


Instream Flow Rights for Protecting River Ecology in Nigeria's Bitumen Zone: Learning From Uganda's Experience

Adedoyin Olusegun Akinsulore  


School of Law, Kampala International University, Uganda

Oluwadamilola Adebola Adejumo 

Obafemi Awolowo University, Nigeria

Paul Atagamen Aidonojie 

School of Law, Kampala International University, Uganda

adedoyin.akinsulore@kiu.ac.ug

Abstract

Water is a vital resource essential for the survival of humans, animals, and ecosystems. Its inclusion in the Sustainable Development Goals (SDGs) underscores its importance. Effective management and regulation of water resources are critical for achieving development across key sectors. However, freshwater scarcity is an increasing concern, particularly with the high water consumption involved in bitumen mining and production. This study employs a hybrid research method to assess water resource regulation in Nigeria and Uganda. A total of 226 questionnaires were distributed to respondents in Nigeria, and the data was analyzed using descriptive and analytical techniques. The findings reveal a lack of a robust legal framework regulating water usage in bitumen mining in Nigeria, in contrast to Uganda, where more

comprehensive water regulations exist. The study further concludes that unregulated water withdrawals for bitumen production in Nigeria threaten the achievement of SDG 6.4, which focuses on sustainable water use. To prevent ecological disasters and ensure the sustainability of freshwater ecosystems in Nigeria's bitumen belt, the study recommends strengthening existing legal and institutional frameworks to guarantee instream flow and sustainable water use in mining activities, drawing from the experiences of countries like Uganda.

Keywords

Bitumen, Freshwater, Instream Flow, Mining, Sustainable Development Goals, Water Management

Introduction

Water is essential for the survival of all living organisms, including humans.¹ Denying access to water without lawful authority infringes upon the right to life and an adequate standard of living, as enshrined in international human rights law.² Water is not only vital for human survival but also critical to maintaining the ecological balance of natural water systems.³ When water is over-extracted without regulation, it disrupts these ecosystems.⁴ In Nigeria, bitumen has been designated as a strategic resource for economic diversification. However, the development of bitumen places significant pressure on freshwater resources in the areas where it is mined, threatening the ecological balance of these regions.⁵

The demand for water in bitumen extraction is substantial. For example, 0.159 cubic meters of water is required to produce a single barrel of bitumen in in-situ drilling operations, while 2.5 barrels of

¹ Amy Hardberger, "Life, liberty, and the pursuit of water: evaluating water as a human right and the duties and obligations it creates," *Nw. Univ. J. Int'l Hum. Rts.* 4 (2005): 331.

² Takele Soboka Bulto, "The emergence of the human right to water in international human rights law: Invention or discovery," *Melb. J. Int'l L.* 12 (2011): 290.

³ Brian D. Richter dkk., "Ecologically Sustainable Water Management: Managing River Flows for Ecological Integrity," *Ecological Applications* 13, no. 1 (Februari 2003): 206–24, [https://doi.org/10.1890/1051-0761\(2003\)013\[0206:ESWMMR\]2.0.CO;2](https://doi.org/10.1890/1051-0761(2003)013[0206:ESWMMR]2.0.CO;2).

⁴ Andrew Watters, "Freshwater Scarcity: The Current Situation in Southern Ontario," *York University, Toronto, Ontario, Canada*, 2019, 145.

⁵ Kayode Ogunsusi, "Bitumen Seepage and its Effects on Biodiversity in Ondo State, Nigeria" (PhD Thesis, Ibadan, University of Ibadan, Ibadan, 2013).

freshwater are necessary to produce one barrel of bitumen in mining operations.⁶ Even more water is consumed in processing bitumen into slurries for extraction. This growing demand for freshwater creates a tension between the pursuit of national economic growth through bitumen exploitation and the need to maintain environmental and ecological balance for both humans and other organisms dependent on local water systems.⁷

While exploiting mineral resources is a proven pathway to economic development, the question arises: Should development prioritize human needs at the expense of the environment? Should it jeopardize the health of ecosystems, including the flora and fauna that depend on these water sources? What, ultimately, is the true meaning of sustainable development?

This paper seeks to address these crucial questions to help prevent ecological disasters and promote the sustainability of freshwater ecosystems, particularly in Nigeria's bitumen-rich regions. It explores the acceptable limits of water use during bitumen mining operations, with a focus on ensuring adequate instream flow. Additionally, it examines the need for legal and institutional frameworks to guarantee sustainable water use in these operations. The significance of this research lies in identifying regulatory gaps that, if addressed, could prevent unsustainable and unregulated withdrawals of freshwater for bitumen production. The paper's key contribution is its call for the establishment of legal rights to regulate or prevent such uncontrolled withdrawals, offering a novel approach to safeguarding water resources in the context of bitumen mining.

Method

This study employs a blended research methodology, integrating both doctrinal and non-doctrinal approaches to explore the legal and socioeconomic aspects of instream flow rights for the protection of

⁶ Lorenzo Rosa dkk., "Environmental Consequences of Oil Production from Oil Sands," *Earth's Future* 5, no. 2 (Februari 2017): 158–70, <https://doi.org/10.1002/2016EF000484>.

⁷ Vsp Vamsi, "The Valuable Natural Resources of the World, Economic Growth & The Global Environment," *International Journal of Engineering Development and Research* 8, no. 3 (2020): 389–421.

river ecology in Nigeria's Bitumen Zone, drawing lessons from Uganda. The doctrinal component focuses on theoretical and conceptual analysis, examining relevant legal frameworks and scholarly literature.⁸ This includes a thorough review of existing legislation, such as the Instream Flow Rights Act and related statutes in both Nigeria and Uganda, as well as an assessment of academic sources from online journals, books, and other publications. The aim is to gain a deeper understanding of the legal structures governing instream flow rights in the Nigerian context.⁹

The non-doctrinal aspect of the study seeks to gather practical insights from stakeholders actively involved in managing and conserving river ecosystems in the Nigerian Bitumen Zone. This is achieved through distributing questionnaires and conducting interviews with individuals and organizations engaged in river ecology and conservation. The goal is to collect firsthand accounts of the challenges, opportunities, and socioeconomic impacts of instream flow rights implementation in the region. The qualitative data gathered is then analyzed thematically to highlight key issues and identify potential solutions.¹⁰

By combining doctrinal and non-doctrinal approaches, this research provides a holistic view of the legal and socioeconomic dynamics surrounding the enforcement of instream flow rights for river ecosystem protection in Nigeria's Bitumen Zone. This comprehensive methodology allows for the development of informed recommendations and strategies aimed at addressing identified challenges and enhancing the effectiveness of instream flow rights initiatives in the region.¹¹

The Legal Framework for In-stream Flow in Nigeria

⁸ Terry Hutchinson, "The doctrinal method: Incorporating interdisciplinary methods in reforming the law," *Erasmus L. Rev.* 8 (2015): 130.

⁹ William M. Landes dan Richard A. Posner, "Legal precedent: A theoretical and empirical analysis," dalam *Scientific Models of Legal Reasoning* (Routledge, 2013), 85–144.

¹⁰ Cameron Holley dkk., "Using adaptive theory and multi-modal case study methods in environmental law research," *Non-doctrinal Research Methods in Environmental Law*, 2023, 130–53.

¹¹ Toufiq A. Sidiqi dan Shirin Tahir-Kheli, "Water Conflicts in South Asia: Managing Water Resource Disputes within and between countries of the region," 2004.

An analysis of Nigeria's water laws reveals a lack of adequate recognition for the in-stream flow needs of rivers and streams. In-stream flow rights, which refer to the maintenance of water levels to support ecosystems, are not recognized as rights that can be acquired through the country's statutory administrative structures governing water resources.¹² Notably, the concept of in-stream flow or rights is absent from Nigeria's primary water resource protection laws. Even with a generous interpretation of existing provisions, any reference to in-stream flow rights is speculative, as the laws make no explicit mention of them.¹³

For instance, Section 5(e) of the Water Resources Act could be interpreted to grant the Minister the authority to recognize and provide for in-stream flow rights, particularly when such actions would protect inland and estuarine fish, flora, and fauna. Similarly, Section 8(d) of the Act grants the Minister powers to "prohibit or regulate activities on land or water that may interfere with the quantity or quality of water in any watercourse or groundwater." Additionally, the Minister has the discretion to refuse licenses for activities that may negatively impact water quality or quantity. However, since the Minister is a political appointee, political affiliations and considerations may influence how these discretionary powers are exercised. This raises concerns that political factors could delay or undermine the proper use of this discretion, even when there is a need to act.¹⁴

A further examination of the River Basin Development Authority (RBDA) Act highlights a significant gap. The RBDA is established to focus solely on the consumptive use of water, with no legal mandate covering the non-consumptive use of water, such as maintaining minimum in-stream flows. As a result, the River Basin Authorities lack the legal authority to ensure adequate in-stream flow in the rivers under their management. This omission has serious consequences for the

¹² Philippus Wester dan Jeroen Warner, "River basin management reconsidered," *Hydropolitics in the developing world: A Southern African perspective*, 2002, 61–71.

¹³ Miguel Solanes, "Legal and Institutional Aspects of River Basin Development," *Water International* 17, no. 3 (Januari 1992): 116–23, <https://doi.org/10.1080/02508069208686131>.

¹⁴ Olawale Ajai, "Law, water and sustainable development: framework of Nigerian law," *Law Env't & Dev. J.* 8 (2012): 89.

aquatic ecosystems, potentially harming the flora and fauna that depend on consistent river flow levels.¹⁵

Legal Framework for the Regulation and Protection of Water

Bodies in Uganda

The sustainable use of water resources in Uganda aligns with the Sustainable Development Goals (SDGs), particularly those addressing water management and environmental sustainability. Uganda's numerous rivers and water bodies serve multiple purposes, contributing significantly to the nation's economic development. Recognizing their commercial and ecological importance, the Ugandan government has established a comprehensive legal framework to regulate and protect these water bodies, ensuring their continued viability for future generations. Key aspects of this framework are outlined below.¹⁶

The Uganda Rivers Act, Chapter 357 of 2002

The Uganda Rivers Act serves as the foundational legal document governing the use and protection of the country's water bodies. In the First Schedule, the Act lists several key rivers, including the Assua, Semliki, Kafu, Muyunja, Kagera, the Nile (from Lake Victoria to Lake Albert), Katonga, and Sezibwa Rivers.

Licensing for Steam Vessels

Section 9 of the Act mandates that all steam vessels operating on Ugandan rivers must obtain a license. These licenses are issued by the Minister or a designated officer and are outlined in Form B of the Second Schedule. Each license is valid from the date of issuance until December 31 of the following year. Failure to secure a license constitutes an offense, punishable by a fine of up to 150 shillings upon conviction.

Regulation of Dredging Activities

Section 4(1) of the Rivers Act prohibits dredging in any river without a license, which must conform to Form A in the Second

¹⁵ Peter Millington, "River basin management: Its role in major water infrastructure projects," *Thematic Review* 3 (2000).

¹⁶ Dante A. Caponera dan Marcella Nanni, *Principles of water law and administration: national and international* (Routledge, 2019), <https://www.taylorfrancis.com/books/mono/10.1201/9780429465703/principles-water-law-administration-marcella-nanni-dante-caponera>.

Schedule. Unauthorized dredging, or violation of a license's terms, constitutes an offense, subject to fines of up to 1,500 shillings per day for the duration of the offense. Section 6 further specifies that violations of dredging license conditions may result in fines of up to 3,000 shillings. In such cases, the licensee is also responsible for any damage caused by the violation. Noncompliance with legal orders or notices related to dredging operations also constitutes an offense under this section.

Additional Dredging Regulations

The Third Schedule of the Act outlines additional regulations applicable to dredging licenses. The Minister retains the authority to impose supplementary regulations on a case-by-case basis as necessary.

Key provisions of the Uganda Rivers Act emphasize strict regulation of dredging activities to protect water bodies. Under Regulation 3, dredging cannot commence without written consent from an inspector. Regulation 4 mandates that licensees provide inspectors with full access to plans and documents, allowing soundings and measurements, and requires written approval before relocating dredging activities. Regulation 7 stipulates that dredgers must be designed to prevent tailings from forming groins or shoals in the riverbed, with inspectors authorized to direct tailing deposition onto riverbanks if necessary. Regulation 8 requires that any obstructions caused by dredging, such as groins or shoals, must be promptly removed if they create erosion or navigation hazards. According to Regulation 11, if dredging in tributaries leads to silt or mud obstructing navigation in the main river or damaging its banks or bed, the licensee is responsible for addressing the issue. Finally, Regulation 12 obliges the licensee to indemnify the government and its officers for any accidents, injuries, damages, or losses resulting from dredging operations or related works.

Presentation and Analysis of Data

This section presents and analyzes the data collected from the survey questionnaires distributed to respondents across Nigeria. The data are organized and examined as follows:

Sample Size and Sampling Strategies

The study targeted a sample size of 226 respondents, selected from various geopolitical zones across Nigeria to ensure a diverse

representation. A simple random sampling technique was employed, as it is well-suited for selecting respondents from a large and heterogeneous population. This method was chosen for its advantages, which include:

1. Greater reliability in selecting participants from diverse populations.
2. Minimization of bias and partiality in the selection process.
3. Simplicity and ease of implementation compared to more complex methods.
4. Appropriateness for legal research using a hybrid methodological approach.

The use of this sampling technique ensured the data collection was broad and representative, facilitating the reliability of the findings.

Data Interpretation

The findings from the questionnaire have been organized and are presented in both tabular and graphical formats for clarity and ease of understanding. This approach helps to visually represent the data and simplify the identification of key trends and insights.

Research Question One

Figure 1: Respondents' identification of their residential areas within Nigeria. This figure displays the geographic distribution of the participants, providing a clear overview of where they reside across the country.

Which of the following Geopolitical Zones in Nigeria do you reside in?

226 responses

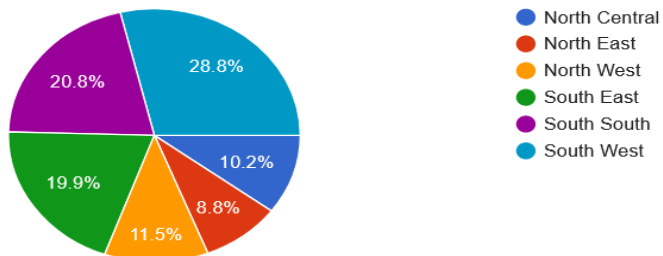


Table 1: Respondents by Geopolitical Zones of Residence in Nigeria

Figure 1 and Table 1 provide a breakdown of the respondents' residences across Nigeria's various geopolitical zones. This categorization offers a clear view of the distribution of participants based on their geographic locations within the country.

S/N	Geopolitical Zones in Nigeria	Responses of Respondents	Percent
1	North Central	23	10.2%
2	North East	20	8.8%
3	North West	26	11.5%
4	South East	45	19.9%
5	South South	47	20.8%
6	South West	65	28.8%
TOTAL		226	100%

Research Question Two

Figure 2 illustrates respondents' views on the importance of addressing concerns regarding water usage in bitumen mining operations involving water bodies. This figure highlights the level of awareness and acknowledgment among participants about the potential environmental impact of water consumption in the bitumen mining industry.

Do you agree that the utilization of large amounts of fresh water in bitumen mining in Nigeria calls for concern given Sustainable Development Goals?

226 responses

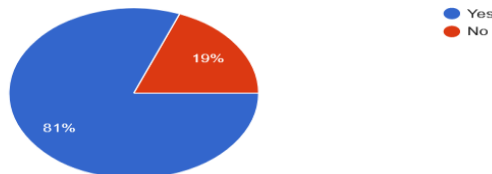


Table 2: Respondents Confirming the Need for Concern Regarding Water Usage in Bitumen Mining

Figure 2 and Table 2 show that respondents overwhelmingly recognize the need for government intervention regarding the substantial water usage involved in bitumen mining in Nigeria's water bodies. These results underscore a shared concern about the environmental and ecological impacts of such activities, highlighting the importance of regulatory oversight.

	Response	Percent
Valid Yes	183	81%
Valid No	43	19%
Total	226	100%

Research Question Three

Figure 3: Identification of the potential impact of unregulated water use for bitumen mining in Nigeria.

What potential environmental impacts do you foresee from unregulated withdrawals of water for bitumen mining and production? You can tick more than one option

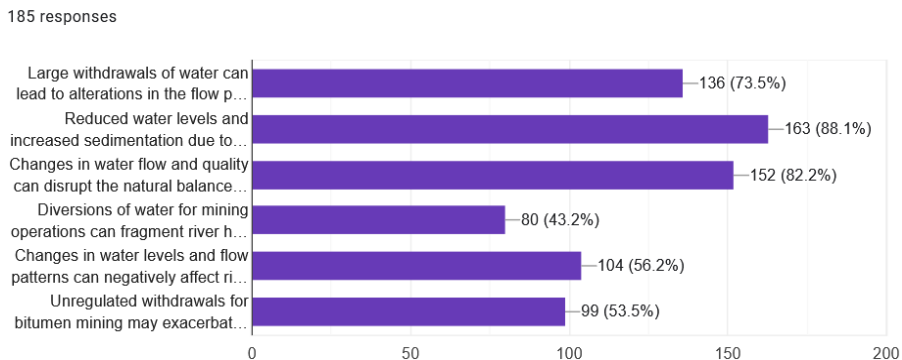


Table 3: Assessment of Potential Impacts of Unregulated Water Use in Bitumen Mining in Nigeria

Figure 3 and Table 3 illustrate clusters of respondents highlighting the potential risks associated with unregulated water usage from local water bodies in bitumen mining.

Impact of unregulated water usage for bitumen mining	Cluster of Response	Percentage
Large withdrawals of water can lead to alterations in the flow patterns and levels of rivers and streams, affecting the habitat of aquatic species.	136	73.5%
Reduced water levels and increased sedimentation due to mining activities can degrade water quality, impacting the health of aquatic ecosystems and the organisms within them.	163	88.1%
Changes in water flow and quality can disrupt the natural balance of ecosystems, leading to declines in biodiversity and the loss of sensitive species.	152	82.2%
Diversions of water for mining operations can fragment river habitats, isolating populations of aquatic species and reducing connectivity between different parts of the ecosystem.	80	43.2%
Changes in water levels and flow patterns can negatively affect riparian vegetation, which plays a critical role in stabilizing	104	56.2%

riverbanks, filtering pollutants, and providing habitat for wildlife.		
Unregulated withdrawals for bitumen mining may exacerbate water scarcity for local communities, affecting their ability to access clean water for drinking, agriculture, and other essential needs.	99	53.5%

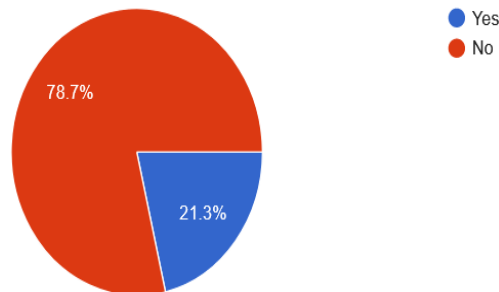
Figure 4: Respondents Assessing the Adequacy of the Legal Framework for Water Use in Bitumen Mining
 Research Question Four

Table 4: Valid Responses Regarding the Adequacy of the Legal Framework for Water Use in Bitumen Mining

Figure 4 and Table 4 present responses regarding the adequacy of the legal framework governing the sustainable use of significant water resources in bitumen mining in Nigeria.

Are there sufficient institutional and legal frameworks in place to ensure sustainable water use in bitumen operations in Nigeria?

225 responses



	Response	Percent
Valid Yes	48	21.3%
Valid No	117	78.7%
Total	225	100%

Research Question Five

Figure 5: Remedies for curtailing the unregulated use of water bodies for bitumen mining in Nigeria

Which recommendations and policies from Uganda would you suggest to enhance freshwater ecosystem sustainability in the Nigerian Bitumen Zone for SDG No. 6.4? You can tick more than option

186 responses

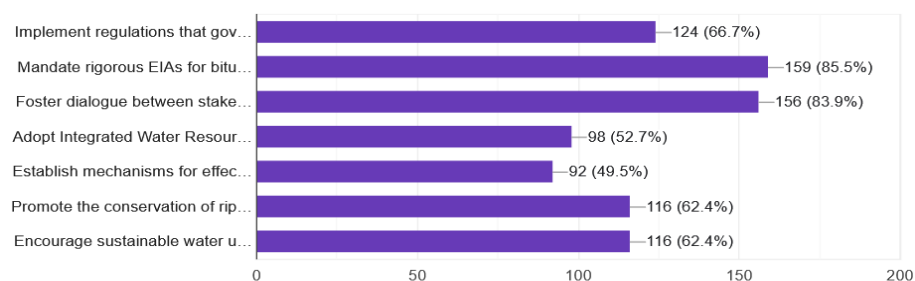


Table 5: Valid remedies for curtailing the unregulated use of water bodies for bitumen mining in Nigeria

Figure 5 and Table 5 are cluster respondents' stipulating the remedies that could be adopted to curtail the unregulated use of water from water bodies in bitumen mining

Remedies to curtail the unregulated use of water bodies for bitumen mining in Nigeria	Cluster of Responses	Percentage
Implement regulations that govern instream flows, ensuring minimum	124	66.7%

water levels are maintained to protect aquatic ecosystems.		
Mandate rigorous EIAs for bitumen mining projects to assess and mitigate environmental impacts, similar to Uganda's requirements.	159	85.5%
Foster dialogue between stakeholders, including local communities, extractive companies, and government agencies, to ensure sustainable water management practices through inclusive decision-making processes.	156	83.9%
Adopt Integrated Water Resource Management (IWRM) principles to coordinate and sustainably manage water resources, balancing competing water demands while safeguarding river ecology and ensuring water security.	98	52.7%
Establish mechanisms for effective environmental monitoring and enforcement to prevent and address environmental violations associated with bitumen mining activities.	92	49.5%

Promote the conservation of riparian habitats and vegetation.	116	62.4%
Encourage sustainable water use practices through education and awareness campaigns, thus promoting ecological conservation and supporting the achievement of SDG No. 6.4.	116	62.4%

The data obtained in this study, presented in tabular and graphical formats for clarity and ease of interpretation, are analyzed as follows: Table 1 and Figure 1 show that the 226 respondents are residents from various geopolitical zones in Nigeria, demonstrating a diverse and informed sample with relevant knowledge about water usage in bitumen mining. According to Figure 2 and Table 2, 81% of respondents expressed concern over the large volumes of water being used in bitumen mining, suggesting that this practice contradicts the Sustainable Development Goal (SDG) for water conservation and sustainable consumption.

Further concerns were supported by findings in Figure 3 and Table 3, which identified the environmental impacts of unregulated water use in bitumen mining:

1. 73.5% of respondents indicated that excessive water use could alter flow patterns and river levels, disrupting aquatic habitats.
2. 88.1% agreed that reduced water levels and increased sedimentation could degrade water quality, affecting the health of aquatic ecosystems.
3. 82.2% believed that changes in water flow and quality could destabilize ecosystems, leading to biodiversity loss.
4. 43.2% noted that water diversions for mining could fragment river habitats, isolating aquatic species populations.

5. 56.2% highlighted that changes in water levels could harm riparian vegetation, crucial for stabilizing riverbanks and supporting wildlife.
6. 53.5% raised concerns that unregulated withdrawals could worsen water scarcity for local communities, affecting access to clean water for essential needs.

These findings point to a significant gap in the regulation of water usage in Nigeria. This is confirmed by Table 4 and Figure 4, where 78.7% of respondents attributed excessive water use to insufficient institutional and legal frameworks. Consequently, there is a need for stronger institutional and legal mechanisms to curb the unregulated use of water in bitumen mining.

Figure 5 and Table 5 outline potential remedies suggested by the respondents:

- a. 66.7% advocated for regulations governing instream flows to maintain minimum water levels and protect aquatic ecosystems.
- b. 85.5% called for mandatory Environmental Impact Assessments (EIAs) for bitumen projects, similar to Uganda's practices, to mitigate environmental damage.
- c. 83.9% recommended fostering dialogue between stakeholders—local communities, companies, and government agencies—to ensure sustainable water management.
- d. 52.7% proposed adopting Integrated Water Resource Management (IWRM) principles to balance competing demands while safeguarding river ecology and water security.
- e. 49.5% emphasized the need for effective environmental monitoring and enforcement mechanisms to address violations in mining activities.
- f. 62.4% supported promoting the conservation of riparian habitats and vegetation.
- g. An additional 62.4% emphasized the importance of raising awareness and promoting sustainable water use practices to support the achievement of SDG No. 6.4.

In summary, these findings highlight the significant risks posed by unregulated water use in bitumen mining in Nigeria, as well as potential sustainable solutions to mitigate these risks and ensure ecological conservation.

Conclusion

In pursuing developmental goals, it is increasingly clear that water is a finite resource that requires careful management and protection from contamination. Sustainable development efforts must prioritize the conservation of river ecosystems, especially in areas impacted by bitumen extraction. Achieving the Sustainable Development Goals (SDGs) by 2030 is critical, with water conservation playing a central role. A genuine commitment from nations is essential, involving both practical interventions and regulatory frameworks to protect water resources. Lessons from regulatory models in regions like Uganda, Alberta, and Canada, where effective laws and voluntary agreements govern water use, can inform strategies to mitigate potential adverse impacts on river ecosystems in Nigeria's Bitumen Zone. SDG 6, which focuses on water management, calls for the integration of water resource principles into legislation and administrative frameworks. This includes capacity-building initiatives, active stakeholder engagement, and adherence to environmental principles such as "user pays" and "polluter pays." Comprehensive water legislation should address usage, ownership, and conservation, clearly delineating responsibilities among government bodies while ensuring stakeholder involvement in decision-making. Additionally, fostering a collaborative approach between host communities and extractive industries can help alleviate conflicts and promote efforts to achieve SDG targets, particularly regarding water-related challenges linked to bitumen mining. Continuous refinement of existing legislation is crucial to address evolving issues in water resource management and the protection of river ecosystems in Nigeria's Bitumen Zone.

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