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Unraveling the complexities of Dam Controversies in India: A Comprehensive Examination.

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ABSTRACT:

A dam is a constructed barrier built across a river or stream to retain and control water. Over the course of history, diverse materials have been employed in dam construction. In ancient times, dam builders relied on natural resources such as rocks and clay, while contemporary dam construction predominantly utilized concrete. India, with a remarkable 4,407 large dams, holds the third position globally in terms of dam numbers, trailing behind China with 23,841 dams and the USA with 9,263. Among India's dams, the Tehri Dam in Uttarakhand, located on the Bhagirathi River, stands out as the country's tallest dam. In Odisha, the Hirakud Dam, situated on the Mahanadi River, claims the title of India's longest dam. Meanwhile, the Kallanai Dam in Tamil Nadu, constructed on the Kaveri River, earns the distinction of being India's oldest dam, boasting an impressive age exceeding 2,000 years. These dams play crucial roles in water resource management, irrigation, and power generation, contributing significantly to India's infrastructure and development.

Dams have long been an integral part of India's development landscape, serving various purposes such as water storage, irrigation, hydroelectric power generation, and flood control. However, the construction and operation of dams in India have not been without their share of controversies. This article delves into the multifaceted issues surrounding dam projects in India, examining the environmental, social, and economic concerns that have emerged over the years.

Need for Dams:

Dams play a significant role in India, serving various purposes that contribute to the country's development and well-being. Here are some of the key reasons for the need for dams in India:

- **Water Resource Management:** Dams are essential for managing and harnessing India's water resources. They help store and regulate water flow, ensuring a steady supply of water for various uses, including agriculture, industry, and domestic consumption.

- **Irrigation:** Dams provide a reliable source of water for irrigation, enabling increased agricultural productivity. This is vital for India's food security, as agriculture is a major contributor to the country's economy.
- **Hydroelectric Power Generation:** Many dams in India are equipped with hydroelectric power plants. These dams generate clean and renewable electricity, reducing the country's reliance on fossil fuels and helping to meet the growing energy demand.
- **Flood Control:** Dams are crucial for flood control and mitigation. They regulate river flows during monsoon seasons, preventing or minimizing flood-related damage to communities, farmlands, and infrastructure downstream.
- **Drinking Water Supply:** Dams serve as reservoirs for storing freshwater, which can be treated and supplied as drinking water to urban and rural areas, meeting the water needs of a rapidly growing population.
- **Industrial and Commercial Use:** Dams provide a consistent source of water for industrial and commercial purposes, supporting economic growth and development.
- **Recreation and Tourism:** Some dam reservoirs also offer recreational opportunities, such as boating, fishing, and tourism, which can boost local economies.
- **Navigation:** Dams can make rivers navigable for transportation, facilitating the movement of goods and reducing transportation costs.
- **Economic Development:** The development of infrastructure around dams, such as roads and electricity supply, can contribute to regional economic development and job creation.
- **Groundwater Recharge:** Dams can help recharge groundwater aquifers by releasing water during non-monsoon periods. This is crucial for replenishing groundwater resources in regions with heavy groundwater extraction.
- **Drought Mitigation:** Stored water in dam reservoirs can be released during dry periods to mitigate the effects of drought by providing water for agriculture and other essential uses.
- **Climate Change Resilience:** Dams can enhance resilience to climate change by ensuring a stable water supply for various sectors and by storing excess water during periods of heavy rainfall for later use during dry spells.¹

How Dam Construction has evolved in India over the years:

¹ Singh, D., Tsiang, M., Rajaratnam, B. *et al.* Observed changes in extreme wet and dry spells during the South Asian summer monsoon season. *Nature Clim Change* 4, 456–461 (2014). <https://doi.org/10.1038/nclimate2208>

Dam construction in India has evolved significantly over the years, driven by technological advancements, changing needs, and a growing understanding of environmental and social considerations. Ancient civilizations in India, such as the Indus Valley and the Mauryan Empire, constructed early dams for irrigation and water storage. These dams were typically made of earth, stone, and wood, and they served local agricultural needs. The Grand Anicut (Kallanai) in Tamil Nadu, built over 2,000 years ago, is one of the oldest irrigation dams in the world. It features an innovative masonry design that demonstrates the engineering skills of ancient India.² During British colonial rule, several dams and irrigation canals were constructed, particularly in the arid regions of western and southern India. These projects aimed at increasing agricultural productivity and revenue collection. After India gained independence in 1947, the government initiated major dam projects as part of the country's development and modernization efforts. The Bhakra-Nangal Dam on the Sutlej River was one of the early iconic projects, focusing on irrigation and hydroelectric power generation. The 1960s and 1970s witnessed significant growth in hydropower projects, such as the Koyna Dam in Maharashtra and the Tehri Dam in Uttarakhand. These projects aimed to meet India's increasing energy demands and promote industrialization. With growing awareness of environmental impacts, modern dam projects began considering ecological factors, leading to the inclusion of fish ladders and environmental safeguards.

Dam Controversies in India:

Dams have played a vital role in India's growth, fulfilling diverse functions like water reservoirs, irrigation, hydroelectric energy production, and flood management. Nevertheless, the establishment and functioning of dams in India have not been free from disputes. The controversies surrounding dams in India are complex and multifaceted, encompassing environmental, social, economic, and cultural dimensions. This article explores the complex challenges associated with dam initiatives in India, addressing the ecological, societal, and economic issues that have surfaced over time using the study of different dams in India such as the Sardar Sarovar Dam, Tehri Dam, Dibang Dam, Hirakud Dam, and Koyna Dam.

Sardar Sarovar Dam:

² thanjavurtourism, <https://thanjavurtourism.com/kallanai-dam.html>, (last visited Feb. 01, 2024).

The Sardar Sarovar Dam, located on the Narmada River in the western Indian states of Gujarat and Madhya Pradesh, has been the center of a long-standing and multifaceted controversy. One of the most significant and persistent issues surrounding the Sardar Sarovar Dam project is the large-scale displacement of people from the dam's reservoir area. Thousands of families, primarily from tribal and marginalized communities, were displaced to make way for the dam and the subsequent filling of its reservoir.

The controversy here revolves around the adequacy of their rehabilitation and compensation. Critics argue that the rehabilitation process has been slow and inadequate, leading to the impoverishment of displaced communities. The Sardar Sarovar Dam has raised concerns about its environmental impact. Altering the flow of the Narmada River has affected the downstream ecosystems, leading to the loss of biodiversity, changes in water quality, and reduced groundwater recharge. Activists and environmentalists have raised alarms about the dam's adverse effects on the Narmada's ecosystem and its long-term sustainability. The dam has also been a source of inter-state disputes, mainly between Gujarat, Madhya Pradesh, and Maharashtra, which share the Narmada River's water resources. Gujarat, which was the primary beneficiary of the dam, has faced opposition from other states, leading to legal and political conflicts over the allocation of water. The Sardar Sarovar Dam controversy has spurred significant social movements and activism, most notably the Narmada Bachao Andolan (NBA), led by social activist Medha Patkar. The NBA has been at the forefront of raising awareness about the dam's impact on local communities, advocating for their rights, and demanding proper rehabilitation and compensation.

Economically, the Sardar Sarovar Dam project has faced scrutiny for cost overruns and delays in construction. Critics argue that the economic benefits have not been realized to the extent promised and that the project's overall cost has escalated. Supporters, on the other hand, contend that the dam has been crucial for irrigation and electricity generation in Gujarat, contributing to the state's development. The Sardar Sarovar Dam controversy has played out in various courts and legal forums. The Supreme Court of India and the Narmada Control Authority have been involved in adjudicating disputes related to the dam. The project's progression has been influenced by government policies and changing political landscapes over the years.

Tehri Dam:

One of the primary concerns regarding the Tehri Dam is its environmental impact. The construction of the dam involved submerging a large area of land, which led to habitat destruction, changes in water quality, and alterations in the river's ecosystem.

Critics argue that these environmental changes have adverse consequences for the region's biodiversity, including the potential threats to endangered species. Tehri Dam is located in a seismically active zone, and concerns have been raised about its safety in the event of a major earthquake. The region's geological vulnerability has led to apprehensions about the dam's structural integrity and its ability to withstand seismic activity. Proponents of the dam assert that it has been designed to withstand seismic events, while opponents remain skeptical. Similar to other dam controversies in India, the Tehri Dam project involved the displacement of local communities. Thousands of families were relocated to make way for the dam and its reservoir. The controversy centers on the adequacy of their rehabilitation and compensation. Critics argue that the affected communities have not been adequately compensated or provided with suitable alternative livelihoods. The Tehri Dam is designed to provide water for irrigation, as well as generate hydroelectric power. Disputes have arisen over the allocation of water resources and the benefits of the dam for different stakeholders. These disputes often involve debates between states or regions that share the water from the dam.

The construction of the Tehri Dam involved significant technological and engineering challenges. The controversy relates to the dam's feasibility, safety, and the potential risks associated with such a large and complex project. Supporters emphasize the engineering achievements, while critics point to the perceived risks and potential environmental damage. The project has also raised concerns about the preservation of local cultural heritage, as it has submerged numerous villages and historical sites. The displacement and loss of cultural heritage have been central points of contention in the controversy.

Dibang Dam:

The Dibang Dam controversy in India encapsulates the contentious proposal to construct a large hydroelectric dam on the Dibang River, situated in the northeastern state of Arunachal Pradesh. This river, renowned for its rich biodiversity, flows through a region characterized by

diverse flora and fauna, making the dam's construction a focal point of environmental and social debates. The controversy primarily stems from the potential alterations in the river's natural flow and the submergence of a substantial forested area, giving rise to concerns about habitat destruction and disruptions in the local ecosystem. Critics of the project express apprehensions regarding the significant environmental and wildlife implications associated with the dam's construction. The modification of the river's flow, a consequence of the dam, raises concerns about potential habitat destruction and disturbances to the intricate balance of the local ecosystem. The reservoir formed by the dam would submerge an extensive forested area that serves as a habitat for a myriad of plant and animal species. This submergence poses a direct threat to the region's diverse wildlife, with fears of displacement and potential loss, particularly for species already classified as endangered. The ecological impact of such alterations requires careful consideration to mitigate potential harm to biodiversity and ecosystem services.

Adding another layer of complexity to the controversy is the seismic activity in the region. The proposed dam's location near a fault line raises questions about its structural safety during seismic events, reminiscent of concerns raised in the Koyna Dam controversy. The seismic risks associated with large-scale dams necessitate rigorous safety assessments and the implementation of measures to mitigate potential hazards. Ensuring the structural integrity of the dam is paramount to prevent catastrophic consequences in the event of an earthquake. Beyond environmental considerations, the controversy extends into the social realm, particularly concerning the displacement of indigenous communities residing in the project's vicinity. The creation of the dam's reservoir would lead to the forced relocation of these communities, raising profound concerns about the preservation of their traditional ways of life. Adequate rehabilitation and compensation for the affected populations become imperative to address the socio-economic repercussions of the dam project. Additionally, preserving the cultural practices and social structures of these indigenous communities requires inclusive planning and community engagement to ensure their voices are heard and their rights respected throughout the decision-making process.³

³ Ecusocmin, <https://www.ecusocmin.org/embracing-inclusive-democracy-empowering-voices-for-collective-decision-making/>, (last visited Feb. 01, 2024).

The Dibang Dam controversy highlights the intricate balance required in large-scale infrastructure development, particularly in ecologically sensitive regions. The potential trade-offs between economic development and environmental and social well-being necessitate a comprehensive and transparent evaluation of the project's impacts. Environmental impact assessments should consider the broader ecosystem dynamics, biodiversity conservation, and potential consequences on local communities. As India grapples with the imperative of meeting its energy needs and pursuing development goals, navigating such controversies becomes crucial. Striking a balance between development aspirations and environmental and social considerations calls for a holistic approach. Incorporating sustainable practices, utilizing advanced technologies to minimize environmental impact, and fostering meaningful dialogue with all stakeholders are essential components of responsible project planning. The lessons gleaned from controversies like the Dibang Dam can contribute to the formulation of improved policies and practices for future infrastructure projects, fostering

Hirakud Dam:

The Hirakud Dam, a monumental multipurpose river valley project situated on the Mahanadi River in Odisha, India, stands as one of the earliest and largest of its kind in the country. While it has significantly contributed to water resource management, irrigation, and power generation, its development has not been without environmental repercussions.

The creation of the Hirakud Dam's reservoir necessitated the submergence of an extensive area of land, encompassing forests, agricultural land, and natural habitats. This has resulted in a direct loss of biodiversity and the destruction of ecosystems that were integral to the region's ecological balance. The dam's alteration of the river's natural flow and the presence of the reservoir have disrupted aquatic ecosystems, leading to a cascade of environmental impacts. Changes in water temperature, flow patterns, and sediment transport within the reservoir have adverse effects on aquatic life, particularly fish populations. The altered conditions can disrupt breeding and feeding patterns, impacting the overall health of aquatic ecosystems. Furthermore, the accumulation of sediment in the dam's reservoir over the years has resulted in siltation, a process that can compromise the dam's efficiency and reduce its water storage capacity. The dam also obstructs the natural downstream transport of sediment, contributing to downstream erosion and potentially causing coastal issues.

Downstream agricultural fields are also affected by the dam's presence, as altered sediment deposition can impact nutrient levels, influencing soil fertility and crop productivity. Changes in water quality downstream are another consequence of the dam's influence. Altered flow patterns, sediment accumulation, and variations in nutrient levels can collectively impact the overall health of the river and its surrounding environment. The ecological balance and biodiversity downstream may be compromised, affecting the livelihoods of communities dependent on the river for various purposes. Beyond these environmental concerns, the presence of the dam has been linked to induced landslides in the surrounding hilly terrain. The alteration of water levels and increased pressure on slopes can trigger landslides, posing risks to human settlements and the broader environment.

This introduces additional challenges for both the safety of local communities and the long-term stability of the landscape.

Addressing the multifaceted environmental challenges associated with the Hirakud Dam necessitates a holistic approach. Strategies for mitigating the impact on aquatic ecosystems, preventing siltation, and managing sediment transport downstream are crucial. Additionally, efforts should be directed toward maintaining water quality and minimizing induced landslides in the surrounding areas. Sustainable reservoir management practices, advanced monitoring systems, and adaptive strategies can contribute to mitigating the environmental consequences while allowing the dam to continue serving its intended purposes. In retrospect, the development and operation of large-scale dams, such as the Hirakud Dam, underscore the importance of considering the long-term ecological consequences of such projects. Striking a balance between harnessing water resources for human needs and safeguarding the environment requires continuous evaluation, adaptive management, and a commitment to sustainable practices. As India navigates its water resource challenges, the lessons learned from dams like Hirakud will play a pivotal role in shaping future policies and practices for responsible water resource management.⁴

Koyna Dam:

⁴ Roberto Bagatin a, Jiří Jaromír Klemeš b, Andrea Pietro Reverberi c, Donald Huisingh , Conservation and improvements in water resource management: a global challenge, 77, Journal of Cleaner Production, Pages 1-9, 2014, <https://doi.org/10.1016/j.jclepro.2014.04.027>

The Koyna Dam, nestled in the state of Maharashtra, India, has become a focal point of controversy, primarily centered around its seismic activity and its association with the significant earthquake of 1967. Positioned in a seismically active zone, the dam has sparked debates and discussions related to reservoir-induced seismicity (RIS) and its potential impact on the region.

The controversy stems from the belief that the impoundment of the Koyna Dam's reservoir, which commenced in 1962, played a role in inducing earthquakes in the vicinity. The most notable and damaging earthquake occurred in 1967, registering a magnitude of 6.3 on the Richter scale. This seismic event resulted in substantial damage, including the loss of lives and property, prompting widespread discussions about the connection between the dam and the heightened seismic activity in the area.⁵

Reservoir-induced seismicity is a phenomenon wherein the filling of large reservoirs behind dams can lead to an increase in both the frequency and magnitude of earthquakes in the surrounding region. In the case of the Koyna Dam, the weight of the reservoir water has been linked to inducing stress in the Earth's crust, potentially triggering earthquakes. This association has raised concerns about the safety and design of dams in seismically active regions. The controversy has prompted engineers and authorities to reevaluate and enhance safety measures for dams in such areas. Strategies to mitigate seismic risks, such as improved monitoring systems, advanced engineering designs, and the implementation of early warning systems, have been explored and implemented. The goal is to strike a balance between harnessing water resources for various purposes and ensuring the safety of communities living in seismically sensitive regions.

The seismic activity around the Koyna Dam has not only raised engineering and safety concerns but has also ignited environmental apprehensions. Dams inducing earthquakes can have far-reaching effects on the local ecosystem, influencing aquatic life, water quality, and the geological stability of the region. Environmental impact assessments are crucial in understanding the broader consequences of dam construction and operation, allowing for

⁵ esa, https://www.esa.int/Applications/Observing_the_Earth/Litli_Hrutur_eruption_seen_from_space, (last visited Feb. 01, 2024).

informed decision-making that considers both developmental needs and ecological sustainability. In conclusion, the Koyna Dam controversy exemplifies the intricate interplay between human infrastructure projects, seismic activity, and environmental concerns. It underscores the importance of comprehensive assessments, ongoing research, and adaptive management practices to address the multifaceted challenges associated with dams in seismically active regions. Balancing the developmental benefits of dams with the need to safeguard communities and ecosystems remains a critical endeavor for engineers, policymakers, and environmentalists alike.⁶

A Summary of Major Causes of Dam Controversies in India:

1. **Environmental Impact:** One of the primary areas of contention in dam construction in India is the environmental impact. Dams can alter the natural flow of rivers, leading to habitat destruction, changes in water quality, and disruptions to aquatic ecosystems. The consequences of these alterations have sparked protests from environmentalists and local communities. Many have raised concerns about the loss of biodiversity, including endangered species, and the disruption of local ecosystems.
2. **Displacement and Social Implications:** Another significant aspect of dam controversies in India is the displacement of communities living in the dam's vicinity. Large-scale dams often require the relocation of villages and communities, resulting in social upheaval and the loss of livelihoods. Protests and disputes arise when the affected populations demand fair compensation and rehabilitation. These issues have drawn attention to the need for better policies and practices in ensuring the welfare of those displaced by dam projects.
3. **Water Sharing Disputes:** Water is a precious resource, and the sharing of river waters can become a contentious issue, especially in regions with multiple states or countries sharing a river basin.⁷ India has witnessed disputes between states over the distribution of river waters, which can escalate into protracted legal battles and political disagreements.

⁶ Huang, D., Jin, F., Wang, G., Feng, K. (2020). Towards Physics-Based Large-Deformation Analyses of Earthquake-Induced Dam Failure. In: Zhang, JM., Zhang, L., Wang, R. (eds) Dam Breach Modelling and Risk Disposal. ICED 2020. Springer Series in Geomechanics and Geoengineering. Springer, Cham. https://doi.org/10.1007/978-3-030-46351-9_10

⁷ Anamika Barua, Sumit Vij & Mirza Zulfiqur Rahman (2018) Powering or sharing water in the Brahmaputra River basin, *International Journal of Water Resources Development*, 34:5, 829-843, DOI: [10.1080/07900627.2017.1403892](https://doi.org/10.1080/07900627.2017.1403892)

The dispute between Tamil Nadu and Karnataka over the Cauvery River is a prime example of such conflicts.

4. Economic Costs and Benefits: Evaluating the economic aspects of dam construction is essential in understanding the full scope of dam controversies. While dams can provide benefits such as hydropower generation and irrigation for agriculture, they also come with significant financial costs. Delays in project completion and cost overruns can strain public finances and raise concerns about the overall viability of dam projects.

5. Indigenous and Cultural Concerns: Dams often have an impact on indigenous populations and their cultural heritage. The submergence of historical and sacred sites can lead to cultural and emotional upheaval within these communities. Addressing these concerns and ensuring the preservation of cultural heritage is vital for dam projects to gain social acceptance.

Balancing the Need for Dams and their Environmental Impact in India:

Balancing the need for dams and their environmental impact in India requires careful planning, sustainable practices, and inclusive decision-making processes. Here are some strategies and approaches to achieve this balance:

- **Comprehensive Environmental Impact Assessments (EIA):** Conduct thorough and transparent environmental impact assessments before and during the planning phase of dam projects. Identify potential environmental risks and impacts, including habitat destruction, water quality changes, and potential seismic activity.
- **Site Selection:** Choose dam sites with minimal ecological and social impact. Prioritize locations with less biodiversity, lower seismic risk, and fewer communities at risk of displacement.
- **Sustainable Design:** Implement environmentally friendly design features, such as fish ladders, sediment control systems, and water flow management mechanisms, to minimize ecological disruption.
- **Adaptive Management:** Develop adaptive management plans that allow for continuous monitoring and mitigation of environmental impacts. This includes addressing issues like siltation and sediment transport.

- **Public Consultation:** Involve local communities, indigenous groups, and environmental organizations in the planning and decision-making process. Their input is valuable for understanding the local context and identifying potential concerns.
- **Resettlement and Compensation:** Ensure fair and just compensation for communities displaced by dam projects. Implement comprehensive rehabilitation programs to help affected communities re-establish their livelihoods.
- **Environmental Safeguards:** Enforce stringent environmental regulations and safeguards to minimize the impact of dam projects. Regular inspections and monitoring are essential.
- **Research and Innovation:** Invest in research and innovation to develop and implement new technologies and practices that reduce the environmental impact of dams.
- **Watershed Management:** Implement holistic watershed management programs that consider the entire river basin. This approach helps in better understanding and mitigating the cumulative effects of multiple dams in a region.
- **Regional Cooperation:** Collaborate with neighboring states or countries sharing the same river basin to address water allocation, ecological conservation, and downstream impact issues collectively.
- **Conservation Measures:** Implement conservation measures to protect endangered species and sensitive habitats in dam-affected areas. Create wildlife corridors and sanctuaries to preserve biodiversity.
- **Environmental Offset Programs:** Develop programs to offset the environmental impact by investing in conservation and restoration efforts in other areas.
- **Decommissioning Plans:** Develop plans for the eventual decommissioning and removal of dams, including the restoration of natural ecosystems, which can be an essential part of minimizing long-term environmental impact.

Balancing the need for dams and their environmental impact is a complex task that requires interdisciplinary cooperation, effective regulation, and a commitment to sustainability. It involves considering the long-term ecological, social, and economic consequences of dam projects and striving for a balance that serves the best interests of both development and environmental conservation.

Environmental Laws and Regulations:

Environmental laws and regulations in India related to dams are aimed at ensuring that dam construction and operation are carried out in an environmentally sustainable and responsible manner.

Key laws and regulations include:

1. The Environment (Protection) Act, 1986: This act empowers the central government to take measures to protect and improve the quality of the environment. It includes provisions for setting environmental standards and regulations for various activities, including dam construction.⁸
2. The Water (Prevention and Control of Pollution) Act, 1974: This act focuses on the prevention and control of water pollution. It includes provisions for regulating and monitoring water quality in dam reservoirs and downstream areas.⁹
3. The Forest (Conservation) Act, 1980: This act is designed to conserve and protect forests. It requires the central government's approval for the diversion of forest land for non-forest purposes, including dam construction.¹⁰
4. The Wildlife Protection Act, 1972: This act aims to protect wildlife and their habitats. It includes provisions for safeguarding the natural habitat of wildlife, which can be affected by dam projects.¹¹
5. The National Environment Policy, 2006: This policy provides a framework for integrating environmental considerations into development activities, including dam construction.¹²
6. The National Water Policy, 2012: This policy promotes sustainable and equitable water resource management, which is highly relevant for dam projects involving water storage and distribution.¹³

⁸ The Environment (Protection) Act, 1986, No. 29, Acts of Parliament, 1986 (India).

⁹ The Water (Prevention and Control of Pollution) Act, 1974, No. 6, Acts of Parliament, 1974 (India).

¹⁰ The Forest (Conservation) Act, 1980, No. 69, Acts of Parliament, 1980 (India).

¹¹ The Wild Life (Protection) Act, 1972, No. 53, Acts of Parliament, 1972 (India).

¹² NATIONAL ENVIRONMENT POLICY 2006,
https://ibkp.dbtindia.gov.in/DBT_Content_Test/CMS/Guidelines/20190411103521431_National%20Environment%20Policy.%202006.pdf (last visited on November 20, 2023)

¹³ NATIONAL WATER POLICY 2012,
https://nwm.gov.in/sites/default/files/national%20water%20policy%202012_0.pdf (last visited on November 20, 2023)

7. The Environmental Impact Assessment (EIA) Notification, 1994 (revised in 2006 and 2020): This notification outlines the process for conducting environmental impact assessments for various development projects, including dams. It sets out procedures for obtaining environmental clearances.¹⁴
8. The Forest Conservation Rules, 2003: These rules provide detailed guidelines for obtaining approvals for forest land diversion, which is often required for dam projects.¹⁵
9. The Wetlands (Conservation and Management) Rules, 2017: These rules focus on the conservation and management of wetlands, which are often impacted by dam construction. They outline procedures for identifying and notifying wetlands and regulating activities within them.¹⁶
10. The National Green Tribunal (NGT) Act, 2010: The NGT is a specialized tribunal that deals with environmental disputes and cases, including those related to dam projects. It has the authority to hear and decide matters related to environmental protection and conservation.¹⁷
11. State-Specific Regulations: Many Indian states have their own environmental laws and regulations that may apply to dam projects, including state environmental impact assessment procedures.

These laws and regulations aim to ensure that dam projects are subjected to rigorous environmental assessments, follow strict environmental safeguards, and adhere to principles of sustainable development. They also provide mechanisms for public participation, environmental clearances, and legal remedies in case of non-compliance. Compliance with these laws is essential for responsible and sustainable dam construction and operation in India.

Role of the Judiciary in Addressing Dam Controversies in India:

Several landmark judgments related to dam controversies in India have shaped the legal landscape and influenced the management of dam projects. Here are some notable decisions:

¹⁴ EIA NOTIFICATION 2006, https://environmentclearance.nic.in/writereaddata/EIA_notifications/2006_09_14_EIA.pdf (last visited on November 20, 2023)

¹⁵ FOREST CONSERVATION RULES 2003, https://forestclearance.nic.in/writereaddata/public_display/news/2%20Handbook.pdf (last visited on November 20, 2023)

¹⁶ WETLANDS (CONSERVATION AND MANAGEMENT) RULES 2017, <https://indianwetlands.in/uploads/Wetlands2017.pdf> (last visited on November 20, 2023)

¹⁷ National Green Tribunal (NGT) Act, 2010, No. 19, Acts of Parliament, 2010 (India).

1. Sardar Sarovar Dam (Narmada Bachao Andolan vs. Union of India¹¹): This case is one of the most significant dam-related judgments in India. The Supreme Court upheld the construction of the Sardar Sarovar Dam on the Narmada River but imposed strict conditions related to environmental safeguards and rehabilitation of displaced communities. The judgment emphasized the need for the "right to life" and the protection of human rights in the context of dam construction.¹⁸
2. Tehri Dam and Environmental Safeguards (Tehri Bandh Virodhi Sangharsh Samiti vs. State of Uttar Pradesh¹²): The Supreme Court's intervention in the Tehri Dam case led to a landmark decision that addressed environmental concerns, particularly the seismic vulnerability of the region. The judgment emphasized the importance of strict adherence to environmental laws and regulations in dam construction.¹⁹
3. Cauvery River Water Dispute (Cauvery Water Disputes Tribunal): While not a court judgment, the Cauvery Water Disputes Tribunal's award¹³ in 2007 was a landmark decision in addressing water-sharing conflicts related to dams. The award provided a formula for the equitable distribution of Cauvery River waters among the states of Karnataka, Tamil Nadu, Kerala, and Puducherry.²⁰
4. Yamuna Pollution and Clean-up (M.C. Mehta vs. Union of India¹⁴ - Yamuna Pollution Case): This case addressed pollution in the Yamuna River, partly attributed to the construction of dams and other factors. The Supreme Court issued directives for the prevention and control of pollution in the river and emphasized the importance of preserving and restoring the river's ecological balance.²¹
5. Indus Waters Treaty¹⁵: These cases involve arbitration under the Indus Waters Treaty between India and Pakistan. The judgments and awards addressed disputes related to the Baglihar Dam and Kishanganga Dam established principles for the design and operation of these dams while respecting water-sharing agreements.²² These landmark judgments and

¹⁸ Narmada Bachao Andolan vs. Union of India, (2000) 10 SCC 664

¹⁹ Tehri Bandh Virodhi Sangharsh Samiti vs. State of Uttar Pradesh, (1992) SCC Supl. (1) 44

²⁰ CAUVERY RIVER WATER DISPUTE AWARD 2007, <https://cdnbbsr.s3waas.gov.in/s3a70dc40477bc2adceef4d2c90f47eb82/uploads/2022/12/2022122858.pdf> (last visited on November 22, 2023)

²¹ M.C. Mehta vs. Union of India, AIR 1988 SC 1037

²² THE INDUS WATERS TREATY 1960, <https://treaties.un.org/doc/Publication/UNT/Volume%20419/volume-419-I-6032-English.pdf> (last visited on November 23, 2023)

decisions have had far-reaching implications for dam projects, water disputes, and environmental protection in India. They highlight the critical role of the judiciary in addressing dam controversies and ensuring equitable, sustainable, and legally compliant outcomes.

CONCLUSION:

In conclusion, the controversies surrounding dam projects in India highlight the delicate equilibrium that must be achieved between development goals and the myriad environmental, social, and economic considerations inherent in large-scale infrastructure initiatives. While dams have undeniably played a pivotal role in advancing the nation's progress by providing crucial services such as water storage, irrigation, and electricity generation, they have simultaneously posed significant challenges that necessitate careful consideration and strategic management. One of the paramount concerns associated with dam projects is their environmental impact. Habitat destruction, alterations in water quality, and the heightened seismic risks, as exemplified by the Koyna Dam controversy, emphasize the imperative need for comprehensive environmental assessments and effective mitigation strategies. The consequences of large dams on local ecosystems are profound, impacting biodiversity and ecological balance. Consequently, the planning and execution of dam projects must be informed by a deep understanding of the intricate ecological web and the potential long-term effects on the environment.

Furthermore, the displacement of communities and disruption of traditional livelihoods due to dam construction have illuminated the necessity for equitable rehabilitation and community engagement. The social implications of large dams extend beyond immediate displacement, affecting cultural practices, social structures, and community cohesion. Therefore, any development initiative involving dams must prioritize the well-being of affected communities, ensuring that their rights are respected, and their voices are heard throughout the

decision-making process. Inclusivity in planning and execution is vital to achieving sustainable and socially responsible development. Balancing the imperatives of development, water resource management, and environmental preservation, while respecting the rights and needs of affected communities, poses a formidable challenge. As India grapples with the escalating demands for water, energy, and flood control, it is crucial to adopt a holistic perspective in approaching dam construction and operation. The nation must leverage the benefits of dams

judiciously, mindful of the potential repercussions on precious ecosystems and cultural heritage, as well as the diverse population that calls these regions home. To navigate the complexities and controversies surrounding dam projects successfully, there is a growing need for transparent decision-making, inclusive policies, and effective communication with stakeholders. Transparent and accountable governance can foster public trust and support, making it essential for authorities to share information openly, address concerns, and incorporate public feedback into decision-making processes. Inclusivity ensures that diverse perspectives are considered, making policies more robust and responsive to the needs of the people and the environment. Balancing these intricate and sometimes conflicting interests will undoubtedly remain an ongoing challenge. It requires a combination of thoughtful policy formulation, active public participation, and a commitment to pursuing sustainable solutions. Incorporating the principles of sustainability into dam planning and operation can help mitigate environmental and social impacts, fostering a harmonious coexistence between development and the preservation of natural and cultural assets. Ultimately, addressing the challenges associated with dam projects will be pivotal for India's sustainable and equitable water resource management in the future. Striking the right balance requires a proactive and adaptive approach that integrates the best available knowledge, embraces diverse perspectives, and upholds principles of environmental stewardship and social justice. Through such an approach, India can navigate the complexities surrounding dam controversies and lay the foundation for a more sustainable and inclusive developmental trajectory.



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