerful and cost-effective method for detecting LULC changes. With the development of RS and GIS techniques, LULC mapping and monitoring have become a detailed and useful way to advance the choice of areas for different uses.

In developing countries, the resource, such as land, forest, and water, are reducing significantly. However, more information regarding the rate of reduction is often lacking. Accurate LULC change information is mandatory to understand the leading causes and the environmental costs of such changes. Moreover, analyzing the different driving forces causing LULC change is crucial to understanding the current changes to forecast future alterations. A detailed study of LULC changing aspects and its driving forces in space and time provided the basis for the sustainability of natural resource systems because it was used to reflect the state and the national resources. Nevertheless, of the increasing concerns about the impact of LULC changes on global changes of the environment and sustainable development, research on LULC change in the Junagarh district is minimal. In this district, the magnitude and dynamics of these changes have not been broadly studied. Little is known about the Spatio-temporal extents of LULC change and no information has been evaluated over time to improve land use planning in the study area. Moreover, to understand the aspects of changes in the human environment across space and time, various studies are required. To address this, the integrated approach of RS and GIS data was used for monitoring the LULC change in the study area. The outcome of this study is expected to be a highly useful user for the sustainable use of natural resources in the study area.

Chapter 2. Material and Methods

2.1. Study area characterization

2.1.1. LULC change data acquisition and preparation

Landsat imagery was used to determine LULC change, while dates were selected based on the availability of the dataset, quality of the dataset, cloud cover, and the pre-monsoon season. Decadal Landsat imageries were acquired for the years 2001, 2011, and 2021 from the USGS Global Visualization Viewer (https://glovis.usgs.gov) using Path/Row 150/45, 149/16 and 149/45 of the study area. These data were used for the generation of LULC maps fed into a GIS.

Google Earth Engine (GEE), employed is a cloud-based computing platform, and it can interpret the most significant problems concerning the land use and land cover mapping of large areas. Users can analyse and visualize all available satellite imageries using a web-based Integrated Development Environment (IDE) code editor without downloading these data to the local machine. By using these techniques, users can easily access, select and process large volumes of data for a large study area. Our study area is covered by three scenes (Path 149, Row 45; Path 149, Row 46 & Path 150, Row 45) or can be merged from three scenes. We have selected all Landsat 5 ETM and 8 OLI atmospherically corrected surface reflectance scenes available on the GEE platform for the years 2001, 2011, and 2021. Table 2 shows the details of the satellites used for the LULC classification of the study area. Also, the flow-chart of the methodology adopted for LULC classification using Random forest technique is provided in Fig. 6.

LULC depends on rainfall, temperature, climatic condition of the region so that to understand the relation between rainfall with temperature and vegetation with temperature and conversely. So, we have observed temperature variation, cumulative rainfall variation, and Normalized Differential Vegetation Index (NDVI) from 2000 to 2020. These trends also help us to know about the LULC changes from 2000 to 2021. MODIS product has been used for this study. TRMM data (TRMM3B43) used for rainfall study, for Land Surface Temperature (LST)

(MOD11A2) is used for the study area and NDVI (MOD13Q1) data has been used. Rainfall of the monsoon season and the cumulative rainfall of the monthly season were also calculated.

Table 2: *Brief description of the satellite datasets used for LULC.*

Year	Satellite	Sensor	Path/Row	Resolution (m)	Acquisition Date	Cloud Cover
2001	Landsat	Landsat 5 ETM	149/45 149/46 150/45	30 m	2001-02-01 2001-01-16 2001-02-17	Less than 10 %
2011	Landsat	Landsat 5 ETM	149/45 149/46 150/45	30 m	2011-01-12 2011-01-28 2011-02-13	Less than 10 %
2021	Landsat	Landsat 8 OLI/TIRS sensors	149/45 149/46 150/45	30 m	2021-01-07 2021-01-23 2021-02-08 2021-02-24	Less than 10 %

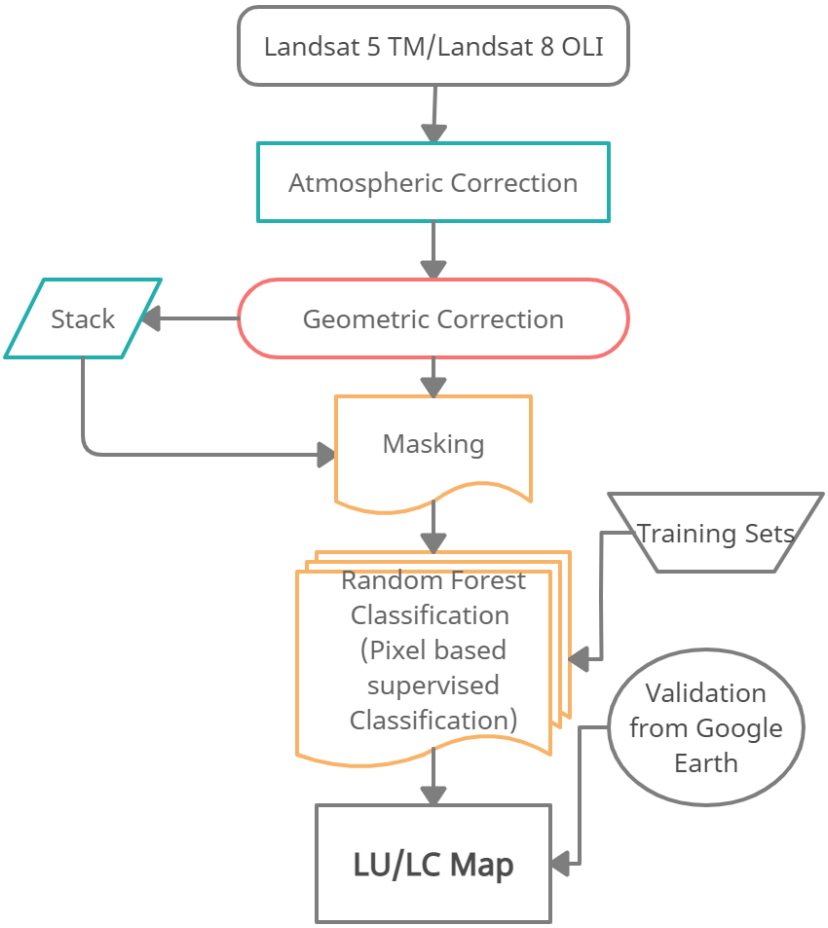

Figure 6: *Flow-chart of the methodology adopted for LULC Classification using Random forest technique.*

Classification

Five land cover types dominate the area of investigation: (1) Agriculture Land, (2) Settlement, (3) Barren Land, (4) Vegetation, and (5) Water. All signatures were selected based on manual visual interpretation of high-resolution images from Google Earth. This method is widely used, applied, and reported in many kinds of literature. Furthermore, to minimize the effect of spatial autocorrelation yet still capture the gradient of land use and land cover type within each class. We have selected training sets as small polygons (i.e., this polygon contains several relatively homogenous pixels of a given land cover type).

Table 3: *Brief description of LULC classes.*

Agricultural land	Crop Fields
Built-up Land	Residential, commercial, industry, transportation, roads, mixed urban.
Vegetation	The continuous stand of trees, many of which may attain a height of 10-15 m including natural forest, mangrove, and plantation forest. The additional details
Water	River, open water, lakes, ponds, and reservoirs.
Barren Land	The land area of exposed soil and barren area influenced by a human.

2.1.2. Preliminary Team's Observations during Field visit

The following observations were made by the expert team of IIT-Gn during the entire site inspection and sampling period between 18/01/2021 to 22/01/2021, at the Junagadh and Gir-Somnath Districts:

- During inspection, mining activity was observed to be stopped at all the 14 leases.
- No mining machinery was observed at each site.
- Public seems to be aware about the mining activities at the locations.
- At four mines the stored pit water was observed which can be helpful to improve the local groundwater table.

2.1.3. Questionnaire survey

During the field visit the questionnaire survey was circulated amongst the companies and local public in order to identify the impact of the mining activity. The detailed questionnaire survey Performa has been attached as follows:

Checklist for _____Mine of

_____

1.	Name of the owner/Firm	:	
2.	Correspondence Address with Pin-Code & Survey No. of the Mine Site	:	
3.	Contact Details (i) Email Address (ii) Mobile Number	:	(i) (ii)
4.	Mining Plan (Include Mine Closure Plan)	:	
5.	Total Project Cost (Provide with and without Environmental Management Plan (EMP) Cost)	:	
6.	Details of Recognized Qualified Person (RQP)	:	
7.	Lease Area (in Hector)	:	
8.	Type of Mining	:	
9.	Period of Mining proposed	:	
10.	Method of Mining	:	
11.	Production (Quantity in Tonnes)	:	
12.	New or existing Mine	:	
13.	If in case of existing Limestone-mine, the length, width and depth to which Mining has already been done (below the ground level/ above the ground level)	:	• Length (m): • Width (m) : • Depth (m) :
14.	If Mining had been done below the ground level/above the Ground level, the height of Mining already done	:	

15.	Name of the owner who had earlier undertaken the Mining & a copy of mining lease issued with date, if he is different from the present applicant	:	
16.	Proof of land ownership. If owned Title Deed. If not then land agreement/ lease copy entered with the owner (to be enclosed) details	:	
17.	Land use pattern for a radius of 500 m to 1 km around the Mining site such as Agriculture, Water body, Habitation etc.	:	
18.	Details of other quarries for a radius of 500 m to 1 km, around the Mining site	:	
19.	Aerial distance to the nearest eco- sensitive areas, Forests, Monuments, Coastal Regulation Zone (CRZ), etc., within 10-15 kms of these areas	:	
20.	Copy of explosives license and a consent letter/ agreement of competent recognized person who has agreed to handle explosive for the blasting, in case of Limestone Mines	:	
21.	Brief details of Air Pollution Control (APC) measures taken during mining and transportation	:	
22.	Brief details of Control measures taken to reduce the generated noise and vibrations		
23.	Water requirement: a) Drinking & domestic purposes KLD b) Dust suppression (KLD) c) Green belt (KLD)	:	
24.	Source of Water (Provide details for the Groundwater Table)	:	
25.	Impact on Water sources (With Statement)	:	• Low : • Moderate : • High :
26.	Positive/Negative impacts of mining activity (With Statement on each segment)	:	• Environmental : • Societal : • Biodiversity: • Climatic:
27.	In case of negative impacts how company will reduce those impacts (With Statement on each segment)		• Engineering-Based: • Administrative: • Technological: • Behavioral:
28.	Chronical analyses/Lab reports of Rock	:	
29.	Temporal Photographs from the beginning (as many as possible)	:	
30.	Total Number of Labors/Machines worked during mining activity	:	

31.	Facilities for long term housing of operational workers	:	
32.	Challenges due to closure of mining activities	:	• Uncertainty in regulation: • Hidden Cost: • Impacts on Labor:

2.2. Sampling location

During our visit to the mining sites the surface water (if available), groundwater, open-well water, pit water samples were collected in order to ascertain the water quality in the region as well effect of mining activities on the potable water resources. In total, thirteen (n=13) open-well/bore-well and four (n= 4) pit water samples were collected from the vicinity of mines. The details regarding each sampling locations are provided in Table 4.

Table 4: *Details regarding collected groundwater samples and their locations.*

Mine No.	Name of the firm	Sample Description	Latitude	Longitude	Altitude (m)
1	M/s Gopalsinh Himmatsinh Chauhan	Pit Water	21°1'47.13''	70°31'1.39''	79.9
		Vikram Bhai Farm Open-well	21°1'47.5''	70°31'0.3''	78.1
2	M/s Vajesinh Dansinh Mori	Naranbhai Farm Open-well	20°59'28.3''	70°37'17''	100.1
3	M/s R. J. Trivedi & Co.	Open-well water	20°59'40.1''	70°24'25.6''	43.7
4	M/s Aher Bhagwan Bhimsinh	Near Bore-well	20°54'6.5''	70°29'22.5''	23.1
5	M/s Somnath Hydrated Lime & Chemicals Industries Pvt. Ltd.	Nagabhai Karabhai Farm Open-well water	21°0'42''	70°24'25''	60.5
6	M/s Noormahamad Kalubhai Patani	Open-well water	21°0'56.8''	70°24'35''	-
7	M/s Vikram Chemical Company	Open-well water	20°51'52.87''	70°57'43.18''	-
8	M/s Dhirajlal Panchabhai Vachhani	Open-well water	21°51'50.30''	70°56'52.8''	-
		Pit Water	21°51'50.33''	70°56'52.79''	-
9	M/s Somnath Hydrated Chemicals	Pit Water	20°4'41.6''	70°17'42.3''	18
		Open-well water	21°4'41.6''	70°17'42.5''	20.5
10	M/s Dinesh Kumar & Company	Open-well water	21°2'51.15''	70°19'34.7''	37.7
12	M/s GHCL Ltd. - Gorakhmadhi	Open-well water	20°58'2.3''	70°31'21.6''	26.5
13	M/s GHCL Ltd. - Kodidra	Dima Manda bore-well	20°54'31.1''	70°31'15.8''	30.7
		Masribhai open-well	20°54'31.1''	70°31'11.7''	48.1
14	M/s S. J. Trivedi Limestone Mine	Pit Water	20°55'43.05''	70°19'47.13''	5
		Maganbhai Wadi Open-well Water	20°55'45.3''	70°19'48.9''	10.35

2.3. Sampling procedure and Test methods

Global Positioning System (GPS) locations of each sampling point was noted with the help of YSI ProDSS multiparameter (626870-1) as well as HANNA (HI9128). Groundwater samples were collected from different open-well, bore-wells and quarry pits with the enough purging detected by water temperature by running the well for ~10 minutes. Grab samples were collected in 500 mL and 125 mL capacity of polyethylene bottles (Tarsons, PP Autoclavable, Wide Mouth Bottle, Cat No. 582240, India). Prior to the collection, bottles were thoroughly washed with diluted nitric acid and then with distilled water before filling bottles with samples. Each bottle was rinsed to avoid any possible contamination in the bottling, and every other precautionary measure were taken. 500 mL bottle was used for raw water collection while 125 mL bottle was meant to collect filtered groundwater samples, using 0.45 µm Millipore membrane on site and preserved with 2% nitric acid to bring pH around 2 for metal analyses (if required). After collection, the samples were transported in an ice-box to IIT–Gn and preserved at 4 ^{0}C until analyses. A sampling blank was also prepared to examine the cross-contamination during transportation. The experiments were performed at Indian Institute of technology Gandhinagar Laboratory, Gandhinagar, Gujarat.

2.3.1. In-situ analysis

Dissolved oxygen (DO), pH, electrical conductivity (EC), oxidation-reduction potential (ORP), and total dissolved solids (TDS) were measured *in-situ* using the HANNA HI9128 multi-parameter water quality portable meter and verified with YSI ProDSS multiparameter (626870-1) and vice-versa. Each equipment has individual sensors or electrodes for recording the pH, EC, ORP and TDS. The equipment was calibrated every day before the start of sampling using the calibration solutions provided with each instrument.

2.3.2. Laboratory analyses

Major anions (F^-, Cl^-, NO_3^-, SO_4^{2-}, Br^-) and cations (Na^+, K^+, Ca^{2+} and Mg^{2+}) were analyzed using Ion-Chromatography (ECO IC, Metrohm, Switzerland). High purity deionized water (18.2 MΩ cm^{-}

[1], ELGA PURELAB Flex 3 system) was used for the sample dilution, if required. Data validation and accuracy of the analytical methods was checked by the application of the Normalized Ionic Charge Balance (NICB) using the following formula:

$$\mathbf{NICB} = \frac{\sum \mathbf{cations} - \sum \mathbf{anions}}{\sum \mathbf{cations} + \sum \mathbf{anions}} \qquad \textbf{----------(1)}$$

The analyses were found complete only if NICB calculated values shows the rang within 5%**.** Methods of collection and analysis of water/effluent samples followed are essentially the same as given by American Public Health Association (APHA) (refer Table 5).

Table 5: *Test methods used for the analysis of all the collected samples.*

Sr. No.	Tests	Methods	Instrument used
1.	pH Value	**IS 3025 (Part – 11) 2002**	
2.	Temperature	**IS 3025 (Part 9):2002**	
3.	Dissolved Oxygen (DO)	**APHA (23rd Edition 2017) 4500-O H**	**YSI ProDSS multiparameter 626870-1 & HANNA HI9828**
4.	Oxidation-Reduction potential (ORP)	**APHA (23rd Edition 2017) 2580 B**	
5.	Conductivity (EC)	**APHA (23rd Edition 2017) 2510 B**	
6.	Total Dissolved Solids (TDS)	**IS 3025 (Part-16) 2006**	
7.	Salinity	**APHA (23rd Edition 2017) 2520 B**	
8.	Total alkalinity as $CaCO_3$	**APHA (23rd Edition 2017) 2320 B**	**Titration**
9.	Fluorides as F^-	**APHA (23rd Edition 2017) 4110 B**	**ECO–IC, Metrohm, Switzerland**
10.	Chlorides as Cl^-		
11.	Bromide as Br^-		
12.	Nitrate–N as NO_3^-		
13.	Sulphate as SO_4^{2-}		
14.	**Lithium as Li**	**APHA (23rd Edition 2017) 4110 B**	**ECO–IC, Metrohm, Switzerland**
15.	**Sodium as Na**		
16.	**Potassium as K**		
17.	**Calcium as Ca**		
18.	**Magnesium as Mg**		

2.3.3. Major anion analysis

The major anions (F^-, Cl^-, NO_3^-, SO_4^{2-}, Br^-) and cations (Li^+, Na^+, K^+, Ca^{2+}, Mg^{2+}) were analyzed using Ion-Chromatography (ECO IC, Metrohm, Switzerland). Standard solutions of anions (F^-, Cl^-, NO_3^-, SO_4^{2-}, and Br^-) and cations (Li^+, Na^+, K^+, Ca^{2+}, Mg^{2+}) were prepared by appropriate dilution of their respective standard stock (Merck) solution of analytical grade (1000 mg L^{-1}, TraceCERT®) for IC to obtain the desired concentrations of each analyte. Before analysis the samples were filtered using 0.22 µm, Ø 25 mm Axiva nylon non–sterile syringe filters. A Metrohm basic ion chromatographic instrument (Eco-IC model, Metrohm AG, Switzerland) controlled using MagIC NET 3.2 software, with a 10 µL sample loop was used in all analyses. The instrument was also equipped with a Pump, an Eluent Degasser and a Liquid Handling Unit with a 0.45 µm filter that required a minimal volume of 10 mL for the samples. Detection was performed with a Conductivity Detector Advanced from Metrohm.

Separation was performed in a Metrosep A Supp 5–250/4.0 column (250 × 4 mm, 5 µm particle size) with Metrosep A Supp 5 Guard/4.0. The carrier material was an anion-exchange polymer of polyvinyl alcohol with quaternary ammonium groups. All measurements were carried out at 32 °C (column temperature) under the following elution conditions: mobile phase (3.2 mM sodium carbonate and 1 mM sodium bicarbonate) at flow-rate of 0.7 mL min^{-1}. In order to adjust the baseline to 15 µS cm^{-1}, 50 mM H_2SO_4 solution was used for chemical suppression. Anions in samples were identified by the coincidence of their retention times with those of commercial standard anions. Peak areas were utilized for quantitative analysis.

2.4. Methodology adopted for damage cost assessment

In order to carry out damage assessment on the account of (i) ecological services forgone forever (ii) cost of damage to environment and pristine ecology (iii) cost of mitigation and restitution of environment & (iv) deterrent environmental compensation distinct from earlier three heads, guidelines issued by CPCB, SEIAA-SEAC Gujarat & Industries & Mines Department, Govt. of

Gujarat were followed and damage assessment costs were determined. The guidelines are summarized in following paragraphs:

2.4.1. Methodology for assessing environmental compensation, CPCB

As per the directions received from Hon'ble NGT, CPCB formed a committee for development of guidelines for assessment of Environmental Compensation. The committee discussed that environmental compensation should be based on "Polluter Pay Principle". The Committee decided to list the instances for taking cognizance of cases fit for violation and levy environmental compensation.

Cases considered for levying Environmental Compensation (EC):

a. Discharges in violation of consent conditions, mainly prescribed standards / consent limits.
b. Not complying with the directions issued, such as direction for closure due to non-installation of OCEMS, non-adherence to the action plans submitted etc.
c. Intentional avoidance of data submission or data manipulation by tampering the Online Continuous Emission / Effluent Monitoring systems.
d. Accidental discharges lasting for short durations resulting into damage to the environment.
e. Intentional discharges to the environment -- land, water and air resulting into acute injury or damage to the environment.
f. Injection of treated/partially treated/ untreated effluents to ground water.

In the instances as mentioned at a, b and c above, Pollution Index (PI) may be used as a basis to levy the Environmental Compensation. CPCB has published guidelines for categorization of industries into Red, Orange, Green and White based on concept of PI. The PI is arrived after considering quantity & quality of emissions/ effluents generated, types of hazardous wastes generated and consumption of resources. PI of an industrial sector is a numerical number in the range of 0 to 100 where increasing value of PI denotes the increasing degree of pollution hazard from the industrial sector. It can be represented by following equation:

$$\boldsymbol{PI} = (\boldsymbol{Water\ Pollution\ Score}, \boldsymbol{Air\ Pollution\ Score}\ \&\ \boldsymbol{HW\ Generation\ Score}) \text{ ----------(2)}$$

After considering various factors including the policy implementation issues, Committee has come up with following formula for levying the Environmental Compensation in instances as mentioned at a, b and c including non-compliance of the environmental standards / violation of directions. The Environmental Compensation shall be based on the following formula:

$$\boldsymbol{EC} = (\boldsymbol{PI} \times \boldsymbol{N} \times \boldsymbol{R} \times \boldsymbol{S} \times \boldsymbol{LF}) \text{ ----------(3)}$$

Where, EC is Environmental Compensation in ₹; PI = Pollution Index of industrial sector; N = Number of days of violation took place; R = A factor in Rupees (₹) for EC; S = Factor for scale of operation LF = Location factor.

The formula incorporates the anticipated severity of environmental pollution in terms of PI, duration of violation in terms of number of days, scale of operation in terms of micro & small/medium/large industry and location in terms of proximity to the large habitations.

Note:

(a) The industrial sectors have been categorized into Red, Orange and Green, based on their Pollution Index in the range of 60 to 100, 41 to 59 and 21 to 40, respectively. It was suggested that the average pollution index of 80, 50 and 30 may be taken for calculating the Environmental Compensation for Red, Orange and Green categories of industries, respectively.

(b) N, number of days for which violation took place is the period between the day of violation observed/due date of direction's compliance and the day of compliance verified by CPCB/SPCB/PCC.

(c) R is a factor in Rupees, which may be a minimum of 100 and maximum of 500. It is suggested to consider R as 250, as the Environmental Compensation in cases of violation.

(d) S could be based on small/medium/large industry categorization, which may be 0.5 for micro or small, 1.0 for medium and 1.5 for large units.

(e) LF, could be based on population of the city/town and location of the industrial unit. For the industrial unit located within municipal boundary or up to 10 km distance from the municipal boundary of the city/town, following factors (LF) may be used:

Table 6: *Location Factor Values.*

Sr. No.	Population (Million)	Location Factor (LF)
1.	1 to <5	1.25
2.	5 to <10	1.5
3.	10 and above	2.0

*Population of the city/town as per the latest Census of India.

#LF will be 1.0 in case unit is located >10km from municipal boundary.

LF is presumed as 1 for city/town having population less than one million.

For notified Ecologically Sensitive areas, for beginning, LF may be assumed as 2.0. However, for critically Polluted Areas, LF may be explored in future.

(f) In any case, minimum Environmental Compensation shall be Rs. 5000/day.

(g) In order to include deterrent effect for repeated violations, Environmental Compensation may be increased on exponential basis, i.e. by 2 times on 1st repetition, 4 times on 2nd repetition and 8 times on further repetitions.

(h) If the operations of the industry are inevitable and violator continues its operations beyond 3 months then for deterrent compensation, EC may be increased by 2, 4 and 8 times for 2nd, 3rd and 4th quarter, respectively. Even if the operations are inevitable beyond 12 months, violator will not be allowed to operate.

(i) Besides EC, industry may be prosecuted or closure directions may be issued, whenever required.

2.4.2. Indicative Guidelines for Assessment of Ecological Damage, SEIAA/SEACGujarat

As per notification vide S.O. 804(E) dated 14.03.2017 it has been notified that the violation cases/non- compliance will involve the assessment of ecological damage, remediation plan and natural and community resource augmentation plan. An Indicative guideline for Assessment of

Ecological Damage is prescribed by SEAC-SEIAA and is assessed as below: Assessment of ecological damage and remediation plan will address the following attributes:

EMP Sub-Components									
AP	WP	SHW	TP	NV	GB	HG	RH/OHS	SC	CER
Air Pollution	Water Pollution	Solid & hazardous waste	Transpor-tation	Noise & Vibrations	Green-belt	Hydro-geology	Risk Hazard/ Occupational Health & Safety	Soil Conservation	Corporate Environmental Responsibility

Attributes	**Scope of Environmental benefits earned**	**COST**	
		Calculations	**Totalcost (Rs.)**
AP	Water requirement per day for sprinkling of water to curb fugitive emission in KL (0.1L/m^2)		
	Cost of 1 KL water for sprinkling in Rupees		
WP	Major water pollution envisioned: 1. Groundwater table intersection if any.2. Run-off water outside the lease and estimated damage		
		Calculations	**Totalcost (Rs.)**
	caused considering period of violation in Rs. Per day		
SHW	When there is an overburden, Quantity of Over Burden in MT * 10 Rs. PerMT O.B. handling charges * 2 (Lifting and shifting frequency)		
	When there is no Overburden, only mining waste handling charges are to be considered.Mine waste in MT * 10 Rs Per MT of mineralwaste handling *2 (Lifting and shifting frequency)		

NV	Existence of House properties/env. Entities within 500 meter of blasting site and if damaged due to blasting. •Nos of such properties/env. Entities. •Built up area of each property/env. Entities •Cost of reconstruction of properties (total) considering current construction cost per Sq. Meter.		
GB	Green Belt developed in 10% of leased areaGreen belt area in M^2. Presume 1 plant per 4 m^2 is to be planted.Cost of single plant: Total cost of green belt		
HG	No major HG issues envisioned, considering no ground water interception If intersectionof ground water is made, cost of one-time remediation plan after estimating extent of contamination of ground water		
RH/OHS	Health Expenditure: Nos of workers* Rs 1000PPE expenditure No of workers*Rs 300 Total expenditure for health and safety for workers* Nos of year		
CER	10% of Mineral (Sale) Value		
SC	Cost of preservation, Handling and reuse of Top soil: (Cost of Soil preservation isassumed to be Rs 10,000 per 1 Hectare)		

Total Assessed Env. Damage Cost in Rupees			
Environmental Damage Cost in % of Mineral Value	(Total Assessed Env. Damage Cost in Rupees/Value of Mineral in Rs) * 100		

Note:

For the aforementioned assessment, following basis are taken into consideration:

(a) Quantity of water sprinkling for curbing fugitive emission is assumed as 0.1 L per m^2.

(b) Cost of water availability is to be considered on prevailing local market

(c) Over burden removal and its shifting are considered as two separate activities.

(d) For damage of house, entire construction of house considering built up area and local prevailing rate of construction are to be considered.

(e) For greenbelt 1 plant is assumed in 4 m^2 area and 10% of lease area is proposed to be developed as green belt.

(f) It is assumed that One Hectare mine requires 2 workers.

(g) Cost of health check-up per worker is Rs 1000/- or prevailing local marker rate.

(h) Cost of PPE per worker is Rs 300/- or prevailing local marker rate.

(i) Cost of preservation, handling and restoration for 1 Ha lease is Rs. 10,000/-.

2.4.3. Resolution passed by Industries & Mines Department, Govt. of Gujarat

In the matter of National Green Tribunal Bar Association Vs Virender Singh (State of Gujarat), an interim action taken report on behalf of State of Gujarat was submitted by Industries & Mines Department, Govt. of Gujarat in compliance of order dated 17.09.2018 passed by the Hon'ble Tribunal in O.A. No. 360 of 2015.

The application preferred by one of the applicants dealing with illegal mining of Mineral Ordinary sand in the State of Gujarat and its adverse effect on the environment was pending final consideration before this Hon'ble Tribunal.

The Hon'ble Tribunal vide it's order dated 13.07.2018 was placed to issue the following directions:

a. *"**4. We are of the view that in view of the increasing illegal mining demonstrated by the affidavit filed by the State itself, the State may also take further preventive steps on precautionary principle andthe action taken by the State in determining compounding fee should be based not merely on the cost of illegally mined materialbut also to restore damage to environment on the principle of Polluter Pays. The amount representing damage to the environment may be separately accounted for and used for restoration of damage to the environment by taking***

appropriatesteps"

In compliance of the above direction, the Industries and Mines Department, State of Gujarat, vide Government Resolution No. NGT/102017/1750/CHH dated 10.09.2018 decided to impose, in addition to the compounding fees, Environmental Compensation in the cases of Illegal mining, storage and Transportation from the offenders.

As per the resolution mentioned above, the computation of Environmental Compensation was given as below:

"4. For the Minor Minerals as categorized under Schedule III of the Gujarat Minor Mineral Concession Rules, 2017 (GMMCR, 2017) and for Minerals other than Minor Minerals as per the Mines and Minerals (Development andRegulation) Act, 1957, the Environmental Compensation payable shall be computed as under:

(a) For Part – A – I Minerals under GMMCR, 2017 = 35% of Value of Mineral
(b) For Part – A – II Minerals under GMMCR, 2017 = 20% of Value of Mineral
(c) For Part – B Minerals under GMMCR, 2017 = 15% of Value of Mineral
(d) Minerals other than Minor Minerals = 15% of Value of Mineral

Value of Mineral = Price per metric tons of respective Mineral (Multipliedby) Quantity of Mineral illegally Mined, Transported & Stored)

Price of Mineral:

- ***Minor Mineral: The last available price per metric tons of such mineral, published by the Government of Gujarat as prescribed under GMMCR, 2017***
- ***Mineral Other than Minor Mineral: The last available average price per metric tons of such mineral as published by the IndianBureau of Mines for the State of Gujarat.***
  Explanation: If for any mineral or mineral grade, the average sale price in respect of the State of Gujarat for any month is not published by Indian Bureau of Mines, the all India average sale price published by Indian Bureau of Mines for such mineral or mineral grade for that month shall be used.

Provided that the Authorized Officer, empowered to impose andcollect penalty/compounding fees under the Gujarat Mineral (Prevention of Illegal Mining, Transportation and Storage) Rules, 2017 shall assess the quantity of mineral illegally mined, transported and stored which will be reckoned for computation of the Value of Mineral."

The Hon'ble Tribunal while appreciating the scheme framed by the State of Gujarat issued following directions vide its order dated 17.09.2018.

a) ***"5. We do not see any difficulty in approving the proposed action but the same cannot take care of all situations if it is found that the damage caused and cost of restoration of ecology to be incurred ishigher. The same must be recovered fully on the principle of'Polluter Pays'. This apart, the cost of damages must include net present value of future eco system services foregone."***

Pursuant to the above direction issued by this Hon'ble Tribunal, a meeting under the Chairmanship of the Commissioner of Geology and mining was held on 19.10.2018 to recommend the necessary steps to be taken in order to comply with the directions issued by the Hon'ble Tribunal. Taking into consideration the recommendations made by the committee, the Industries and Mines Department, Govt. of Gujarat, vide its Government Resolution No. NGT/102017/1750/CHH dated 29.11.2018 has amended the scheme dated 10.09.2018 by incorporating following changes:

(i) The Environmental Compensation have been increased from

- ***"a. For Part – A – I Minerals under GMMCR, 2017 = 35% ofValue of Mineral***
- ***b. For Part – A – II Minerals under GMMCR, 2017 = 20% ofValue of Mineral***
- ***c. For Part – B Minerals under GMMCR, 2017 = 15% of Value of Mineral***
- ***d. Minerals other than Minor Minerals = 15% of Value of Mineral"***

to

"a. For Part – A – I Minerals under GMMCR, 2017 = 41% ofValue of Mineral

b. For Part – A – II Minerals under GMMCR, 2017 = 26% ofValue of Mineral

c. For Part – B Minerals under GMMCR, 2017 = 21% of Value of Mineral

d. Minerals other than Minor Minerals = 21% of Value of Mineral"

(ii) Following further provisos have been inserted in Para 4:

"Provided further that, all situations, wherein the authorities are of the view that the damage caused and the cost of restoration ofecology to be incurred is higher, shall be referred to the GujaratPollution Control Board for assessment of actual damage caused to the Ecology, net present value of future eco system services foregone and the Cost of Restoration.

Provided further that, if after assessment by GPCB the actual damage caused and the Cost of restoration of Ecology is found tobe higher than the abovementioned EnvironmentalCompensation, the same shall be recovered fully on the principleof 'Polluter Pays' from the offender by the authorities empowered under Para – (2)."

Chapter 3. Results and Discussion

3.1. LULC change classification of the study area

The Fig. 7(a-c) and Table 6 summarize the trend of LULC change from the year 2001 to 2021 in a decadal interval based on land use and land cover of the study area. Initially, when the study carried out for the year 2001 the pattern of LULC as the percentage of the total area discussed, was dominated by barren land (59.7%), as well as agricultural land (32.5%) of the total area followed by waterbody (0.3%), vegetation (5.5%) and settlement (2%). It is observed that barren land use has the most significance. This reason may be the less rainfall count during that time, less agricultural practices, or less water availability in the study area.

Afterwards, the change in the trend was observed for the year 2011, except for the small variation in a waterbody and barren land. Agriculture land increased up-to (58.5 %) whereas barren land reduced significantly (24.7%) followed by vegetation (13.2%), Waterbody (1.2 %), and settlement (2.4 %).

In the year 2021 the observation confirmed that agricultural land (52.6 %) has a larger area as compared to barren land and vegetation respectively. The period (2011-21) indicates the general decrease in barren land (23.4 %) including the increase in vegetation (19.6 %) and settlement (32 %) whereas waterbody remains the same throughout the period. The land use supporting the agricultural activities and economic activities increased indicated by the settlement and cultivation.

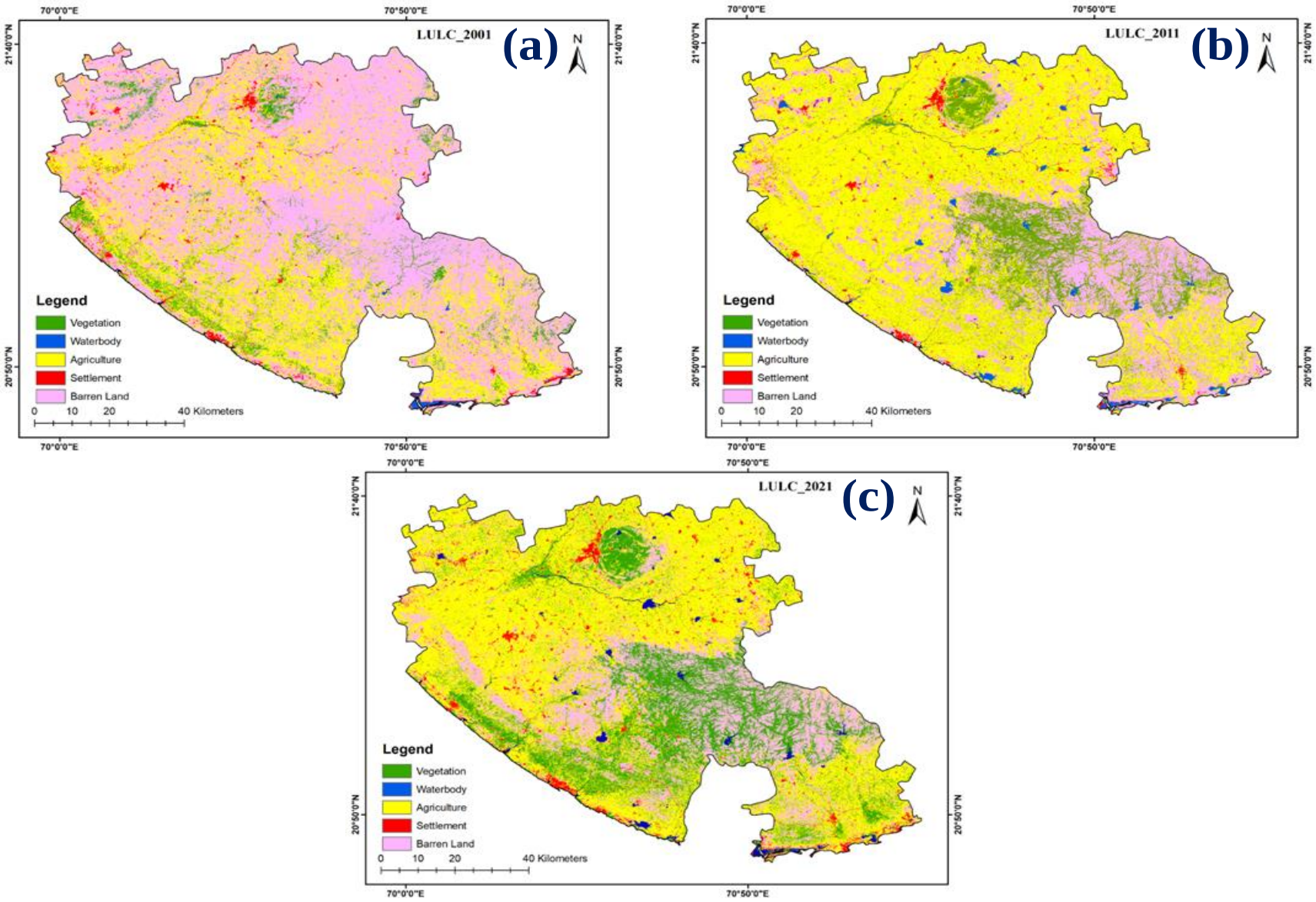

Figure 7: *LU/LC classification of the study area for the year 2001 (a), 2011 (b) and 2021 (c).*

Table 7 and 8 represent the changing area and their corresponding percentage from one LULC class to another in comparison with the total area of each LULC from 2001 to 2021. During the period the observation indicates various land-use changes, which escort the sustainable use of land resources. Initially, in the year 2001, the pattern of LULC was dominated by barren land (59.7 %) followed by agricultural land. The change in the trend was observed for all land use for the year 2001 to 2021. While for the year 2021 the observation determined that, LULC pattern is the percentage of the total area dominated by Agricultural land and vegetation. During the year 2001-21, period considered in the study, barren land decreased from (59.7 %) to (23.4%) and agricultural land increased significantly. Between 2001 and 2011 vegetation increased by (7.7%), waterbody increased by (0.8%), agricultural land has a massive change up to (26%), settlement enlarged by (0.4%) whereas barren land reduced up to (35%).

Similarly, the 2011-2021 study interval indicates that the vegetation and settlement increased by (6.4%) and (0.8%) respectively, whereas agricultural activities and barren land reduce collectively, from 2001 to 2021 experienced the highest conversion with almost (14.1%) of its total area converted to vegetation and rest to agricultural land (20 %) and settlement (1.3%) while most of the barren land (-36.3 %) reduced significantly.

Table 7: *Percentage wise LU/LC area classification of the study area for the year 2001, 2011 and 2021.*

YEAR	2001		2011		2021	
LU/LC	Area (sq.km)	Area (%)	Area (sq.km)	Area (%)	Area (sq.km)	Area (%)
VEGETATION	485	5.5	1169	13.2	1734	19.6
WATERBODY	30	0.3	104	1.2	105	1.2
AGRICULTURE	2882	32.5	5182	58.5	4654	52.6
SETTLEMENT	176	2.0	213	2.4	287	3.2
BARREN LAND	5284	59.7	2187	24.7	2076	23.4
TOTAL	8856	100	8856	100	8856	100

Table 8: *Percentage wise LU/LC area classification of the study area with respect to variable time zone.*

YEAR	2001 - 2011		2011 - 2021		2001 - 2021	
LU/LC	Area (sq.km)	Area (%)	Area (sq.km)	Area (%)	Area (sq.km)	Area (%)
VEGETATION	684	7.7	565	6.4	1248	14.1
WATERBODY	75	0.8	1	0.0	75	0.9
AGRICULTURE	2301	26.0	-528	-6.0	1772	20.0
SETTLEMENT	37	0.4	74	0.8	111	1.3
BARREN LAND	-3097	-35.0	-111	-1.2	-3207	-36.2
TOTAL	684	7.7	565	6.4	1248	14.1

3.2. Land Surface Temperature (LST), Cumulative rainfall, and Normalised Difference Vegetation Index (NDVI) of the study area

Figure 8 shows the various aspects for the study area such as Land Surface Temperature (LST) (1st Column), Cumulative rainfall (2nd Column), and Normalised Difference Vegetation Index (NDVI) (3rd Column) for the five-year interval from 2000 to 2020. Moderate Resolution Imaging Spectro-Radiometer (MODIS) 16 days composite of NDVI with 250 m spatial resolution and LST of 8 days composite with 1 km spatial resolution were acquired from 2000 to 2020 from NASA's website (ladsweb.nascom.nasa.gov). For the same period, meteorological monthly cumulative rainfall from NASA Geovani TRMM (TRMM 3B43) has been used.

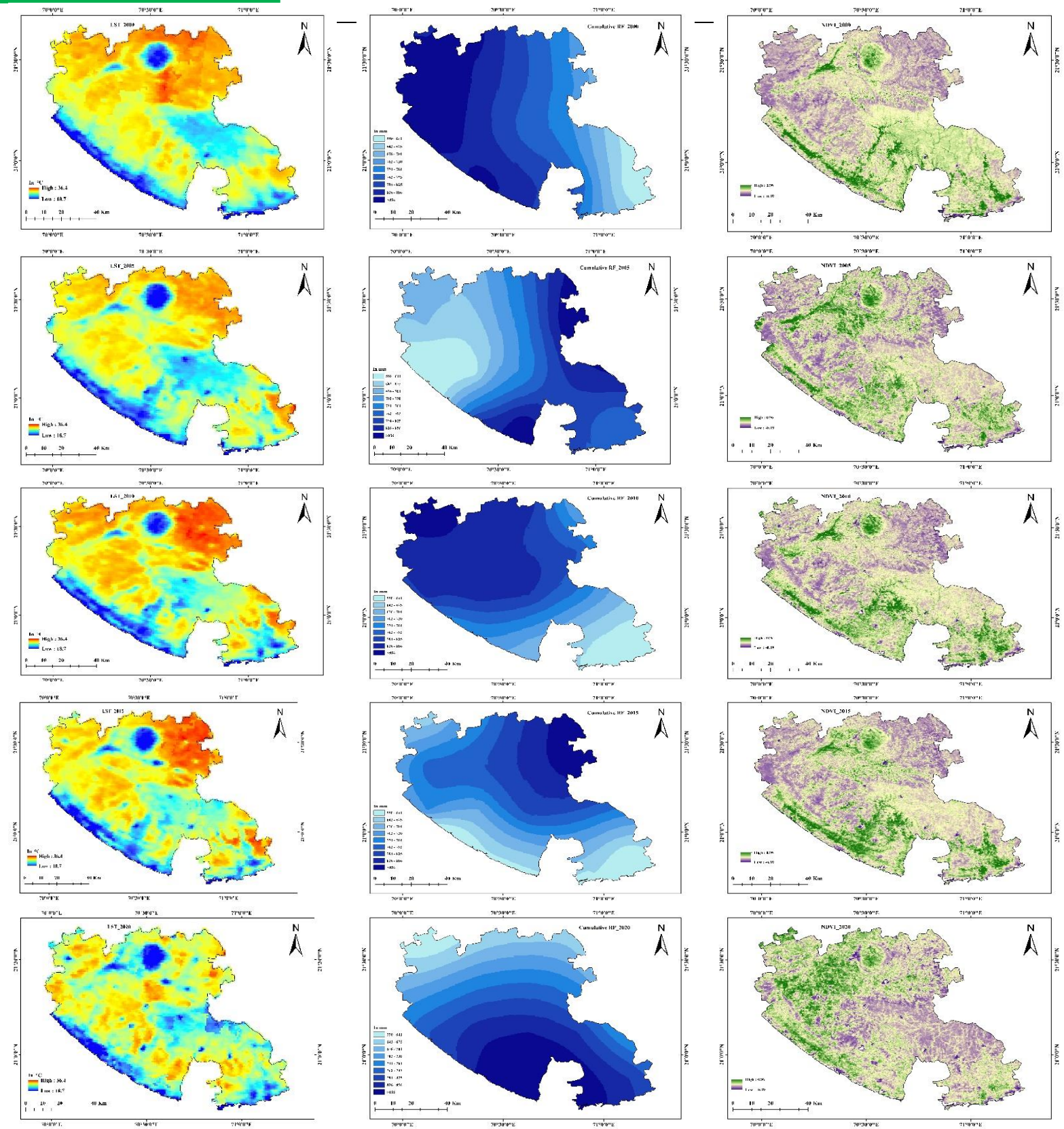

Figure 8: *LST (Left Column); Cumulative rainfall (Middle Column) and NDVI (Right Column) of the study area for the year 2000, 2005, 2010, 2015, and 2020.*

3.3. Results of the collected water samples

Limestone mining is expected to have limited effects such as lower water quality, rerouting of recharge water in aquifers, increased runoff, and hence a localised reduction in groundwater storage. The most significant impact of quarrying on water is mine dewatering and the resulting fall in the water table. If a quarry comes into contact with a phreatic aquifer, when a quarry crosses a phreatic aquifer, it has a significant impact on groundwater movement. The water might simply flow at a high rate from the phreatic aquifer into the mine hole. To assist mineral excavation, the pit must be dewatered, and the water pumped out is usually dispersed to adjacent locations.

As a result, a large amount of water is wasted in the mining area, while the water level downstream rises. Water pumped from a quarry is likely to be lost to the groundwater system in the area. Wells, springs, and streams inside the cone of depression may dry up or have their flows drastically reduced and the overall direction of groundwater movement may be modified. Many humans caused sinkholes are generated within this cone of depression.

The formation of sinkholes as a result of the collapse of the cavities in the karst system is depicted in Fig. 9 (a, b). the groundwater table is declining owing to mining activities and the creation of sinkholes as a result of the collapse of the cavities in the karst system. Because the karstic system (lime stone) has a low capacity for self-purification, the water running through it is very sensitive to pollution.

Mining activities have the potential to significantly alter discharge direction and, as a result, water quality. If the target limestone is unsaturated, it can act as a protective cover for the underlaying aquifer during aggregate mining. If this cover is lost as a result of mining, the hole caused by the mining could lead to surface water flowing into the groundwater. Moreover, if surface water is contaminated, groundwater quality can soon deteriorate. Quarrying can also result in the construction of sinkholes, which trap surface water. Dust can get into conduits and other microscopic openings and end up in the groundwater.

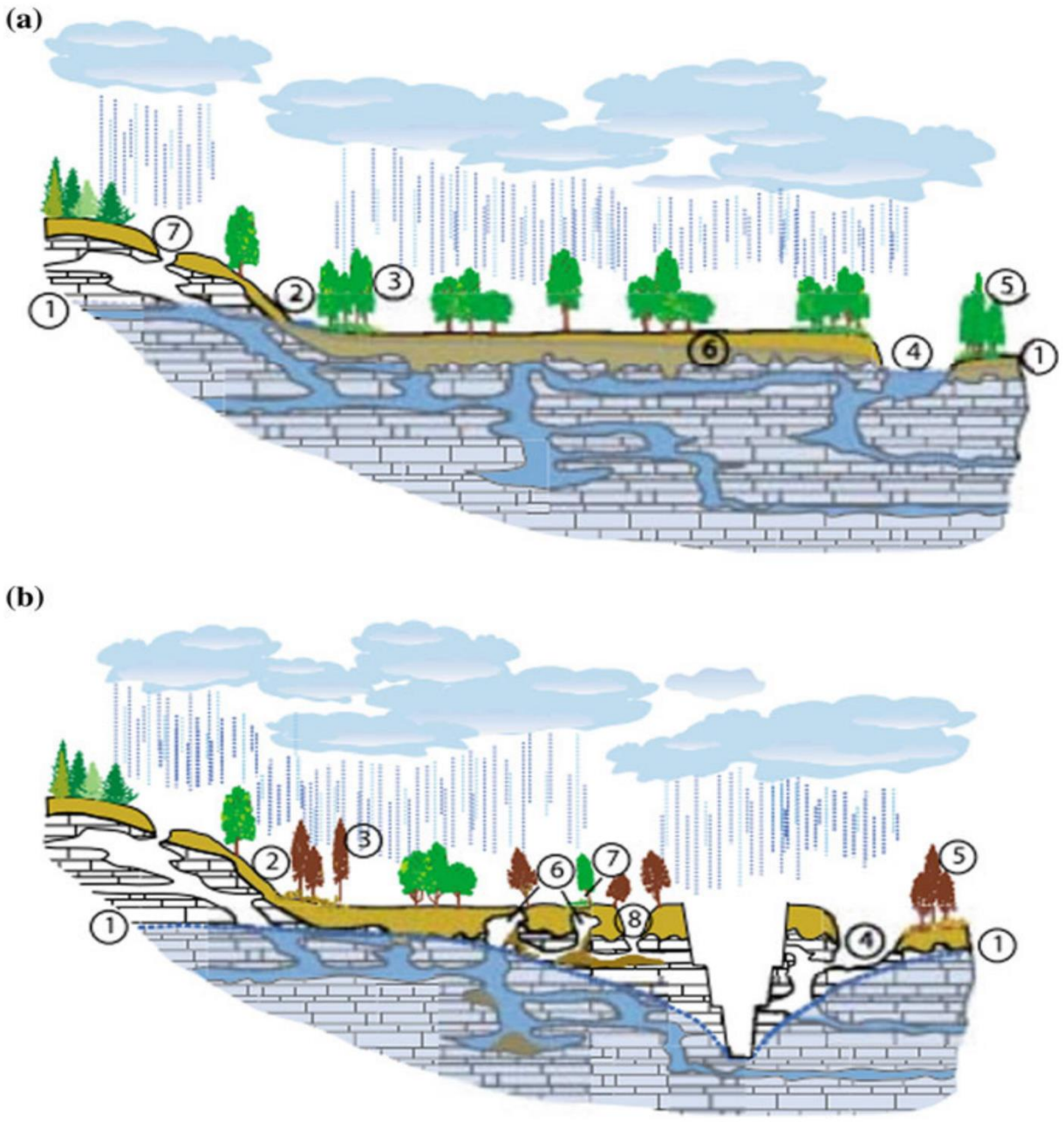

Figure 9: ***(a)*** *Hypothetical cross section showing karst area under conditions prior to quarry development. The water table (1) is generally above the soil/bedrock contact. Natural groundwater discharges to a spring (2), and a perennial stream (4), which supports wetland (3) and a riparian woodland (5). The surface of the bedrock is highly irregular (6) and is referred to as pinnacle bedrock. A natural sinkhole occurs where the water table is below the soil/bedrock contact (7).*

(b) *Hypothetical cross section showing karst area under worst-case conditions after quarry development. Under actual conditions, none, some or all of these conditions may exist. Quarry dewatering has lowered the water table (1) below the soil/bedrock contact. Natural groundwater discharge to a spring (2) and perennial stream (4) has stopped, resulting in the destruction of the wetland (3), drying up of the stream (4) and destruction of the riparian woodland (5). Underground*

cavities formed in the soil in the area of the pinnacle bedrock due to the loss of buoyant support and piping (6). The ground above the cavity has subsided, resulting in the formation of a wet area, and the tilting of fence posts or trees (7). Ultimately, these cavities could collapse, creating a collapse sinkhole (8).

3.3.1. Hydrogeochemical parameters

The hydrogeochemical parameters such as, pH, DO, EC, TDS, Salinity and ORP were measured *in-situ* (onsite) using the HANNA HI9128 multi-parameter water quality portable meter and further verified with the YSI ProDSS multiparameter (626870-1) at the laboratory for validation. The results of the hydrogeochemical parameters for all the collected open-well, pit water and bore-well samples from the surrounding vicinity of the mines are mentioned in Table 9.

Table 9: *Hydro-geochemical parameters of collected water samples from different locations adjacent to existing mining area.*

Mine No.	Sample Description	pH	DO (mg/L)	EC (µS/cm)	TDS (mg/L)	Salinity (ppt)	ORP (mV)
DW Std IS 10500 :2012		**6.5-8.5**	**–**	**2500**	**2000**	**–**	**–**
1	Pit Water	7.27	1.42	1150	741	0.56	219.6
	Vikram Bhai Farm Open-well	6.94	1.13	1913	956	0.98	203.6
2	Naranbhai Farm Open-well	7.02	0.89	1559	969	0.74	226.2
3	Open-well water	7.41	1.53	967	653	0.5	220.3
4	Near Bore-well	6.9	1.31	955	571	0.43	199.4
5	Nagabhai Karabhai Farm Open-well water	7.68	1.4	1124	700	0.53	239.6
6	Open-well water	7.79	1.45	1831	914	0.93	232.5
7	Open-well water	7.33	1.3	**2666**	1333	1.38	244.2
8	Pit Water	7.83	1.42	1776	885	0.9	218.1
	Open-well water	7.5	1.72	1260	630	0.63	183.4
9	Pit Water	7.68	1.5	1804	903	0.92	239.6
	Open-well water	6.92	1.6	**2605**	1302	1.35	203.8
10	Open-well water	7.58	1.48	1090	748	0.57	226.4
12	Open-well water	6.94	1.27	1696	1065	0.82	203.6

	Dima Manda bore-well	7.01	1.34	1609	1007	0.78	238.5
13	Masribhai open-well	7.05	1.14	1117	698	0.53	233.8
14	Pit Water	7.46	0.97	404.7	297	0.22	216.1
	Maganbhai Wadi Open-well Water	7.02	1.09	**6204**	**4205**	3.54	236.3

***Results marked in bold, exceed the limit.**

The physico-chemical characteristics of collected water samples are presented in Table 9 and the obtained results are compared with the IS-10500:2012 standards. It is observed from results that most of the parameters are found within permissible limit. In addition, the water samples collected from the quarry pit show superior quality as compared to the open-well or the bore-well water samples.

3.3.2. Major ions

The findings of major anions and cations for all the collected water samples are depicted in Table 10. From the results it is evident that the Fluoride (F-) content was exceeded IS standard limit in 77.8% of the collected water samples. In the studied area, the concentration of F^- in the collected groundwater, open-well and pit water samples ranged between 0.61 mg L^{-1} to 5.74 mg L^{-1}. Fluorine occurs in limestone, sandstone and in clay minerals. It seems that the problem of high F^- content in the collected water samples is directly or indirectly related with open limestone quarries. F^- plays an important role on the formation of dental enamel and normal mineralization in bones but can cause dental fluorosis and adversely affect the central nervous system, bones and joints at high (>1.5 mg L^{-1}) concentrations. Excessive intake of fluoride results in skeletal and dental fluorosis. Several symptoms lead to death, when fluoride doses reach 250–450 mg mL^{-1}. Moreover, it has been found that IQ of the children living in the high fluoride areas (>3.15 mg/ml) was significantly lower.

Table 10: *Concentration of anions and cations present in the collected water samples from the nearby locations of the mining area.*

Mine No.	Sample Description	F^-	Cl^-	NO_3^-	SO_4^{2-}	Br^-	Li^+	Na^+	K^+	Ca^{2+}	Mg^{2+}
DW Std IS 10500 :2012		**1.5**	**1000**	**45**	**400**	**–**	**–**	**200**	**12**	**200**	**100**
1	Pit Water	1.34	77.6	38.1	39.6	0.00	0.0	60.2	0.5	34.7	**108**
	Vikram Bhai Farm Open-well	1.34	79.1	35.9	40.0	2.37	0.0	57.7	2.0	34.9	**129**
2	Naranbhai Farm Open-well	**1.61**	153	**72.7**	60.6	0.99	0.0	127	2.3	34.0	**127**
3	Open-well water	**1.75**	89.3	**68.2**	25.6	0.85	0.0	65.8	1.6	19.5	**103**
4	Near Bore-well	**1.69**	321	**70.4**	51.6	0.97	0.0	105	0.4	48.1	**165**
5	Nagabhai Karabhai Farm Open-well water	**2.53**	101	**49.0**	41.2	0.96	0.0	111	0.6	35.4	55.5
6	Open-well water	**1.53**	91.9	**57.7**	35.8	0.96	0.0	89.5	0.5	38.0	61.1
7	Open-well water	**2.38**	29.1	36.7	6.2	0.00	0.0	109	1.8	52.4	**124**
8	Open-well water	**2.01**	67.2	**105**	19.2	0.89	0.0	113	2.1	31.7	60.6
	Pit Water	**2.01**	73.3	36.5	30.6	1.01	0.0	63.6	2.5	26.0	44.3
9	Pit Water	1.19	47.0	**47.8**	15.5	0.00	0.0	28.2	0.0	13.6	39.1
	Open-well water	**2.54**	71.1	**54.6**	21.7	0.00	0.0	56.5	0.2	31.3	57.8
10	Open-well water	**1.60**	398	**145**	111	1.24	0.33	159	3.4	32.5	**169**
12	Open-well water	**2.74**	237	**100**	47.3	1.76	0.0	111	4.6	32.8	**174**
	Dima Manda bore-well	**2.75**	206	**85.5**	53.2	1.62	0.0	119	0.0	38.2	**143**
13	Masribhai open-well	**2.10**	336	**82.5**	179	1.53	0.33	**226**	5.5	27.0	**151**
14	Pit Water	0.61	17.0	6.3	8.6	0.00	0.13	23.5	7.3	10.2	53.9
	Maganbhai Wadi Open-well Water	**5.74**	**1965**	**124**	193	5.78	0.0	817	**12.1**	131	**296**
Minimum		0.61	17	6.30	6.20	0	0	23.5	0	10.2	39.1
Maximum		5.74	1965	145	193	5.78	0.33	817	12.1	131	296
Average		2.12	242	69	54	1	0	136	3	37	114
% of Samples above IS std.		77.8	5.56	72.2	0.00	0.00	0.00	11.1	5.56	0.00	61.1

3.4. Sample calculations for damage assessment

3.4.1. As per CPCB Guidelines

According to the CPCB guideline on methodology for assessing penalty & Environmental compensation and action plan to Utilize the fund (Guideline is attached herewith) the penalty shall be calculated considering the following formula:

$$\boldsymbol{EC\ or\ Penalty\ in}\ ₹\ = (\boldsymbol{PI} \times \boldsymbol{N} \times \boldsymbol{R} \times \boldsymbol{S} \times \boldsymbol{LF}) \text{ ----------(4)}$$

PI = Pollution Index of industrial sector: PI factor is considered as **60** because for these fourteen mines no significant WaterPollution and Hazardous Pollution is observed.

N = Number of days of violation took place: Number of days is considered as **250 mining days/year** considering holidays and monsoon season.

R = A factor in Rupees (₹) for EC/Penalty: All cases are pertaining to EC violations, factor considered is **250**.

S = Factor for scale of operation: Considering all the mining projects under small category, factor considered is **0.5**.

LF = Location factor: LF Considered is **1.0**, as population is ± less than 1 million.

Table 11: *Sample calculations for damage assessment as per CPCB guidelines for the mining lease of M/s. Gopalsinh Himmatsinh Chauhan.*

Mine. No.	General Information				CPCB Guidelines for compensation					
	Lessee	Lease area (Ha)	Production (considered under violation)							
			Production Year	Total Production	PI	N	R	S	LF	EC/Penalty (Rs.)
1	M/s Gopalsinh Himmatsinh Chauhan	2	2016-17	66588.91	60	500	250	0.5	1	**37,50,000**
		2	2017-18	23372.13						
		2	2018-19	0						
Total				**89961.04**						**37,50,000**

3.4.2. As per SEIAA-SEAC Gujarat Guidelines

For assessment of Damage cost based on SEIAA-SEAC Gujarat guidelines, the factors considered/calculations made are explained in Table 12 with sample calculation

Table 12: *Sample calculations for damage assessment as per SEIAA-SEAC, Gujarat for the mining lease of M/s. Gopalsinh Himmatsinh Chauhan.*

Attributes	Scope of Environmental benefits earned	Cost assessment for environmental damage	
		Sample calculations for Mine No.: 1	Total cost (Rs.)
AP	Water requirement per day for sprinkling of water to curb fugitive emission in KL (0.1 L/m^2)	Lease area: **2.0 Ha (20,000 m^2)** Water requirement: **0.1 L/m^2/Day** Cost of water: **Rs. 100/KL** No. of days: **250 days per year** **Total cost: 20,000 x 0.1/1000 x 100 x 250**	**50,000/- per year**
TP	Cost of water sprinkling on Kutcha road outside mine lease up to nearest Pakka major road to curb fugitive emission in KL	Road length: **0 m** Water requirement: **0.1 L/m^2/Day** Cost of water: **Rs. 100/KL** No. of days: **250 days per year** **Total cost: 0 x 0.1/1000 x 100 x 250**	**0.00/- Per year**
WP	Major water pollution envisioned: 1. Groundwater table intersection if any. 2. Water runoff outside the lease area and estimated damage caused considering period of violation in Rs. Per day	No water pollution issues envisioned as limestone is inert material and groundwater intersection was not observed. Hence, damage pertaining to this aspect is considered as zero.	**0.00/-**
SHW	When there is an overburden (O.B.), Quantity of O.B. in MT x 10 Rs. O.B. handling charges Per MT x 2 (Lifting and Shifting frequency)	Average thickness of O.B. or waste rock is observed to be about **1 f (0.3 m)** and bulk density of O.B. is considered as **2 T/m^3** Cost of reclamation: **Rs. 10/MT x 2** Total Cost: **20,000 x 0.3 x 2 x 10 x 2**	**2,40,000/-**
NV	Existence of House properties/env. entities within 500 m of blasting site and if damaged due to blasting. • Nos. of such properties/env. Entities. • Built up area of each property/env. Entities. • Cost of reconstruction of properties (total) considering current construction cost per m^2.	No blasting is being carried out in the mines. No damage on any private or public properties have been observed or no such complaint has been received. Hence, cost is considered as zero.	**0.00/-**
GB	Green Belt developed in 10% of leased area Green belt area in m^2. Presume 1 plant per 4 m^2 is to be planted. Cost of single plant: Total cost of green belt	Lease area: **2.0 Ha (20,000 m^2)** No. of sapling: **1 sapling / 4 m^2** Cost of sapling including plantation: **Rs. 100/plant** Watering cost: **1 L/plant/day x Rs. 100/KL** No. of watering days: **250** Nurturing is required for **3 years only** Total cost: **20,000 x 0.1/4 x 100** Gardener salary: **5000 (for one month) x 12** Maintenance cost: **Watering cost + Gardener salary**	Plantation cost: **50,000/- &** Maintenance cost: **72,500/-**
HG	No major HG issues envisioned, considering no ground water	No groundwater intersection was observed. Hence, no damage cost is calculated.	**0.00/-**

	interception If intersection of ground water is made, cost of one-time remediation plan after estimating extent of contamination of ground water		
RH/OHS	Health Expenditure: Nos of workers x Rs. 1000 PPE Expenditure: No of workers x Rs. 300 Total expenditure for health and safety for workers x Nos of year	Annual production for one year: **66,588.91 MT**. Average output per man per shift: **5** Supervisory manpower: **2** Total working days: **250 days** Average No. of worker: **66,588.91/250/5+2** Total expenditure: **(55 x 1000) + (55 x 300)**	**71,500/-**
CER	10% of Mineral Value	Since the CER guidelines are applicable from May 1, 2018, the CER guidelines as per Companies act are considered. Hence, **2% of the sale price of mineral** (for that particular year) is considered for estimating CER cost: CER: **2,87,87,531 x 0.02**	**5,75,751/-**
SC	Cost of preservation, Handling and reuse of Top soil: (Cost of Soil preservation is assumed to be Rs 10,000 per 1 Hectare)	Lease area: **2 Ha** Soil conservation cost: **Rs. 10,000 per Ha** Total cost for soil conservation: **2 x 10,000**	**20,000/-**

3.4.3. As per GR of Industries and Mine Department, Gujarat

For assessment of Damage cost based on GR of Industries and Mine Department, Government of Gujarat guidelines, the factors considered/calculations made are explained in Table 13 with sample calculation.

Table 13: *Sample calculations for damage assessment as per GR of Ind and Mine Dept., Gujarat for the mining lease of M/s. Gopalsinh Himmatsinh Chauhan.*

Mine. No.	General Information				Declared Mineral Sale Value by CGM/IBM (Rs.)	Total Sale Value of Mineral (Rs.)	Damage Assessment Cost (Rs.) (21% of total mineral value)
	Lessee	Lease area (Ha)	Production (considered under violation)				
			Production Year	Total Production			
1	M/s. Gopalsinh Himmatsinh Chauhan	2	2016-17	66588.91	320	21308451.2	**60,45,382**
		2	2017-18	23372.13	320	7479081.6	
		2	2018-19	0	400	0	
Total				**89961.04**		**2,87,87,533**	

3.5. Damage cost assessment

As per the objectives of the present study, damage assessment on the account of (i) ecological services forgone forever (ii) cost of damage to environment and pristine ecology (iii) cost of mitigation and restitution of environment & (iv) deterrent environmental compensation distinct from earlier three heads, has been carried out with reference to the guidelines issued by CPCB, SEAC Gujarat and Industries & Mines Department, Govt. of Gujarat as mentioned. The estimated damage cost and compensation calculated by each of the three guidelines, as mentioned above, are summarized in the Table 14.

All the mine leases are located in barren / waste land and no significant natural vegetation / tree cover was observed in or around the mine leases. The mining leases are mostly surrounded by agriculture lands. As such, there were no ecological services foregone forever. Also, it was observed that no significant damage to the environment or pristine ecology has been occurred due to these 14 limestone mines. Hence, no damage cost on the account of (i) ecological services forgone forever (ii) cost of damage to environment and pristine ecology, has been calculated. However, cost of mitigation and restitution of environment was estimated using the Industries & Mines Department, Government of Gujarat Resolution and SEAC-SEIAA Gujarat guidelines. The deterrent environmental compensation was calculated using CPCB guidelines. The individual project details and damage cost assessment for all the 14 mine leases are given in Annexure IV, V and VI.

Table 14: *Summary of the damage cost assessment using three standard methods and the recommended value.*

Sr. No.	Lessee and location of Lease	Environmental compensation as per CPCB guidelines (INR)	Damage assessment cost as per guidelines of SEAC/SEIAA, GoG (INR)	Damage assessment cost as per guidelines of Industries and Mines GoG (INR)	Total damage assessment cost recommended by previous committee (INR)	Recommended damage assessment cost levied from lease holders Average value of three calculation methods (A), (B) and (C) (INR)
		(A)	(B)	(C)	(D)	(E)
1.	M/s Gopalsinh Himmatsinh Chauhan	37,50,000/-	13,02,051/-	60,45,382/-	**60,45,382/-**	**36,99,144/-**
2.	M/s Vajesinh Dansinh Mori	37,50,000/-	7,11,150/-	3,61,721/-	**37,50,000/-**	**16,07,624/-**
3.	M/s R. J. Trivedi & Co.	4,31,25,000/-	81,42,609/-	1,77,75,679/-	**4,31,25,000/-**	**2,30,14,429/-**
4.	M/s Aher Bhagwan Bhimsinh	3,93,75,000/-	77,39,327/-	2,46,86,172/-	**3,93,75,000/-**	**2,39,33,500/-**
5.	M/s Somnath Hydrated Lime & Chemicals Industries Pvt. Ltd.	2,25,00,000/-	1,62,88,102/-	7,99,12,364/-	**7,99,12,364/-**	**3,95,66,822/-**
6.	M/s Noormahamad Kalubhai Patani	56,25,000/-	26,31,809/-	1,26,31,063/-	**1,26,31,063/-**	**69,62,624/-**
7.	M/s Vikram Chemical Company	18,75,000/-	5,99,012/-	1,25,866/-	**18,75,000/-**	**8,66,626/-**
8.	M/s Dhirajlal Panchabhai Vachhani	56,25,000/-	33,71,427/-	1,96,50,505/-	**1,96,50,505/-**	**95,48,977/-**
9.	M/s Somnath Hydrated Chemicals	3,93,75,000/-	1,69,73,085/-	8,69,60,844/-	**8,69,60,844/-**	**4,77,69,643/-**
10.	M/s Dinesh Kumar & Company	56,25,000/-	27,03,856/-	1,15,74,733/-	**1,15,74,733/-**	**66,34,530/-**
11.	M/s Rajsi Rana Jotava Limestone Mine	56,25,000/-	22,99,749/-	1,01,22,773/-	**1,01,22,773/-**	**60,15,841/-**
12.	M/s GHCL Ltd.	4,50,00,000/-	98,64,455/-	2,25,30,544/-	**4,50,00,000/-**	**2,57,98,333/-**
13.	M/s GHCL Ltd. (Kodidra)	56,25,000/-	16,52,630/-	26,04,574/-	**56,25,000/-**	**32,94,068/-**
14.	M/s S. J. Trivedi Limestone Mine	3,37,50,000/-	75,40,786/-	1,01,63,194/-	**3,37,50,000/-**	**1,71,51,327/-**

Chapter 4. Summary and Limitations

Following the Hon'ble NGT order dated 01/05/2019 and 15/06/2020 in the matter of O.A. 58/2018 Protection of Environment and Public Service Committee Vs Union of India & Ors., the Gujarat Pollution Control Board (GPCB) approached IIT-Gandhinagar to provide their professional services for evaluation of the damage assessment of the Lime Stone mines in Junagadh and Gir Somnath District. On the acceptance of financial proposal from IIT-Gn, GPCB had issued work order for the aforementioned project vide letter no. GPCB/LGL: NGT: Gen: 109(2)/571461 dated 28/10/2020.

Upon receiving the work order from GPCB, IIT-Gn project team had carried out several remote-sensing-based investigations to understand the field situation through several timeline impression images. The dynamics of land use/land cover (LULC) changes, the effect of mining on the LULC changes are studied in detail. The different land use classes mainly vegetation, water body, agriculture land, settlement and barren land in Junagadh and Gir-Somnath district are identified in order to understand the impact of LULC change on the environment. Also, we had prepared the questionnaire/checklists before the field visit commenced between 18th to 23rd January, 2021. A detailed survey on various aspects of mining status, stakeholder's perceptions, vegetation status, and other environmental indicators were carried out during field visit. The preliminary survey included the collection of local geological data for the Junagadh district in order to understand the soil characteristics. Besides, samples were taken for hydro-geochemical analyses. During our visit to the mining sites, the soil/sediment, surface water, groundwater, open-well water, pit water samples (if available) were collected in order to ascertain the water quality in the region as well as to trace the effect of mining activities on the potable water resources. The collected samples are undergone investigation for various water quality parameters. In total, thirteen (n=13) open-well/bore-well and four (n=4) pit water samples were collected from the vicinity of mines. The physicochemical analyses (hydrogeochemical parameters, cations, anions, and trace metal ions) of the collected samples for the proper identification of their composition, suitability for drinking

purpose, and the potential effect of mining pollution on water quality. Our observations can be summarized as follows:

- The study provides the trend of major changes in the LULC classes of study area during the time period from 2001 to 2021. It is observed that there is a significant impact of mining on barren land reduction (-36.3 %).
- In the year 2021 the observation confirmed that agricultural land (52.6%) has a larger area as compared to barren land (23.4%) and vegetation (19.6%). The period (2011-21) indicates the general decrease in percentage area of barren land (23.4%) including the increase in vegetation (19.6%) and settlement (32%). The land use supporting the agricultural activities and economic activities increased indicated by the settlement and cultivation.
- A primary investigation reveals that in all the 14 mines, the open cast mining is done through either manually or through surface miners/other mechanized means but without blasting which suggested that it has not caused the damage to the extent that can create visible impacts on the surroundings and nearby people.
- A detailed questionnaire survey discloses the environmental, societal, biodiversity and climatic impacts of all the mines. However, the positive impacts are overwhelming the negative ones considering the proper management such as, the green belt development along the roads, providing work and shelter to people who live hand-to-mouth in the rural area of the district, less impact on the biodiversity and climate due to non-usage of blasting type of mining process.
- The physico-chemical analysis results suggested that for all the collected open-well/bore-well samples (n=13) the values of pH were ranged from 6.90 to 7.83 with an average value of 7.29, signifying that the groundwater present in the nearby location is neutral in nature with negligible impact from the mining activity.
- The Fluoride (F^-) content was exceeded IS standard limit in 77.8% of the collected water samples suggested that open limestone quarries are directly/indirectly accountable for

such higher content of F^- which can cause dental fluorosis as well as adversely affect the central nervous system, bones and joints at high (>1.5 mg L^{-1}) concentrations.

- The water samples collected from the quarry pit show superior quality as compared to the open-well or the bore-well water samples.
- The environmental damage penalty recommended by the previous committee was not rational since some of the lease holders had very less mineral production only for one to two years however, the levied penalty is four to five times of their earned values. Hence, we hereby recommend the average value for total damage assessment calculated using all the three methods (i.e. CPCB, Industries and Mines, GoG and SEIAA/SEAC, GoG) which certainly seems to be realistic and indemnify by the lease holders.
- Overall, with proper functioning of these mines the local people will be benefitted by getting direct employment in the mining project and indirect employment opportunities in the associated services. The project will provide livelihood to the poorest section of the society who are economically and socially backward. It will provide employment to the people residing in the vicinity of mining area directly or indirectly. The mine management will also help the people in the nearby villages by providing financial aid to schools, conducting medical and social awareness campaigns, help in the formation of self-help groups, etc. Thus, the project will bring socio-economic development of the area, which is much needed.

Major limitations of the project are highlighted as follows:

- The damage to the ecology cannot be determined because assessment of environmental damage compensation particularly loss of ecological damage is very complex and required substantial time as well as resources.
- The environmental attributes such as, air pollution, water pollution, hazardous waste generation, noise & vibration, cannot be precisely identified due to non-operational condition of all the mines.

- The ongoing pandemic (COVID-19) restricted the IIT-Gn team members to carry out detailed door-to-door survey which would certainly help in understanding the impact on the mining activity on individuals.
- The assigned project was only for four months hence, it cannot be possible to carry out continuous water (groundwater/surface water) monitoring for all three seasons (monsoon, pre-monsoon, and post-monsoon), required to understand the seasonal fluctuations on the water quality due to mining activity.

Chapter 5. Conclusions

After the rigorous analyses of dynamics of land use and land cover (LULC) changes for 20 years in Junagadh and Gir-Somnath districts; detailed survey on various aspects of mining status, stakeholder's perceptions, vegetation status, and other environmental indicators; collection of baseline historical geological data; on-site visit as well as surface water, groundwater, open-well water, pit water samples analyses we conclude that there is a significant positive impact of mining on the reduction of barren land and generation of livelihood to the poorest section of the society in the region. Also, no major environmental impact could be seen due to the mining activities supporting the hypothesis that all the 14 leased mines will allowed to be operative with levying average value for total damage assessment calculated from all the three methods (i.e. CPCB, Industries and Mines, GoG and SEIAA/SEAC, GoG) owing to the following reasons:

- The area and depth of mining is relatively small. Average mining area in these cases is about 4 Ha and average depth is about 3 m.
- The LULC analyses results of past 20 years period suggested sharp reduction of barren land (-36.3 %) and increase in vegetation (19.6%) and settlement area (32%) in the studied region.
- Due to open cast mining in all the 14 mines which was performed without blasting technique suggested negligible damage and associated impacts on the nearby habitats.
- Compared to the collected water samples, the quarry pit water shows superior quality. Also, in the survey local people confirmed that they utilize this pit water for their day to day activities.
- A detailed questionnaire survey discloses that due to the closure of all 14 mines, mine diggers/workers who live hand-to-mouth by working in here are most affected and some of them also lost shelter also.

Overall, with proper functioning of these mines the local people will be benefitted by getting direct employment in the mining project and indirect employment opportunities in the associated services. The project will provide livelihood to the poorest section of the society who are

economically and socially backward. It will provide employment to the people residing in the vicinity of mining area directly or indirectly. The mine management will also help the people in the nearby villages by providing financial aid to schools, conducting medical and social awareness campaigns, help in the formation of self-help groups, etc. Thus, the project will bring socio-economic development of the area, which is much needed.

Considering above the experts from IIT-Gn unanimously decided to recommend to levy average value for total damage assessment calculated through three various methods. The final recommended figures for the each mine are tabulated as follows:

Sr. No.	Lessee	Recommended damage assessment cost levied from the lease holders (INR)
1.	M/s Gopalsinh Himmatsinh Chauhan	**36,99,144/-**
2.	M/s Vajesinh Dansinh Mori	**16,07,624/-**
3.	M/s R. J. Trivedi & Co.	**2,30,14,429/-**
4.	M/s Aher Bhagwan Bhimsinh	**2,39,33,500/-**
5.	M/s Somnath Hydrated Lime & Chemicals Industries Pvt. Ltd.	**3,95,66,822/-**
6.	M/s Noormahamad Kalubhai Patani	**69,62,624/-**
7.	M/s Vikram Chemical Company	**8,66,626/-**
8.	M/s Dhirajlal Panchabhai Vachhani	**95,48,977/-**
9.	M/s Somnath Hydrated Chemicals	**4,77,69,643/-**
10.	M/s Dinesh Kumar & Company	**66,34,530/-**
11.	M/s Rajsi Rana Jotava Limestone Mine	**60,15,841/-**
12.	M/s GHCL Ltd.	**2,57,98,333/-**
13.	M/s GHCL Ltd. (Kodidra)	**32,94,068/-**
14.	M/s S. J. Trivedi Limestone Mine	**1,71,51,327/-**
Total		**19,87,12,161/-**

Chapter 6. Recommendations

- Thick plantation is recommended along the mine boundary within lease area to reduce noise and vibration although it is not the major problem since blasting has not been performed for mining process.
- The fertile topsoil must be stored separately from the overburden produced during mining operations. It is recommended that topsoil be reused as soon as possible for plantations and greenbelt development. The installation of drains around the stockpiles prevents erosion and waste. Land reclamation activities such as backfilling exhausted pits, slope stabilization, and pit conversion to water reservoirs can be carried out.
- Overburden handling has a significant impact on surface mining projects and must be carefully planned while taking mining activities and site rehabilitation into account. As a result, the following fundamental steps are recommended for proper overburden management:

  (a) Examine site-specific aspects such as geographic location and surface morphology;

  (b) From a geotechnical standpoint, evaluate the micro and macro properties of overburden materials in detail;

  (c) Evaluate and compare the efficiency that can be obtained from alternative options of excavation–transportation and dumping waste rock and soil.
- Implementation of land reclamation work after mineral excavation should be done with a thorough understanding of local geology and ecology.
- The management should provide ear muffs and helmets to the workers in the mine and stress on its utilization.
- The regular medical check-up of workers is to be carried out. Green belt development is to be stressed and workers must be motivated for plantation care. The general environmental

awareness is given to the local workers. Regular maintenance of vehicle is carried out. Slogans of environment, health and safety are recommended for display.

- Effective network of drains with sedimentation pits should be developed to prevent the flow of eroded material to nearby drainage. Harvesting rainwater in mined-out pits will help towards maintaining the groundwater regime of the region.

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Annexures

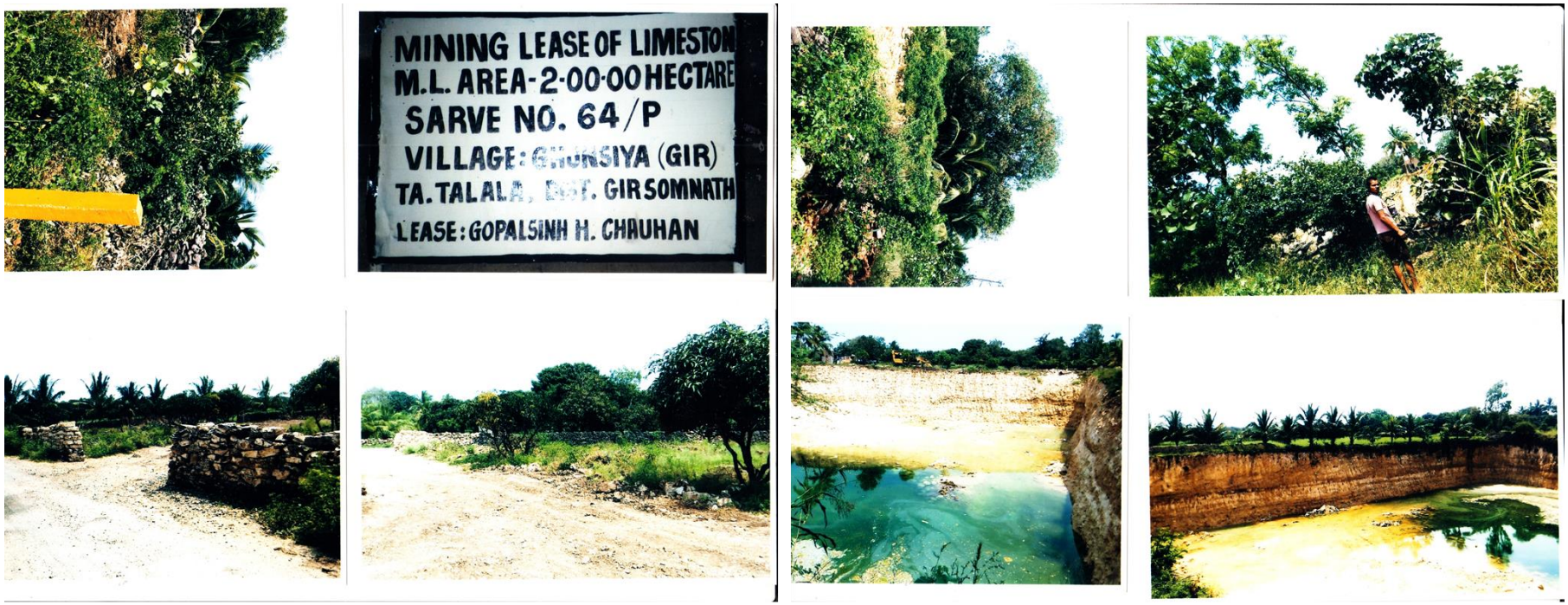
Annexure I: *Photographs of Mining site visit.*

Group Meeting with all stakeholders and representatives of all 14 mining sites.

Water & Soil sampling in the vicinity of mining sites.

Pit created after mining is filled with water and recharging the groundwater actively.

Annexure II: *Temporal variations through photographs.*



Mine No. 1: **Lime Stone Mine of Goplasinh Himatsinh Chauhan (2.00 Ha Lease Area)**

Village: Ghusiya, TAL: Talala, DIST: Gir Somnath.

Latitude: 21°01'47.13‘’N & Longitude: 70°31'01.39"E

OLD PHOTOGRAPH OF MINES

PLANTATION PHOTOGRAPH

MONSOON SEASON PHOTOGRAPH

MINES PHOTOGRAPH

Mine No. 3: **Lime Stone Mine of M/s R. J. Trivedi & Co.**
(7.69 Ha Lease Area)
Village: Umba, TAL: Veraval, DIST: Gir Somnath.
Latitude: 20°59'40.71‘’N & Longitude: 70°24'15.55"E

Mine No. 9: **Lime Stone Mine of M/s Somnath Hydrated Chemicals (10.00 Ha Lease Area)**

Meghal River, Village: Zadaka, TAL: Malia, DIST: Gir Somnath.

Latitude: 21°04'47.37‘’N & Longitude: 70°17'45.04"E

Mine No. 11: **Lime Stone Mine of M/s Rajsi Rana Jotava**
(4.00 Ha Lease Area)
Village: Khorasa, TAL: Malia, DIST: Gir Somnath.
Latitude: 21°02'51.00‘’N & Longitude: 70°19'19.84"E

Mine No. 12: **Lime Stone Mine of M/s GHCL Ltd.**
(8.73 Ha Lease Area)
Village: Gorakhmadhi, TAL: Sutrapada, DIST: Gir Somnath.
Latitude: 20°54'39.00‘’N & Longitude: 70°31'16.95"E

Mine No. 13: **Lime Stone Mine of M/s GHCL Ltd.**
(4.70 Ha Lease Area)
Village: Kodidra, TAL: Veraval, DIST: Gir Somnath.
Latitude: 20°57'57.91‘’N & Longitude: 70°31'12.97"E

Annexure III: *Major flora species found in the study area.*

SR. NO.	COMMON NAME	SCIENTIFIC NAME
CROPS		
1.	Dhana	*Coriandrum sativum*
2.	Ghau/Wheat	*Triticum aestivum*
3.	Bajra	*Gossipium spp.*
4.	Ground nut	*Arachis hypogea*
5.	Jawar	*Sorghum vulgare*
6.	Til	*Sesamum indicum*
HORTICULTURE CROPS		
1.	Nariyal	*Cocus nucifera*
2.	Mango	*Mangifera indica*
3.	Chiku	*Manilkara zapota*
4.	Keda	*Musa acuminata*
HERBS		
1.	Dhaturo	*Datura irmoxia*
2.	Ghas	*Parthenium Sp.*
3.	Gulab	*Rosa indica*
4.	Taradiyu	*Digitaria adscendens*
5.	Kasundri	*Cassia occidentalis*
6.	Tulsi	*Ocimum sactum*
7.	Dhamaso	*Fangonia cretica*
SHRUBS		
1.	Saru	*Casurina equisetifollium*
2.	Kanthar	*Capparis sepiaria*
3.	Bordi	*Zyziphus jujuba*
4.	Gandhatu	*Lantana Camera*
5.	Chiku	*Manilkara zapota*
6.	Arni	*Clerodenron phlomoides*
7.	Jambudi	*Syzigium samarangense*
8.	Jasud	*Hibiscus rosa*
TREES		
1.	Nariyel	*Cocos nucifera*
2.	Pipal	*Ficus religiosa*
3.	Desi Baval	*Accasia nilotica*
4.	Emli	*Temerindus indica*
5.	Arduso	*Ailanthus excelsa*
6.	Jambu	*Syzizium cumini*
8.	Karanj	*Pongamia pinnata*
9.	Sagwan	*Tectona grandis*
10.	Sitaphal	*Annona squamosa*
11.	Garmalo	*Cassia fistula*

Annexure IV: *Major fauna species found in the study area.*

SR. NO.	COMMON NAME	SCIENTIFIC NAME
INSECTS		
1.	Kidi	*Lasius niger*
2.	Karodiyo	*Argiope anasuja*
3.	Machhar	*Anopheles Sp.*
4.	Hathilo vaniyo	*Sympetrum plaveolum*
5.	Madhmakhi	*Apus indicus*
BIRDS		
1.	Baj	*Accipitar badius*
2.	Chakli	*Petronia petronia*
3.	Kagado	*Corvus splendens*
4.	Baglo	*Ardeola grayii*
5.	Kalo baglo	*Egretta gularis*
6.	Bulbul	*Pycnonotus leucotis*
7.	Popat	*Psittacula krameri*
8.	Kabutar	*Columba livia*
9.	Chas	*Coracius bengalensis*
10.	Chandul	*Eremopterix griseus*
REPTILES		
1.	Nag	*Naja naja*
2.	Kachandi	*Calotus versicolor*
3.	Garodi	*Sitana ponticeriana*
4.	Dedko	*Duttaprynus melenosticitus*
MAMMALS		
1.	Monkey	*Semnopithecus entellus*
2.	Nilgay	*Boselaphus tragocamelus*
3.	Chachundar	*Rattus norvegicus*
4.	Bhund	*Sus scrofa*
5.	Indian Fox	*Vulpes bengalensis*
6.	Indian Hare	*Lepus nigricollis*
7.	Jackal	*Canis aureus*
8.	Siyal	*Canis aureus*
9.	Undar	*Ratus ratus*
10.	Vagol	*Pteropus giganteus*
11.	Khiskoli	*Funambulus palmarum*
12.	Chamachidiyu	*Scotophiluskutilil*

Annexure V: *Primary data collected through the lease-holders using standard questionnaire survey.*

Checklists		Ghusiya Lime Stone Mine	Jasadhar Lime Stone Mine	Umba Lime Stone Mine	Ajotha Lime Stone Mine
Name of the owner/Firm	:	**M/s. Gopalsinh Himatsinh Chauhan**	**M/s. Vajesinh Dansinh Mori**	**M/s. R. J. Trivedi & Co.**	**M/s. Aher Bhagwan Bhimsinh**
Survey No.		**64/p**	**152**	**65/70**	**389/1**
Mine Address	:	Village Ghusiya, Taluka - Talala, Dist. – Gir Somnath	Village Jasadhar, Taluka - Talala, Dist. – Gir Somnath	Village Umba, Taluka - Veraval, Dist. – Gir Somnath	Village Ajotha, Taluka - Veraval, Dist. – Gir Somnath
Contact Details (i) Email Address (ii) Mobile Number	:	(i) gopalsinh.chauhan2664@gmail.com (ii) 9624047851	(i) vikramconstruction@hotmail.com (ii) 9429198488	(i) rjtrivedi9@gmail.com (ii) 9898334298	(i) samirminerals@yahoo.in (ii) 9824659216
Lease Area (in Hector)	:	2.00	2.00	7.69	6.47
Mining Plan (Include Mine Closure Plan)	:	Applicable	Applicable	Mining Plan no 682(23)(MS-458)/2008 Attached as annexure 1	IBM REGN. No. IBM/14004/2012
Total Project Cost (Provide with and without Environmental Management Plan (EMP) Cost)	:	Around 50 Lakh	Project-cost	1.10 Cr. with EMP	
Details of Recognized Qualified Person (RQP)	:	Nirmal Kumar Jain, Udaipur	Oversease Mintec	ARUN KUMAR YADAV (RQP) Over seas Min tech Consultant Jaipur	IBM/14004/2012
Type/Method of Mining	:	Mining is to be carried out by opencast method)(Other than fully Mechanized)	Opencast Mining / Mechanized method	Opencast Mining / Semi-mechanized method	Opencast Mining / Semi-mechanized method
Period of Mining proposed	:	2048	50 Years	Upto 22/09/2024	2016-17 to 2018-19

Method of Mining	:	Mining is to be carried out by opencast method)(Other than fully Mechanized)	Mechanic	Open cast, Semi – mechanized method	Open Cast Mining.
Production (Quantity in Tonnes)	:	66588.91 M.T (2016-17) 23372.13 M.T. (2017-18) 0.00 M.T (2018-19)	10000 MT.	Period of mining plan 2015 to 31/3/2020 22114 Cu MT to 29870 Cu MT (around 50 000.00 M.T) per annum Production Suspended from 2018	196030M.T (2016-17) 560 M.T. (2017-18) 00 M.T(2018-19) From AUGUST - 2018 , the work operations are completely stopped.
New or existing Mine	:	Existing Mine	Exe sting Mines	Existing mine since 23/09/1974	
If in case of existing Limestone-mine, the length, width and depth to which Mining has already been done (below the ground level/ above the ground level)	:	● Length (m): 540 Avg ● Width (m) : 100 Avg. ● Depth (m) : 12 Avg.	· Length (m):33 · Width (m) :32 · Depth (m) :1.5	Above ground level :- 1 to 3 m Below ground level Length (m) Width (m) Depth (m) :- 1 43 23 1 2 31 8 0.7	· Length (m): · Width (m) : · Depth (m) :
If Mining had been done below the ground level/above the Ground level, the height of Mining already done	:	below the ground level about 35 feet	Not Applicable	Above Ground level Height was 1 m to 3 m Below ground level done as above	- 3mtrs - average below ground level - Average height of the workings : 3mtrs.
Name of the owner who had earlier undertaken the Mining & a copy of mining lease	:	Not applicable	Attached mining plan lease deed	N A	N.A.

issued with date, if he is different from the present applicant					
Proof of land ownership. If owned Title Deed. If not then land agreement/ lease copy entered with the owner (to be enclosed) details	:	Grant order & Deed attached herewith	Attached mining plan lease deed	Lease Deed enclosed.	Lease Deed enclosed.
Land use pattern for a radius of 500 m to 1 km around the Mining site such as Agriculture, Water body, Habitation etc.	:	Agriculture land in such as radius of 500 M.	.	Nearest human habitation 850 m , no water body to 01 km , all surrounded by agriculture land	
Details of other quarries for a radius of 500 m to 1 km, around the Mining site	:	Not Aplicable	Kisansinh dansinh mori mines.	Limestone mine of DCW ltd at Inaj within 1 km radius	
Aerial distance to the nearest eco- sensitive areas, Forests, Monuments, Coastal Regulation Zone (CRZ), etc., within 10-15 kms of these areas	:	Forest area distance is about 7.19 km. There is no coastal Zone (CRZ) within 15-20 kms. of these areas.	NO	Gir National Park: 13 km Arabian Sea: 16 km No monuments within 15 km	No

Copy of explosives license and a consent letter/ agreement of competent recognized person who has agreed to handle explosive for the blasting, in case of Limestone Mines	:	There is no blasting in this mine, we don't have any explosives license for this Limestone Mines	There is no blasting in this mine, we don't have any explosives license for this Limestone Mines	There is no blasting in this mine, we don't have any explosives license for this Limestone Mines	There is no blasting in this mine, we don't have any explosives license for this Limestone Mines
Brief details of Air Pollution Control (APC) measures taken during mining and transportation	:	GPCB report is attached herewith.	Water Sprinking for dust suppression planting trees along the periphery during mining and transportation.	Water sprinkling will be done twice during the day in summer season and once during the day in winter season for settling the dust particle due to transportation of material	Water sprinkling
Brief details of Control measures taken to reduce the generated noise and vibrations	:	There are not any mager noise and vibrations in this mines .	Vehicles will be installed with muffer machinery will be lubricated periodically.	Thick plantation is proposed along the mine boundary within lease area which reduce noise and vibration	- using less noise generating machinery i.e. small scale machinery.
Water requirement: **a) Drinking & domestic purposes KLD** **b) Dust suppression (KLD)** **c) Green belt (KLD)**	:	Total requirement of water for this mining project is 6.0 KLD, out of which 1.0 KLD for domestic use for drinking purpose will be purchased from open market and remaining of 5 KLD will be used from the stored rainwater into pit sumps for mining allied activities like afforestation	0.2KLPD 2.13 KLPD 2.22 KLPD	a)Drinking & domestic purposes (KLD) : 0.60 kld b) Dust suppression (KLD): 0.58 kld c) Green belt (KLD) : 7.93 kld	a- 0.5 KLD b- 1KLD c - 1KLD

		and dust suppression purpose etc.			
Source of Water (Provide details for the Source of Water) (Provide details for the GroundwaterTable)	:	When rain falls to the ground, some of it flows along the land surface to streams, rivers or lakes, some moisturizes the ground. Part of this water is used by vegetation; some evaporates and returns to the atmosphere. Part of the water also seeps into the ground, flows through the unsaturated zone and reaches the water table, which is an imaginary surface from where the ground beneath is saturated	12M	Near by Well from agriculture farm	From Near by village
Impact on Water sources (With Statement)	:	● Low : ● Moderate : <u>Moderate</u> ● High :	Low : There is No Seasonal Stream near mining area. · Low: · Moderate : · High :	· Since water table is very deep & mining will be carried out much above the water table therefore there will be no impact on ground water	Ground water is faraway from the workings i.e. Mine workings are less than 4mtrs from the surface level , hence there is no any chance to disturb the ground water. There is no any processing plants or process. Hence there is no any chance of impact on surface water. How ever due to ground water recharging , the water level goes up and available through out the year for agricultural works in the surrounding areas

Positive/Negative impacts of mining activity (With Statement on each segment)	:	● Environmental: ● Societal: ● Biodiversity: ● Climatic: ● Positive	· Environmental: positive because we follow rule of EIA 2006. · Societal: mining creates jobs and economic opportunities. · Biodiversity: · Climatic:	· Environmental : Green belt along the roads will improve the environment of surrounding · Societal : The project will contribute additional revenue to the state and central Govt in form of royalty and other taxes the people in area will be to utilize improved facilities with regard to education, health care , hygiene and small business opportunities etc · Biodiversity: Less impact on Bio diversity · Climatic: There is no hazardous gas generation in mining activity	Engg: Adequate qualified and competent persons are deployed for statutory compliance to maximum level. Admin: Total operations are monitored by qualified and competent persons. Tech: Small scale Rock breakers are in use for ROM Generation in the place of conventional blasting methods which is environmental friendly. Behavior: A lot of changes are taken place in the society in terms of education, living style, medical improvements and economic levels due to the company establishments.

In case of negative impacts how company will reduce those impacts (With Statement on each segment)		● Engineering: ● Administrative: ● Technological: ● Behavioral:	· Engineering-Based: change in EMP plan and reduce impacts. · Administrative: Manage good relationship. · Technological: Use new technology for reduce impacts. · Behavioral: We create good relationship with works and villagers. We will work of mines according to EIA Report	· Engineering-Based: Qualified mining engineer is hired · Administrative: Total mining activity are monitored by experience and qualified person · Technological: Uses of latest technology to reduce impact · Behavioral: Due to increase in economical strength of labor educational and agriculture improvement has become possible and awareness in medical health checkup increase	Engg: Adequate qualified and competent persons are deployed for statutory compliance to maximum level. Admin: Total operations are monitored by qualified and competent persons. Tech: Small scale Rock breakers are in use for ROM Generation in the place of conventional blasting methods which is environmental friendly. Behavior: A lot of changes are taken place in the society in terms of education, living style, medical improvements and economic levels due to the company establishments.
Chronical analyses/Lab reports of Rock	:	Analyses Report attached herewith	Attached	Attached below as annexure - 3	Copy is enclosed
Temporal Photographs from the beginning (as many as possible)	:	Temporal Photographs attached herewith	Attached	Attached below	Copies are enclosed.

Total Number of Labors/Machines worked during mining activity	:	Five to Seven peson work during the mining activitiy	5 Labour and 1 Machines	14 labor	Approximately 50 persons are working directly/indirectly. 2 JCB, 4 Trucks were in operation.
Facilities for long term housing of operational workers	:	Yes	We have built labour for operation workers.	Labor are from the same village	There is the provision of Construction of Labour quarters with required facility.
Challenges due to closure of mining activities	:	● Uncertainty in regulation: ● Hidden Cost: ● Impacts on Labor: Impacts on Labor	· Uncertainty in regulation: · Hidden Cost: · Impacts on Labor: labour get job work from our mines.	· Uncertainty in regulation : Due to uncertainty Mine Owner remain totally blank from the laws changes frequently without giving time and notice ,though all major steps has been taken to adhere with laws · Hidden Cost : To bear heavy Bank interest , Advance payment to certain limit to labor , difficulties in repayment of bank / market dues · Impacts on Labor : They face very difficulties to earn daily wages up to near by center like Veraval far as much as 15 km instead of	· Uncertainty in regulation: · Hidden Cost: · Impacts on Labor:

				working in mine near to their home Due to pandemic situation their lively hood has gone even worse Mining activity for labour is most safest method for their lively hood	

Checklists		Kherali Lime Stone Mine	Kherali Lime Stone Mine	Damasa Lime Stone Mine	Undari Lime Stone Mine
Name of the owner/Firm	:	**M/s. Somnath hydrated Lime & Chemicals Industries Pvt. Ltd.**	**M/s. Noormahamad Kalubhai Patani**	**M/s. Vikram Chemical Co.**	**M/s. Dhirajlal Panchanbhai Vachhani**
Survey No.		**42/1**	**49**	**110/p**	**49/p**
Mine Address	:	Village Kherali, Taluka - Veraval, Dist. – Gir Somnath	Village Kherali, Taluka - Veraval, Dist. – Gir Somnath	Village Damasa, Taluka - Una, Dist. – Gir Somnath	Village Undari, Taluka - Una, Dist. – Gir Somnath
Contact Details (i) Email Address (ii) Mobile Number	:	(i) smpatel@yahoo.com (ii) 9825907082	(i) samirminerals@yahoo.in (ii) 9824659216	(i) vikramconstruction@hotmail.com (ii) 9429198488	(i) Rajeshnladani@gmail.com (ii) 9825073466/ 9978011900
Lease Area (in Hector)	:	1	4.2593 hectares	2.00 Hact.	4.00 Ha
Mining Plan (Include Mine Closure Plan)	:	Applicable	IBM REGN.NO.IBM/545/ 2011	Applicable	Applicable

Total Project Cost (Provide with and without Environmental Management Plan (EMP) Cost)	:			Project-cost	18 Lakh, As per EIA report
Details of Recognized Qualified Person (RQP)	:	Shilendrasinghbist	IBM/545/2011	Oversease Mintec	Mr. Vinod kumar Jain
Type/Method of Mining	:	Opencast Mining / Mechanized method	Opencast Mining / Mechanized method	Opencast Mining / Mechanized method	Opencast Mining / Mechanized method
Period of Mining proposed	:	50 years	2016-17 to 2018-19	50 Years	50 Year
Method of Mining	:	Machine	Open Cast Mining.	Mechanic	Mechanized (Using JCB, HITACHI, & Dumper)
Production (Quantity in Tonnes)	:	155042,MT	21061 M.T (2016-17) 43765 M.T. (2017-18) 98509 M.T(2018-19)	25000 MT.	2,87,012 (2020-21) as per mining plan and working operation are stopped from 25/10/2018
New or existing Mine	:	Exe sting mines		Exe sting Mines	Existing Mine
If in case of existing Limestone-mine, the length, width and depth to which Mining has already been done (below the ground level/ above the ground level)	:	· Length (m):114 M · Width (m) :98 M · Depth (m) :207 M	· Length (m): · Width (m) : · Depth (m) :	· Length (m):61 · Width (m) :10 · Depth (m) :1.5	As per mining plan and EIA report
If Mining had been done below the ground level/above the Ground level, the height of	:	Not Applicabile	- 3mtrs - average below ground level - Average height of the workings : 3mtrs.	Not Applicable	Not Applicable

Mining already done					
Name of the owner who had earlier undertaken the Mining & a copy of mining lease issued with date, if he is different from the present applicant	:	Attached lease deed	N.A.	Attached mining plan lease deed	Not Applicable
Proof of land ownership. If owned Title Deed. If not then land agreement/ lease copy entered with the owner (to be enclosed) details	:	Lease Deed enclosed.	Lease Deed enclosed.	Attached mining plan lease deed	Deed Attached (Annexure 01)
Land use pattern for a radius of 500 m to 1 km around the Mining site such as Agriculture, Water body, Habitation etc.	:	Open River		Nirma Limited Mines.	Other Mining site and agriculture
Details of other quarries for a radius of 500 m to 1 km, around the Mining site	:	West Gaverhment land		Nirma Limited Mines.	Hashmukhbhai Tulsibhai Hariyani (500-meter, Quarry Lease)
Aerial distance to the nearest eco- sensitive areas, Forests, Monuments, Coastal Regulation Zone (CRZ),	:	NO	No eco sensitive zone, Forest, Monuments, CRZ etc. located within 10-15 Kms. of the lease area.	NO	Not Applicable

etc., within 10-15 kms of these areas					
Copy of explosives license and a consent letter/ agreement of competent recognized person who has agreed to handle explosive for the blasting, in case of Limestone Mines	:	There is no blasting in this mine, we don't have any explosives license for this Limestone Mines	There is no blasting in this mine, we don't have any explosives license for this Limestone Mines	There is no blasting in this mine, we don't have any explosives license for this Limestone Mines	There is no blasting in this mine, we don't have any explosives license for this Limestone Mines
Brief details of Air Pollution Control (APC) measures taken during mining and transportation	:	Water Sprinking for dust suppression planting trees along the periphery during mining and transportation.	Water sprinkling	Water Sprinking for dust suppression planting trees along the periphery during mining and transportation.	Water Sprinkling for dust suppression planting tail trees along the periphery during mining and transportation
Brief details of Control measures taken to reduce the generated noise and vibrations	:	Vehicles will be installed with muffler machinery will br lubricated perioclically	- using less noise generating machinery i.e. small scale machinery.	Vehicles will be installed with muffer machinery will be lubricated periodically.	All vehicles are installed with muffler machinery and lubricated periodically
Water requirement: **a) Drinking & domestic purposes KLD** **b) Dust suppression (KLD)** **c) Green belt (KLD)**	:	1.0KLPD 8.52KLPD 14.84KLPD	a- 0.5 KLD b- 1KLD c - 1KLD	0.2KLPD 2.13 KLPD 2.22 KLPD	a) 2000 Lit/day b) 4000 Lit/day c) 1000 Lit/day

Source of Water (Provide details for the Source of Water) (Provide details for the GroundwaterTable)	:	From Near by village	12M	Mine Pit (Ground water table in meter BGL 45- 50 M)
Impact on Water sources (With Statement)	: · Low : · Moderate : · High :	Ground water is faraway from the workings i.e. Mine workings are less than 4mtrs from the surface level , hence there is no any chance to disturb the ground water. There is no any processing plants or process. Hence there is no any chance of impact on surface water. How ever due to ground water recharging , the water level goes up and available through out the year for agricultural works in the surrounding areas	Low : There is No Seasonal Stream near mining area. · · Moderate : · High :	There is no seasonal stream and nallah flowing through the mining area, due to ground water recharging, the water level goes up and available throughout year for agriculture works in surrounding areas

Positive/Negative impacts of mining activity (With Statement on each segment)	:	· Environmental :Positive because we foollw rule of EIA 2006 · Societal :Mining creates jobs and economic opportunities · Biodiversity: · Climatic:	Engg: Adequate qualified and competent persons are deployed for statutory compliance to maximum level. Admin: Total operations are monitored by qualified and competent persons. Tech: Small scale Rock breakers are in use for ROM Generation in the place of conventional blasting methods which is environmental friendly. Behavior: A lot of changes are taken place in the society in terms of education, living style, medical improvements and economic levels due to the company establishments.	· Environmental :positive because we follow rule of EIA 2006. · Societal :mining creates jobs and economic opportunities. · Biodiversity: · Climatic:	· Environmental: Positive impact because we follow rule of EIA 2006 · Societal: Mining creates jobs and economic opportunities · Biodiversity: less impact on biodiversity · Climatic: we follow environment rule for less impact in climate.

In case of negative impacts how company will reduce those impacts (With Statement on each segment)		· Engineering-Based:based change In EMP plan and reduse impacts · Administrative: mange good relationshipwith · Technological: use new technology for reduse impacts · Behavioral: we create good relationshipwith worker and villagers	Engg: Adequate qualified and competent persons are deployed for statutory compliance to maximum level. Admin: Total operations are monitored by qualified and competent persons. Tech: Small scale Rock breakers are in use for ROM Generation in the place of conventional blasting methods which is environmental friendly. Behavior: A lot of changes are taken place in the society in terms of education, living style, medical improvements and economic levels due to the company establishments.	· Engineering-Based:change in EMP plan and reduse impacts. · Administrative:manage good relationship. · Technological:use new technology for reduce impacts. · Behavioral:We create good relationshipwith works and villagers.	· Engineering-Based: Qualified and competent persons are deployed · Administrative: Total operations are monitored by qualified · Technological: use new technologies for reduce impact · Behavioral: A lot of changes are taken place in the society in terms of education, medical improvements due to the company establishment
Chronical analyses/Lab reports of Rock	:	Attached	Copy is enclosed	Attached	Lab Report Attached (Annexure 02)
Temporal Photographs from the beginning (as many as possible)	:	Attached	Copies are enclosed.	Attached	Site Photographs are Attached (Annexure 03)
Total Number of Labors/Machines worked during mining activity	:	5 worker and 1 machines	Approximately 50 persons are working directly/indirectly. 1 JCB, 3 Trucks were in operation.	5 Labour and 1 Machines	10 Number of Labors use, JCB & Dumper Trucks are use during Mining activity

Facilities for long term housing of operational workers	:	NO	There is the provision of Construction of Labour quarters with required facility.	We have built labour for operation workers.	No
Challenges due to closure of mining activities	:	· Uncertainty in regulation: · Hidden Cost: · Impacts on Labor: Labor get job work from our mines	· Uncertainty in regulation: · Hidden Cost: · Impacts on Labor:	· Uncertainty in regulation: · Hidden Cost: · Impacts on Labor:labour get job work from our mines.	· Uncertainty in regulation: · Hidden Cost: · Impacts on Labor:

Checklists		**Zadaka Lime Stone Mine**	**Khorasa Lime Stone Mine**	**Khorasa Lime Stone Mine**	**Gorakhmadhi Lime Stone Mines**	**Kodidra Lime Stone Mines**	**Dari Lime Stone Mine**
Name of the owner/Firm	:	**M/s. Somnath hydrated Chemicals**	**M/S. Dinesh Kumar & Company**	**M/s. Rajsi Rana Jotava Limestone Mine**	**M/s. GHCL Limited**	**M/s. GHCL Limited**	**M/s. S. J. Trivedi Limestone Mine**
Survey No.		**Meghal River bed**	**2/p**	**29/p**	**408/6/p**	**81/p**	**123**
Mine Address	:	Village Zadaka, Taluka - Maliya, Dist. – Junagadh	Village Khorasa, Taluka - Maliya, Dist. – Junagadh	Village Khorasa, Taluka - Maliya, Dist. – Junagadh	Village Gorakhmadhi, Taluka - Sutrapada, Dist. – Gir Somnath	Village Kodidra, Taluka - Veraval, Dist. – Gir Somnath	Village Dari, Taluka - Veraval, Dist. – Gir Somnath
Contact Details (i) Email Address (ii) Mobile Number	:	(i) smpatel@yahoo.com (ii) 9825907082	(i) dineshkumarandcompanyvrl@gmail.com (ii) 9824623327	(i) transportsagar@ymail.com (ii) 9426236736	(i) mining@ghcl.co.in : muralimohan@ghcl.co.in (ii) 93288 49666 ; 9099093070	(i) mining@ghcl.co.in : muralimohan@ghcl.co.in (ii) 93288 49666 ; 9099093070	(i) rjtrivedi9@gmail.com (ii) 9898334298
Lease Area (in Hector)	:	10.00	5.00	4.00	4.36	4.70	Original granted area 9.35 Ha Current

							lease area 4.95 Ha from 2007
Mining Plan (Include Mine Closure Plan)	:	Applicable	Applicable	684(4)(1)/MP/ -250/2019-20-GNR/2369 on Dated 25.11.2019. Enclosed mining plan	Mine plan was vaid upto 31st March 2019.Mining stopped in July 2018	684(4) (1) / MP-08 dtd. 30/03/2017. Valid upto 31st March 2021.	Attached as Annexure 1
Total Project Cost (Provide with and without EMP Cost)	:		Total Project cost 51 lakh with EMP and without EMP 1576525	Project Cost-30 Lacs Environmental Management Plan- 3.22 Lac	50 laks/year (It includes infrastructure, out sourcing cost, admin, legal and statutory compliance costs etc.)	60 laks /Year(It includes infrastructure, out sourcing cost, admin, legal and statutory compliance costs etc.)	20 lakh without EMP
Details of RQP	:	Shilendra singh bist	Mr. Vinod kumar jain	Mr. Arun Kumar Yadav	Shri. S.C. Sharma, ; IBM/5292/2011	Shri. S.C. Sharma, ; IBM/5292/2011	Vinod kumar Jain (RQP) Udaipur
Type/Method of Mining	:	Opencast Mining / Mechanized method	Opencast Mining / Mechanized method	Opencast Mining / Mechanized method	Opencast Mining / Mechanized method	Opencast Mining / Semi-mechanized method	Opencast Mining / Mechanized method
Period of Mining proposed	:	50 years	50 year	34.4 Years	2017-18 to 2018-19	2017-18 to 2020-21	Upto 26/03/2020
Method of Mining	:	Machine	Mechanized	Mechanized	Open Cast Mining.	Semi mechanized mines. Limestone mineral is dislodged by using rock breaker and further broken down into required plant size by deployment of labours.	Open cast, Semi – mechanized method

Production (Quantity in Tonnes)	:	155042,MT	120846 as per mining plan and working operation are stopped from 28/10/2018	99906 MT Enclosed mining plan	11941.800 M.T. (2017-18) 2727.670 M.T(2018-19) From 1st July-2018 , the work operations are completely stopped.	14252.470 M.T. (2017-18) 9341.710 M.T(2018-19) From 1st July-2018 , the work operations were completely stopped.	264378.00 MT from 1968 to 2014 Since then mine closed
New or existing Mine	:	Existing mines	Existing Mine	Existing Mine	Existing	Existing	Existing mine since 1968
If in case of existing Limestone-mine, the length, width and depth to which Mining has already been done (below the ground level/ above the ground level)	:	· Length (m):114 M · Width (m) :98 M · Depth (m) :207 M	· Length (m):3 · Width (m) :3 · Depth (m) :15	· Length (m):3 · Width (m) :3 · Depth (m) :4	· Length (m):200 mts. · Width (m) : 110 mts · Depth (m) : 3 mts.	l Length (m):370 mts. · Width (m) :70 mts. · Depth (m) :2 to 6 mts.	Above ground level: - 1 to 3 m Below ground level Length (m) Width (m) Depth (m) :- 1 45 45 4
If Mining had been done below the ground level/above the Ground level, the	:	Not Applicable	Not applicable	NA	- 3mtrs - average below ground level - Average height of the workings: 3mtrs.	- 5 mtrs - average below ground level - Average height of the workings: 4 mtrs.	Above Ground level Height was 1 m to 3m Below ground level done as above

height of Mining already done							
Name of the owner who had earlier undertaken the Mining & a copy of mining lease issued with date, if he is different from the present applicant	:	Attached lease deed	Not applicable	NA	N.A.	N.A.	NA
Proof of land ownership. If owned Title Deed. If not then land agreement/ lease copy entered with the owner (to be enclosed) details	:	Attached	Attached (annexure 01)	Lease Deed Enclosed	Lease Deed enclosed.	Lease Deed enclosed.	Lease deed copy attached as annexure - 2

Land use pattern for a radius of 500 m to 1 km around the Mining site such as Agriculture, Water body, Habitation etc.	:	Open River	Other Mining site and agriculture		**North**- Agricultural land, **East**- Agricultural land and a seasonal river at a distance of 500 mts.**South** –Agricultural land, **West**- Agricultural land	**North** of lease Agricultural land, **East** of Lease- Waste land and mining lease of M/S Ambuja cement at a distance of about 125 mts., **South** of lease – Agricultural land, **West** of lease- Agricultural land and a seasonal river at a distance of 150 mts.	No Nearest human habitation to 01 km, all surrounded by barren or Govt waste land
Details of other quarries for a radius of 500 m to 1 km, around the Mining site	:	West Gaverhment land	Rajshibhai ranabhai jotva lime stone mines		Nakhada Mine boundary of GHCL Ltd, is at a distance of 0.9 Kms. from Gorakhmadi lease.	Lease of M/S Ambuja Cement at a distance of about 125 mts. from our lease area towards west side.	No mining lease around 1 km
Aerial distance to the nearest eco-sensitive areas, Forests, Monuments, Coastal Regulation Zone (CRZ), etc.,	:	NO	Not applicable	None	No eco sensitive zone, Forest, Monuments, CRZ etc. located within 10-15 Kms. of the lease area.	No any eco sensitive zone, CRZ monuments etc fall within 10-15 Kms from lease area except one forest land in village Pandava which is at a distance of about 1 kms	GIR NATIONAL PARK 23.3 km Lease area outside CRZ

within 10-15 kms of these areas						from lease boundary.	
Copy of explosives license and a consent letter/ agreement of competent recognized person who has agreed to handle explosive for the blasting, in case of Limestone Mines	:	There is no blasting in this mine, we don't have any explosives license for this Limestone Mines	There is no blasting in this mine, we don't have any explosives license for this Limestone Mines	There is no blasting in this mine, we don't have any explosives license for this Limestone Mines	There is no blasting in this mine, we don't have any explosives license for this Limestone Mines	There is no blasting in this mine, we don't have any explosives license for this Limestone Mines	There is no blasting in this mine, we don't have any explosives license for this Limestone Mines
Brief details of Air Pollution Control (APC) measures taken during mining and transportation	:	Water Sprinkling for dust suppression planting trees along the periphery during mining and transportation.	Water sprinkling for dust suppression planting tail tress along the periphery during mining and transportation	· Water sprinkling will be done twice during the day in summer season and once during the day in winter season for settling of dust particles. · Sharp drill bits will be used for drilling and they will be maintained periodically to reduce the generation of dust. · Drilling machines will have bag	Water sprinkling. Quarterly Air monitoring by third party.	Water sprinkling	Water sprinkling will be done twice during the day in summer season and once during the day in winter season for settling the dust particle due to transportation of material

				filters attached to them also to prevent the dust to get air borne.			
Brief details of Control measures taken to reduce the generated noise and vibrations	:	Vehicles will be installed with muffler machinery will be lubricated prevocalically	Vehicles will be installed with muffler machinery will be lubricated periodically	· Proper and timely maintenance of machine excavator, transport vehicle will help to reduce sound nuisance as much as possible. · Trees will be planted on both the sides of the roads and near the office etc. to attenuate noise generated during mining. · Noise level measurement in the mine area will be carried out quarterly. Use of personal protective equipment i.e. ear plugs/ear muffs etc. to the operator of excavator and transport vehicle will be	Using less noise generating machinery i.e. small scale machinery. Regular maintenance and servicing of the machine.	Using less noise generating machinery i.e. small-scale machinery.	Thick plantation is proposed along the mine boundary within lease area which reduce noise and vibration

		provided. · Proper maintenance, oiling and greasing of machines at regular intervals will be done to reduce noise generation. · Regular monitoring of noise level will be done quarterly at the stations identified. Regular medical examination of workers for audiometric will be done, and also use of ear muffs by workers on duty will be ensured. · Use of physical barriers and greenbelt development around the mine lease area to restrict the noise levels from going outside the proposed mine boundary during operation.

Water requirement (KLD): a) Drinking & domestic purposes b) Dust suppression c) Green belt	:	1.0KLPD 8.52KLPD 14.84KLPD	a)0.5 KLPD b)4.26 KLPD C)7.42 KLPD	0.0945 0.35 4.12	a- 0.5 KLD b-1KLD c - 1KLD	a- 0.5 KLD b-1KLD c - 1KLD	a) Drinking & domestic purposes (KLD): 0.60 b) Dust suppression (KLD): 0.58 c) Green belt (KLD): 7.93
Source of Water (Provide details for the Source of Water) (Provide details for the Groundwater Table)	:		Mine Pit (Ground Water Table in meter BGL 40-43 M)	From plant site	From plant site.	From plant site	Nearby Well from agriculture farm
Impact on Water sources (With Statement)	:	· Low: · Moderate: · High:	There is no seasonal stream and nallah flowing through the mining area due to ground water recharging, the water level goes up and available throughout the year for agricultural works in the surrounding areas	Low: - As the mining activity will be very limited and deployment of machines will be very limited, the impact predicted due to spillage will be negligible as it will restrict to mining pits and up to the dump / stack areas.	Ground water is far away from the workings i.e. Mine workings are less than 4mtrs from the surface level, hence there is no any chance to disturb the ground water. There is no any processing plants or process. Hence there is no any chance of	Ground water is far away from the workings i.e. Mine workings are less than 6 m from the surface level, hence there is no any chance to disturb the ground water. There is no any processing plants or process. Hence there is no any chance of	Since water table is very deep & mining will be carried out much above the water table therefore there will be no impact on ground water

				impact on surface water. However due to ground water recharging, the water level goes up and available throughout the year for agricultural works in the surrounding areas	impact on surface water. However due to ground water recharging, the water level goes up and available throughout the year for agricultural works in the surrounding areas	
Positive/ Negative impacts of mining activity (With Statement on each segment)	:	· Environmental: Positive because we follow rule of EIA 2006 · Societal: Mining creates jobs and economic opportunities · Biodiversity: · Climatic:	· Environmental: positive impact because we follow rule of EIA 2006 · Societal: mining creates jobs and economic opportunities · Biodiversity: less impact on biodiversity · Climatic: we follow environment rule for less impact in climate	· Environmental: There will be positive impact due to greenbelt development in and around the mine area. · Societal: Living condition will be improved due to employment meet from project. · Biodiversity: No negative impact anticipated. · Climatic: No negative impact anticipated.	l A lot of changes are taken place in the society in terms of education, living style, medical improvements and economic levels due to the company establishments. l Rocky land is converted into agricultural land, which is improving environmental conditions. It has its own impact on agri. Production, for social and public support.	A lot of changes are taken place in the society in terms of education, living style, medical improvements and economic levels due to the company establishments.	Environmental : Green belt along the roads will improve the environment of surrounding Societal : The project will contribute additional revenue to the state and central Govt in form of royalty , DMF ,NMET and other taxes the people in area will be to utilize improved facilities

	with regard to education, health care , hygiene and small business opportunities etc Biodiversity : Less impact on Bio diversity Climatic: we follow environment rules for less impact in climate however there is no hazardous gas or water generation in mining activity

In case of negative impacts how company will reduce those impacts (With Statement on each segment)	· Engineering- Based: based change In EMP plan and reduce impacts · Administrative: mange good relationship with · Technological: use new technology for reduce impacts · Behavioral: we create good relationship with worker and villagers	· Engineering-Based: qualified and competent persons are deployed · Administrative: Total operations are monitored by qualified · Technological: use new technology for reduce impacts · Behavioral: A lot of changes are taken place in the society in terms of education, medical improvements due to the company establishments	None · Engineering-Based: · Administrative: · Technological: · Behavioral: A lot of changes are taken place in the society in terms of education, living style, medical improvements and economic levels due to the mine's establishments	l Engg: Adequate qualified and competent persons are deployed for statutory compliance to maximum level. l Admin: Total operations are monitored by qualified and competent persons. l Tech: Small scale Rock breakers are in use for ROM Generation in the place of conventional blasting methods which is environmental friendly. l Behavior: A lot of changes are taken place in the society in terms of education, living style, medical improvements and economic levels due to the company	**Positive:** We are excavating the area so there is pit and in rainy seasons it is filled up by water which recharges the nearby area and used by nearby farmers. **Negative:** When we do mine the negative impact may be noise, air and water pollution and safety of the nearby area's people. For that we are taking utmost care like in place of drilling and blasting we are using small scale rock breaker, sprinkling water on haul roads for suppression of dust and we are working above the ground water table. For safety we made bunds, did whole	Engineering-Based: Qualified mining engineer is hired Administrative: Total mining activity are monitored by experience and qualified person Technological: Uses of latest technology to reduce impact Behavioral: Due to increase in economic strength of labor educational and agriculture improvement has become possible and awareness in medical health checkup increase

					establishments. l We are excavating the area so there is change in topography. However the mined out pits are filled up by water in rainy season which recharges the ground water table in nearby areas which is available for agricultural works throughout year.	area fenced off and our staffs and security guards are there for unauthorized entry to near and around the areas.	
Chronical analyses/ Lab reports of Rock	:	Attached	Attached (annexure 02)	Copy is enclosed	Copy is enclosed	Copy is enclosed	Attached as annexure - 3
Temporal Photographs from the beginning (as many as possible)	:	Attached	Attached (annexure 03)	Copies are enclosed	Copies are enclosed.	Copies are enclosed.	Attached below
Total Number of Labours/ Machines worked during mining activity	:	5 worker and 1 machine	5 worker and 1 machine	Labours 5 Machine 1	App. 50 person were working directly/indirectly (like local people, sellers, merchants etc.) 1JCB, 5 Trucks were in operation.	App. 18 person are working directly/indirectly. 1JCB and 5 Trucks were in operation.	14 labor

Facilities for long term housing of operational workers	:	NO	No	NA as local labour will be deployed	There is the provision of Construction of Labour quarters with required facility.	There is the provision of Construction of Labour quarters with required facility.	Labor are from the same village
Challenges due to closure of mining activities	:	· Uncertainty in regulation: · Hidden Cost: · Impacts on Labor: Labor get job work from our mines	· Uncertainty in regulation: · Hidden Cost: · Impacts on Labor:	None	· Uncertainty in regulation: · Hidden Cost: · Impacts on Labor · Unemployment to local people.	Uncertainty in regulation: Hidden Cost: We deployed statutory person for safety and environmental caring purpose which costs us. Impacts on Labor:	Uncertainty in regulation : Due to uncertainty Mine Owner remain totally blank from the laws changes frequently without giving time and notice ,though all major steps has been taken to adhere with laws Hidden Cost : To bear heavy Bank interest , Advance payment to certain limit to labor , difficulties in repayment of bank / market dues Impacts on Labor :

	They face very difficulties to earn daily wages up to nearby center like Veraval far as much as 15 km instead of working in mine nearby to their home Due to pandemic situation their lively hood has gone even worse Mining activity for labor is most safest method for their lively hood

Annexure VI: *Damage cost assessment calculated with CPCB Guidelines for individual mines.*

Mine. No.	Lessee	CPCB Guidelines for penalty/compensation					
		Pollution Index (PI)	Number of days in Violation (N)	Factor in Rs (R)	Scale of Operation (S)	Location Factor (LF)	Total EC/Penalty (Rs.)
1.	M/s Gopalsinh Himmatsinh Chauhan	60	500	250	0.5	1	**37,50,000**
2.	M/s Vajesinh Dansinh Mori	60	500	250	0.5	1	**37,50,000**
3.	M/s R. J. Trivedi & Co.	60	5750	250	0.5	1	**4,31,25,000**
4.	M/s Aher Bhagwan Bhimsinh	60	5250	250	0.5	1	**3,93,75,000**
5.	M/s Somnath Hydrated Lime & Chemicals Industries Pvt. Ltd.	60	3000	250	0.5	1	**2,25,00,000**
6.	M/s Noormahamad Kalubhai Patani	60	750	250	0.5	1	**56,25,000**
7.	M/s Vikram Chemical Company	60	250	250	0.5	1	**18,75,000**
8.	M/s Dhirajlal Panchabhai Vachhani	60	750	250	0.5	1	**56,25,000**
9.	M/s Somnath Hydrated Chemicals	60	5250	250	0.5	1	**3,93,75,000**
10.	M/s Dinesh Kumar & Company	60	750	250	0.5	1	**56,25,000**
11.	M/s Rajsi Rana Jotava Limestone Mine	60	750	250	0.5	1	**56,25,000**
12.	M/s GHCL Ltd.	60	6000	250	0.5	1	**4,50,00,000**
13.	M/s GHCL Ltd. (Kodidra)	60	750	250	0.5	1	**56,25,000**
14.	M/s S. J. Trivedi Limestone Mine	60	4500	250	0.5	1	**3,37,50,000**

Annexure VII: *Damage cost assessment calculated as per Guidelines of SEIAA-SEAC, GoG for individual mines.*

Sr. No.	General Information				Air Pollution (AP)		Transport		Water Pollution	Solid & Hazardous Waste (SHW)		Noise & Vibration (NV)	Green Belt (GB)			Hydrogeology (HG)	Risk Hazards/Occupati		Corporate Environmental	Soil Conservatio	Total Damage Assessment Cost (Rs.)
	Lessee	Lease area (Ha)	Production (considered under violation)		Water requirement (KLD)	Cost of Water per year (Rs.)	Length of Road (m)	Cost of water sprinkilling (Rs.)	Water pollution envisioned	Quantity of OB/Mine waste (MT)	Cost of Handling OB/Mine waste (Rs.)		10% of lease area (Sq.m)	Cost of GB (Rs.)	Maintenance Cost (Rs.)		No. of Workers	Cost (Rs.)	2% of Mineral sale value	Cost of Soil Preservation (Rs.)	
			Production Year	Total Production																	
1	M/s Gopalsinh Himmatsinh Chauhan	2	2016-17	66588.91	2	50000	0	0	0	12000	240000	0	2000	50000	72500	0	55	71500	426169.024	20000	
		2	2017-18	23372.13	2	50000	0	0	0			0			72500	0	21	27300	149581.632		
		2	2018-19	0	0	0	0	0	0			0			72500	0	0	0	0		
	Total			**89961.04**		**1,00,000**		**0**	**0**		**2,40,000**	**0**		**50,000**	**2,17,500**	**0**		**98,800**	**5,75,751**	**20,000**	**13,02,051**
2	M/s Vajesinh Dansinh Mori	2	2016-17	3218	2	50000	2500	18750	0	12000	240000	0	2000	50000	72500	0	5	6500	20595.2	20000	
		2	2017-18	2164.75	2	50000	2500	18750	0			0			72500	0	4	5200	13854.4		
		2	2018-19	0	0	0	0	0	0			0			72500	0	0	0	0		
	Total			**5382.75**		**1,00,000**		**37,500**	**0**		**2,40,000**	**0**		**50,000**	**2,17,500**	**0**		**11,700**	**34,450**	**20,000**	**7,11,150**
3	M/s R. J. Trivedi & Co.	7.69	1996	2100	7.69	192250	1000	7500	0	46140	922800	0	7690	192250	108063	0	4	5200	10080	76900	
		7.69	1997	3700	7.69	192250	1000	7500	0			0			108063	0	5	6500	17760		
		7.69	1998	1430	7.69	192250	1000	7500	0			0			108063	0	3	3900	6864		
		7.69	1999	170	7.69	192250	1000	7500	0			0				0	2	2600	816		
		7.69	2000	2350	7.69	192250	1000	7500	0			0				0	4	5200	11280		
		7.69	2001	5965	7.69	192250	1000	7500	0			0				0	7	9100	33404		
		7.69	2002	2152	7.69	192250	1000	7500	0			0				0	4	5200	12051.2		
		7.69	2003	44	7.69	192250	1000	7500	0			0				0	2	2600	246.4		
		7.69	2004	160	7.69	192250	1000	7500	0			0				0	2	2600	896		
		7.69	2005-06	1230	7.69	192250	1000	7500	0			0				0	3	3900	6888		
		7.69	2006-07	14184	7.69	192250	1000	7500	0			0				0	13	16900	79430.4		
		7.69	2007-08	7450	7.69	192250	1000	7500	0			0				0	8	10400	41720		
		7.69	2008-09	8690	7.69	192250	1000	7500	0			0				0	9	11700	48664		
		7.69	2009-10	16888	7.69	192250	1000	7500	0			0				0	16	20800	108083.2		
		7.69	2010-11	10424	7.69	192250	1000	7500	0			0				0	10	13000	66713.6		
		7.69	2011-12	8200	7.69	192250	1000	7500	0			0				0	9	11700	52480		
		7.69	2012-13	3930	7.69	192250	1000	7500	0			0				0	5	6500	25152		
		7.69	2013-14	4734	7.69	192250	1000	7500	0			0				0	6	7800	30297.6		
		7.69	2014-15	6191	7.69	192250	1000	7500	0			0				0	7	9100	39622.4		
		7.69	2015-16	47363.91	7.69	192250	1000	7500	0			0				0	40	52000	303129.024		
		7.69	2016-17	39560	7.69	192250	1000	7500	0			0				0	34	44200	253184		
		7.69	2017-18	57150	7.69	192250	1000	7500	0			0				0	48	62400	365760		
		7.69	2018-19	22300	7.69	192250	1000	7500	0			0				0	20	26000	178400		
	Total			**266365.91**		**44,21,750**		**1,72,500**	**0**		**9,22,800**	**0**		**1,92,250**	**3,24,188**	**0**		**3,39,300**	**16,92,922**	**76,900**	**81,42,609**

Sr. No.	General Information				Air Pollution (AP)		Transport		Water Pollution	Solid & Hazardous Waste (SHW)		Noise & Vibration (NV)	Green Belt (GB)			Hydrogeology (HG)	Risk Hazards/Occupati		Corporate Environmental	Soil Conservatio	Total Damage Assessment Cost (Rs.)
	Lessee	Lease area (Ha)	Production (considered under violation)		Water requirement (KLD)	Cost of Water per year (Rs.)	Length of Road (m)	Cost of water sprinkilling (Rs.)	Water pollution envisioned	Quantity of OB/Mine waste (MT)	Cost of Handling OB/Mine waste (Rs.)		10% of lease area (Sq.m)	Cost of GB (Rs.)	Maintenance Cost (Rs.)		No. of Workers	Cost (Rs.)	2% of Mineral sale value	Cost of Soil Preservation (Rs.)	
			Production Year	Total Production																	
4	M/s Aher Bhagwan Bhimsinh	6.47	1994-95	700	6.47	161750	1500	11250	0	38820	776400	0	6470	161750	100438	0	3	3900	3360	64700	
		6.47	1995-96	1900	6.47	161750	1500	11250	0			0			100438	0	4	5200	9120		
		6.47	1996-97	755	6.47	161750	1500	11250	0			0			100438	0	3	3900	3624		
		6.47	1997-98	100	6.47	161750	1500	11250	0			0				0	2	2600	480		
		6.47	1998-99	17250	6.47	161750	1500	11250	0			0				0	16	20800	82800		
		6.47	1999-2000	25804	6.47	161750	1500	11250	0			0				0	23	29900	123859.2		
		6.47	2000-01	11484	6.47	161750	1500	11250	0			0				0	11	14300	64310.4		
		0	2001-02	0	0	0	0	0	0			0				0	0	0	0		
		6.47	2002-03	60	6.47	161750	1500	11250	0			0				0	2	2600	336		
		6.47	2003-04	35	6.47	161750	1500	11250	0			0				0	2	2600	196		
		6.47	2004-05	20	6.47	161750	1500	11250	0			0				0	2	2600	112		
		6.47	2005-06	10	6.47	161750	1500	11250	0			0				0	2	2600	56		
		6.47	2006-07	15	6.47	161750	1500	11250	0			0				0	2	2600	84		
		0	2007-08	0	0	0	0	0	0			0				0	0	0	0		
		0	2008-09	0	0	0	0	0	0			0				0	0	0	0		
		6.47	2009-10	42	6.47	161750	1500	11250	0			0				0	2	2600	268.8		
		6.47	2010-11	24	6.47	161750	1500	11250	0			0				0	2	2600	153.6		
		6.47	2011-12	20	6.47	161750	1500	11250	0			0				0	2	2600	128		
		6.47	2012-13	10	6.47	161750	1500	11250	0			0				0	2	2600	64		
		6.47	2013-14	20	6.47	161750	1500	11250	0			0				0	2	2600	128		
		6.47	2014-15	30	6.47	161750	1500	11250	0			0				0	2	2600	192		
		6.47	2015-16	125565	6.47	161750	1500	11250	0			0				0	102	132600	803616		
		6.47	2016-17	196030	6.47	161750	1500	11250	0			0				0	159	206700	1254592		
		6.47	2017-18	560	6.47	161750	1500	11250	0			0				0	2	2600	3584		
		0	2018-19	0	0	0	0	0	0			0				0	0	0	0		
	Total			**380434**		**33,96,750**		**2,36,250**	**0**		**7,76,400**	**0**		**1,61,750**	**3,01,313**	**0**		**4,51,100**	**23,51,064**	**64,700**	**77,39,327**
5	M/s Somnath Hydrated Lime & Chemicals Industries Pvt. Ltd.	15.1352	2005-06	83160	15.1352	378380	200	1500	0	90811	1816224	0	15135	378380	154595	0	69	89700	465696	151352	
		15.1352	2006-07	184456.7	15.1352	378380	200	1500	0			0			154595	0	150	195000	1032957.52		
		15.1352	2007-08	151950	15.1352	378380	200	1500	0			0			154595	0	124	161200	850920		
		15.1352	2008-09	69618	15.1352	378380	200	1500	0			0				0	58	75400	389860.8		
		15.1352	2009-10	67231	15.1352	378380	200	1500	0			0				0	56	72800	430278.4		
		15.1352	2010-11	31248	15.1352	378380	200	1500	0			0				0	27	35100	199987.2		
		0	2011-12	0	0	0	0	0	0			0				0	0	0	0		
		15.1352	2012-13	96456.47	15.1352	378380	200	1500	0			0				0	79	102700	617321.408		
		15.1352	2013-14	99750	15.1352	378380	200	1500	0			0				0	82	106600	638400		
		15.1352	2014-15	52350	15.1352	378380	200	1500	0			0				0	44	57200	335040		
		0	2015-16	0	0	0	0	0	0			0				0	0	0	0		
		15.1352	2016-17	102250	15.1352	378380	200	1500	0			0				0	84	109200	654400		
		15.1352	2017-18	194350	15.1352	378380	200	1500	0			0				0	157	204100	1243840		
		15.1352	2018-19	94000	15.1352	378380	200	1500	0			0				0	77	100100	752000		
	Total			**1226820.17**		**45,40,560**		**18,000**	**0**		**18,16,224**	**0**		**3,78,380**	**4,63,785**	**0**		**13,09,100**	**76,10,701**	**1,51,352**	**1,62,88,102**

Sr. No.	General Information				Air Pollution (AP)		Transport		Water Pollution	Solid & Hazardous Waste (SHW)		Noise & Vibration (NV)	Green Belt (GB)			Hydrogeology (HG)	Risk Hazards/Occupati		Corporate Environmental	Soil Conservatio	Total Damage Assessment Cost (Rs.)
	Lessee	Lease area (Ha)	Production (considered under violation)		Water requirement (KLD)	Cost of Water per year (Rs.)	Length of Road (m)	Cost of water sprinkilling (Rs.)	Water pollution envisioned	Quantity of OB/Mine waste (MT)	Cost of Handling OB/Mine waste (Rs.)		10% of lease area (Sq.m)	Cost of GB (Rs.)	Maintenance Cost (Rs.)		No. of Workers	Cost (Rs.)	2% of Mineral sale value	Cost of Soil Preservation (Rs.)	
			Production Year	Total Production																	
6	M/s Noormahamad Kalubhai Patani	4.2593	2016-17	21061	4.2593	106483	500	3750	0	25556	511116	0	4259.3	106483	86621	0	19	24700	134790.4	42593	
		4.2593	2017-18	43765	4.2593	106483	500	3750	0			0			86621	0	37	48100	280096		
		4.2593	2018-19	98509	4.2593	106483	500	3750	0			0			86621	0	81	105300	788072		
	Total			**163335**		**3,19,448**		**11,250**	**0**		**5,11,116**	**0**		**1,06,483**	**2,59,862**	**0**		**1,78,100**	**12,02,958**	**42,593**	**26,31,809**
7	M/s Vikram Chemical Company	2	2016-17	0	0	0	0	0	0	12000	0	0	2000	50000	72500	0	0	0	0	20000	
		2	2017-18	1873	2	50000	750	5625	0		240000	0			72500	0	3	3900	11987.2		
		2	2018-19	0	0	0	0	0	0			0			72500	0	0	0	0		
	Total			**1873**		**50,000**		**5,625**	**0**		**2,40,000**	**0**		**50,000**	**2,17,500**	**0**		**3,900**	**11,987**	**20,000**	**5,99,012**
8	M/s Dhirajlal Panchabhai Vachhani	4	2016-17	80630	4	100000	1500	11250	0	24000	480000	0	4000	100000	85000	0	67	87100	516032	40000	
		4	2017-18	109276.3	4	100000	1500	11250	0			0			85000	0	89	115700	699368.32		
		4	2018-19	82009.54	4	100000	1500	11250	0			0			85000	0	68	88400	656076.32		
	Total			**271915.84**		**3,00,000**		**33,750**	**0**		**4,80,000**	**0**		**1,00,000**	**2,55,000**	**0**		**2,91,200**	**18,71,477**	**40,000**	**33,71,427**
9	M/s Somnath Hydrated Chemicals	10	1995	43	10	250000	0	0	0	60000	1200000	0	10000	250000	122500	0	2	2600	206.4	100000	
		10	1996	46	10	250000	0	0	0			0			122500	0	2	2600	220.8		
		10	1997	66	10	250000	0	0	0			0			122500	0	2	2600	316.8		
		10	1998	46	10	250000	0	0	0			0				0	2	2600	220.8		
		10	1999	8690	10	250000	0	0	0			0				0	9	11700	41712		
		10	2000	44000	10	250000	0	0	0			0				0	37	48100	211200		
		10	2001	39610	10	250000	0	0	0			0				0	34	44200	221816		
		10	2002	55311.61	10	250000	0	0	0			0				0	46	59800	309745.016		
		10	2003	45590.89	10	250000	0	0	0			0				0	38	49400	255308.984		
		10	2004	57142.78	10	250000	0	0	0			0				0	48	62400	319999.568		
		10	2005-06	163274.5	10	250000	0	0	0			0				0	133	172900	914337.2		
		10	2006-07	146640.2	10	250000	0	0	0			0				0	119	154700	821185.12		
		10	2007-08	245506.6	10	250000	0	0	0			0				0	198	257400	1374836.96		
		10	2008-09	97861.05	10	250000	0	0	0			0				0	80	104000	548021.88		
		10	2009-10	52892.48	10	250000	0	0	0			0				0	44	57200	338511.872		
		10	2010-11	128603	10	250000	0	0	0			0				0	105	136500	823059.2		
		10	2011-12	84975.64	10	250000	0	0	0			0				0	70	91000	543844.096		
		10	2012-13	56191.78	10	250000	0	0	0			0				0	47	61100	359627.392		
		10	2013-14	62440.73	10	250000	0	0	0			0				0	52	67600	399620.672		
		0	2014-15	0	0	0	0	0	0			0				0	0	0	0		
		0	2015-16	0	0	0	0	0	0			0				0	0	0	0		
		10	2016-17	21079.37	10	250000	0	0	0			0				0	19	24700	134907.968		
		10	2017-18	103638.5	10	250000	0	0	0			0				0	85	110500	663286.4		
		0	2018-19	0	0	0	0	0	0			0				0	0	0	0		
	Total			**1413650.13**		**52,50,000**		**0**	**0**		**12,00,000**	**0**		**2,50,000**	**3,67,500**	**0**		**15,23,600**	**82,81,985**	**1,00,000**	**1,69,73,085**

Sr. No.	General Information				Air Pollution (AP)		Transport		Water Pollution	Solid & Hazardous Waste (SHW)		Noise & Vibration (NV)	Green Belt (GB)			Hydrogeology (HG)	Risk Hazards/Occupati		Corporate Environmental	Soil Conservatio	Total Damage Assessment Cost (Rs.)
	Lessee	Lease area (Ha)	Production (considered under violation)		Water requirement (KLD)	Cost of Water per year (Rs.)	Length of Road (m)	Cost of water sprinkilling (Rs.)	Water pollution envisioned	Quantity of OB/Mine waste (MT)	Cost of Handling OB/Mine waste (Rs.)		10% of lease area (Sq.m)	Cost of GB (Rs.)	Maintenance Cost (Rs.)		No. of Workers	Cost (Rs.)	2% of Mineral sale value	Cost of Soil Preservation (Rs.)	
			Production Year	Total Production																	
10	**M/s Dinesh Kumar & Company**	5	2016-17	46210	5	125000	100	750	0	3000	600000	0	5000	125000	91250	0	39	50700	295744	50000	
		5	2017-18	72649.47	5	125000	100	750	0			0			91250	0	60	78000	464956.608		
		5	2018-19	42706.87	5	125000	100	750	0			0			91250	0	36	46800	341654.96		
	Total			**161566.34**		**3,75,000**		**2,250**	**0**		**6,00,000**	**0**		**1,25,000**	**2,73,750**	**0**		**1,75,500**	**11,02,356**	**50,000**	**27,03,856**
11	**M/s Rajsi Rana Jotava Limestone Mine**	4	2016-17	39524	4	100000	150	1125	0	24000	480000	0	4000	100000	85000	0	34	44200	252953.6	40000	
		4	2017-18	70725	4	100000	150	1125	0			0			85000	0	59	76700	452640		
		4	2018-19	32310	4	100000	150	1125	0			0			85000	0	28	36400	258480		
	Total			**142559**		**3,00,000**		**3,375**	**0**		**4,80,000**	**0**		**1,00,000**	**2,55,000**	**0**		**1,57,300**	**9,64,074**	**40,000**	**22,99,749**
12	**M/s GHCL Ltd.**	8.7311	1995	54317.94	8.7311	218278	1750	13125	0	52387	1047732	0	8731.1	218278	114569	0	45	58500	260726.112	87311	
		8.7311	1996	43059.89	8.7311	218278	1750	13125	0			0			114569	0	36	46800	206687.472		
		8.7311	1997	52778.57	8.7311	218278	1750	13125	0			0			114569	0	44	57200	253337.136		
		8.7311	1998	48847.7	8.7311	218278	1750	13125	0			0				0	41	53300	234468.96		
		8.7311	1999	12811.46	8.7311	218278	1750	13125	0			0				0	12	15600	61495.008		
		8.7311	2000	2131.85	8.7311	218278	1750	13125	0			0				0	4	5200	10232.88		
		8.7311	2001	5692.2	8.7311	218278	1750	13125	0			0				0	7	9100	31876.32		
		8.7311	2002	4601.16	8.7311	218278	1750	13125	0			0				0	6	7800	25766.496		
		8.7311	2003	3071.2	8.7311	218278	1750	13125	0			0				0	4	5200	17198.72		
		8.7311	2004	2823.01	8.7311	218278	1750	13125	0			0				0	4	5200	15808.856		
		8.7311	2005-06	2360.08	8.7311	218278	1750	13125	0			0				0	4	5200	13216.448		
		8.7311	2006-07	4286.95	8.7311	218278	1750	13125	0			0				0	5	6500	24006.92		
		8.7311	2007-08	6392.02	8.7311	218278	1750	13125	0			0				0	7	9100	35795.312		
		8.7311	2008-09	8255.84	8.7311	218278	1750	13125	0			0				0	9	11700	46232.704		
		8.7311	2009-10	17701.58	8.7311	218278	1750	13125	0			0				0	16	20800	113290.112		
		8.7311	2010-11	24182.94	8.7311	218278	1750	13125	0			0				0	21	27300	154770.816		
		8.7311	2011-12	19069.33	8.7311	218278	1750	13125	0			0				0	17	22100	122043.712		
		8.7311	2012-13	16976.87	8.7311	218278	1750	13125	0			0				0	16	20800	108651.968		
		8.7311	2013-14	16412.46	8.7311	218278	1750	13125	0			0				0	15	19500	105039.744		
		8.7311	2014-15	10569.03	8.7311	218278	1750	13125	0			0				0	10	13000	67641.792		
		8.7311	2015-16	8914.05	8.7311	218278	1750	13125	0			0				0	9	11700	57049.92		
		8.7311	2016-17	12840.6	8.7311	218278	1750	13125	0			0				0	12	15600	82179.84		
		8.7311	2017-18	11941.8	8.7311	218278	1750	13125	0			0				0	12	15600	76427.52		
		8.7311	2018-19	2727.67	8.7311	218278	1750	13125	0			0				0	4	5200	21821.36		
	Total			**392766.2**		**52,38,660**		**3,15,000**	**0**		**10,47,732**	**0**		**2,18,278**	**3,43,708**	**0**		**4,68,000**	**21,45,766**	**87,311**	**98,64,455**

Sr. No.	General Information				Air Pollution (AP)		Transport		Water Pollution	Solid & Hazardous Waste (SHW)		Noise & Vibration (NV)	Green Belt (GB)			Hydrogeology (HG)	Risk Hazards/Occupati		Corporate Environmental	Soil Conservatio	Total Damage Assessment Cost (Rs.)
	Lessee	Lease area (Ha)	Production (considered under violation)		Water requirement (KLD)	Cost of Water per year (Rs.)	Length of Road (m)	Cost of water sprinkilling (Rs.)	Water pollution envisioned	Quantity of OB/Mine waste (MT)	Cost of Handling OB/Mine waste (Rs.)		10% of lease area (Sq.m)	Cost of GB (Rs.)	Maintenance Cost (Rs.)		No. of Workers	Cost (Rs.)	2% of Mineral sale value	Cost of Soil Preservation (Rs.)	
			Production Year	Total Production																	
13	M/s GHCL Ltd. (Kodidra)	4.7	2016-17	12945.34	4.7	117500	500	3750	0	28200	564000	0	4700	117500	89375	0	12	15600	82850.176	47000	
		4.7	2017-18	14136.07	4.7	117500	500	3750	0			0			89375	0	13	16900	90470.848		
		4.7	2018-19	9341.71	4.7	117500	500	3750	0			0			89375	0	9	11700	74733.68		
	Total			**36423.12**		**3,52,500**		**11,250**	**0**		**5,64,000**	**0**		**1,17,500**	**2,68,125**	**0**		**44,200**	**2,48,055**	**47,000**	**16,52,630**
14	M/s S. J. Trivedi Limestone Mine	9.35	1996-97	3629	9.35	233750	2000	15000	0	56100	1122000	0	9350	233750	118438	0	5	6500	17419.2	93500	
		9.35	1997-98	6290	9.35	233750	2000	15000	0			0			118438	0	7	9100	30192		
		0	1998-99	0	0	0	2000	15000	0			0			118438	0	0	0	0		
		9.35	1999-2000	3000	9.35	233750	2000	15000	0			0				0	4	5200	14400		
		9.35	2000-01	10585	9.35	233750	2000	15000	0			0				0	10	13000	59276		
		9.35	2001-02	9175	9.35	233750	2000	15000	0			0				0	9	11700	51380		
		9.35	2002-03	10424	9.35	233750	2000	15000	0			0				0	10	13000	58374.4		
		9.35	2003-04	9902	9.35	233750	2000	15000	0			0				0	10	13000	55451.2		
		9.35	2004-05	13020	9.35	233750	2000	15000	0			0				0	12	15600	72912		
		9.35	2005-06	10092	9.35	233750	2000	15000	0			0				0	10	13000	56515.2		
		9.35	2006-07	11916	9.35	233750	2000	15000	0			0				0	12	15600	66729.6		
		9.35	2007-08	11754	9.35	233750	2000	15000	0			0				0	11	14300	65822.4		
		9.35	2008-09	11750	9.35	233750	2000	15000	0			0				0	11	14300	65800		
		9.35	2009-10	11785	9.35	233750	2000	15000	0			0				0	11	14300	75424		
		9.35	2010-11	11760	9.35	233750	2000	15000	0			0				0	11	14300	75264		
		9.35	2011-12	11739	9.35	233750	2000	15000	0			0				0	11	14300	75129.6		
		9.35	2012-13	11754	9.35	233750	2000	15000	0			0				0	11	14300	75225.6		
		9.35	2013-14	7258	9.35	233750	2000	15000	0			0				0	8	10400	46451.2		
		9.35	2014-15	962	9.35	233750	2000	15000	0			0				0	3	3900	6156.8		
		0	2015-16	0	0	0	2000	15000	0			0				0	0	0	0		
		0	2016-17	0	0	0	2000	15000	0			0				0	0	0	0		
		0	2017-18	0	0	0	2000	15000	0			0				0	0	0	0		
		0	2018-19	0	0	0	2000	15000	0			0				0	0	0	0		
	Total			**166795**		**42,07,500**		**3,45,000**	**0**		**11,22,000**	**0**		**2,33,750**	**3,55,313**	**0**		**2,15,800**	**9,67,923**	**93,500**	**75,40,786**

Annexure VIII: *Damage cost assessment calculated as per GR of Industries and Mine Department, Government of Gujarat guidelines for individual mines.*

Mine. No.	General Information				Declared Mineral Sale Value by CGM/IBM (Rs.)	Total Sale Value of Mineral (Rs.)	Damage Assessment Cost (Rs.) (21% of total mineral value)
	Lessee	Lease area (Ha)	Production (considered under violation)				
			Production Year	Total Production			
1	M/s. Gopalsinh Himmatsinh Chauhan	2	2016-17	66588.91	320	21308451.2	60,45,382
		2	2017-18	23372.13	320	7479081.6	
		2	2018-19	0	400	0	
Total				**89961.04**		**2,87,87,533**	
2	M/s Vajesinh Dansinh Mori	2	2016-17	3218	320	1029760	3,61,721
		2	2017-18	2164.75	320	692720	
		2	2018-19	0	400	0	
Total				**5382.75**		**17,22,480**	
3	M/s R. J. Trivedi & Co.	7.69	1996	2100	240	504000	1,77,75,679
		7.69	1997	3700	240	888000	
		7.69	1998	1430	240	343200	
		7.69	1999	170	240	40800	
		7.69	2000	2350	240	564000	
		7.69	2001	5965	280	1670200	
		7.69	2002	2152	280	602560	
		7.69	2003	44	280	12320	
		7.69	2004	160	280	44800	
		7.69	2005-06	1230	280	344400	
		7.69	2006-07	14184	280	3971520	
		7.69	2007-08	7450	280	2086000	
		7.69	2008-09	8690	280	2433200	
		7.69	2009-10	16888	320	5404160	
		7.69	2010-11	10424	320	3335680	
		7.69	2011-12	8200	320	2624000	
		7.69	2012-13	3930	320	1257600	
		7.69	2013-14	4734	320	1514880	
		7.69	2014-15	6191	320	1981120	
		7.69	2015-16	47363.91	320	15156451.2	
		7.69	2016-17	39560	320	12659200	
		7.69	2017-18	57150	320	18288000	
		7.69	2018-19	22300	400	8920000	
Total				**266365.91**		**8,46,46,091**	

Mine. No.	General Information				Declared Mineral Sale Value by CGM/IBM (Rs.)	Total Sale Value of Mineral (Rs.)	Damage Assessment Cost (Rs.) (21% of total mineral value)
	Lessee	Lease area (Ha)	Production (considered under violation)				
			Production Year	Total Production			
4	M/s Aher Bhagwan Bhimsinh	6.47	1994-95	700	240	168000	2,46,86,172
		6.47	1995-96	1900	240	456000	
		6.47	1996-97	755	240	181200	
		6.47	1997-98	100	240	24000	
		6.47	1998-99	17250	240	4140000	
		6.47	1999-2000	25804	240	6192960	
		6.47	2000-01	11484	280	3215520	
		0	2001-02	0	280	0	
		6.47	2002-03	60	280	16800	
		6.47	2003-04	35	280	9800	
		6.47	2004-05	20	280	5600	
		6.47	2005-06	10	280	2800	
		6.47	2006-07	15	280	4200	
		0	2007-08	0	280	0	
		0	2008-09	0	280	0	
		6.47	2009-10	42	320	13440	
		6.47	2010-11	24	320	7680	
		6.47	2011-12	20	320	6400	
		6.47	2012-13	10	320	3200	
		6.47	2013-14	20	320	6400	
		6.47	2014-15	30	320	9600	
		6.47	2015-16	125565	320	40180800	
		6.47	2016-17	196030	320	62729600	
		6.47	2017-18	560	320	179200	
		0	2018-19	0	400	0	
Total				**380434**		**11,75,53,200**	
5	M/s Somnath Hydrated Lime & Chemicals Industries Pvt. Ltd.	15.1352	2005-06	83160	280	23284800	7,99,12,364
		15.1352	2006-07	184456.7	280	51647876	
		15.1352	2007-08	151950	280	42546000	
		15.1352	2008-09	69618	280	19493040	
		15.1352	2009-10	67231	320	21513920	
		15.1352	2010-11	31248	320	9999360	
		0	2011-12	0	320	0	
		15.1352	2012-13	96456.47	320	30866070	
		15.1352	2013-14	99750	320	31920000	
		15.1352	2014-15	52350	320	16752000	
		0	2015-16	0	320	0	
		15.1352	2016-17	102250	320	32720000	
		15.1352	2017-18	194350	320	62192000	
		15.1352	2018-19	94000	400	37600000	
Total				**1226820.17**		**38,05,35,066**	

Mine. No.	General Information				Declared Mineral Sale Value by CGM/IBM (Rs.)	Total Sale Value of Mineral (Rs.)	Damage Assessment Cost (Rs.) (21% of total mineral value)
	Lessee	Lease area (Ha)	Production (considered under violation)				
			Production Year	Total Production			
6	M/s Noormahamad Kalubhai Patani	4.2593	2016-17	21061	320	6739520	1,26,31,063
		4.2593	2017-18	43765	320	14004800	
		4.2593	2018-19	98509	400	39403600	
Total				**163335**		**6,01,47,920**	
7	M/s Vikram Chemical Company	2	2016-17	0	320	0	1,25,866
		2	2017-18	1873	320	599360	
		2	2018-19	0	400	0	
Total				**1873**		**5,99,360**	
8	M/s Dhirajlal Panchabhai Vachhani	4	2016-17	80630	320	25801600	1,96,50,505
		4	2017-18	109276.3	320	34968416	
		4	2018-19	82009.54	400	32803816	
Total				**271915.84**		**9,35,73,832**	
9	M/s Somnath Hydrated Chemicals	10	1995	43	240	10320	8,69,60,844
		10	1996	46	240	11040	
		10	1997	66	240	15840	
		10	1998	46	240	11040	
		10	1999	8690	240	2085600	
		10	2000	44000	240	10560000	
		10	2001	39610	280	11090800	
		10	2002	55311.61	280	15487250.8	
		10	2003	45590.89	280	12765449.2	
		10	2004	57142.78	280	15999978.4	
		10	2005-06	163274.5	280	45716860	
		10	2006-07	146640.2	280	41059256	
		10	2007-08	245506.6	280	68741848	
		10	2008-09	97861.05	280	27401094	
		10	2009-10	52892.48	320	16925593.6	
		10	2010-11	128603	320	41152960	
		10	2011-12	84975.64	320	27192204.8	
		10	2012-13	56191.78	320	17981369.6	
		10	2013-14	62440.73	320	19981033.6	
		0	2014-15	0	320	0	
		0	2015-16	0	320	0	
		10	2016-17	21079.37	320	6745398.4	
		10	2017-18	103638.5	320	33164320	
		0	2018-19	0	400	0	
Total				**1413650.13**		**41,40,99,256**	

Mine. No.	General Information				Declared Mineral Sale Value by CGM/IBM (Rs.)	Total Sale Value of Mineral (Rs.)	Damage Assessment Cost (Rs.) (21% of total mineral value)
	Lessee	Lease area (Ha)	Production (considered under violation)				
			Production Year	Total Production			
10	M/s Dinesh Kumar & Company	5	2016-17	46210	320	14787200	1,15,74,733
		5	2017-18	72649.47	320	23247830.4	
		5	2018-19	42706.87	400	17082748	
Total				161566.34		5,51,17,778	
11	M/s Rajsi Rana Jotava Limestone Mine	4	2016-17	39524	320	12647680	1,01,22,773
		4	2017-18	70725	320	22632000	
		4	2018-19	32310	400	12924000	
Total				142559		4,82,03,680	
12	M/s. Gopalsinh Himmatsinh Chauhan	8.7311	1995	54317.94	240	13036305.6	2,25,30,544
		8.7311	1996	43059.89	240	10334373.6	
		8.7311	1997	52778.57	240	12666856.8	
		8.7311	1998	48847.7	240	11723448	
		8.7311	1999	12811.46	240	3074750.4	
		8.7311	2000	2131.85	240	511644	
		8.7311	2001	5692.2	280	1593816	
		8.7311	2002	4601.16	280	1288324.8	
		8.7311	2003	3071.2	280	859936	
		8.7311	2004	2823.01	280	790442.8	
		8.7311	2005-06	2360.08	280	660822.4	
		8.7311	2006-07	4286.95	280	1200346	
		8.7311	2007-08	6392.02	280	1789765.6	
		8.7311	2008-09	8255.84	280	2311635.2	
		8.7311	2009-10	17701.58	320	5664505.6	
		8.7311	2010-11	24182.94	320	7738540.8	
		8.7311	2011-12	19069.33	320	6102185.6	
		8.7311	2012-13	16976.87	320	5432598.4	
		8.7311	2013-14	16412.46	320	5251987.2	
		8.7311	2014-15	10569.03	320	3382089.6	
		8.7311	2015-16	8914.05	320	2852496	
		8.7311	2016-17	12840.6	320	4108992	
		8.7311	2017-18	11941.8	320	3821376	
		8.7311	2018-19	2727.67	400	1091068	
Total				392766.2		10,72,88,306	

Mine. No.	General Information				Declared Mineral Sale Value by CGM/IBM (Rs.)	Total Sale Value of Mineral (Rs.)	Damage Assessment Cost (Rs.) (21% of total mineral value)
	Lessee	Lease area (Ha)	Production (considered under violation)				
			Production Year	Total Production			
13	M/s GHCL Ltd. (Kodidra)	4.7	2016-17	12945.34	320	21308451.2	26,04,574
		4.7	2017-18	14136.07	320	7479081.6	
		4.7	2018-19	9341.71	400	0	
Total				**36423.12**		**1,24,02,735**	
14	M/s S. J. Trivedi Limestone Mine	9.35	1996-97	3629	240	870960	1,01,63,194
		9.35	1997-98	6290	240	1509600	
		0	1998-99	0	240	0	
		9.35	1999-2000	3000	240	720000	
		9.35	2000-01	10585	280	2963800	
		9.35	2001-02	9175	280	2569000	
		9.35	2002-03	10424	280	2918720	
		9.35	2003-04	9902	280	2772560	
		9.35	2004-05	13020	280	3645600	
		9.35	2005-06	10092	280	2825760	
		9.35	2006-07	11916	280	3336480	
		9.35	2007-08	11754	280	3291120	
		9.35	2008-09	11750	280	3290000	
		9.35	2009-10	11785	320	3771200	
		9.35	2010-11	11760	320	3763200	
		9.35	2011-12	11739	320	3756480	
		9.35	2012-13	11754	320	3761280	
		9.35	2013-14	7258	320	2322560	
		9.35	2014-15	962	320	307840	
		0	2015-16	0	320	0	
		0	2016-17	0	320	0	
		0	2017-18	0	320	0	
		0	2018-19	0	400	0	
Total				**166795**		**4,83,96,160**	