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# Sand Mining and its Impact on Environment: A study in Haldia Municipality, Haldia, Purba Medinipur.

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**Abstract-**

Sand mining is the process of removing sand and gravel, and it is becoming an environmental issue as the demand for sand in industry and construction grows. Sand mining‟ is a practice that is used toextract sand, from various environments, such as beaches, and inland dunes and dredged from ocean beds, and river beds of deltaic regions. The mining is in operation in all the continents of the Globe. Environmental problems occur when the rate of extraction of sand, gravel and other materials exceeds the rate of deposition. Sand mining has several effects on the river environment. Sand mining disturbs and destroys the habitat in mined areas. It causes changes in the river's channel form, physical habitats, and food webs - the river's ecosystem. It also increases the velocity of the flow in the river, which destroys the flow regime and eventually erodes the river banks. Sand mining is the extraction of sand from various environments, such as beaches, inland dunes, ocean beds, and deltaic river beds. When the rate of extraction of sand, gravel, and other materials exceeds the rate of deposition, environmental issues arise.

**Keywords -Sand Mining, impact, environment**

## 1. Introduction

Soil is an important resource covering the land surface. Human communities depend on soil for agriculture, construction and even as a habitat for various organisms (Mwangi, 2007). People benefit from soil, particularly sand and gravel but interfere and disturb the resource through excessive exploitation to fulfill their needs. Sand is frequently used in manufacturing an abrasive or in concrete. It is also used on icy and snowy roads, usually in conjunction with salt, to reduce the melting point temperature of the road surface. Sand can be used to replace eroded coastlines. Sand mining is the extraction of sand from beaches and inland dunes, as well as from ocean and river

beds. At present Thousands of tons of sand are being illegally mined to meet the rising demand of the construction industry and for mineral extraction, despite a Supreme Court order that prohibits sand mining without the necessary clearance from the required authorities and limits the quantities that can be mined. So there is worldwide concern about the environment which prompted to carry out this study on the environment. It seems there is excessive mining of soil components for construction in both rural and urban development.

Gravel is mixed with river sand in filling and compacting foundations. River sand is a component of concrete in making slabs while pit sand is required for plastering buildings. River sand is used in most mixtures because it is a strong resource which strengthens even pit sand in plastering and makes durable bricks. The study concentrated on exposing the environmental impacts of mining pit sand, river sand and gravel extraction for long time construction in Haldia Municipality. This research was also meant to provide guidelines for the evaluation of potential positive and negative environmental impacts. Recommendations have been made for sustainable use of the environment while supporting the positive impacts. Alternatives to sand had been suggested.

## 2. Statement of the problems

Due to rapid urbanization, Sand Mining is expanding at an alarming rate. Expansion means growth in infrastructure and, the construction of new roads, commercial malls and residential areas (Wokorach, 2002). Development is a process of gradually becoming bigger, better, and more advanced in business, trade and industrial activities. The growth of towns and cities demands much more infrastructure and the construction of strong structures such as tarred roads, commercial shopping malls and accommodation for the ever-increasing population. As urban areas develop, there is likely to be a disturbance of the environment. There is a need for the use of various soil components such as pit sand, river sand and gravel from various sites of the surrounding the city. Therefore people seem to be extracting these soil components excessively without considering the impact on the environment. Soil mining has become a daily sight with tipper trucks carrying pit sand, river sand and gravel from rivers and open fields. It seems there are no strict rules to govern soil extraction. There seemed to be a problem of environmental alteration, ecosystem and agricultural land destruction as well as riverbed and bank degradation due to excessive removal of pit sand, rivers and gravel which prompted to investigate the depth of these environmental impacts.

## 3. Objectives

i. To assess and evaluate the environmental impacts of sand mining

**ii.** To make recommendations on sustainable sand mining

## 4. Study area and context

**Haldia** is an industrial port city in Purba Medinipur district in the Indian state of West Bengal. It has a major river port and industrial belt located approximately 124 km (77 mi) southwest of Kolkata near the mouth of the Hooghly River, one of the distributaries of the Ganges. The Haldia Township is bordered by the Haldi River, an offshoot of the Ganges River. Haldia is a centre for petrochemical businesses and is a major trade port for Kolkata.

## 5. Literature Review

Soil is a cheap natural resource made up of gravel, sand, clay, and loam which constitute the different types. Pit sand, river sand and gravel are components of soil which take years to form but are extracted in a matter of days. Sand and gravel are underground geological resources formed from eroding mountain rocks carried by streams and rivers. Sand mining has both positive and negative environmental impacts.

Stebbins (2006) gave the background to the formation of sand and gravel deposits, a legacy of the continental ice sheets that melted thousands of years ago. As the ice melted, fast-moving rivers were formed leaving deposits of coarse sand.

(Stebbins, 2006). Draggan (2008) discussed sand and gravel as commodities used in industry, especially construction. In construction, the components are used either mixed with other materials or as is, while in industry, sand and gravel are used in the production of other materials like aggregates. Sand is mostly quartz grains (Silicon dioxide) formed from the weathering of granite rocks. The quartz grains accumulated in rivers, streams, deltas and beaches. Therefore, quartz is very valuable as sand because of its silica content. The physical properties of sand and gravel particularly in abrasive properties make the resources useful for traction on icy roads, roadways and railroads including sand blasting (Draggan, 2008).

According to Draggan (2008), sand and gravel are crucial resources for economic development activities in developed and developing nations. Recovery from river channels, flood plains and glacial deposits as well as processing of these resources is costly but valuable in construction and industry (Draggan, 2008). United Nations Conference on Environment and Development Report (2002) supported proper use of the environment and urged governments to develop but recognize the conservation and rehabilitation of all natural resources. The report revealed that over-extraction of soil for urban development is an environmental problem common worldwide. The use of soil as a source of raw materials is depleting the resource and has adverse impacts.

Impacts of sand mining and gravel extraction can be classified into three categories as presented by Stebbins (2006).There are physical impacts which are a result of mining from streambed causing alteration of channel slope and changes in channel morphology. Water quality impacts are caused by sand mining and dredging activities, reducing water quality for downstream users and increasing treatment costs. Ecological impacts such as loss of habitats and species disturbance are a result of mining gravel and sand continuously leading to the removal of channel substrate, suspension of sediments and clearance of vegetation.

The environmental impacts noted were changes in fluvial morphology, deep tunnels on river beds and an increase in the velocity of flowing water resulting in erosion on river banks. In some cases, there is a depletion of water resources leading to food shortages and hardships for people. Demand for soil in the country has increased today which has led to the excessive stream and land extraction of pit sand, river sand and gravel causing land degradation, riverbank deepening and loss of ecosystems (Mbaiwa, 2008). Soil mining is an environmental issue

worldwide.

There is a need to consider the sustainable use of natural resources in project development through sound sand and gravel extraction. The activity is of great concern to environmentalists as it has more negative impacts than positive. As more impacts are felt, there is a need for immediate environmental control and restoration.

Sand and gravel are natural resources formed by the weathering of rocks over a long period by the action of wind and water. Sand is a widely used construction material throughout the world. It is a non-renewable resource as it takes a very long time to form; its demand in the construction industry is extremely high. Sand also plays a very important role in the protection of the coastal environment as it reduces the impacts of the strong tidal waves before they reach the shoreline.

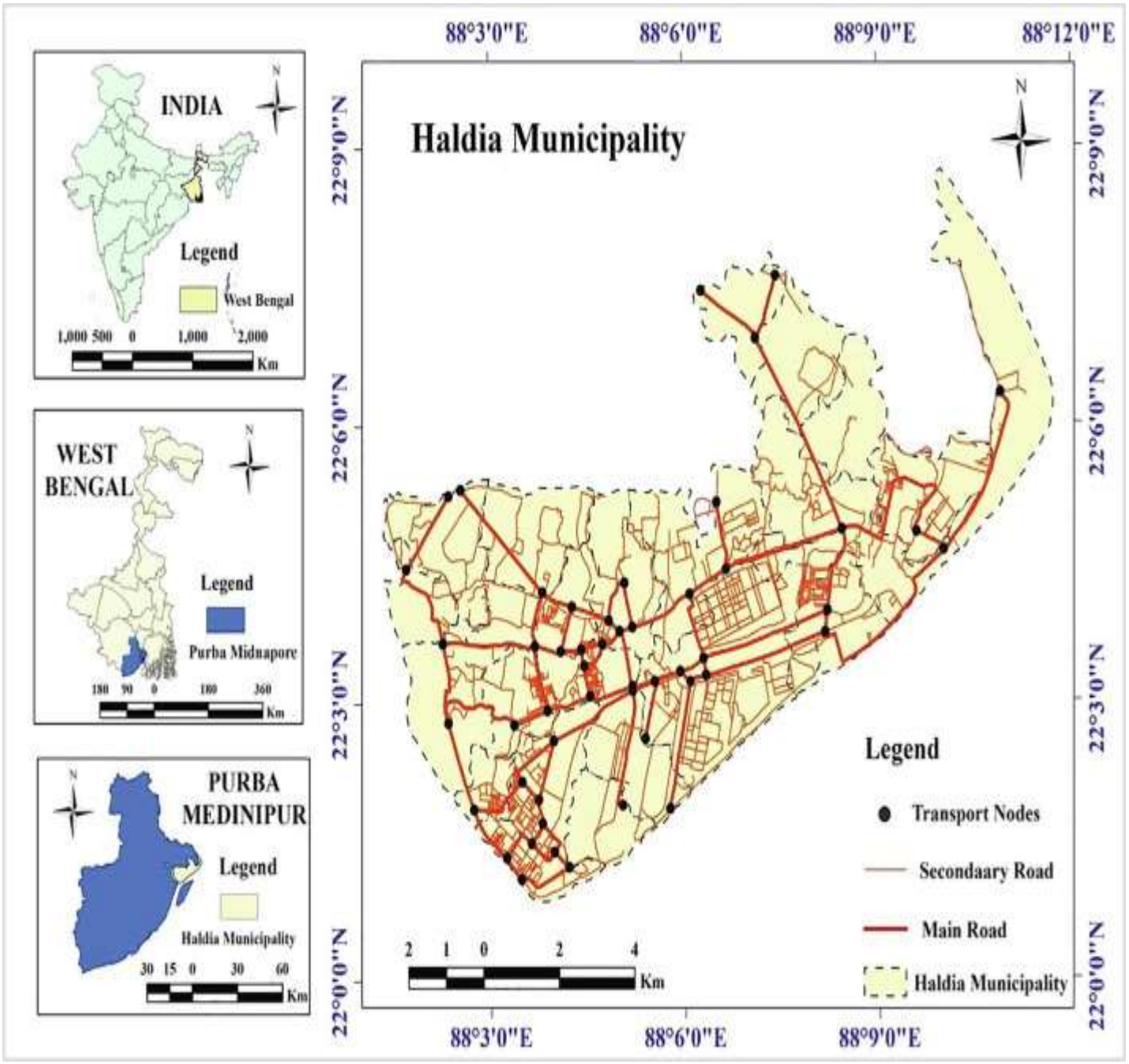
Sand also acts as a habitat for many marine organisms **(Jonah *et al.*, 2015).**Sand mining refers to the process of removal of sand from rivers, streams and lakes. Mining of sand includes various methods such as skimming, dry and wet pool mining, bar excavations and scalping **(Hill, 1999).**

Due to the increasing demand for sand for construction purposes a lot of legal and illegal sand mining is carried out creating immense pressure on sand resources. Mining activities have resulted in many serious environmental hazards such as soil pollution, deforestation, water pollution, depletion of ground water table etc. **(Bindhusri and Arunachalam, 2015).**

Many studies have been carried out to conserve land use land cover with the help of different satellite data. GIS can be used in the demarcation, management and planning of sand mining zones. With the help of high-resolution images like Cartosat and World View 2 legal and illegal sand mining can be demarcated accurately **(Mitra and Singh, 2015).**With the help of GIS, one can also estimate the volume of sand that can be mined from the mining area **(Atejioye and Odeyemi, 2018)**.Excess river sand mining has affected the biodiversity of rivers and had a huge impact on the nearby environment - including air, water and soil contamination.

In the process of mining, the minerals, chemicals or other contamination, present in the sand, enters the ground or surface water, resulting in the change of physical-chemical properties of water. Uncontrolled sand mining degrades the river and threatens its tropic structure.

## 6. Location Maps of the Study Area



## 7. Impact of Sand Mining

I. Sand mining is a direct cause of erosion and has an impact on local wildlife.
II. It can alter the river bed, force the river to change course, erode banks, and cause flooding.
III. It causes river and estuary deepening, as well as the expansion of river mouths and coastal inlets.
IV. It may also result in saline water intrusion from the nearby sea.
V. In stream mining can have far-reaching consequences that extend beyond the immediate mine sites.
VI. It harms wildlife by removing basking and egg-laying habitats.
VII. It can also devastate fisheries, causing financial hardship for the operators.
VIII. As the amount of sand reaching the oceans changes, rivers are unable to replenish the sand on beaches and in deltas.
IX. Increased riverbed and bank erosion raises the concentration of suspended solids in the water both at the excavation site and downstream. Suspended solids can harm water users and aquatic ecosystems.
X. Every year, many hectares of fertile streamside land are lost, as well as valuable timber resources and wildlife habitats in riparian areas. Degraded stream habitats reduce fisheries productivity, biodiversity, and recreational potential.

## 8. Sand Mining- Environmental Consequences

i. **Forcing the river to change its course:** Sand and boulders operate as a buffer for the riverbed, preventing it from shifting direction.
ii. **Using illegally dug sand is the same as stealing water:** Sand contains a lot of water, and when it's mined and loaded onto trucks carelessly, a lot of water is lost in the process.
iii. **Depletion of groundwater tables:** Sand, which is part of the aquifer, functions as a link between the running river and the water table in a riverbed.
iv. **Adverse impact on Microorganisms:** Many microorganisms are not visible or well-known but are important for soil structure and fertility. Sand dredging physically deprives them of their environment.
v. **Threat to agriculture:** The majority of modern mines in developing countries are found in rural areas where agriculture is the primary source of income. This has the potential to harm farmers by increasing competition for essential resources and polluting the environment.
vi. Groundwater levels have dropped dramatically in the villages and towns along the river, and wells are almost always dry.
vii. **Damage to Coastal Ecosystem:** This harmful unlawful practice causes erosion along the shoreline in beaches and waterways.
viii. It devastates the intertidal zone and raises the risk of saline water infiltration into fresh water.
ix. One of the most serious consequences of beach sand mining is the lack of protection against storm surges caused by tropical storms and tsunamis.
x. **Affects Livelihood:** Agriculture and fisheries are important sources of income for people in rural regions and a negative impact can limit livelihood diversity and raise poverty levels.

xi. **Affects Tourism:** Sand mining degrades the physical appeal of beaches and riverbanks while also putting these places' biological systems in jeopardy. If such beaches and riverfront locations become famous tourist sites, they would lose their tourism potential.

**9. Sand Mining Policy-**

The following policies should be taken into consideration before approving sand and gravel mining permits-

I. Ensure conservation of the river equilibrium and its natural environment.

II. Avoid aggradations at the downstream reach especially those with hydraulic structuressuch as jetties, water intakes etc.

III. Ensure the rivers are protected from bank and bed erosion beyond their stable profile.

IV. Avoid interfering with the river maintenance work by the Department of Irrigation andDrainage (DID) or other agencies.

V. No obstruction to the river flow and water transport.

VI. Avoid pollution of river water leading to water quality deterioration.

**10. Sand mining guideline-**

The distance between sites for sand and gravel mining shall depend on the replenishment rate of the river. A sediment rating curve for the potential sites shall be developed and checked against the extracted volumes of sand and gravel. Sand and gravel may be extracted across the entire active channel during the dry season (May to September).Layers of sand and gravel which could be removed from the river bed shall depend onthe width of the river and the replenishment rate of the river. Sand and gravel shall not be allowed to be extracted where erosion may occur, such asat the concave bank. Sand and gravel shall not be extracted within 1,000 meters from any crucial hydraulic structure such as pumping station, water intakes, bridges, buildings and such structures. Sand and gravel mining could be extracted from the downstream of the sand bar at river bends. Retaining the upstream one to two-thirds of the bar and riparian vegetation is accepted as a method to promote channel stability. The flood discharge capacity of the river could be maintained in areas where there are significant flood hazards to existing structures or infrastructure. Sand and gravel mining may be allowed to maintain the natural flow capacity based on surveyed cross-section history. Alternatively, off-channel or floodplain extraction is recommended toallow rivers to replenish the quantity taken out during in-stream mining.

**11. Conclusion-**

Minerals are part of a nation‟s natural wealth. The nation is to advance industrially and economically by the proper development and exploitation of these resources. It has to be remembered that the sand once removed cannot be replaced in the next generation. It will take centuries for replacement. Sand sustains the rivers and the percolation of water to far-off distances both for the growth of trees to sustain drinking water and raise cultivation. It is almost a lifeline to the human existence. Without considering the precise gift provided by nature, commercial exploitation for short-term gains by pumping out the sand indiscriminately from the rivers, dunes and beaches will destroy the whole environment. People employ huge machinery like cranes and other pumping mechanisms causing

untold natural calamities and loss to society. To maintain the balance between the environment and sand mining, the Governments should regulate the mining.

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