THIMPHU RIVER WARRIORS

Community-Led River Governance and Monitoring

Programme

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Background

Nestled in the Eastern Himalayas, Bhutan is known for its pristine landscapes, spiritual heritage, and deep-rooted reverence for nature. The capital city, Thimphu, cradled along the *Wang Chhu* (commonly referred to as the Thimphu River [1]), is no exception. This river has not only shaped the geography of Bhutan's urban center but has also been a vital source of life, culture, and sustenance for the people residing along its banks. However, like many urban rivers, the Thimphu River faces growing pressure from **increasing urbanization**, **improper waste disposal**, and **infrastructural development** [2]. Studies indicate that untreated wastewater and solid waste from the city are major contributors to pollution in the river, posing threats to public health and aquatic biodiversity [3]. The government of Bhutan has made strides in implementing environmental policies, but the need for community-driven action and sustainable urban water management has never been more urgent.
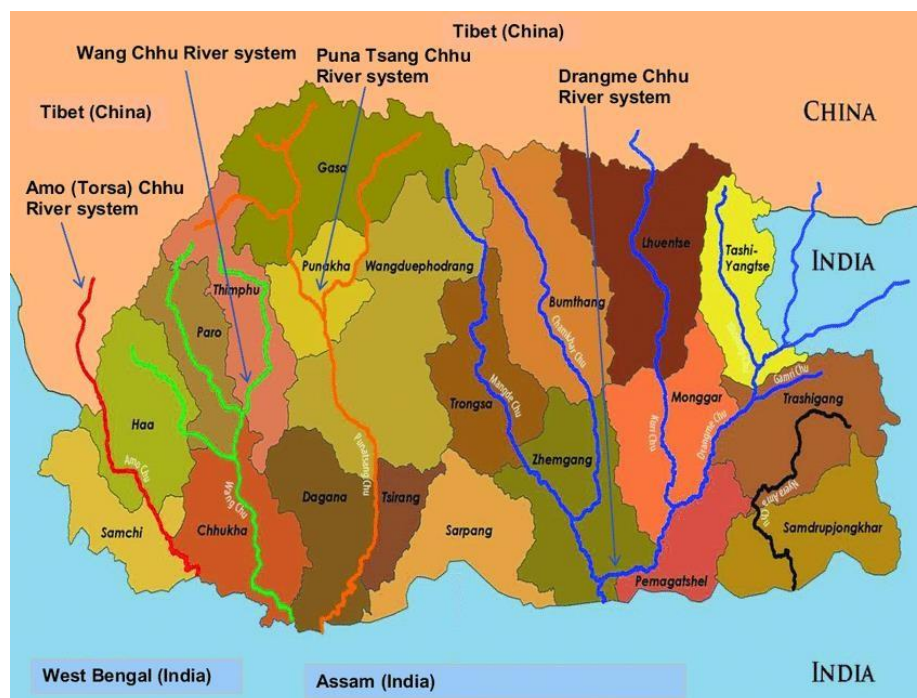

Figure 1: Major River systems in Bhutan

In response to this, the **Maritime Research center's River Warriors for Bhutan initiative** envisions empowering local communities to restore and protect the Thimphu River. Rooted in the spirit of **Gross National Happiness**—Bhutan's guiding development philosophy—this movement seeks to blend traditional values with modern environmental practices to ensure the long-term health of the river ecosystem [4]. Environmental conservation is one of the four pillars of Bhutan's Gross National Happiness philosophy, guiding policies and development plans to ensure ecological sustainability. Our vision is to protect, rejuvenate, and empower communities along the Thimphu River through a people-centered and tech-integrated approach.

Objectives

These River Warriors will be trained to engage with citizens, local authorities, and educational institutions to **foster awareness**, **identify the challenges** (pollution sources for the river), **document the state of the river**, deliver insights and **recommendations** to **drive the restoration** and **understanding the feasibility of application of technology for continuous evaluation and monitoring of the Bhutan river systems**. The action plan follows a participatory model: first, the warriors initiate dialogue with the community to map challenges—ranging from water pollution and unbalanced water resource management. Based on this, customized solutions such as smart water monitoring systems, decentralized

waste treatment models, and ecological restoration techniques are being studied and are implemented based on their feasibility.

In alignment with Bhutan's National Environment Strategy and the Thimphu Structure Plan 2002–2027 [5], the **initiative aims to promote nature-based solutions** and integrate **river revitalization into urban planning**. By adopting digital tools like GIS mapping, IoT-enabled water sensors, and mobile-based community reporting platforms, the warriors will facilitate data-driven decision-making, ensuring transparency and accountability. This initiative also highlights the importance of youth engagement and traditional knowledge. **Schools, research centers and colleges from the local areas in Thimphu will be key partners**, nurturing young eco-leaders and embedding environmental stewardship into education. Our vision is to transform the Thimphu River from a neglected urban stream into a symbol of resilience, harmony, and community pride. With continued support from government agencies, civil society, and global environmental networks, the River Warriors for Bhutan pledge to uphold the sanctity of the Thimphu River—preserving it not only as a water resource but as a **living cultural and ecological heritage**.

Methodology

We identify the need for <u>100 brilliant and driven individuals</u> with a strong connection to environmental values, Bhutanese cultural heritage, and the spirit of Gross National Happiness.

MRC will initiate discussions to possibly collaborate with Bhutanese authorities including **Royal Society for Protection of Nature**, **and National Environmental Commission**, while also looking forward to actively work with local bodies including Schools, Colleges, Research Institutions and **Thimphu Thromde**. The local partnerships and collaborations will help MRC to invite applications for the river warriors. These River Warriors will be changemakers, working at the grassroots level across Bhutan's Thimphu River to support the sustainable development, ecological balance, and well-being of riverine communities. The river warriors will be completed supported by **Maritime Research Center** (MRC) Team in terms of the required training, workshops, and capability building.

For their tasks, warriors will be distributed among **5 pillars** as described below, in order:

- Policy Intervention
- People, Economy and Nature
- Technology Intervention
- Capacity and Capability Building
- To See, To Understand and To Share

These pillars are outlined in detail as follows.

Policy Intervention (20 Warriors)

The policy-focused River Warriors will be responsible for influencing and shaping the frameworks that govern Bhutan's river management and sustainable water use. Their work is policy-centric but deeply rooted in ground realities.

1. **Problem Identification and Analysis**: These warriors will begin by conducting baseline assessments to map out the social, economic, and ecological issues affecting Bhutan's rivers. This includes identifying sources of pollution, encroachments along riparian zones, and barriers to effective water governance. The warriors will engage with residents, local leaders, and institutions to understand lived experiences and community-specific challenges, ensuring no issue is overlooked.
2. **Stakeholder Engagement**: Bhutan's river health is influenced by a web of stakeholders—from rural farmers and religious institutions to policymakers and urban developers. These warriors will convene inclusive

forums, bringing together these voices to build consensus. Particular attention will be given to **marginalized** groups, such as **women in rural communities and youth**, ensuring participatory governance. Warriors will facilitate dialogues that **prioritize local knowledge** and lived experiences while aligning with national development goals and Bhutan's commitment to Gross National Happiness.

3. **Monitoring and Evaluation**: They will establish metrics and mechanisms to measure the performance of existing river-related policies (e.g., the Water Act, Thimphu City Development Plan) [5, 6]. This includes tracking water quality standards, conservation efforts, pollution control regulations, and local enforcement efficacy. The goal is to create a **feedback loop between the community and policymakers, helping policies evolve dynamically**.

Deliverable: Each warrior will contribute to developing a comprehensive Policy Brief that synthesizes field insights and stakeholder engagement. The brief will include case studies on vulnerable riverine communities, mapping the socio-economic and environmental impacts they face. It will also identify critical policy gaps and offer actionable recommendations to enhance enforcement, simplify regulatory frameworks, and embed traditional knowledge into governance practices. Finally, it will present a clear formulation strategy for implementing sustainable, inclusive, and enforceable water governance models tailored to Bhutan's unique cultural and ecological context.

People, Economy, and Nature (10 Warriors)

This team will work through the lens of a holistic framework derived from the **River Domain Awareness** adaptation of the Underwater Domain Awareness concept by the director of Maritime Research Center, Dr. (Cdr.) Arnab Das [7]. Their focus will be the interconnectedness of human, economic, and ecological systems.

1. **People**: These warriors will investigate how communities along the riverbanks are affected by environmental degradation. This includes rising water-borne diseases, dwindling water availability, and displacement due to riverbank erosion or urban expansion. Special emphasis will be placed on long-term social consequences, such as the loss of cultural practices linked to river rituals or the economic marginalization of subsistence farmers and fisherfolk.

2. **Economy**: Warriors will analyse the economic impacts of river degradation, identifying patterns of inefficiency, corruption, or regulatory lapses that hinder sustainable growth. They will also evaluate how economic policies or local practices might unintentionally compromise river health and long-term economic resilience.

3. **Nature**: Warriors will assess the environmental consequences of developmental and human activities, from sand mining and construction to deforestation and waste dumping. Using data, field visits, and local interviews, they will map critical ecological degradation points, including erosion-prone areas and biodiversity hotspots under threat.

Deliverable: team will produce a region-specific Environmental Impact Assessment (EIA) that provides a comprehensive analysis of the local context. The assessment will identify key drivers of environmental degradation, examine socio-economic dependencies linked to the river ecosystem, and develop ecological and hydrological impact models to understand the full extent of human and natural influences.

Technology Intervention (40 Warriors)

These warriors are tasked with leveraging modern technology to solve complex challenges within Bhutan's river systems. They'll be the architects of a digital transformation in river management.

1. **Identifying Tech-Applicable Problems**: These warriors will begin by identifying operational inefficiencies that can be solved through technology—such as inconsistent water quality testing, lack of flood warning systems, or unmonitored pollution sources. This stage involves rigorous needs assessments through fieldwork and community consultations, ensuring solutions are appropriate and sustainable.

2. **Integrating Technology into Existing Systems**: Solutions will be designed to integrate with Bhutan's current infrastructure and governance systems. This includes linking sensor networks with existing municipal bodies where the sensors provide the real time status of the condition of the water of the river system. Training

programs will be provided to ensure government officers and local leaders can confidently manage new tools.

3. **Developing and Implementing Technology**: These warriors will collaborate closely with developers and data scientists to create a suite of technology-driven solutions tailored to Bhutan's river systems. This includes the development of IoT sensors for real-time water quality monitoring, AI and machine learning models for accurate flood forecasting, mobile applications to enable citizen science and pollution reporting, and GIS-based river mapping tools that support environmental zoning and development control.

4. Marine (River) Spatial Planning: By adapting **Marine Spatial Planning** into **River Spatial Planning**, warriors will create data-driven spatial strategies for land use, ecosystem protection, infrastructure development, and hazard mapping along riverbanks.

Capacity and Capability Building (20 Warriors)

This group focuses on community education, capacity enhancement, and long-term empowerment of river-dependent populations.

- **Skill Training and Knowledge Transfer**: River Warriors will develop and deliver localized training programs to farmers, local leaders, and youth. Topics will include sustainable agriculture, eco-tourism, water-efficient irrigation, and river-friendly farming practices. Through workshops, field demonstrations, and printed guides in Dzongkha and regional dialects, practical knowledge will be transferred effectively.

- **Promotion of Blue-Green Economy Principles**: Warriors will advocate for economic models that value ecosystem services, promote biodiversity, and ensure long-term sustainability. They will help establish eco-clubs, green enterprise incubators, and training on nature-based livelihoods.

- **Government Policy and Scheme Promotion**: They'll act as liaisons between rural communities and government schemes—spreading awareness of incentives, subsidies, and developmental opportunities available under Bhutan's 13th Five-Year Plan, Water Flagship Programme, and other national initiatives.

- **Community Empowerment Through Tech:** Warriors will guide rural youth and women to use digital tools to monitor river health, access markets, and report issues. Initiatives like SMS-based alerts of climate change and river water quality, and localized digital dashboards will democratize data and promote community-led river governance.

To See, To Understand, To Share (10 Warriors)

Based on the concept provided by Dr. Arnab Das [8], the warriors will facilitate developing a data-driven solution pipeline—deploying tech, analysing it, and delivering it back to the community in actionable forms.

1. **To SEE (Deployment Team)**: They will be in charge of installing and maintaining hardware like sensors, weather monitors, solar-powered stations, and GPS trackers. They'll ensure systems are tamper-proof, sustainable, and securely transmitting data from Bhutan's remotest river sites.

2. **To UNDERSTAND (Data Processing Team)**: Mathematicians, statisticians, and data engineers in this team will clean, validate, and model data for:
   a. Water quality trends
   b. Pollution source identification
   c. Rainfall-runoff models
   d. Ecological risk assessment

   They will use tools like Python, Data Science, and geospatial analytics to draw meaningful conclusions that feed directly into planning and emergency response mechanisms.

3. **To SHARE (Development Team)**: This team will work with software developers to build apps, websites, and community dashboards in both English and Dzongkha. They'll ensure that inferences from data are made understandable and useful for every citizen—be it a farmer, policymaker, or student.

Key Challenges and Problem Statements to be taken up by Thimphu River warriors

These includes a list of key challenges faced in the Thimphu River ecosystem which needs to be addressed quickly and efficiently, and also require sound manpower and an expert team to lead the efforts. Through the River Warriors program, MRC aims to deep delve into understanding the local phenomenon and actions giving rise to such challenges and what are the feasible ways to address it. The list is not exhaustive and we always welcome the ideas of our local partners while the collaboration for the programme is underway:

No.	Key Challenge	Problem Statement	Description	Proposed Interventions & Warriors Allocation
1	**Urbanization and Land Use Pressure**	Rapid urban growth in Thimphu is leading to encroachment on riparian buffers and improper land use, causing bank erosion, siltation, and habitat loss.	Thimphu city's expansion has outpaced planning capacities, resulting in unregulated development along the riverbanks [9, 10]. Studies show built-up areas along the Thimphu River increased significantly between 1990 and 2018 [11]. This urban sprawl reduces green cover, increasing surface runoff and destabilizing the riverbanks, thus increasing sediment loads and reducing habitat quality for aquatic life. Riparian encroachment also hampers the river's ability to filter pollutants naturally.	**Policy Warriors (5)** Formulate urban planning guidelines and push for buffer zone enforcement. **Technological Warriors (5-10):** Use GIS/remote sensing to monitor encroachments. **To See/Understand/Share Warriors (up to 5):** Collect stories from locals and urban planners to understand change dynamics and spread awareness.
2	**Water Quality Degradation (Nutrients & Heavy Metals)**	Effluent from households, car workshops, and minor industries is directly discharged into the river, increasing nitrate, phosphate, and heavy metal concentrations.	Studies show elevated concentrations of lead, chromium, and nitrate in the Thimphu River [12], particularly during the dry season. The river, which is a key source for downstream irrigation and domestic use, faces eutrophication risk due to unchecked nutrient inflows [13]. Absence of a centralized wastewater treatment plant for Thimphu means untreated greywater finds its way into the river. This affects both human and aquatic health and reduces the river's ability to support biodiversity.	**Technological Warriors (6-10):** Build low-cost, decentralized greywater treatment pilots. Monitor water quality using IoT-based sensors. **Policy Warriors (4-10):** Advocate for stricter wastewater discharge standards and mandatory workshop effluent filters. **Capability Warriors (3):** Train municipal workers and workshop owners in waste handling.
3	**Climate Change Impact & Glacier-fed Flow Variability**	Changing precipitation patterns and glacier retreat in upstream catchments affect river flow and water security in Thimphu.	Bhutan's rivers are glacier-fed and sensitive to shifts in monsoon and temperature. IPCC reports and national assessments [14] predict that decreasing glacier mass and increasing frequency of Glacial Lake Outburst Floods (GLOFs) could drastically alter seasonal flow in rivers like the Thimphu. This variability puts pressure on both flood management infrastructure and water supply reliability, especially in dry months. Increased sediment from erratic flows also clogs irrigation and treatment systems.	**Policy Warriors (5-10):** Collaborate with National Centre for Hydrology and Meteorology (NCHM) to integrate climate risks in river basin management. **Technological Warriors (6-10):** Support modeling of glacier melt impact using climate projections and remote sensing. **People/Economy/Nature Warriors (3-5):** Capture traditional knowledge on seasonal water management and integrate with science.
4	**Loss of Aquatic Biodiversity**	Degradation of water quality and riparian encroachment is	Macroinvertebrates, which are good indicators of river health, have been found in lower diversity in the	**To See, Understand & Share Warriors (5-9):** Conduct citizen-led biodiversity documentation

No.	Key Challenge	Problem Statement	Description	Proposed Interventions & Warriors Allocation
	and Riparian Habitats	driving decline in native fish and macroinvertebrates.	midstream Thimphu River [15]. Riparian deforestation, sedimentation, and changing water temperatures due to urban heat island effects are reducing habitat suitability. Migratory fish are also affected by fragmentation and flow modification. Reintroduction of species and habitat restoration are needed alongside continuous monitoring.	and macroinvertebrate sampling. **Policy Warriors (3):** Push for riparian zone protection laws and biodiversity corridors. **Technological Warriors (4-10):** Use AI tools for image-based identification of aquatic species. Develop biodiversity health index dashboard.
5	**Lack of Integrated River Governance & Public Participation**	Fragmented institutional responsibilities and low public involvement hinder coordinated river management.	Multiple institutions like Thimphu Thromde, NEC, MoAF, and MoWHS handle different aspects of the river (waste, land, water), often with overlapping or unclear mandates [16]. This creates policy gaps and weak enforcement. Community members often lack clarity on whom to approach for river-related concerns. Integrated river basin governance with community participation is essential to improve long-term outcomes.	**Policy Warriors (6):** Lead the effort to form a Thimphu River Basin Management Committee. **Capability Warriors (5):** Train youth groups, CSOs, and schools to act as River Custodians. **To See/Understand/Share Warriors (4):** Conduct participatory river walks, storytelling sessions, and community audits.
6	**Springshed management for water security for the people of Bhutan**	Urban development and infrastructure expansion are negatively impacting the natural Springshed areas around Thimphu.	The Inadequate attention to Springshed management has reduced groundwater recharge, leading to scarcity of water for both communities and ecosystems. As per ICIMOD, the Department of water, Bhutan, acknowledges the need of watershed management. As per the statement by ICIMOD, "*we built consensus regarding the crucial challenge presented by water insecurity across all gewogs. The critical importance of scaling Springshed management was also acknowledged.*"	**Policy warriors (3-5):** Understanding the ineffectiveness of the current regulations to curb the infrastructure encroachment of the natural ecosystems around Thimphu River. **Technology Warriors(10-15):** Develop GIS based approaches to map the complete trajectory of the Springs draining in the Thimphu and identify chokepoints (where the flow is immensely disturbed by human activities) using remote sensing.

Framework Credibility: Underwater Domain Awareness (UDA)

The Thimphu River initiative is conceptually anchored in the **Underwater Domain Awareness (UDA) framework**—a multidisciplinary policy, technology, and capacity-building construct developed to enable holistic understanding, monitoring, and governance of aquatic domains. While originally conceptualized for underwater and maritime environments, the UDA framework has since evolved to incorporate **riverine, freshwater, and socio-ecological systems**, making it highly relevant to Bhutan's river governance context. The UDA framework has received **national-level policy recognition in India**, including its adoption as a reference architecture for capacity-building and strategic planning in aquatic domains. It has informed policy-oriented studies and advisory engagements related to underwater security, environmental monitoring, and sustainable use of water-based commons. Elements of the framework have also been acknowledged in inter-ministerial and strategic forums, reflecting its robustness and applicability across governance scales.

This integrated approach is particularly suited to river systems like the Thimphu River, where ecological health, urban development, cultural values, and community livelihoods intersect.

There are four platforms to present the body of work:

UDA Digest It is an online digital platform for textual contents. There are four types of publications including issue briefs, commentaries, expert articles and short reports. There are over a hundred articles in this platform covering varied dimensions of the UDA framework.

UDA Knowledge Center This comprises of inhouse research publications in three formats, including research notes, innovation notes and case studies. This platform provides the state-of-the-art literature review and identifies the research gaps and way ahead.

UDA Learning Center This provides the E-Learning modules on varied subjects covering the UDA framework. This provides automated evaluation mechanism with extensive video and text-based reading material.

UDA Dialogues This is an audio and video channel for expert talks, strategic interactions, panel discussions and more. This also comprises of presentations by our research fellows on their research outcomes.

Programme Formulation and Execution

The river warriors' program will **contain a continuous training of the river warriors** while they are also working on the ground to understand the unique characteristics of the local region.

Training of the warriors (Engage)

- **Workshops** The selected warriors will receive training on the domain knowledge via webinars and workshops conducted by MRC. The platforms of MRC will provide them with enough literature including well crafted research notes, MRC's internal publications, Articles on recent issues and case studies and gap analysis will provide the complete picture of the global challenges. The MRC's internal team have policy matter experts, Technology matter experts and software matter experts to drive the innovation in Thimphu River. They will sensitize the river warriors about the effective policy and technology interventions, which the warriors will take forward based on their interactions with the coastal communities.
- **Webinars** The webinars will be addressing the multiple aspects of the UDA framework, including Science & Technology (S&T), Communities, Sustainable Blue Economy, Riverine aspects, Sediment Management, Acoustic Habitat Degradation, Geopolitics, Underwater Archaeology, Sustainable Development Goals, Disaster Management and more. Every month one webinar will be conducted and experts and domain specialists will be invited to share their inputs. The audience will comprise of students, young professionals, strategists, practitioners, researchers and more. The webinars will be conducted by MRC, however they will partner various stakeholders and entities to on-board them. These webinars will be for a duration of two hours and a detailed report will be generated post the webinar to be communicated to all concerned.

Warriors' Tasks (Outreach)

Documentations: Each River Warrior will maintain a standardized digital and physical record of all outreach activities, sensor deployments, and community engagements. This includes:

- **Field trip reports** with geotagged photographs, water-sampling logs, and minutes from stakeholder meetings

- **Community feedback forms** capturing local observations, traditional knowledge, and action-item tracking
- **Policy engagement dossiers** summarizing inputs from NEC consultations, where all the records maintained by the warriors should be uploaded to the MRC's repository.

Case studies: Warriors will develop in-depth case studies.

- **Baseline assessment** of ecological, social, and infrastructural conditions
- **Intervention design** detailing the technology or nature-based solution implemented
- **Outcome evaluation** using quantitative metrics (e.g., water-quality improvement, reduced erosion rates) and qualitative stakeholder interviews
- **Lessons learned** and scalability recommendations

Ground Validation: MRC has developed innovative tools that helps monitoring water quality parameters to predict the health of water in terms of supporting the life of the ecosystems. The tool deployment in the Thimphu River by river warriors will help locals understand the power of Technological interventions in their daily actions.

Impact and Outcomes

1. Institutionalization of Data-Driven River Governance: The initiative will establish real-time monitoring systems—combining IoT sensors, GIS tools, and field data—to guide evidence-based decision-making. This will enable dynamic, transparent, and adaptive river management practices.

2. Revival of Community Ownership and Traditional Knowledge: Local communities will be empowered to become environmental custodians, with their traditional knowledge documented and integrated into modern river restoration efforts. This strengthens cultural identity while anchoring solutions in local realities.

3. Bridging Stakeholders and Strengthening Accountability: River Warriors will facilitate dialogue across institutions, civil society, and citizens. This will lead to improved coordination, better enforcement of policies, and the formation of a dedicated Thimphu River Basin Management Committee.

4. Creation of Scalable, Replicable Models: The tools, strategies, and training content developed will serve as blueprints for similar initiatives across Bhutan, enabling sustainable river governance throughout the Eastern Himalayas.

Beneficiaries

1. Local Communities Along the Thimphu River: Farmers, fisherfolk, women, and youth living along the riverbanks will directly benefit from improved water quality, ecological restoration, and livelihood diversification. Through training, outreach, and access to digital tools, they will be better equipped to manage their resources and participate in decision-making. The initiative will also enhance climate resilience by promoting sustainable land and water-use practices.

2. Government Agencies and Policymakers: Agencies such as the National Environment Commission (NEC), Thimphu Thromde, and the Ministry of Works and Human Settlement will gain access to granular, real-time data and community feedback, enabling more targeted and effective policy implementation. The policy briefs, EIAs, and governance assessments produced by River Warriors will directly inform regulatory updates and new frameworks.

3. Educational Institutions and Youth: Schools, colleges, and research institutions in Thimphu will partner in outreach, citizen science, and data interpretation. Students will have opportunities to engage in environmental stewardship, field research, and digital innovation. This fosters a generation of

environmentally conscious, technically skilled leaders prepared to take forward Bhutan's sustainable development goals.

4. Environmental Researchers and Technologists: The initiative creates a live, field-integrated lab for environmental and technological experimentation. Researchers can test ecological models, engineers can refine IoT tools, and software developers can co-create citizen science platforms. The MRC's knowledge ecosystem will ensure that findings and innovations feed back into the national and global sustainability discourse.

Schedule

The complete duration of programme is approximately 18 months. The tentative schedule of the programme is shown below:

Stage	Months	Description
I	1-3	**Identification and selection of the River warriors**: This is the selection phase, of the suitable candidates from local communities near the Thimphu River. It will involve MRC's reaching out to the local authorities (including **Thimphu Thromde**), universities and research institutions of Bhutan to invite candidate applications. Major focus will be given on candidates driven by the enthusiasm and motivation to work in this domain of river awareness and water management. Having the relevant knowledge of traditional practices and local characteristics will be a plus point for the candidates applying.
II	3-5	**Fundamental training of the selected candidates**: The selected candidates will be delivered lessons and trainings by MRC subject matter experts to sensitize them about the ground issues and impeding threats to the ecosystem around Thimphu River. All the studies will be backed by High Quality research carried out by MRC's research team having good experience and research output under their belt. They will understand the need of timely policy interventions and how technology can drive the sustainable future of Thimphu River. The candidates will learn from **our ground experts** of how to outreach to the local communities, understand their concerns and collect their feedback. These experts have experience of carrying out such field expeditions frequently with utmost perfection.
III	5-9	**River warriors begins outreach:** In this Phase, the river warriors will be deployed on the ground in a planned manner. Based on the interests and capabilities of the warriors, they will be assigned a task among 5 major pillars (Policy Intervention, Technological Intervention, Capacity and Capability building, To See, To Understand and To Share, and People Economy and Nature). They will be in frequent contact with the MRC's team to report their findings and get feedback from MRC's research experts. In this phase, the river warriors will be expected to ingrain the qualities needed to be a true warrior to understand challenges of their people.
IV	5-15	**River Warriors work on their documentations:** Documenting the state of the people, the nature (ecosystem around Thimphu River) and the dynamics to how all of these conditions are changing is the major outcome of this whole programme. These documentations will carry the true image of the real weakness of the government policies and what are the gaps between the legislation and its implementation. Major researches can be formed above these records and our research team will aim to help the work go places with our learning and outreach portals including UDA Digest, UDA Knowledge centre, UDA Dialogues and also our E-learning modules.
V	9-18	**MRC Team to drive innovations**: MRC team is keen to digitize the state of monitoring of the Thimphu River to make daily activities more evaluated and recorded to ensure sustainable human actions. Our software experts and engineering team will provide adequate support to local partners from Bhutan to provide expertise in deployment of IoT sensors, as well as providing them digital tools to help them monitor and evaluate things effectively. **River warriors are now tasked with the work of hosting workshops for the local people** where MRC Team will also join and present their work while also learning from the local people about the support they need.

| VI | 12-18 | **Continuous interaction of local people with MRC Team:** A major part of the programme is also dedicated to bridge the gap between the people and policy makers, and thus MRC will invite the people from local communities to interact and share their experiences and hardships (if any) with listeners from bureaucracy, research community, journalists and other elite panels through webinars making their voices heard. |
| VII | 16-18 | **Wrap up and deliverables evaluations**: While the complete framework of Engage, Outreach and Sustain is a meant to be an ongoing process, this programme will effectively identify the gaps in the regulations around Thimphu river so that local authorities can be sensitized regarding it, while we call this a wrap up, it will be mainly a way to consolidate all the findings and properly document them to be shared in the open source (for the research community) to provide the real image of the condition of Thimphu river. |

Budgetary Estimate Breakup

S. No	Item	Budget (in INR)
I	Costs pertaining to training programmes for the river warriors and hosting workshops for local people	25,00,000
II	Travel and accommodation costs for MRC's core team occasional visit to Thimphu and adjacent areas for discussions with MRC's local partners and river warriors	7,00,000
III	Technology related costs (costs for the hardware resources including sensors and cloud infrastructure costs for hosting the software tools to be developed by MRC)	10,00,000
IV	Consumables and Miscellaneous	3,00,000
V	Other overhead for the Programme management	2,00,000
VI	Additional Contingencies costs (5% of the budget)	2,35,000
	Total	**49,35,000**

*None of the costs includes any payment to MRC staff salaries from the funding received

Travel Details (tentative)

- **One or two MRC's Core Team members from India** to have **few visits to Bhutan** (especially during the Stage I of the course) to understand and experience the local characteristics and initiate discussions with the suitable partners for collaborating upon the project work.
- MRC **will also extend invitations to our prominent partners**, **and few river warriors** (a max of 5, one from each pillar mentioned above, based on the funding granted and availability) to the MRC's Center in Pune India for in-person discussions and to give them a broad perspective of all the research work and publications done by MRC in the domain of Blue Economy and Maritime Domain Awareness.

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