**LAGI 2025 Fiji Narrative Template**

1. **Concept Narrative**

Our design responds directly to the environmental challenges of the Anthropocene—an era marked by significant human impact on the planet. In Fiji, plastic pollution is not only a pressing ecological issue but also a symbol of the broader global crisis. Rather than viewing plastic waste solely as a problem, we see it as an opportunity: a local, abundant, and untapped material resource for regenerative construction. Our proposal transforms this waste into a sustainable asset through computational design and digital fabrication.

We propose using 3D printing to convert plastic waste into modular building components. This process leverages our expertise in computational design, digital fabrication, and material science. Computational design enables the creation of adaptable, site-specific solutions, from furniture to full-scale infrastructure. These parametric scripts are openly shared online, allowing for broad access, local adaptation, and participatory design. Community members can contribute directly to shaping structures that reflect their needs, values, and identity.

For the fabrication of our design, we propose the development of a mobile, floating 3D printing facility. The ‘Floating Factory’ will be brought to the site, minimizing the need for difficult and costly material transportation. This ‘Floating Factory’ will process locally collected plastic, generating custom components on demand and on location. By decentralizing fabrication and production, we address remote logistical challenges while offering a replicable, low-cost, and sustainable model for other island communities.

Our immediate design priorities address two fundamental needs identified by the community: consistent access to freshwater and reliable electricity. These essential utilities are integrated into our architectural interventions, reinforcing the relationship between infrastructure and daily life. The built structures are intended to serve multifunctional purposes—as shelters, gathering spaces, and education hubs—enhancing social cohesion and everyday resilience.

From the outset, three guiding principles shaped our approach:

1. Material Integrity: In accordance with biosecurity guidance, we avoid importing any foreign living materials. Our use of recycled plastic ensures no ecological disruption while reducing local waste burdens.
2. Community Ownership: Our approach emphasizes inclusion at every stage—from co-design workshops to training in 3D printing and system maintenance. This nurtures skills development, fosters pride, and ensures long-term sustainability through community stewardship.
3. Practical Logistics: Recognizing the logistical difficulty of transporting materials to Naviti Island, our solution mitigates this by producing building components on-site. This strategy significantly reduces cost, construction time, and environmental impact.

The co-benefits of our approach are multifold. Environmentally, it reduces plastic waste and import dependency. Economically, it introduces new skills and potential employment pathways in fabrication and design. Socially, it reinforces communal ties through shared making and shared space. For visitors, the structures become immersive experiences of innovation, culture, and ecological harmony—demonstrating how high-tech solutions can remain grounded in local tradition and need.

Our design is not only a system or structure—it is a platform for empowerment, environmental action, and a resilient future shaped by and for the community.

1. **Technical Narrative**

Our proposed design integrates innovative, low-impact technologies to address energy, water, and waste challenges simultaneously. At the core of our system is the transformation of plastic waste into a structural and functional asset, using 3D printing to fabricate modular vessels that act as both supports for solar panels and storage units for rainwater and potential energy.

The central technology in our proposal is a mobile, floating 3D printing factory – the ‘Floating Factory’. This facility enables the conversion of locally collected plastic waste into durable, site-specific components. This approach was selected for its circular economy potential—it addresses a significant environmental issue while creating value locally. Community members can participate by collecting plastic, receiving compensation, and acquiring skills in operating the printing facility and assembling components, ensuring a sense of ownership and long-term engagement.

The primary functional output of the printed vessels is twofold: solar energy generation and water collection. Each vessel is designed to structurally support two solar panels of approximately 1 kW each (2 kW total), mounted on a surface area of 3.2–4 m². These panels not only generate electricity but also act as a rainwater collection surface. The rainwater is channelled into the printed vessels, which are designed to hold between 10,000 and 15,000 litres of water each. With 35 such units, the total estimated water storage capacity ranges from 350,000 to 525,000 litres, providing substantial year-round freshwater resilience.

The energy output from the proposed 35 vessels closely aligned with the competition’s 75 kW target. The system is inherently scalable: additional vessels can be fabricated as needed using the Floating Factory, responding to future demand or population growth.

Beyond passive storage, each vessel integrates an internal hydro-pumped storage system—a miniaturized version of grid-scale energy storage. Using the versatility of 3D printing, internal geometries are designed with two reservoirs at different elevations. When excess electricity is available (e.g., during peak sunlight hours), water is pumped from the lower to the upper reservoir, storing energy as gravitational potential. During periods of high energy demand or low solar input, water flows back through a turbine, generating electricity on-site. This system effectively transforms each vessel into an energy storage unit or ‘water battery’, helping balance energy availability throughout the day. Our systems inputs are

* Locally collected plastic waste (as raw material for 3D printing)
* Solar radiation (for photovoltaic panels)
* Rainwater (collected from solar surfaces)
* Labor and community participation

Whereas out systems outputs are:

* Electricity (approx. 70 kW total generation)
* Stored rainwater (350,000–525,000 L capacity)
* Stored energy via hydro-pumped mini-reservoirs
* Local employment and training opportunities
* Reduction in plastic pollution

This integrated system is not only technically efficient but socially and environmentally regenerative. It harnesses the potential of waste, water, and sunlight through synergistic design, empowering communities while addressing urgent infrastructure needs.

1. **Prototyping and Pilot Implementation Statement**

Our team brings years of expertise in 3D printing with recycled plastic, including successful fabrication of large-scale building elements. Members of our group have even developed custom large-format 3D printers with build volumes up to 2.6 × 2.6 × 3.6 meters. While this technical experience forms a strong foundation, we recognize that establishing a floating 3D printing factory—installed on a vessel capable of reaching Naviti Island—is a significant logistical challenge. To address this, we propose a parallel, two-track approach: one focusing on design co-development and prototyping, the other on infrastructure creation and financial implementation.

The first track begins with community collaboration. Our prototyping process will be deeply participatory, grounded in dialogue with local stakeholders. We will initiate the effort by conducting contextual research through interviews, site walks, and participatory workshops. These interactions will help us identify community priorities, spatial constraints, and practical considerations for using plastic waste as a construction material.

The design process will be co-created with the community using our computational design tools, which enable adaptable, iterative models based on local feedback. Rather than imposing fixed designs, we aim to empower local voices in shaping their own infrastructure. Together, we will explore vessel placement strategies, functional design options, and cultural relevance. This ensures the resulting prototypes not only serve technical needs but also resonate with local identity and environmental context.

Once the co-design process is complete, we will proceed with detailed engineering for structural performance, hydrodynamic stability, internal hydro-pumped reservoirs, and solar integration. Electrical planning, including solar panel orientation, wire routing, and control systems, will also be refined. A full-scale prototype will be fabricated remotely at the applicant’s fabrication facility, which is already equipped with advanced design, engineering, and manufacturing capabilities. The prototype will first undergo performance testing at this facility before being shipped to Naviti Island for community-led evaluation and feedback.

The second track focuses on the development of the floating factory itself. This initiative will be established as a philanthropic endeavour under the umbrella of the applicant’s existing nonprofit entity. The organization has a proven record of securing funding through grants, corporate partnerships, donations, and sustainable revenue models focused on ocean plastic removal. The floating factory aligns with its mission and expands impact by enabling hyper-local, circular economy solutions.

In this phase, we will design and retrofit a vessel with the necessary equipment, including large-scale 3D printers, waste processing units, and training spaces. We will also collaborate with the community on staffing, training, and maintenance planning, ensuring operational longevity and knowledge transfer.

To ensure transparency and long-term viability, we will implement clear governance structures, community representation, and ongoing impact measurement. By combining technical precision with inclusive planning, this pilot will create both infrastructural value and local empowerment, serving as a replicable model for other island communities facing similar challenges.

1. **Operations and Maintenance Statement**

Our proposed technology focuses on the production of modular, 3D-printed vessels that serve as the structural support system for solar panels, combining energy generation, water collection, and energy storage in one scalable design. Providing a robust and self-sustaining system for supporting solar infrastructure is a key requirement for this competition, and we address it by transforming plastic waste into a multifunctional asset.

Each vessel supports two 1 kW solar panels (approx. 3.2–4 m² surface area), which not only generate electricity but also act as rainwater collection surfaces. Water is stored in the vessel’s internal tank, with a capacity of 10,000 to 15,000 litres per unit. With 35 units deployed, the system can deliver up to 70 kW of energy and store between 350,000 and 525,000 litres of water, meeting community needs for electricity and year-round freshwater access.

Moreover, the vessels incorporate an internal hydro-pumped storage system. Using 3D-printed internal geometries, each vessel includes two reservoirs at different elevations. When excess solar energy is available, water is pumped from the lower to the upper reservoir, storing energy as gravitational potential. During periods of low sunlight or high demand, the stored water flows through micro-turbines to generate additional electricity. In essence, each unit functions as a “water battery,” contributing to the reliability and resilience of the system.

To ensure long-term operability, our operations and maintenance strategy centers on local empowerment. The vessels are fabricated from locally collected plastic using a floating factory—a mobile 3D printing platform that docks near the community. This not only reduces material transport costs but also creates jobs. Community members can be paid for collected plastic and might be trained to operate the printer, assemble the vessels, and manage system installation.

A rotating maintenance team—trained during the pilot phase and selected in collaboration with village leaders—will handle daily operations. Responsibilities include cleaning solar panels, checking rainwater inlets, maintaining pump and valve systems, and monitoring power output. These tasks will be supported by easy-to-understand, illustrated manuals and mobile-accessible maintenance tools.

The vessels’ modularity is key to maintenance efficiency: each is independently functional, so issues with one do not impact the rest. Spare parts and maintenance kits will be stored locally, and reprinting of components can be done using community-supplied plastic. IoT sensors in each unit will monitor performance indicators like energy generation, water levels, and system health, alerting both local teams and our support network when intervention is needed.

Over time, the floating factory becomes a regional repair and production hub. With growing experience, the community can train others, fabricate additional vessels, and support neighbouring islands facing similar challenges. By turning a waste problem into a renewable infrastructure solution, we create a system that is not only sustainable, but owned, operated, and grown by the people it serves.

1. **Environmental Impact Assessment**

Our proposal has been designed from the outset to minimise harm and maximise benefit to the local environment. We recognise that Naviti Island and the surrounding marine and terrestrial ecosystems are ecologically sensitive, and any intervention must tread carefully. As such, we take a proactive approach to environmental impact, prioritising material safety, low-impact fabrication, and ecological regeneration.

The primary material used in our system—plastic waste—is not imported but locally collected. This reduces both transport emissions and ecological risk. We explicitly avoid introducing any foreign or living materials that could pose a biosecurity hazard. All vessels and components are fabricated using clean, sorted plastic waste processed on-site via the floating factory. This ensures no contamination of the local ecosystem from invasive species, seeds, insects, or other biologically active agents.

Each of our 3D-printed vessels is designed for minimal disturbance. They are modular and can be positioned without permanent foundations, avoiding damage to sensitive ground or aquatic habitats. This ‘light-touch’ approach means units can be removed, relocated, or upgraded without long-term environmental disruption.

To further mitigate potential issues, the rainwater harvesting systems are enclosed and equipped with filtration to prevent contamination and mosquito breeding. The hydro-pumped energy storage systems are sealed, closed-loop systems designed to eliminate leakage and avoid interaction with groundwater or surface runoff.

Energy generation is entirely solar-based, with no combustion, fuel, or emissions involved. The system's energy balance is carbon-negative: by repurposing plastic waste that would otherwise contribute to pollution or landfill, we remove existing environmental burdens. The floating factory, which processes the waste and prints the vessels, is powered by clean energy sources and designed for temporary docking, avoiding dredging or permanent alteration to shorelines.

Ongoing monitoring is built into the proposal. IoT sensors will not only track technical performance but also detect anomalies in water quality, structural integrity, or temperature fluctuations—early warnings that might signal ecological disruption. These insights will be reviewed jointly by the technical team and community members trained in environmental stewardship.

We also plan for periodic ecological audits in collaboration with local environmental authorities and NGOs. These audits will include biodiversity surveys, soil and water quality testing, and assessments of any unintended ecological impacts. The modular nature of the system allows for rapid adaptation if any intervention proves problematic.

Crucially, the design doesn’t just avoid harm—it contributes positively. The project removes plastic waste from the environment and converts it into infrastructure. It reduces reliance on imported construction materials, thereby lowering associated emissions and ecosystem pressures. The rainwater collection system eases demand on natural freshwater sources. Educational programs around plastic recycling and sustainable water and energy use foster a culture of environmental responsibility within the community.

In summary, our intervention is guided by a principle of regenerative design: not just to avoid damage, but to leave the site and its ecosystems better than we found them. Through circular material use, local empowerment, and continuous monitoring, we ensure this solution protects and uplifts the natural systems that surround it.