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Qualitative analysis of socio-environmental factors of sand mining on Mithri Tributary of Luni River at Kosana, Pipar Jodhpur Dist. of Rajasthan, India

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Abstract

The study conducted in Mithri River which is the tributary of Luni River situated in Kosana village of Jodhpur district, Rajasthan shows that socio-environmental situation due to sand mining is in controlled condition except for the disturbance of land profile. Indiscriminate and illegal sand mining has created negative impacts on land use, deforestation and fauna diversity. Mining activities and piling of mined sand near the river bank is affecting the natural topography of the River bed. In this study, the difference expected to occur in livelihood and community standards of the study area.

Keywords: Environmental Impact Assessment, Sand mining, Rajasthan.

Introduction

Sand mining is the process of taking away of sand from their natural composition[1]. Rivers are natural sources which are given benefits to the human being for centuries. But it is required to understand how the river ecosystem functions and sustain its life. Lots of world's rivers have been changed by over exploitation of living and nonliving wealth of river. Nature of many rivers has been distorted by haphazard mining of nonliving resources like sand and gravel from the riverbed. Sand mining projects have socio-economical profit for community, but it can also have environmental trouble[2-10]. Analysis of Socio-Environmental effect factors due to sand mining is a practice of examining the environmental impacts of a projected development or mining, considering interconnected socio-economic, cultural and human-health impacts, both positive and negative[1,3,4,7,11-17]. Excessive sand mining is a common practice throughout India. It is quite essential for construction sector whose development is a must for countries like India. But also this is an environmental degradation process which is damaging the soil profile and in turn, disturbing the geography of the Area. This can further lead to unwanted changes which may be not favorable to the ecosystem. This study analyzed the various environmental factors like ground and surface water quality, soil quality, air quality, noise quality, flora and fauna diversity along with social impact[12,13]. These environmental factors are compared to the normally accepted standards. The mining site comprises of Mithri River which is the tributary of Luni River. The project study conducted within a fringe of 12 km radius from the proposed leased sand mining site. The site area is located between village Kosana and Malawas in Pipar Tehsil in Jodhpur district (Figure-1). The area is covered in the survey of India Toposheet no. 45 F/11.

The study has been done by emphasizing on the method by which data has been collected, preserved and analyzed referring to the various researches carried out in this area. The Important discussion about the current scenario and interesting finding are highlighted in the next section.

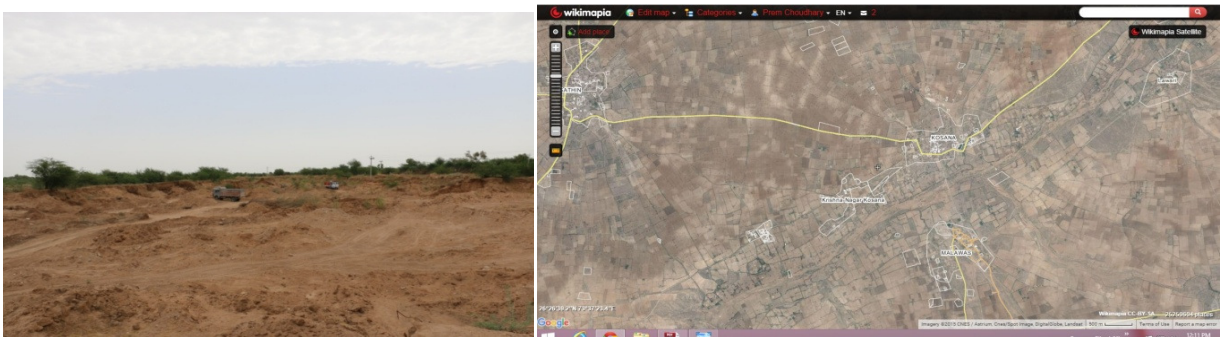

Figure-1: Mining Site and Satellite Image of Mining site.

Methodology

The study period defined is Dec 2015 –Jan 2016, Feb 2016. The disciplines covered by the baseline data collection program include the effect of land pattern, air, water, noise, soil environment, social life, diversity of plant life and fauna due to sand mining. Ground data on geo-environmental components of the study area were collected for verification of information about the different features in the study areas.

Measurement of air quality: Ambient air monitoring measurement was carried out on a weekly basis in surrounding areas of the mining lease area to assess the ambient air quality at the source. Air quality assessment was conducted at 5 locations (Figure-2) over a period of the winter season. Major air pollutants viz, Particulate matter (PM10), Nitrogen Dioxide (NO_2), Sulphur Dioxide (SO_2) representing the basic air pollutants in the region were identified for Ambient Air Quality Monitoring (AAQM).

Measurement of noise quality: Noise levels were measured on mine site and inhabited areas located within 12 km radius in the region of the site with Sound Level Meter apparatus. Permissible limits of sound were checked by Noise Quality Standard which is mentioned in Environment Protection Act, 1986.

Measurement of soil quality: For studying the soil environment of the region, 5 locations were selected to assess the existing soil conditions around the lease area representing various land use conditions. The concentrations of physical and chemical parameters were determined.

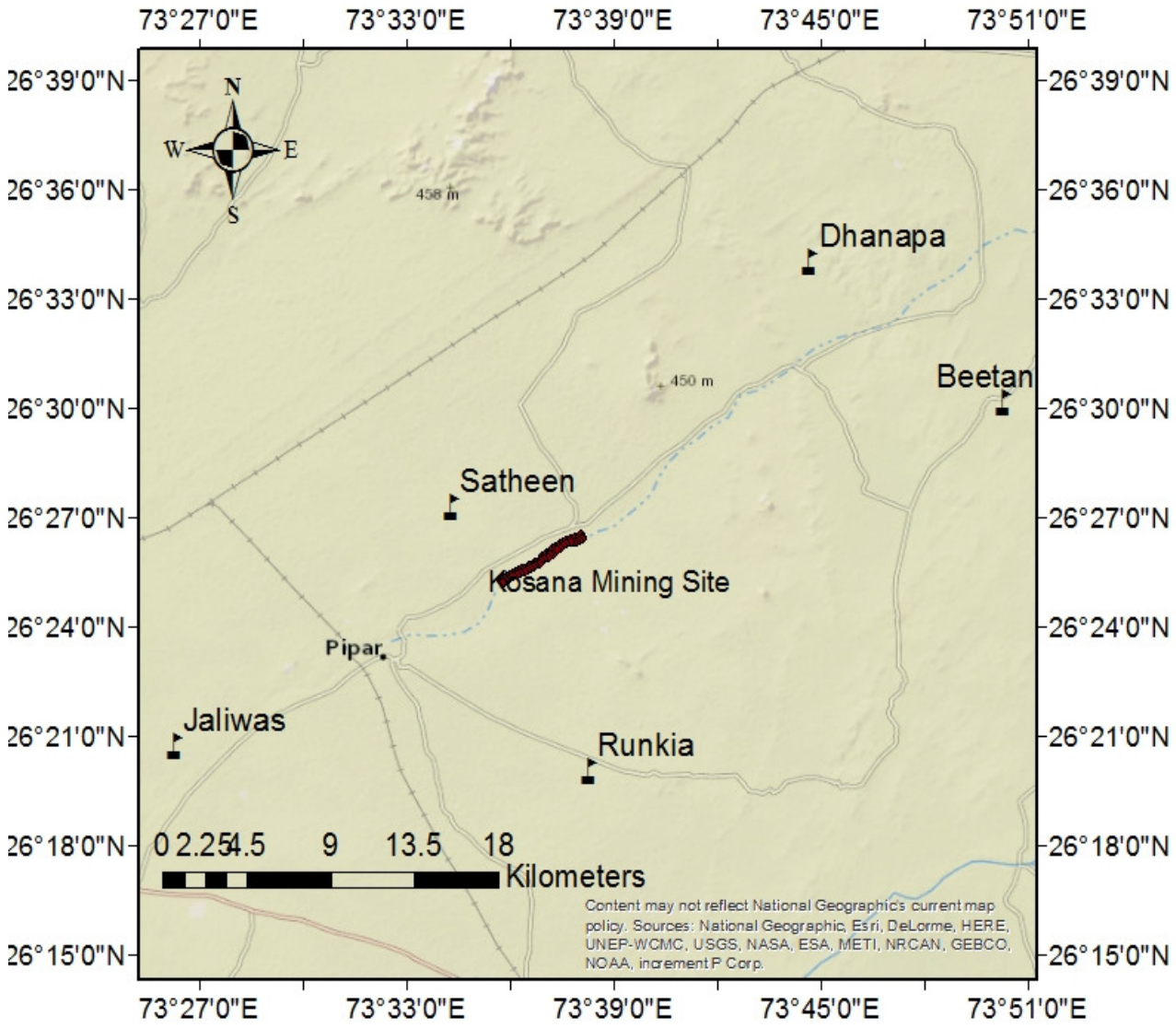

Figure-2: Sampling Stations of Air Quality.

Flora fauna assessment: General Field investigation was conducted to identify the plant species with the help of taxonomists of related field and nearby institutions and local people.

Socio-economic assessment: Effect of social life due to sand mining was determined by help of group discussion with local inhabitants, business persons, agriculture laborers, unemployed group. The domestic survey was also conducted through interviews to give their outlook about the effects of the project on employment opportunities, education, health care, transportation facility and financial status.

Results and discussion

Results of study are mention in Figures and Tables.

Table-1: Ambient Air Quality Monitoring Sampling Stations.

Station	Sampling Location	Coordinates
AAQM 1	Jaliwas	N 26.34493; S 73.43833
AAQM 2	Satheen	N 26.45492; S 73.57214
AAQM 3	Beetan	N 26.50208; S 73.83816
AAQM 4	Runkia	N 26.33397; S 73.63832
AAQM 5	Dhanapa	N 26.56677; S 73.74516

Table-2: Ambient Air Quality Monitoring.

AAQM Location	Jaliwas (AAQM 1)			Satheen (AAQM 2)			Beetan (AAQM 3)			NAAQ Standards (24 hours)
	Max	Min	98% tile	Max	Min	98% tile	Max	Min	98% tile	
SO_2 µg/m³	22	16.6	21.89	21.6	16.7	21.5	21.6	16.1	21.49	80
NO_2 µg/m³	10.5	7.4	10.43	10.4	7.4	10.34	10.4	7.4	10.34	80
PM10 µg/m³	72.5	68.5	75.06	75.6	67.3	75.43	76.7	67.3	76.51	100
AAQM Location	Runkiya (AAQM 4)			Dhanapa (AAQM 5)			NAAQ Standards (24 hours)			
	Max	Min	98% tile	Max	Min	98% tile				
SO_2 µg/m³	21.6	16.8	21.5	21.9	16.4	21.79	80			
NO_2 µg/m³	10.5	7.4	10.43	10.5	7.1	10.43	80			
PM10 µg/m³	75.5	67.9	75.34	75.1	67.4	74.94	100			

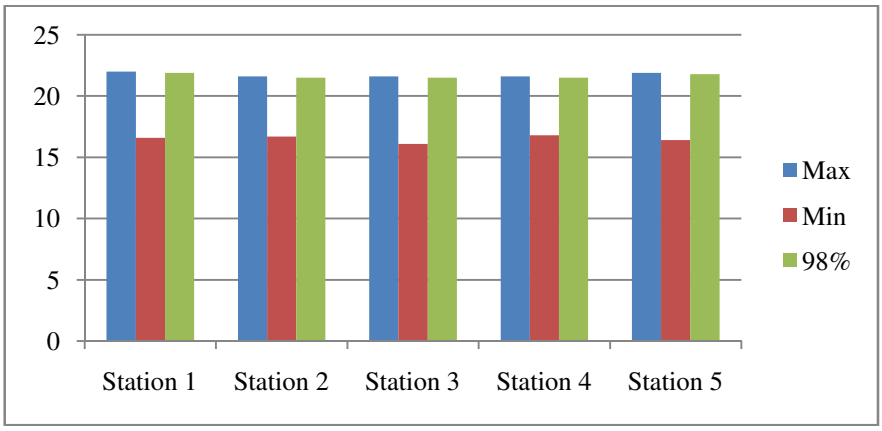

Figure-3: Level of SO_2 at Atmosphere Monitoring Station.

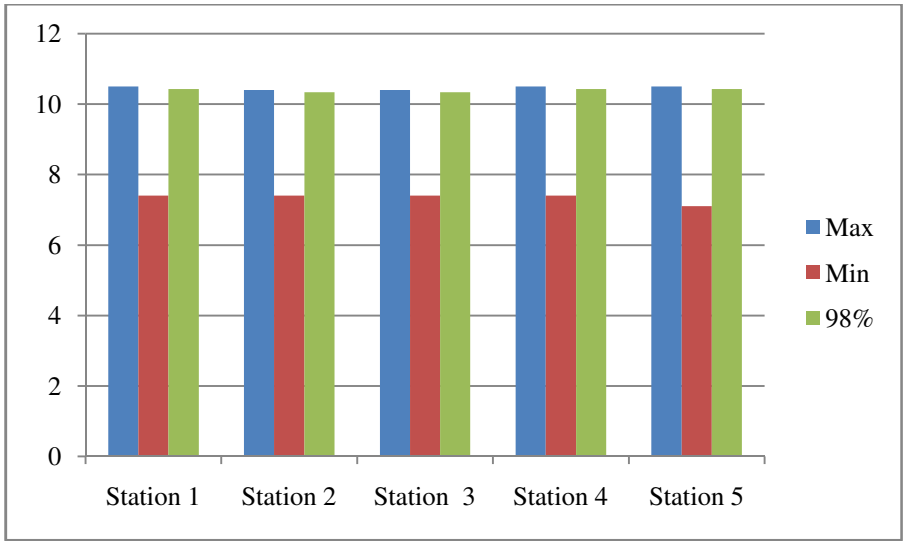

Figure-4: Level of NO_2 at Atmosphere Monitoring Station.

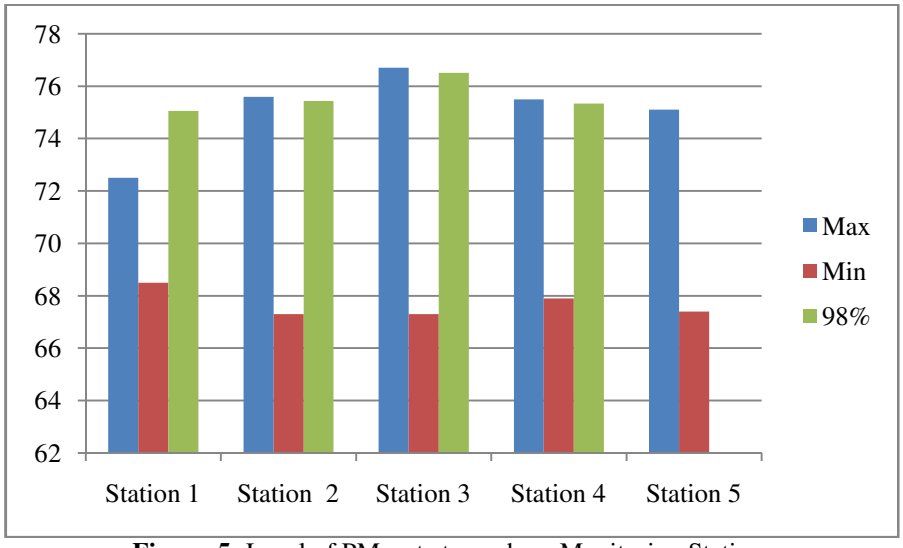

Figure-5: Level of PM_{10} at atmosphere Monitoring Station.

Air Monitoring: The maximum and minimum concentrations of SO_2 were found to be 22 µg/m^3 and 16.1 µg/m^3 respectively. The maximum and minimum concentrations of NO_2 were found to be 10.5 µg/m^3 and 7.1 µg/m^3 respectively. The minimum and maximum concentration of PM10 for all the AAQM stations were found to be 76.7 µg/m³ and 67.3 µg/m³ respectively. As observed in air monitoring results the level of SO_2, NO_2 and PM 10 at all locations are much below from the prescribed limit National Ambient Air Quality (NAAQ) Standards levels.

Noise Monitoring: Ambient noise levels were measured at 5 locations around the proposed project site. A noise level ranges from 50.33 to 52.5 Leq dB in the day time and from 35.17 to 38.59 Leq in the night time. Thus noise levels at all locations were observed to be within the prescribed limits. The area has calm surroundings. There is no heavy traffic, industry or noisy habitation in the area except the existing mine.

Table-3: Noise Sample and Measurement.

Station	Sampling Location	Coordinate Sampling Locations	Noise Environment Leq. dB (A)	
			Day Time	Night Time
N 1	Jaliwas	N 26.34493; S 73.43833	52.50	35.17
N 2	Satheen	N 26.45492; S 73.57214	50.33	36.17
N 3	Beetan	N 26.50208; S 73.83816	51.57	37.64
N 4	Runkiya	N 26.33397; S 73.63832	53.17	38.59
N 5	Dhanapa	N 26.56677; S 73.74516	51.54	38.18

Table-4: CPCB Noise Standards.

Category of Zones	Leq in dB (A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40

i. Day time from 6:00 AM to 10:00 PM, ii. Night Time is reckoned between 10:00 PM to 6:00 AM, iii. Silence Zone is defined as an area up to 100 m around premises of Hospitals, Educational Institute.

Table-5: Soil Sampling Stations.

Station	Sampling Location	Coordinate Sampling Locations
S 1	Jaliwas	N 26.34493; S 73.43833
S 2	Satheen	N 26.45492; S 73.57214
S 3	Beetan	N 26.50208; S 73.83816
S 4	Runkiya	N 26.33397; S 73.63832
S 5	Dhanapa	N 26.56677; S 73.74516

Table-6: Analysis Report of Soil Monitoring Station.

Parameters	Unit	Locations				
		S1	S2	S3	S4	S5
pH		7.81	7.91	8.30	7.54	7.84
EC at 25˚	µS/cm	250	314	420	264	326
Calcium (as Ca)	mg/kg	1282	961	1561.23	1198.02	1362.20
Magnesium (as Mg)	mg/kg	121.8	219.3	632	118.77	267.91
Sodium (as Na)	mg/kg	27.0	183.0	27.96	26.05	9.09
Potassium (as K)	mg/kg	24.0	86.0	76.9	22.01	164.33
Water holding Capacity	% by Mass	32.5	28.60	29.15	30.44	18.3
Porosity	% by Mass	28.10	22.0	24.0	25.18	18.32
Sand	% by mass	69.23	83.72	82.86	66.61	93.3
Clay	% by mass	0.77	8.84	5.71	0.72	3.37
Silt	% by mass	30.0	7.44	11.43	28.14	3.33
Cation Exchange Capacity	Meq/100gm	3.56	4.36	5.86	4.12	5.06
Sodium Absorption Ratio		1.68	2.13	2.56	0.99	3.86
Nitrogen	% by mass	0.048	0.056	0.061	0.066	0.051
Phosphorus	mg/kg	8.90	10.62	9.86	9.45	11.68
Zinc (Zn)	mg/kg	3.68	4.62	5.03	4.31	4.36
Bulk Density	gm/cc	1.388	1.51	1.60	2.124	1.474
Organic Matter	% by mass	0.36	0.48	0.64	0.29	0.41

Soil monitoring: The analysis results show that soil is basic in nature, as pH value ranges from 7.54 to 8.30 with organic matter 0.29% to 0.64%. The concentration of Nitrogen, Phosphorus, and Potassium has

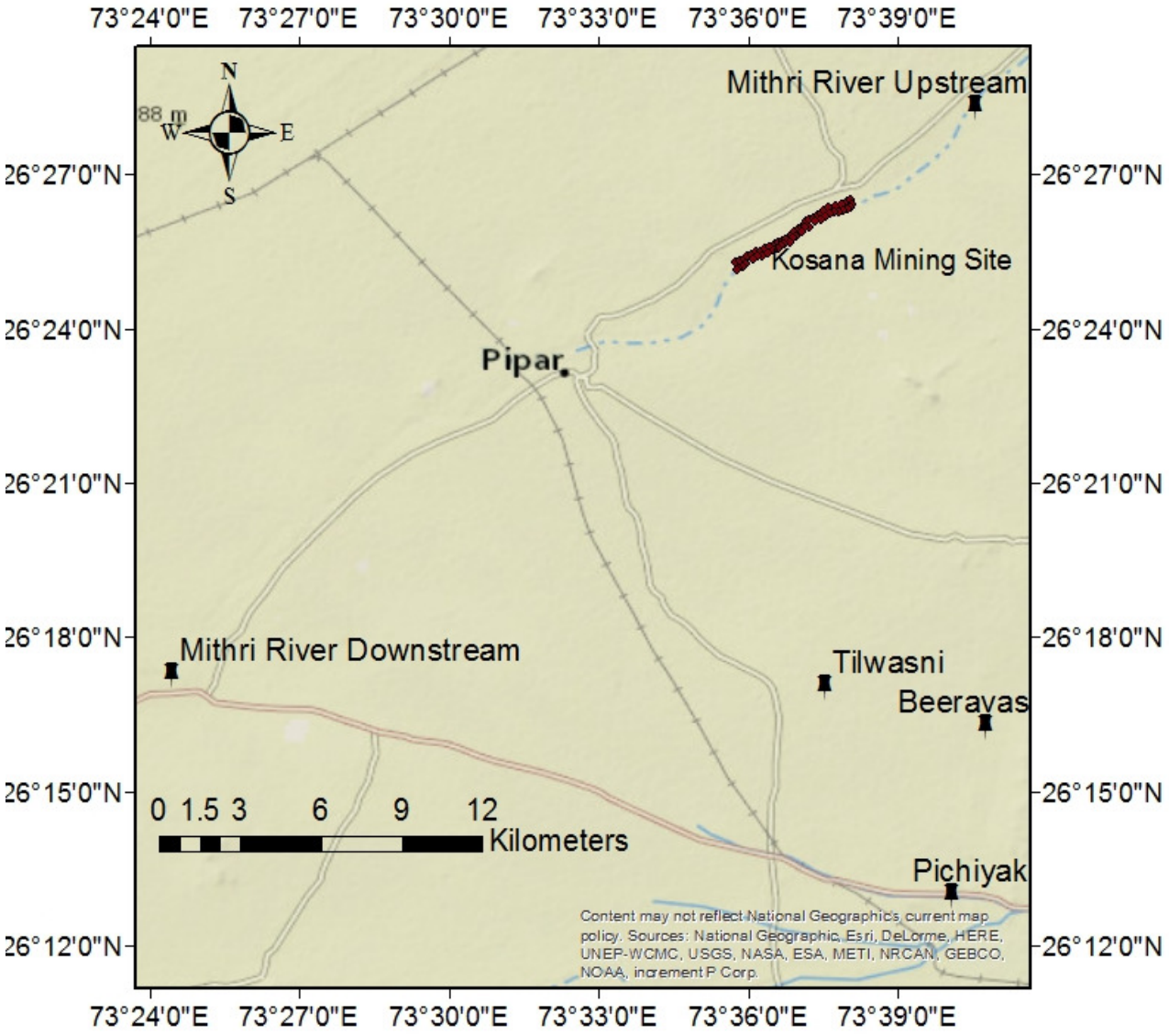

Figure-6: Water Sample Locations.

Table-7: Ground and Surface Water Sampling Station.

Station	Sampling Location	Coordinates
GW1	Pichiyak	N 26.21642; S 73.66846
GW2	Beeravas	N 26.27104; S 73.67960
GW3	Tilwasni	N 26.28395; S 73.62573
SW1	Mithri River Upstream	N 26.47176; S 73.67620
SW2	Mithri River Downstream	N 26.28792; S 73.40729

Table-8: Ground and Surface Water Analysis Report.

Location	GW 1	GW 2	GW 3	GW 4	SW 1	SW 2	Limits of IS: 10500-2012	
Para-Meters							Desirable limit (Max.)	The permissible limit in the Absence of Alternate Source (Max.)
Colour, (Hazen units)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5	5
Odour	Accep -table	Accep -table	Accep -table	Accep -table	Accep -table	Accep -table	Accep -table	Accep -table
Taste	Accep -table	Accep -table	Accep -table	Accep -table	Accep -table	Accep -table	Accep -table	Accep -table
Turbi-dity (NTU)	1	< 1	1	<1	1	1	1	5
pH value	7.86	7.23	7.32	8.21	7.52	8.16	6.5-8.5	
Total Dis-solved Solid (mg/l)	1495	1486	1244	1684	586.7	849.8	500	2000
Boron (mg/l)	0.28	0.21	0.14	0.19	<0.1	<0.1	0.5	1
Calcium (mg/l)	165.51	170.21	101.88	125.0	42.79	49.89	75	200
Chlo-rides (mg/l)	325.49	298.54	256.87	412.57	309.68	496.92	250	1000
Fluorides (mg/l)	1.98	1.65	2.31	2.31	0.95	1.16	1.0	1.5
Iron (mg/l)	0.532	0.623	0.387	0.387	0.239	0.273	0.3	No Relaxation
Magnesium (mg/l)	178.9	137.41	62.76	57.0	29.02	34.29	30	100
Nitrate (mg/l)	60.32	58.65	42.78	39.95	18.91	24.74	45	No Relaxation
Sulphate (mg/l)	375.87	327.60	198.5	186.0	41.74	54.98	200	400
Alkalinity (mg/l)	400	387	354.26	487.36	371.09	419.6	200	600
Total Hardness (as $CaCO_3$ Mg/l)	870	991	512.98	614.98	297.1	333.8	200	600

Table-9: List of Medicinal Plants in Study Area.

Botanical Name	Common Name	Family
Abrus precatorius	Chirmi	Fabaceae
Acacia nilotica	Babul	Fabaceae
Aegle marmelos	Bel	Rutaceae
Albizia procera	Kala Siras	Mimosaceae
Aloe vera	Gwarpatha	Liliaceae
Azadirachta indica	Neem	Meliaceae
Butea monosperma	Palash	Fabaceae
Dalbergia latifolia	Sisam	Fabaceae
Dendrocalamus strictus	Manvel, Bans	Poaceae
Emblica officinalis	Aamla	Euphorbiaceae
Eucalyptus	Nilgiri	Myrtaceae
Ficus religiosa	Peepal	Moraceae
Ficus bengalensis	Bargad	Moraceae
Jatropha curcas	Ratanjyot	Euphorbiaceae
Lagerstroemia parviflora	Kalhariya, Kakdiyo	Lythraceae
Lannea coromandelica	Moledi	Anacardiaceae
Madhuca indica	Mahua	Sapotaceae
Mangifera indica	Aam	Anacardiaceae
Ocimum gratissimum	Vantulsi	Lamiaceae
Pithecellobium dulce	Jungle jalebi	Fabaceae
Polyalthia longifola	Ashoka	Annonaceae
Tridax procumbens	Kumru	Asteraceae
Syzygium cumini	Jamun	Myrtaceae
Tamarindus indica	Imli	Fabaceae
Tectona grandis	Sagaum	Verbenaceae
Terminalia arjuna	Arjun	Combretaceae

Table-10: List of Faunal Species observed in the study area

Scientific Name	Common Name	Family
Boselaphus tragocamelus	Nilgai (Blue bull)	Bovidae
Canis aureus	Jackal	Canidae
Funambulus pennati	Squirrel	Sciuridae
Vulpes bengalensis	Indian fox	Canidae
Herpestes javanicus	Mongoose	Herpestidae
Lepus nigricollis	Hare	Leporidae
Semnopithecus entellus	Hanuman	Cercopithecidae
Rattus rattus	Rat	Muridae

Table-11: List of Avifaunal Species Observed in the Study area.

Scientific Name	Common Name	Family
Acridotheres	Indian Myna	Sturnidae
Bubulcus ibis	Cattle egret	Ardeidae
Columba livia	Blue rock pigeon	Columbidae
Corvus splendens	House crow	Corvidae
Franeolinus pondercerianus	Gray partidage	Phasianidae
Merops orientalis	Green bee-eater	Meropidae
Passer domesticus	House sparrow	Passerinae
Saxicoloides fulicata	Indian robin	Turdinae
Streptopelia decaocto	Indian ring dove	Columbidae
Streptopelia senegalensis	Little brown dove	Columbidae
Tringa hypoleueos	Common sandpiper	Sandpiper
Turdoides caudatus	Common babbler	Timalimae
Pycnonetus cafer	Red vented bulbul	Pycnonotidae
Dicrurus admimilbs	Black Drongo	Dicruridae
Copsychus Saularis	Magpie Robin	Corvidae

With anthropological survey, it is observed that the flora and fauna diversity has decreased due to sand mining.

Social impact: The impact of mining on socio-economic scenario has both facets. Being a commercial activity, it provides the opportunity for both direct and indirect employment.

Impact on Soil Profile: River sand mining in this Study area has another serious negative impact which was analyzed through previous satellite images and present scenario by visualization which is River bank erosion, river channel widening in this area as shown in satellite pictures (Figure-4) and real site images (Figure-5)

Figure-7: Satellite pictures of sand mining area for various years.

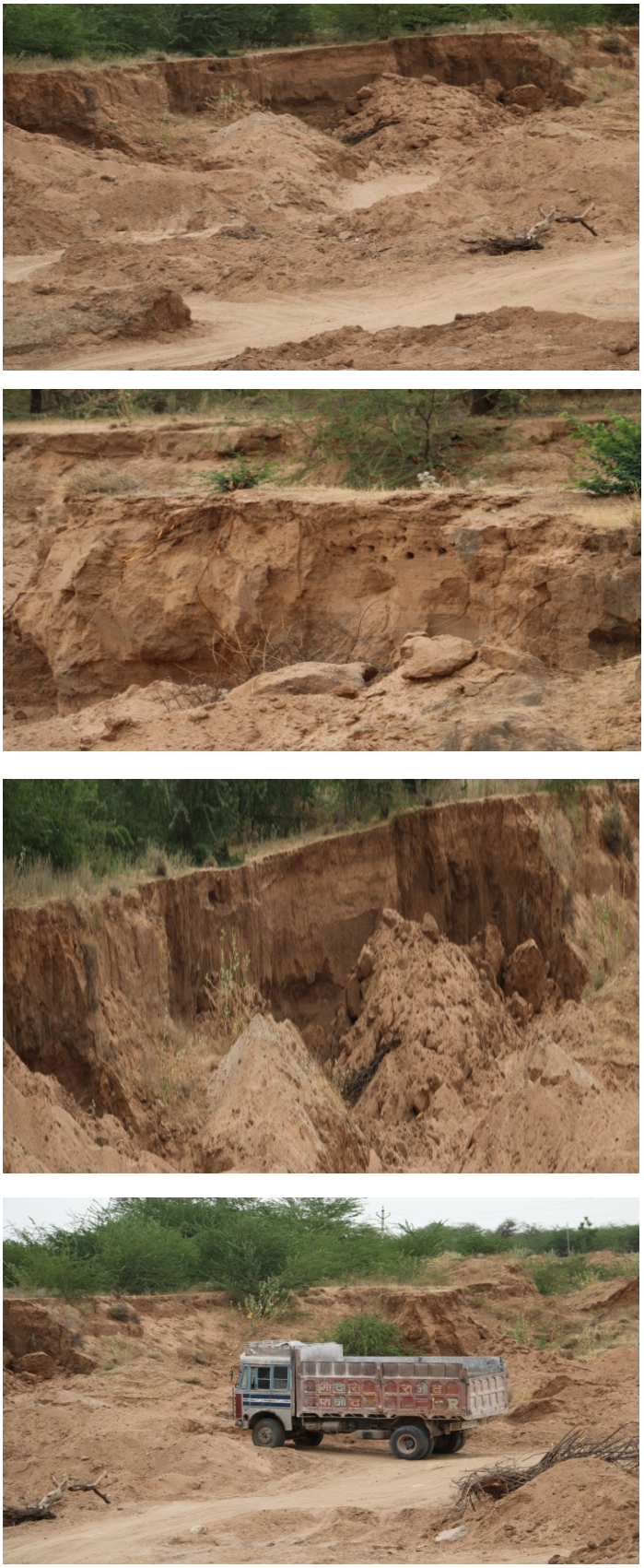

Figure-8: Bank Erosion of River due to Sand Mining.

Conclusion

In the study are unwanted mining activities and stocking of mined sand near the stream bank is affecting the natural topography of the River bed. Mining pits are responsible for river waterway shifting as well as damaging of the land profile. The sand reserve in the study area has been decreased to a substantial amount because of sustained and haphazard sand mining. No major impacts on soil, water, noise and air environment are noted due to mining activities. They all are within a permissible limit as per standards. The collection of minor minerals from the river bed does not cause any occupational ill effects. Except for dust generation, there is no source which can show a probability of health related diseases. The development of mining in the area is providing opportunities for direct and indirect employment and infrastructure development.

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