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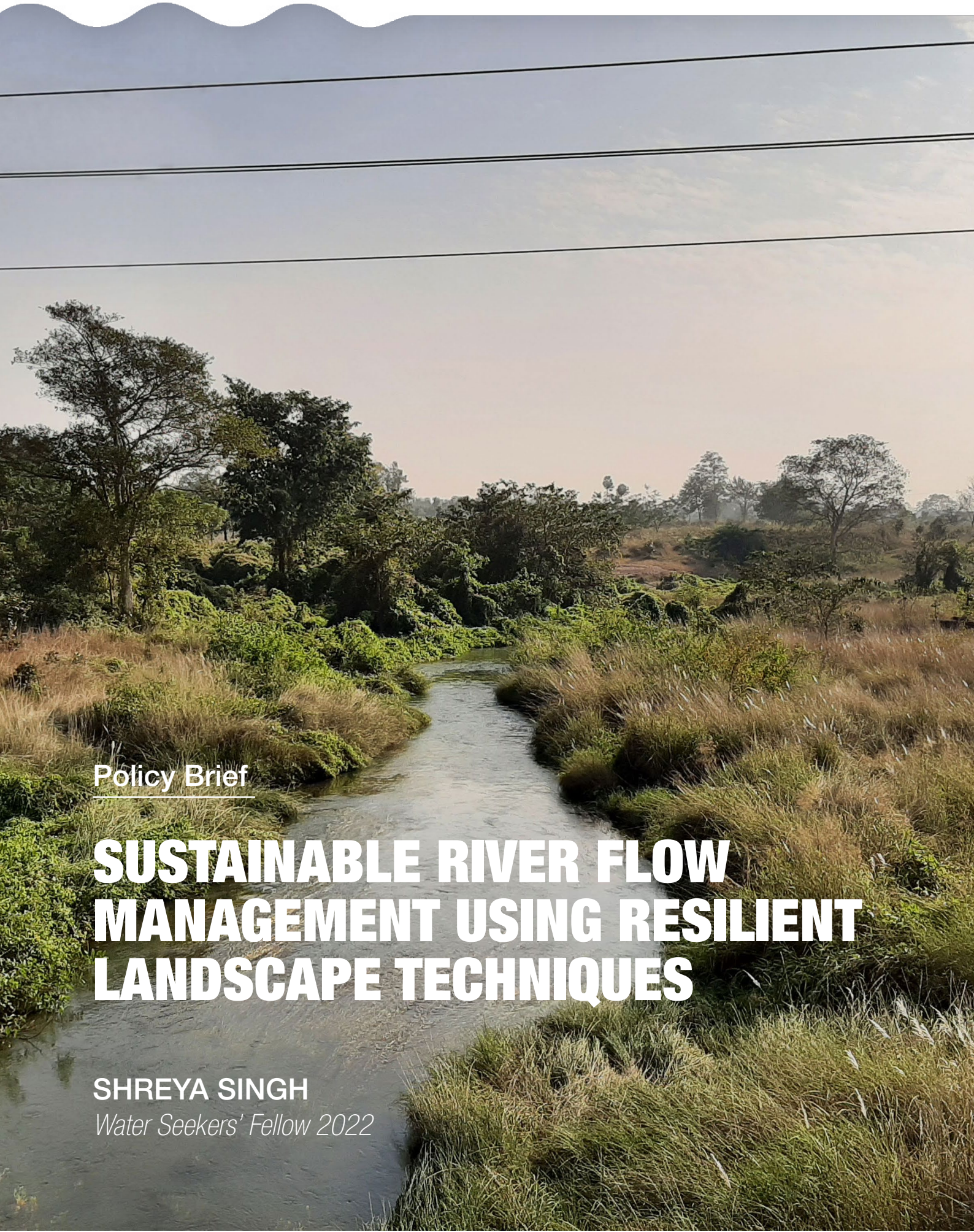
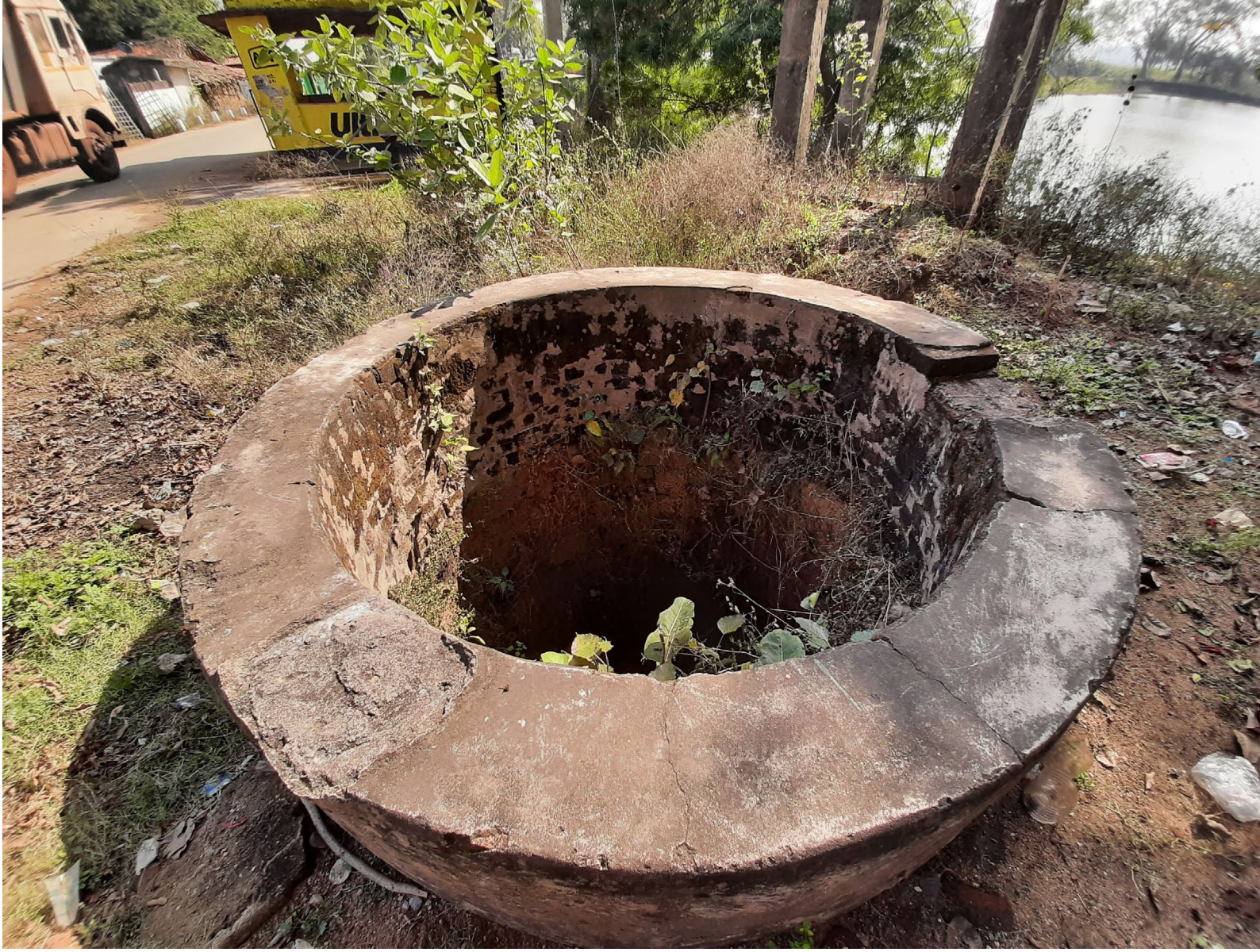


Policy Brief

SUSTAINABLE RIVER FLOW MANAGEMENT USING RESILIENT LANDSCAPE TECHNIQUES

SHREYA SINGH
Water Seekers' Fellow 2022



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Cover photograph by SHREYA SINGH

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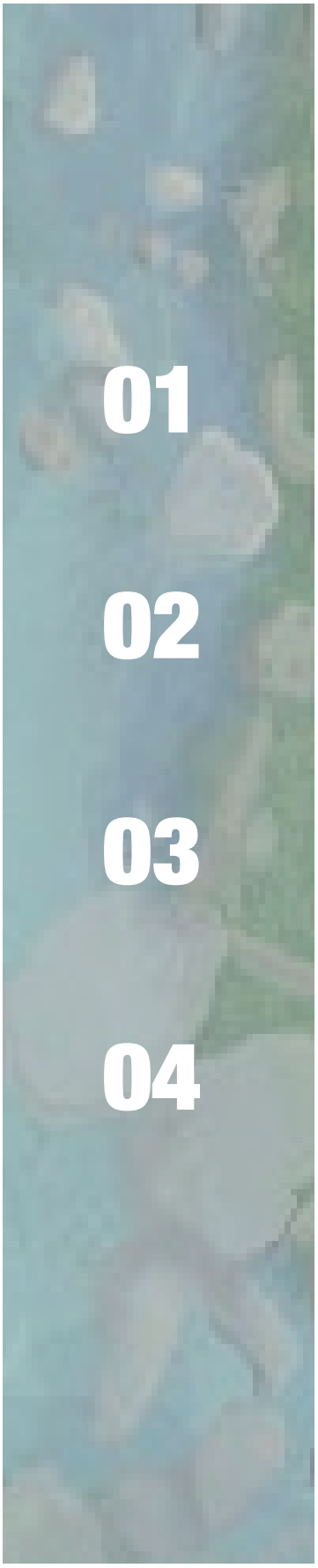

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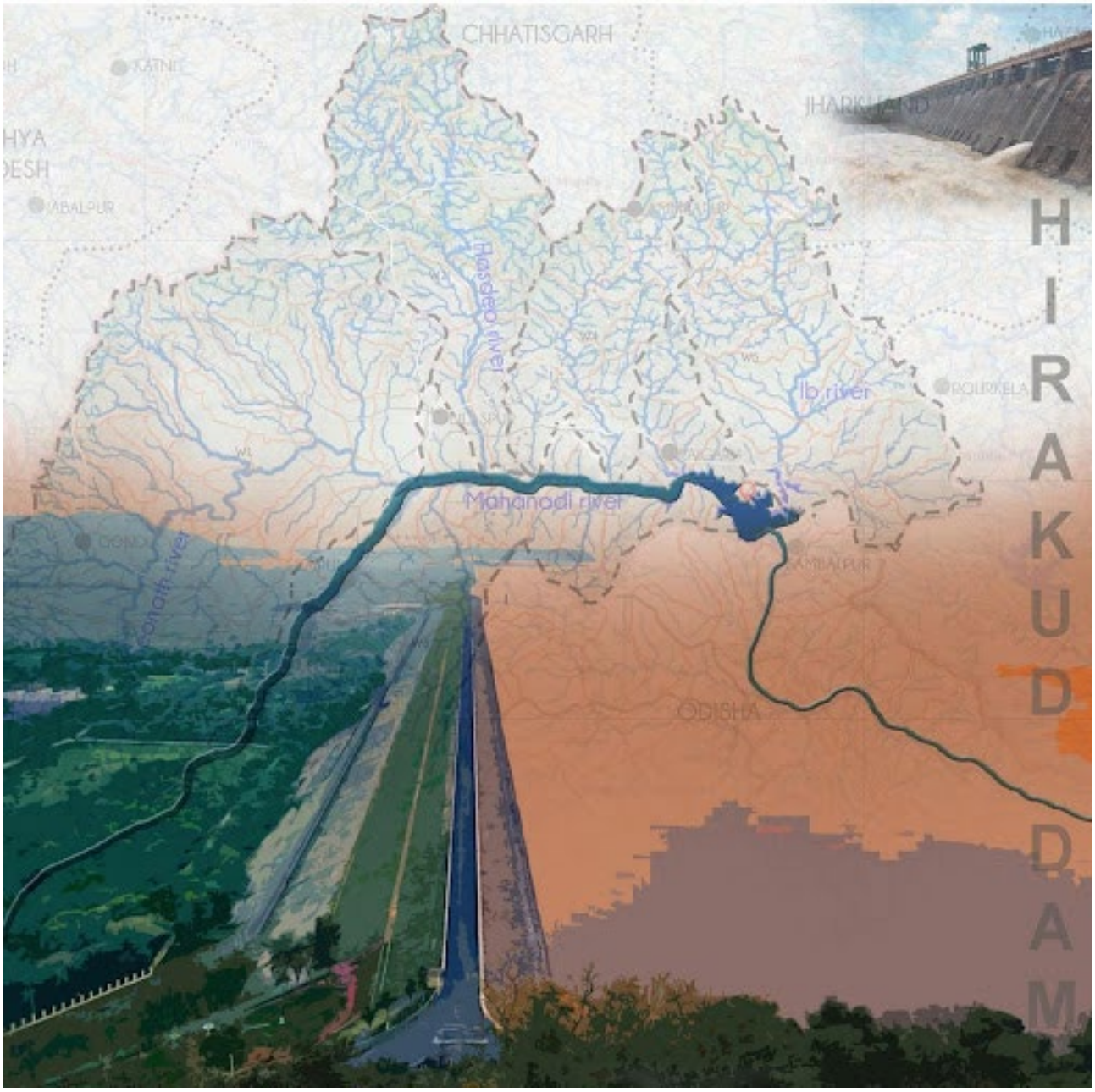


The vision is to protect our river and revive the river flow ecosystem.

The vision of this policy brief is to protect our rivers and revive their flow ecosystem. Two significant issues arise due to the presence of a dam in a river landscape: **sedimentation in the reservoir and fragmentation of the river upstream of the dam**. In order to effectively manage these issues in both the short and long term, various strategies and policies have been identified.

- **To address sedimentation**, it is crucial to tackle the major factors that contribute to the increase in silt load from the catchment. These factors include land use change, intensification of agricultural practices, vegetation loss, and lack of soil conservation measures. This policy brief emphasizes the importance of sustainable land use practices, soil conservation measures, and the conservation of vegetation to reduce sedimentation at both the site and landscape level.
- **Regarding fragmentation**, the policy brief proposes strategies to promote the connectivity of river ecosystems and mitigate the impacts of dam-induced isolation. These strategies may include the implementation of fish passages or bypass channels to facilitate the movement of aquatic species, the restoration of riparian vegetation to create habitat corridors, and the adoption of environmental flow releases to mimic natural flow patterns. By incorporating these measures, the policy brief aims to address the issue of fragmentation and promote the resilience of river ecosystems.

To address these issues in the long run, the following strategies could be taken up:

For higher order of stream (streams with larger drainage areas and higher flow volumes),

a. Enhance water quality by implementing specific measures such as:

- Implementing best management practices in agriculture to reduce runoff and sedimentation, such as using cover crops and implementing precision irrigation techniques.

Establishing riparian buffers with native vegetation to filter pollutants and reduce sedimentation.

- Encouraging the adoption of soil and water conservation measures, such as contour plowing and terracing, to minimize erosion and sediment runoff.

b. Implement nature-based solutions such as:

- Employing stream edge stabilization techniques using bioengineering methods, such as coir logs or vegetative mats, to prevent erosion and maintain the stability of stream banks.

- Creating and restoring wetlands along river streams to enhance water quality, promote natural filtration, and provide habitat for various species.

- Evaluating the feasibility of widening river streams in appropriate areas to improve flow dynamics and enhance the ecological functioning of the river ecosystem.

c. Promote the densification of vegetation and reforestation efforts, particularly in the upstream areas, to stabilize slopes, reduce erosion, and enhance ecosystem resilience.

d. Adopt site-specific and catchment-specific soil and water conservation measures instead of damming higher-order streams. Examples of such measures include:

- Implementing check dams or sediment retention ponds to trap sediments and reduce downstream sedimentation.

- Promoting the use of contour bunds or terraces to slow down water flow, prevent erosion, and facilitate infiltration.

- Encouraging the adoption of agroforestry practices in the catchment area to improve soil health and reduce erosion.

For Middle and lower order of streams

a. Establish vegetative buffer strips along riparian edges to reduce sediment and nutrient runoff, protect water quality, and provide habitat for wildlife.

b. Address water quality and water scarcity issues through a combination of measures such as:

- Implementing effective water quality monitoring programs.
- Promoting water conservation practices and efficient irrigation techniques.
- Developing appropriate water allocation strategies to ensure sustainable water use.

c. Implement flood management strategies, including wetland restoration and river meander restoration, to enhance floodplain connectivity and reduce the risk of flooding.

- Wetland restoration: Restoring wetlands along river systems increases the storage capacity for floodwaters, allowing them to be absorbed and released slowly, reducing peak flows downstream and mitigating flooding risks. Wetlands also act as natural filters, improving water quality by trapping sediments and pollutants.

- River meander restoration: Restoring natural bends and curves in rivers promotes meandering patterns. This creates more space for floodwaters to spread out, decreasing the force and speed of the water flow. By allowing rivers to accommodate higher volumes of water during periods of high flow, meander restoration helps reduce the likelihood of flooding and provides natural floodplain storage.

Implementing wetland restoration and river meander restoration as part of flood management strategies enhances the natural capacity of river systems to handle increased water flow and reduces the risk of flooding in downstream areas. These nature-based approaches work in harmony with the river's natural processes, providing multiple benefits such as improved ecosystem health, increased biodiversity, and enhanced resilience to climate change impacts.

d.Regulate water flow and maintain water quality by implementing buffer zones, such as riparian buffers and vegetative buffers, along the reservoir.

- Riparian buffers: Riparian buffers are strips of vegetation, consisting of trees, shrubs, and other native plants, located along the banks of a river or reservoir. By establishing riparian buffers along the reservoir, we create a natural barrier that helps filter and trap sediments, nutrients, and pollutants that may otherwise enter the water body. These buffers also provide shade, which helps regulate water temperature, and their root systems stabilize the soil, reducing erosion and preventing excessive sedimentation.

- Vegetative buffers: In addition to riparian buffers, vegetative buffers can be implemented in the surrounding areas of the reservoir. These buffers consist of native vegetation, such as grasses and plants, and are strategically designed to intercept runoff and filter out contaminants before they reach the water body. Vegetative buffers help slow down the flow of water, allowing for sedimentation and filtration processes to occur, thereby improving water quality and reducing the transport of pollutants.

By implementing riparian buffers and vegetative buffers along the reservoir, we create protective zones that serve multiple purposes:

- Water flow regulation: The buffers act as natural flow regulators by slowing down the velocity of water entering the reservoir. This helps to prevent excessive runoff, reduce erosion, and stabilize the water flow, particularly during periods of heavy rainfall or snowmelt. The buffers also promote infiltration, allowing water to percolate into the ground, which can help replenish groundwater levels and maintain a more consistent flow in the reservoir.

- Water quality maintenance: The buffers act as a physical and biological filter, capturing sediments, nutrients, and pollutants carried by runoff. The vegetation within the buffers plays a vital role in absorbing and transforming these contaminants, improving water quality and reducing the risk of algal blooms and other waterborne issues. Additionally, the presence of buffers helps minimize direct inputs of pollutants, such as pesticides and fertilizers, into the reservoir, further protecting water quality.

Implementing riparian buffers and vegetative buffers as part of reservoir management practices helps to regulate water flow, reduce sedimentation, and maintain water quality, ultimately contributing to the overall health and sustainability of the river ecosystem.

e. Implement measures to reduce stream bank erosion, such as:

- Planting native vegetation along stream banks for stabilization.

- Implementing erosion control measures in upstream areas, such as soil bioengineering techniques.

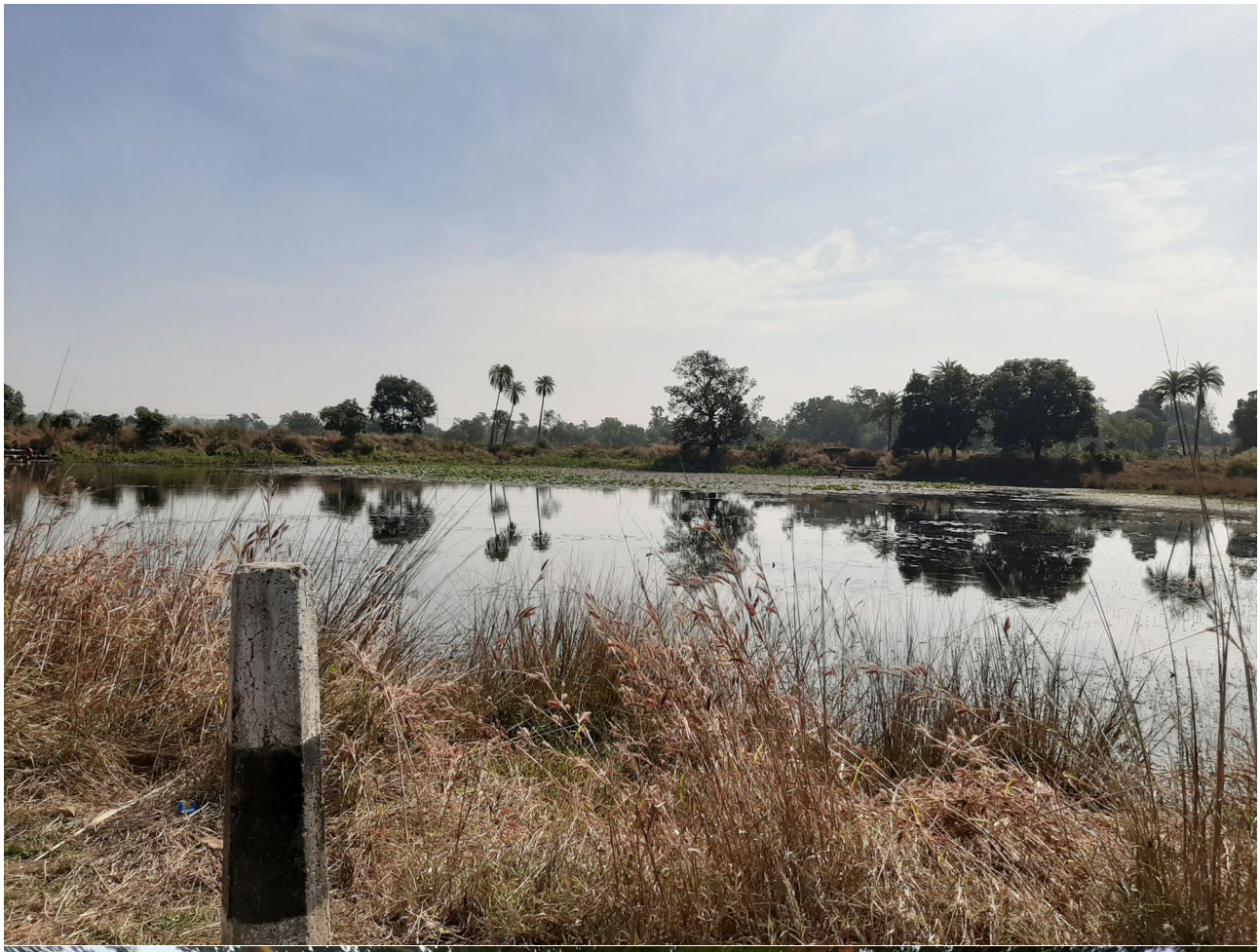
- Promoting sustainable land management practices to reduce sedimentation and erosion.

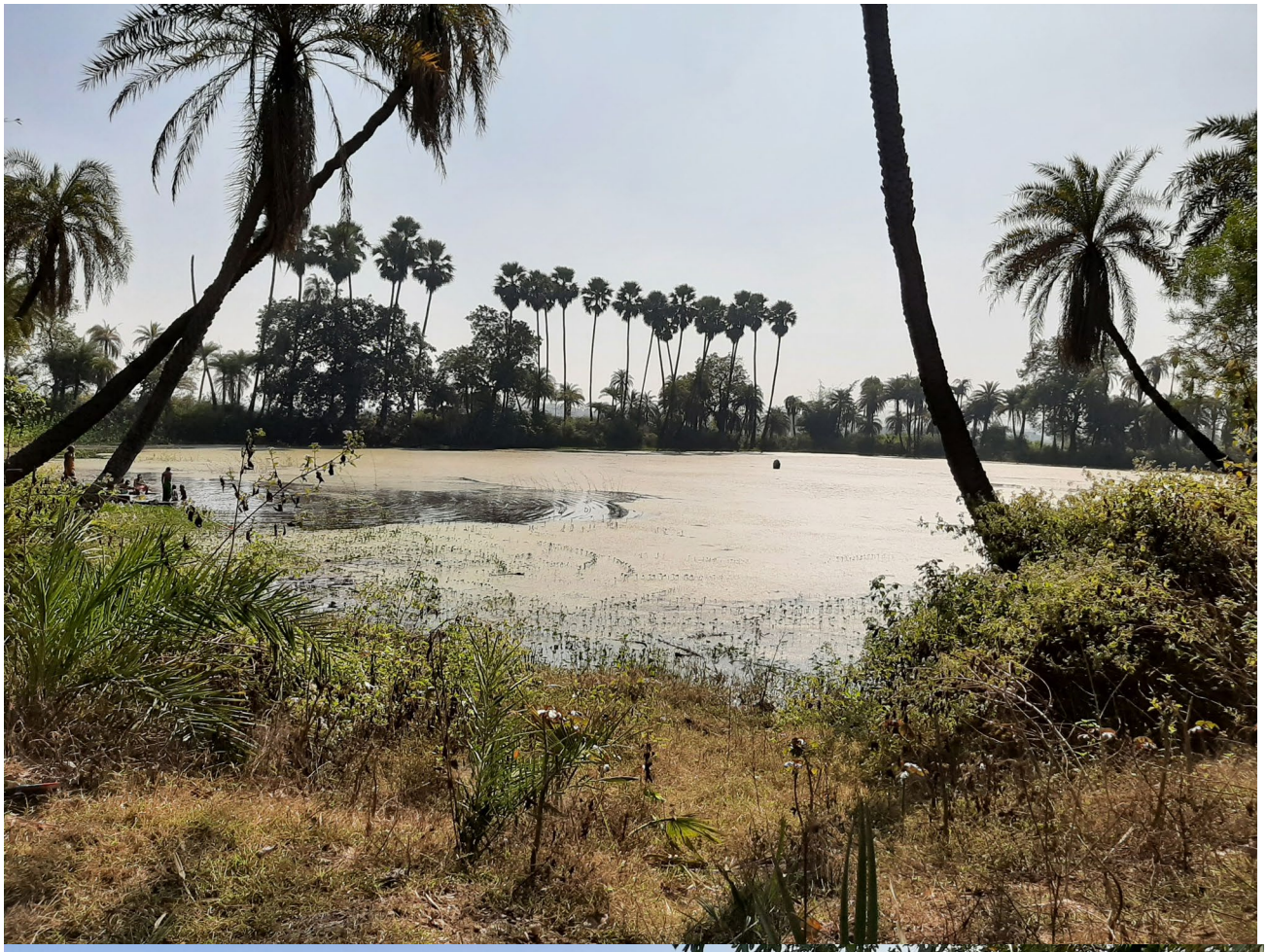
To address these issues in the short-term basis, the following strategies could be taken up:

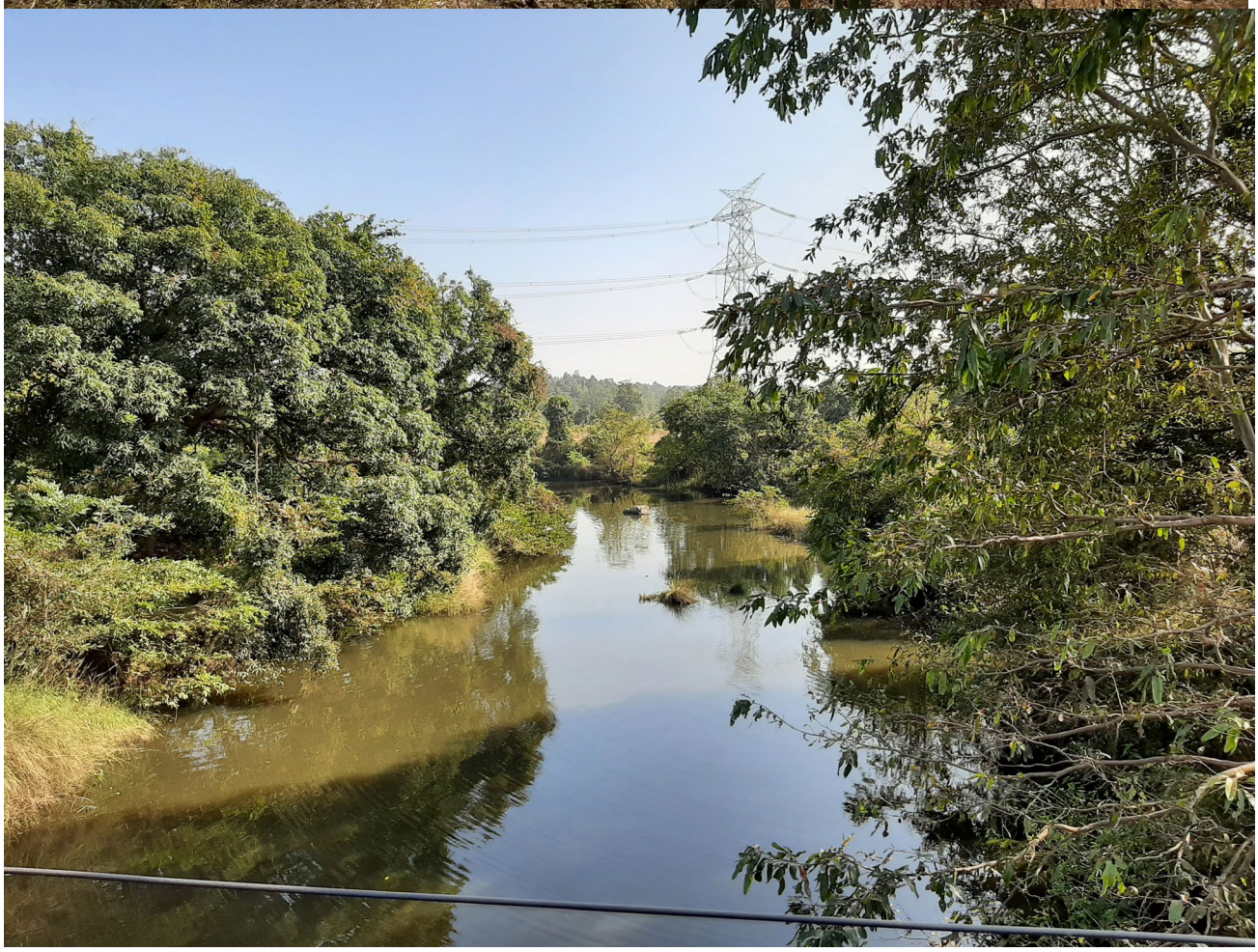
1. **Implement traditional water harvesting techniques** in collaboration with local communities to support micro-watershed recovery. This approach involves working with communities to revive traditional water conservation practices, such as constructing small check dams, contour bunds, and farm ponds. These techniques help capture rainwater, reduce surface runoff, and recharge groundwater levels. Successful examples of traditional water harvesting techniques can be found in catchments like the Mahanadi River Basin in India, where the implementation of check dams has led to increased water availability and improved stream flow during dry periods.

2. **Explore the use of alternate techniques in riverbed management**, such as sub-surface dams, rock riffles, and rock arch rapids. These structures are designed to mimic natural river features and promote natural flow patterns. Sub-surface dams are underground barriers that trap water within the riverbed, helping maintain water levels and prevent excessive sedimentation. Rock riffles and rock arch rapids introduce roughness and turbulence to the river flow, which enhances the natural flushing of sediments and improves overall river health. The efficacy of these structures has been demonstrated in catchments like the Snake River in the United States, where sub-surface dams have successfully regulated water flow and rock riffles have reduced sediment accumulation.

3. **Incorporate sustainable water management practices into urban design infrastructure**. This involves integrating water-sensitive urban design (WSUD) principles into the planning and development of urban areas within the catchment. WSUD techniques include features such as green roofs, permeable pavements, and constructed wetlands, which help capture and treat stormwater runoff, reduce pollution, and replenish groundwater resources. By implementing WSUD practices in urban hotspots within the catchment, such as the metropolitan area of Brisbane, Australia, we can mitigate the negative impacts of urbanization on river flow and water quality, ensuring a more sustainable water management approach.





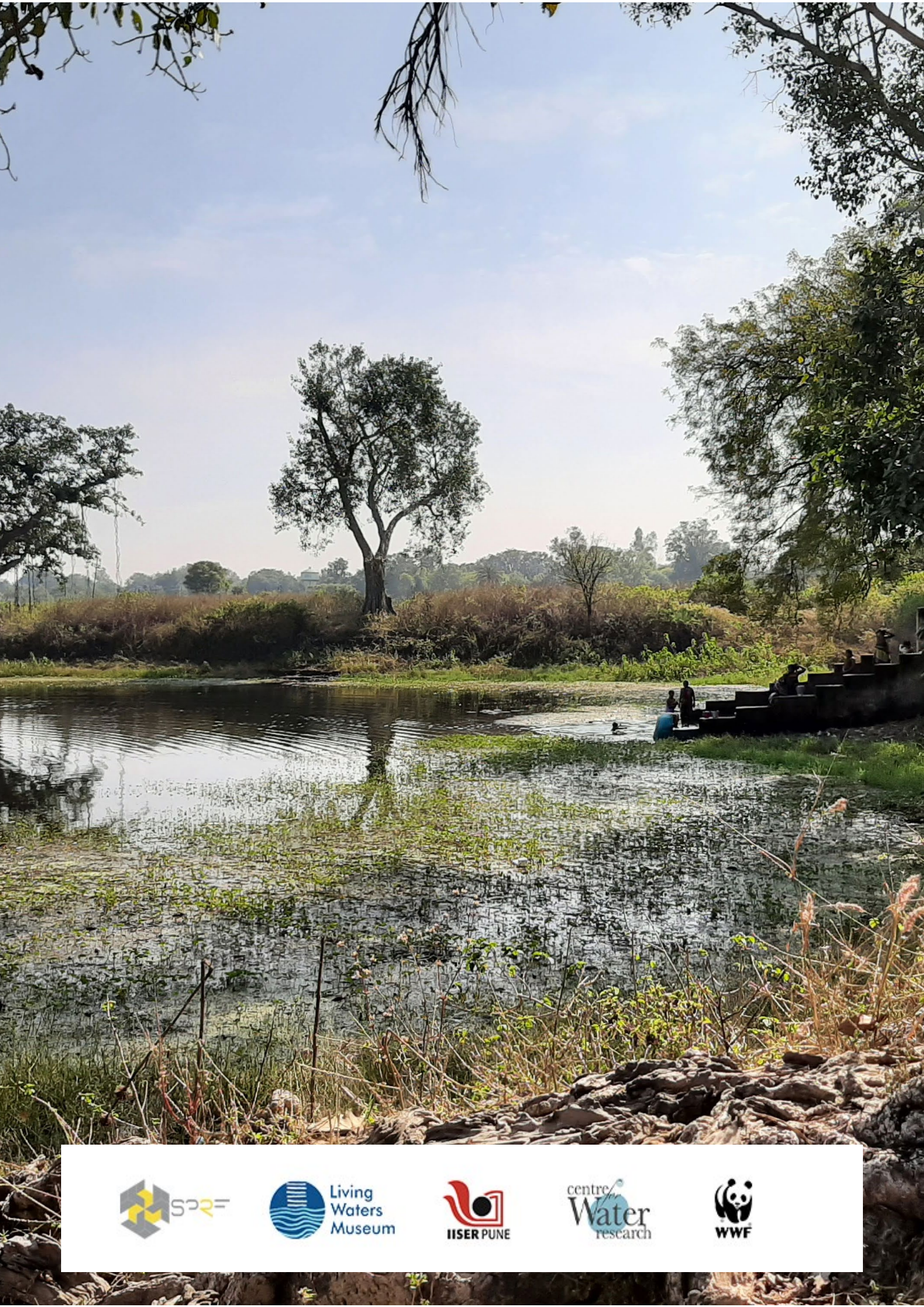


Based on these strategies, the following policies could be taken up and implemented: The process of planning, developing, and controlling the use and protection of water resources, including surface water and groundwater, needs to be done in order to revive traditional water harvesting structure in the short-run and river flow in the long run to manage water resources effectively. These policies may be:

- **Water allocation:** Develop and implement water allocation policies that prioritize the maintenance of sustainable river flows, considering the specific needs of different sectors (e.g., domestic, agricultural, industrial, environmental). These policies should take into account the ecological requirements of rivers and ensure sufficient water is reserved for maintaining healthy ecosystems and supporting aquatic biodiversity.
- **Water pricing:** Establish water pricing policies that incentivize sustainable water use and promote efficient practices. Implement tiered pricing structures that encourage conservation and discourage wasteful consumption. Consider introducing differential pricing for different water users to reflect the importance of sustaining river flows and encourage responsible water management.
- **Water conservation:** Implement comprehensive water conservation measures, including but not limited to improving irrigation techniques, promoting water-efficient technologies and practices in agriculture, and encouraging the adoption of low-flow fixtures and appliances in domestic and industrial settings. Provide incentives and support for farmers and water users to adopt water-saving practices and technologies.
- **Water quality:** Enforce and enhance policies that regulate the chemical, physical, and biological quality of water resources. Implement monitoring programs and set water quality standards to ensure that rivers maintain a healthy ecological balance and are safe for human consumption and other uses. Develop pollution control measures and promote best management practices to prevent contaminants from entering the waterways.
- **Water governance:** Strengthen the legal and institutional frameworks for water governance to ensure effective management of water resources. Establish clear roles and responsibilities for different stakeholders, including government agencies, water utilities, and community organizations, to facilitate coordinated and integrated decision-making. Encourage public participation and engagement in water resource management processes to ensure transparency and accountability.

It is crucial to adopt a context-specific and integrated approach to water resource management that addresses the challenges of sustainable river flow. These policies should be designed to promote the resilience and health of river ecosystems, mitigate the impacts of human activities, and balance the needs of various stakeholders. By implementing these policies, we can work towards sustainable river flow management and ensure the long-term viability of our water resources.

Overall, water resource management is a complex and multifaceted issue that requires careful planning and collaboration among different sectors and stakeholders. By taking a proactive approach to managing water resources, we can ensure that this vital resource is used sustainably and equitably, and that it remains available for future generations. It involves finding ways to balance the demands for water with the available supply, and to ensure that water resources are used sustainably and equitably.



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