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Requirements of Sand Mining Industry for Sustainable Management in Smart cities, India

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Abstract: The sand mining industry plays a crucial role in supporting various sectors of the economy, but its sustainability and responsible management are essential to mitigate its environmental impact and ensure the long-term availability of this valuable resource. Consequently, many stakeholders, including governments, industry players, and environmental organizations, are working to find solutions to the challenges associated with sand mining. The demand for sand is driven by various industries, particularly construction, which uses sand in concrete and asphalt production. As urbanization and infrastructure development increase worldwide, the demand for sand has risen significantly. Sustainable sand mining practices aim to balance the need for sand with environmental protection. This involves responsible extraction, reclamation of mined areas, and reducing dependence on natural sand through recycling and alternative materials. In some areas, illegal sand mining is a significant problem. It often occurs in sensitive ecological areas and can lead to conflicts between illegal miners, local communities, and authorities.

Keywords: sand mining, sustainability, environmental protection, Sustainable

I. INTRODUCTION

The sand mining industry involves the extraction of sand from various sources, such as rivers, beaches, quarries, and underwater deposits, for various purposes, including construction, manufacturing, and landscaping. Sand is crucial natural resource used in a wide range of industries and applications, making it one of the most consumed and traded commodities globally. Sustainable management of the sand mining industry in smart cities in India is crucial to ensure environmental protection, economic development, and social well-being. Sand mining, when done without proper planning and regulation, can have adverse effects on the environment, including soil erosion, water pollution, and habitat destruction. While pressure on governments to regulate sand mining is increasing, more needs to be done to find alternatives for use in construction and for solving the world's continuing housing crises. River bank erosion, river channel widening as shown in figure 1 in sand mine area is huge problem due to excessive sand mining [1, 2]. There are some key requirements for sustainable sand mining management in smart cities in India as mentioned in figure 2 and this paper discusses about requirements of sustainable management for sand mining industry [3].

Figure 1: Bank Erosion of river due to excessive sand mining

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Figure 2: Key requirement chart for sustainable sand mining

Regulatory Framework: It is required to develop and enforce a comprehensive regulatory framework for sand mining that includes guidelines, permits, and monitoring mechanisms [4, 5] and ensure that the regulatory framework is aligned with national and state-level laws and policies related to environmental protection and land use.

Environmental Impact Assessment (EIA): EIAs for all sand mining projects must be mandatory to assess potential environmental impacts [6, 7]. It is also necessary to implement the recommendations of EIAs to mitigate negative effects, such as reclamation of mined areas and afforestation.

Zoning and Planning: Designated mining zones should be established with keeping in mind ecological sensitivity and proximity to water bodies [8, 9 & 10]. Smart cities should incorporate sand mining plans into their overall urban planning to prevent conflicts with future development projects.

Monitoring and Enforcement: There is requirement to implement a robust monitoring and enforcement system to ensure compliance with regulations with using the technology such as GPS tracking to monitor mining activities in real time.

Alternative Construction Materials: Encourage the use of alternative construction materials like manufactured sand (M-sand) to reduce the demand for natural sand and promote research and development for sustainable construction practices.

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Community Engagement: It is required to involve local communities in decision – making process and revenue-sharing mechanisms and educate communities about the importance of sustainable mining practices and the consequences of illegal sand mining.

Resource Assessment: Government should conduct regular assessments of sand resources to determine their availability and estimate extraction limits and develop strategies for sustainable extraction rates to prevent resource depletion.

Rehabilitation and Restoration: Sand miners are required to rehabilitate and restore mined areas once mining operations cease and implement reforestation and soil conservation measures to restore ecological balance [11, 12].

Water Management: It is required to implement measures to minimise water table depletion caused by sand mining, such as regulating the depth of excavation and promote rainwater harvesting and groundwater recharge in mining areas [13]

Research and Innovation: There is need of the hour to invest in research to find innovative and sustainable alternatives to sand in construction and infrastructure projects and support the development of eco-friendly extraction technologies [14].

Transparency and Accountability: Promote transparency in the sand mining industry through public access to information about mining permits, production, and revenue [15, 16].

Capacity Building: Train and build the capacity of regulatory authorities, mining operators, and local communities in sustainable mining practices and environmental conservation.

Collaboration: Collaboration with neighbouring smart cities and states to develop consistent and coordinated policies and regulations for sand mining.

II. CONCLUSION

Sustainable sand mining management in smart cities requires a holistic approach that balances economic development with environmental protection and social equality. It's essential to continuously review and adapt policies and practices to ensure the long-term well –being of both the cities and their surrounding ecosystems. Sand mining can have significant environmental impacts, including habitat destruction, altered river and beach dynamics, erosion, and damage to aquatic ecosystems. It can also contribute to sedimentation and water quality issues. Many countries have regulations in place to govern sand mining operations and minimize their environmental impact. These regulations may address issues such as permitting, environmental assessments, and reclamation efforts. Research is ongoing to develop sustainable practices for sand extraction and to better understand the environmental impacts. Innovations in dredging technology and sediment management can help mitigate some of the negative effects.

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