



## Terms of Reference

CONSULTANCY: PILOT OF WASTEWATER TREATMENT SYSTEM IN SARGASSUM UPCYCLING PROCESS

### 1. BACKGROUND:

#### MAR Fund and MAR+Invest

The Mesoamerican Reef (MAR) coastline stretches for 1,000 kilometers from the tip of the Yucatan Peninsula in Mexico to the Bay Islands and coastal Honduras, through the Caribbean coast of Guatemala, all of Belize and Quintana Roo, Mexico. The MAR includes the largest barrier reef in the Atlantic and is an integral component of an interconnected and transboundary system of coastal habitats. The MAR region is world renowned for its diverse natural wonders as well as its rich cultural and ethnic diversity.

The annual value of the MAR is US\$ 4.5 billion, integrated by reef-related tourism (US\$ 3.9 B), reef-related fisheries (US\$ 183 M), and shoreline protection (between US\$ 320 and US\$ 438 M).<sup>1</sup> However, much of this value is at risk. If the MAR continues to decline, by 2030 the per annum value of the system could fall by US\$ 3.1 billion a year (in tourism, fisheries and coastal development). Conversely, a shift towards healthy reefs by 2030 could unlock an additional US\$ 2.5 billion annually across the three sectors.<sup>2</sup>

The Mesoamerican Reef Fund (MAR Fund) is a regional, private environmental fund created with the objective of supporting the protection of the Mesoamerican Reef (MAR) ecoregion, shared by Mexico, Belize, Guatemala and Honduras. Its mission is to drive regional funding and partnerships for the conservation, restoration and sustainable use of the MAR. One of MAR Fund's strategies is to create a blue economy innovation accelerator.

The Global Fund for Coral Reefs (GFCR) is a blended finance instrument to mobilize action and resources to protect and restore coral reef ecosystems. GFCR supports efforts to incubate and accelerate revenue-generating interventions that can sustainably finance the mitigation and elimination of unsustainable direct and indirect local drivers of coral reef degradation.

In 2022, GFCR approved the creation of MAR+Invest, the business and finance facility for the MAR. MAR+Invest, led by MAR Fund, convenes a partnership of organizations from the MAR countries, including New Ventures Group & Viwala, Mexican Fund for the Conservation of Nature & Sureste

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<sup>1</sup> IDB – WRI. Economic Valuation of the Mesoamerican Reef.

<https://publications.iadb.org/publications/english/document/Economic-Valuation-of-the-Ecosystem-Services-of-the-Mesoamerican-Reef-and-the-Allocation-and-Distribution-of-these-Values.pdf>

<sup>2</sup> UN Environment, ISU, ICRI and Trucost 2018. The Coral Reef Economy: The business case for investment in the protection, preservation and enhancement of coral reef health. 36pp



Sostenible, and the Healthy Reefs for Healthy People Initiative. The program partners bring together diverse expertise on conservation, monitoring, leadership, capacity building, conservation finance, innovation and impact investment sectors.

MAR+Invest supports the development of enterprises that generate coral positive outcomes and market returns. It calls for proposals to identify potential market initiatives in different stages of development, with a reef positive end result for the MAR.

It identifies, incubates, and enables finance solutions that offer a scale of impact capable of reducing local threats to the reef, generate alternative livelihoods, increase financial sustainability for coastal and marine protected areas in the MAR, grow an Emergency Fund managed by MAR Fund, and ultimately attract capital to develop a coral positive investment portfolio. During the first phase, which started in July 2022, MAR+Invest established the technical assistance facility (MARTAF), managed by MAR Fund, and the Financing Facility, managed by New Ventures. These two structures are the foundation of MAR+Invest to attract catalytic and commercial capital to the ecoregion to build the resilience of MAR coral reefs via blended finance. Now, in the second phase from June 2024 to May 2026, MAR+Invest will consolidate its plans to grow the Blue Economy sector for the MAR region, by supporting reef-positive ventures and attracting capital.

More information about this initiative can be found at : <https://mar-invest.org/>

### **CARBONWAVE SARGASSUM BIOREFINERY**

Sargassum, a type of brown seaweed, has been rapidly proliferating in the Atlantic Ocean, forming massive floating mats that have become a pressing concern for the Caribbean region. These blooms have significantly increased in frequency and intensity over the past decade, posing a serious threat to the delicate marine ecosystems of the Caribbean, particularly coral reefs.

When sargassum washes ashore, it can smother coral reefs, blocking sunlight and preventing photosynthesis, leading to coral bleaching and death. Additionally, decomposing sargassum releases nutrients and toxins into the water, degrading water quality and harming marine life. The accumulation of sargassum on reefs can also increase sedimentation, smothering corals and reducing their ability to feed and reproduce. The accumulation of sargassum on reefs can also increase sedimentation, smothering corals and reducing their ability to feed and reproduce<sup>3</sup>.

Several factors are believed to contribute to the proliferation of sargassum, including increased nutrient pollution from agricultural activities and coastal development, as well as changes in ocean currents and temperatures due to climate change. The combined effects of these factors have resulted

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<sup>3</sup> F. Antonio-Martínez, Y. Henaut, A. Vega-Zepeda, et al., "Leachate Effects of Pelagic *Sargassum* spp. on Larval Swimming Behavior of the Coral *Acropora Palmata*," *Scientific Reports* 10 (2020): 3910, <https://doi.org/10.1038/s41598-020-60864-z>.



in a dramatic increase in sargassum blooms, posing a significant threat to the health and biodiversity of Caribbean coral reefs<sup>4</sup>.

Addressing the sargassum problem requires a multifaceted approach involving mechanical removal strategies, research and development of mitigation techniques, and international cooperation. Investing in these efforts is crucial to protect the vital ecosystems of the Caribbean and ensure the long-term sustainability of the region's marine resources.

Carbonwave is a pioneering company dedicated to the sustainable collection and transformation of Sargassum seaweed from the Caribbean, a natural resource with vast potential. The company's innovative approach focuses on converting this abundant marine biomass into valuable products for the agricultural and cosmetics industries.

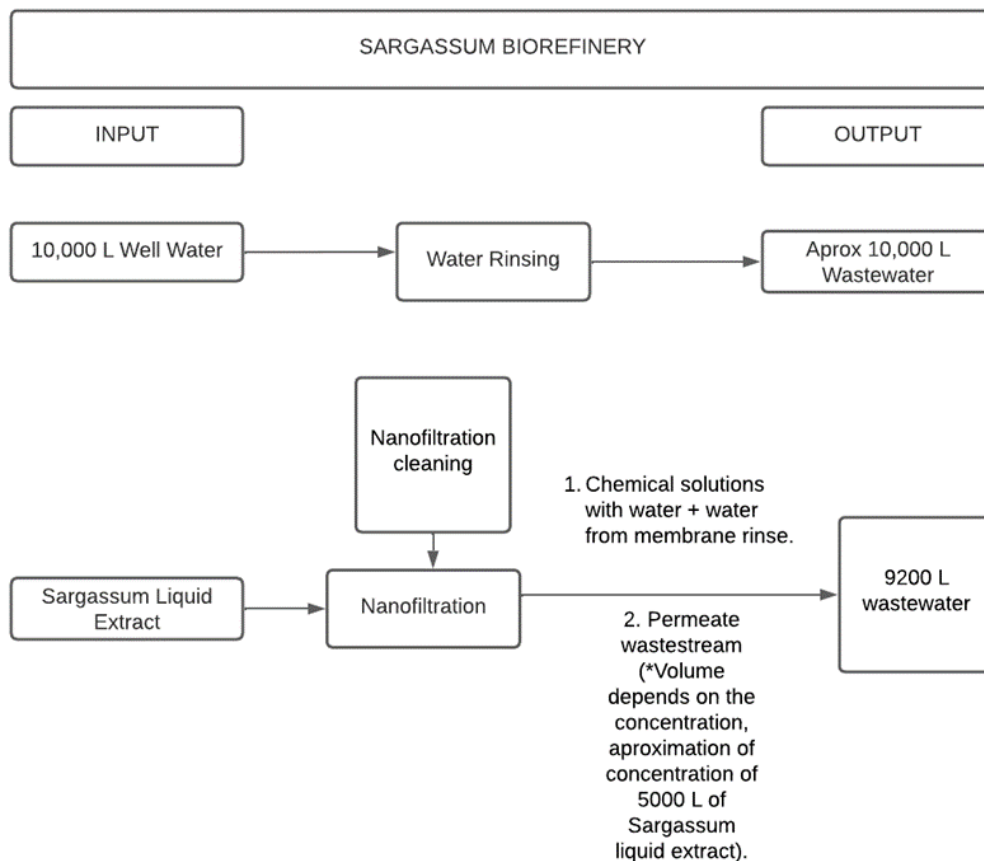
In agriculture, Carbonwave produces bio-stimulants that enhance plant growth and soil health. These bio-stimulants are designed to improve crop resilience and productivity, offering farmers a sustainable solution that supports higher yields while reducing environmental impact. For the cosmetics industry, Carbonwave develops natural emulsifiers derived from Sargassum. These emulsifiers provide superior performance and skin benefits, enabling the creation of effective and environmentally friendly beauty and personal care products. Carbonwave's commitment to sustainability and innovation drives its mission to transform the challenges posed by Sargassum into beneficial, earth-friendly solutions. Through its cutting-edge technology and eco-conscious practices, Carbonwave is leading the way in creating a greener, more sustainable future. However, Carbonwave's processing of Sargassum is notably water-intensive, requiring approximately 10,000 liters of water per processing cycle. This process generates a significant amount of wastewater that must be disposed of safely. As Carbonwave scales up its production, managing water usage and wastewater disposal has become a critical focus area.

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<sup>4</sup> Mengqiu Wang *et al.* The great Atlantic *Sargassum* belt. *Science* **365**, 83–87 (2019). DOI: [10.1126/science.aaw7912](https://doi.org/10.1126/science.aaw7912)



## DIAGRAM. FACILITY WATER EFFLUENT



Note: The maximum capacity for processing Fresh Sargassum is 8-10 tons per day.

### Mitigation of Sargassum Contamination

Upcycling sargassum with an efficient water use method will have several positive environmental impacts as it avoids contamination.

#### 1. Efficient Processing of Sargassum

- By processing 8-10 tons of sargassum per day, the facility can remove significant amounts of this seaweed from beaches, directly reducing the volume of sargassum that washes ashore.



- Efficient processing helps prevent the accumulation of sargassum, which can decompose and release harmful substances into the marine environment and the air, impacting tourism and local ecosystems, such as reefs.
- 2. Pollutant Removal from Wastewater**
    - Sargassum processing generates wastewater that may contain various pollutants such as organic matter, salts, and possibly toxic substances.
    - The pilot wastewater treatment system aims to effectively remove these pollutants, ensuring that any discharged water is clean and safe, thus preventing secondary pollution of coastal waters.
  - 3. Water Reuse and Conservation**
    - Treating and reusing wastewater within the facility can reduce the demand for fresh water, which is crucial in regions where water scarcity is an issue.
    - By recycling water, the facility minimizes its environmental footprint, promoting sustainable practices that can be scaled up.
  - 4. Reduced Environmental Impact**
    - Reducing the facility's freshwater consumption by 80-90% means that less water is extracted from local sources, preserving these for other critical uses.
    - Lower water consumption also means reduced energy use and lower operational costs, making the processing facility more sustainable and economically viable.
  - 5. Scalable and Sustainable Solution**
    - The pilot's success will provide valuable data and confidence for full-scale implementation.
    - Once fully implemented, the facility can process larger volumes of sargassum with minimal environmental impact, providing a scalable solution to sargassum contamination.

#### **Additional Benefits**

- **Economic Impact:** Cleaner beaches enhance tourism and local businesses, providing economic benefits to coastal communities.
- **Ecological Balance:** Removing sargassum and treating wastewater helps maintain the health of marine ecosystems, supporting biodiversity.
- **Innovation in Waste Management:** Developing effective wastewater treatment for sargassum processing can serve as a model for other facilities dealing with similar issues, promoting wider adoption of sustainable practices.

In summary, piloting and implementing a wastewater treatment system at Carbonwave's sargassum processing facility not only improves the efficiency and environmental impact of sargassum removal but also ensures that the process itself does not contribute to further contamination. By treating and reusing water, the facility can operate sustainably, setting a precedent for environmentally responsible sargassum management.



## 2. Objectives of the consultancy

The objective of this consultancy is to pilot a wastewater treatment system to reduce the use of water required for the processing of sargassum, by reusing and properly treating these waters.

## 3. Contract responsibilities

- A. **Assess current Wastewater Treatment System at Carbonwave:** test the system and provide a baseline of data for effluent quality, treatment efficiency, and compliance with environmental regulations
- B. **Pilot a Wastewater Treatment System:** This involves testing a smaller-scale version of the proposed system to evaluate its effectiveness in a controlled environment.
- C. **Verify Effectiveness in Pollutant Removal:** Assessing how well the system can remove harmful pollutants from the wastewater generated during sargassum processing.
- D. **Water Reuse:** Examining the potential for treated water to be reused within the facility, significantly reducing the need for freshwater.
- E. **Reduce Water Consumption by 80-90%:** Aiming for a substantial reduction in the overall water usage, which can have multiple environmental and operational benefits.

The consultancy report will contain a written report in Word, a PowerPoint presentation of the key findings and a 5-minute video presenting the results. All data should be shared in an Excel database, and pictures in high resolution. If taking and using pictures that include people, the consultant must request a signed waiver releasing the use of their image for communication purposes.

The consultant must follow the Environmental and Social Management System of MAR Fund. For more information, visit: <https://marfund.org/en/esms/>

## 4. Oversight

The consultant will report directly to the MAR+Invest Coordinator (MAR Fund) who will act as focal point for this consultancy and will coordinate the revision of products with Pegasus Capital, when required. She will also coordinate between the consulting team and the Research & Development (R&D) team of Carbonwave, who will be responsible for the technical evaluation of the delivered products.

The final products and report will be approved ultimately by MAR Fund.

## 5. Duration of the contract

This consultancy will have a maximum duration of 6-10 months and starts on the date of the contract signature.

## 6. Payments

The payments will be disbursed based on the products delivered for this consultancy, and based on the work plan and timeline developed by the consultant and agreed to by MAR Fund.



## 7. Place of Work

The consultant must work from his/her place of residence and be able to travel, if necessary, to the sites of interest in these terms of reference.

## 8. Qualifications and attributes of the consultants

The consultant(s) or consulting agencies will have the following profiles:

- Water Science and Treatment Consultant(s): Requires a minimum of 2 years' experience in business operations and the implementation of water treatment plants.
- Capable of producing high-quality technical documents in both English and Spanish languages.
- Strategic and innovative thinking.

## 9. Applications procedure

The consultant(s) or consulting agency will provide:

- A technical proposal that includes a detailed work plan, methodology, activity timetable, deliverable planning, and the proposed implementation of the pilot, along with any other relevant information. The study must include the items described in Annex A.
- An economic proposal, in USD, with the detailed budget by product. The total amount must include all expenses of the consultancy, including needed travel.
- A portfolio of similar projects carried out by the consulting agency.
- CVs of project participants.
- Three references.

## CONSIDERATIONS:

- Proponents are responsible for all costs associated with the preparation and presentation of proposals submitted to MAR Fund for this request for proposals, and therefore there is no obligation on behalf of MAR Fund to cover such costs – either in whole or in part – or to provide any advance or compensation if their proposal is not selected.
- Proponents acknowledge and accept that the preparation of the proposal(s) does not constitute a financial obligation on behalf of MAR Fund, and therefore the economic and financial responsibility for the preparation of the proposal(s) is exclusive of the proponent(s), regardless of the selection process outcome.
- The selection process will be carried out in accordance with MAR Fund's internal evaluation guidelines and the result will be final.
- Only proponents who advance to the next stage of the selection process will be contacted.

## 10. Deadline and contact

The required documentation must be sent by **February 17, 2025** to the following emails:

[ajones@marfund.org](mailto:ajones@marfund.org) and [saguilar@carbonwave.com](mailto:saguilar@carbonwave.com).



## Annex A

Water Quality Analysis and Protocols for Sargassum Processing.

### Well Water Analysis

Objective: To establish a baseline quality for the well water used in the processing of Sargassum.

Parameters to Measure: pH, Total Dissolved Solids (TDS), Hardness (calcium and magnesium), Microbial contamination (*E. coli*, coliforms), Heavy metals (lead, arsenic, mercury).

Frequency: Monthly

Sample Points: Directly from the well.

### Rinse Tank Water Analysis

Objective: To evaluate the contamination levels after the water has been used to rinse Sargassum, focusing on pollutants picked up during the cleaning process.

Parameters to Measure: pH, Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Oil and Grease (FOG), Sand and debris content

Microbial contamination (*E. coli*, coliforms)

Frequency: Monthly

Sample Points: From various rinse tanks at different stages of the rinsing process.

### Nanofiltration System Water Analysis

Objective: To assess the efficiency of the nanofiltration system in removing contaminants and ensuring the quality of the treated water for potential reuse or discharge.

Parameters to Measure: Ph, TDS, TSS, BOD, COD, FOG), Heavy metals (lead, arsenic, mercury), Microbial contamination (*E. coli*, coliforms).

Frequency: Monthly

**Sample Points:** Sargassum liquid extract input, permeate, and retentate.

Methodology

**Sample Collection:** Use sterilised containers for collecting water samples.

Follow standard procedures for sample preservation and transportation to the laboratory to prevent contamination.

Laboratory Analysis: Conduct tests in a certified laboratory using standard methods.