Terms of Reference for Consultancy

Technical Component

Pilot Technical Concept and Plan

Izbet Alhamra – Beheira -Egypt

Project Title	**Al-Murunah Project:** Building Climate Resilience through Enhanced Water Security in MENA
Implementing organizations	- International Water Management Institute (IWMI) - Centre for Environment and Development for the Arab Region and Europe (CEDARE)
Project Location	Izbet Alhamra, Abu Almatamir district, Beheira Governorate

I. Background

In response to water and climate change challenges in Egypt, the Government of the United Kingdom (FCDO) has funded the five-year "Al Murunah" Project to increase water security in the MENA region through the integration of Resilient Nature-Based Solutions for Water (RNBSW) and Agricultural Water Management (AWM) in the face of climate change and land degradation. While identifying and demonstrating pragmatic approaches to investing in NBSW/AWM in the region, the initiative will focus on four countries - Jordan, Lebanon, the Occupied Palestinian Territories (OPT), and Egypt. The central premise of the Al Murunah Project is that appropriately designed on-the-ground NBSW and AWM interventions can, in tandem, enhance water security in the agricultural regions of the Middle East, thereby increasing the resilience of households and communities in the targeted area.

II. Pilot Technical Concept and Plan– Technical Component

1. **Introduction –** The RNBWS initiative is specifically aimed at improving agroecological practices within smallholder farms and gender categories (women and youth) located in Izbat Al-Hamra, Abu Al-Matamir District, Egypt. This initiative adopts a comprehensive approach that encompasses sustainable crop diversification and intensification practices, all tailored to local soil and water salinity conditions. Furthermore, the initiative actively promotes women-led value chains for AOC-certified artichokes, facilitates local Community-based Organizations (CBOs) access to loans, and introduces advanced water conservation and efficiency systems and crop management practices.

Key components that emphasize resilience and sustainability and are designed to support the existing Community-Based Organizations led by women and youth include:

- Innovative cropping systems that feature a diverse range of salt-tolerant crops.
- Sustainable infrastructure development to enhance agricultural practices.
- A strengthened value chain that focuses on post-harvest processing and packaging.
- Improvement in access to agriculture inputs/ end users' markets and financial resources.

The diagram presented in Figure 1 visually illustrates the RNBWS framework for Egypt, highlighting the interconnectedness between these key components.

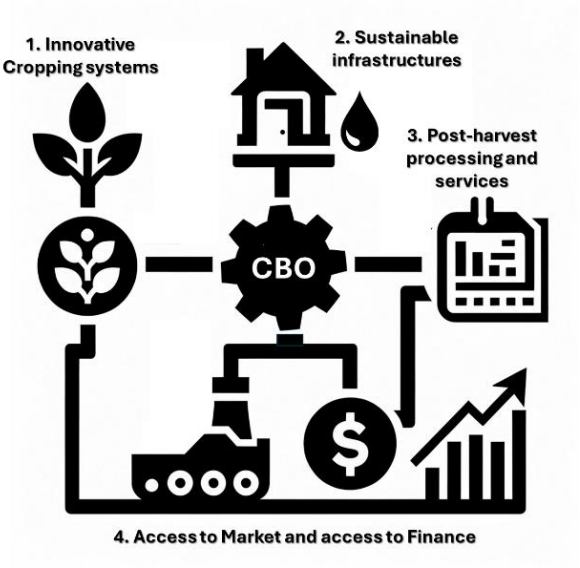

Figure 1. The RNBWS definition in Egypt: pilot integrated components.

III. Pilot components

1.1. Innovative cropping systems based on crop diversification and intensification

This component focuses on the implementation of sustainable strategies for crop diversification and intensification that are well-suited to the soil and water salinity conditions in the intervention area. It involves:

- The use of a rotational approach that includes salt-tolerant fodder crops, intercropping systems, and perennial crops.
- These innovative farming systems will be trialed within a technology platform, consisting of one field multiplication, and two field production plots serviced using a sustainable water supply and distribution system (including water mobilization and distribution, as outlined in the second component below).
- Within this platform, we will compare conventional farming practices with innovative technology packages. These packages incorporate the cultivation of salt-tolerant crops, and the introduction of adapted nutrient trap shrubs for the local crop-livestock integrators, and the design of customized management techniques.
- This approach will be developed in collaboration with leading farmers, aiming to enhance agricultural diversity and productivity in the region.

1.2. Sustainable Infrastructure Development

- **Water conservation, supply, and management:** The infrastructure for these facilities includes a water conservation, supply, and management platform that incorporates:
  - **An integrated Solar-Powered Irrigation System (SPIS)**. This system allows for water conservation and allocation to the field multiplication and production plots. It features a geotextile water reservoir that enables irrigation during periods when Mesqa water is not available.
  - **Upstream/downstream water allocation:** The system includes pressurized water upstream pumping and downstream allocation services to meet the water needs of the three field plots designated for seed multiplication, plant propagation, and field crop production. This system could also serve a demonstration hydroponic setup for the women-CBO with a cost share option with a local NGO like Muzara'a.

2. RNBWS technical solution

The Resilient Nature-Based Water Solutions (RNBWS) suited to soil and water salinity conditions, foster women-led value chains for AOC-certified artichokes and the youth-led mechanization services facilitates

through access to finance for the local CBOs and farmers to support produce transformation, machinery services to produce seeds and valorize farms by-products, and to support production inputs procurement for lead farmers and early adopters (Figure 2).

2.1. Innovative Cropping Systems

The component is divided into two field plot types: seed multiplication and plant propagation, and field production plots, in 3 lead farmer's fields over 2.5 feddan and for scaling for additional feddans in early adopters' farms. A Technology Platform for the Innovative Cropping System will demonstrate (peer-to-peer) a variety of crops that are grown to withstand the local environmental conditions. These include salt-tolerant and water-efficient crops like sorghum, corn, artichoke, barley, and fodder beet, as well as the multi-cut Sesbania, which is proposed as an alternative along with selected hedge shrubs to conventional fodder due to its water efficiency,

2.1.1. Field multiplication plot 1

Implementation Location: This subcomponent of a minimum of a half-feddan (approximately 0.207 hectares) is strategically located at the main lead farmer field plot (having the highest resources among the targeted farming community), designated as Multiplication Plot 1. This plot's implementation ensures a consistent and reliable supply of seeds and propagation materials for alternative, non-conventional, and drought/salt-tolerant crops.

Crop Selection and Germplasm: The primary objective of this subcomponent is to produce high-quality seeds and propagation materials from internationally recognized CGIAR germplasm. These genetic resources will be selected among those that have been rigorously tested within the Delta Nile region to ensure their adaptability and resilience, and using data from the climate change downscaling work will help assess phenology and stresses.

Ensuring Crop Availability: Multiplication Plot 1 serves as a critical resource to maintain a continuous supply of suitable crops for the project's duration. Beyond project completion, it contributes to the program's long-term sustainability and scalability.

Crop Management System: A dedicated crop management system will be established and meticulously followed from tillage/sowing to harvest. This system is designed to achieve high seed yield objectives and maximize productivity. The crop management system integrates three crucial aspects:

- **Water Management:** Precise irrigation practices will be implemented to maintain optimal rootzone soil moisture levels (within the Readily Available Water, RAW), ensuring proper growth and seed production. This includes efficient water mobilization and distribution techniques.
- **Nutrient Management:** A balanced nutrient management plan will provide essential nutrients to support healthy crop development and seed production. This may involve the use of fertilizers and soil amendments.
- **Pest Management:** Integrated pest management strategies will safeguard crops against potential threats, maintaining seed and propagation material quality.

The resultant Technology Package for is an intensive input technology package. This package includes the latest agricultural technologies, practices, and inputs required for producing top-quality seeds and propagation materials. Detailed guidelines and protocols for each stage of production, including seed treatment, spacing, planting, nutrient application, irrigation scheduling, and pest management, will be provided.

Seed Quality Assurance: Robust quality assurance protocols will be in place to monitor and maintain the genetic purity and viability of seeds and propagation materials. Regular testing for seed health, germination rates, and disease tolerance/resistance will be conducted.

Monitoring and Data Collection: Continuous monitoring and data collection will be implemented to track water and soil water salinity in the arable layer, and crop performance and ensure that seed yield objectives are met. This data-driven approach allows for timely adjustments and optimization of crop management practices.

Capacity Building and Training (and/or other private sector companies, CEDARE/NARS**):** Local farmers and the youth CBO involved in Multiplication Plot 1 will receive comprehensive training on

implementing the crop management system and utilizing the intensive input technology package. This capacity-building ensures that best practices are followed.

In summary, the Seed Multiplication and Plant Propagation subcomponent integrates advanced agricultural practices with a focus on sustainability and adaptability to local conditions. By maintaining a reliable supply of high-quality seeds and propagation materials, it supports the success of the overall agricultural initiative in the Delta Nile region, fostering agricultural sustainability and resilience.

2.1.2. Field production plots 2-3

Plot Description: This subcomponent encompasses two field production plots, namely Field Production Plot 2 and Field Production Plot 3, each occupying one feddan (approximately 1.038 acres) within a farmer's field. These plots are located at the distal reaches of irrigation canals, often referred to as end-Mesqa. The objective is to employ a comprehensive agricultural diversification system tailored to small-scale holdings in 2 Lead Farmers plots. The adoption will be based on peer-to-peer effect with potential early adopters among farmers in vicinity of these Field Production Plots will adopt by the principle of seeing is believing.

Crop Rotation and Diversification: The heart of this subcomponent is the implementation of a dynamic crop rotation system. This rotation involves a carefully planned sequence of crops to optimize yield, soil fertility, and sustainability. Salt-tolerant fodder crops are at the forefront of this diversification system. These crops are chosen for their resilience in the local soil and water salinity conditions. The diversification system includes the cultivation of species mixtures and hedges, enhancing biodiversity and providing multiple benefits, including pest control and soil conservation.

Crop Types Selection and Intercropping: The cropping calendar comprises two main phases:

- **Winter Intercropping:** During the winter season, artichokes are intercropped with barley and fodder beet. This combination not only maximizes land use but also ensures continuous productivity throughout the year.
- **Late Summer Cultivation:** In late summer, dual-purpose sorghum and maize are cultivated. These crops serve both as food and fodder, providing versatility for crop-livestock integrators. The case of crop-chicken breeders is also taken into consideration.

Water-Efficient Alternative: Perennial multi-cut Sesbania is introduced as a water-efficient alternative to traditional berseem fodder. Sesbania's ability to thrive with limited water resources makes it a sustainable choice for intercropping arrangements. Additionally, adapted extra-nutrient trap shrubs and hedges are strategically planted to serve as natural barriers and living fences. These adaptations enhance environmental sustainability and support pest management.

Integrated Nutrient and Pest Management (INPM) Technology Packages will be meticulously designed and implemented. These packages are tailored to optimize nutrient use, reduce the reliance on chemical pesticides, and enhance crop health and productivity.

Integration with Livestock Farming: The cropping systems proposed under this subcomponent are designed to seamlessly integrate with existing livestock farming practices and chicken production setups. Male farmers predominantly manage livestock and women managing poultry, and the diversified crops ensure a consistent supply of fodder and feedstock for their animals to insolate the farmers from the market inflation.

Collaborative Approach: The cropping layout and design for Field Production Plots 2 and 3 are developed collaboratively. Leading farmers and experts from CEDARE/NARS/Private sector actors like Mozar3 and IWMI actively participate in this process. The efficacy of the conventional cropping system will be compared with the innovative model described above. This comparative analysis will provide valuable insights into the performance and benefits of the diversification system.
In summary, the Field Production Plots subcomponent embodies a holistic approach to agriculture, combining crop rotation, diversification, and sustainable practices. By fostering crop resilience, ensuring year-round productivity, and supporting livestock integration, this subcomponent contributes to the overall success and sustainability of the Resilient Nature-Based Water Solutions (RNBWS) initiative in the Delta Nile region.

The costs of inputs to support the Lead farmers and early adopters is around **£15,000**. Field Technical Monitoring and Auditing has an approximate budget of **£30,000**.

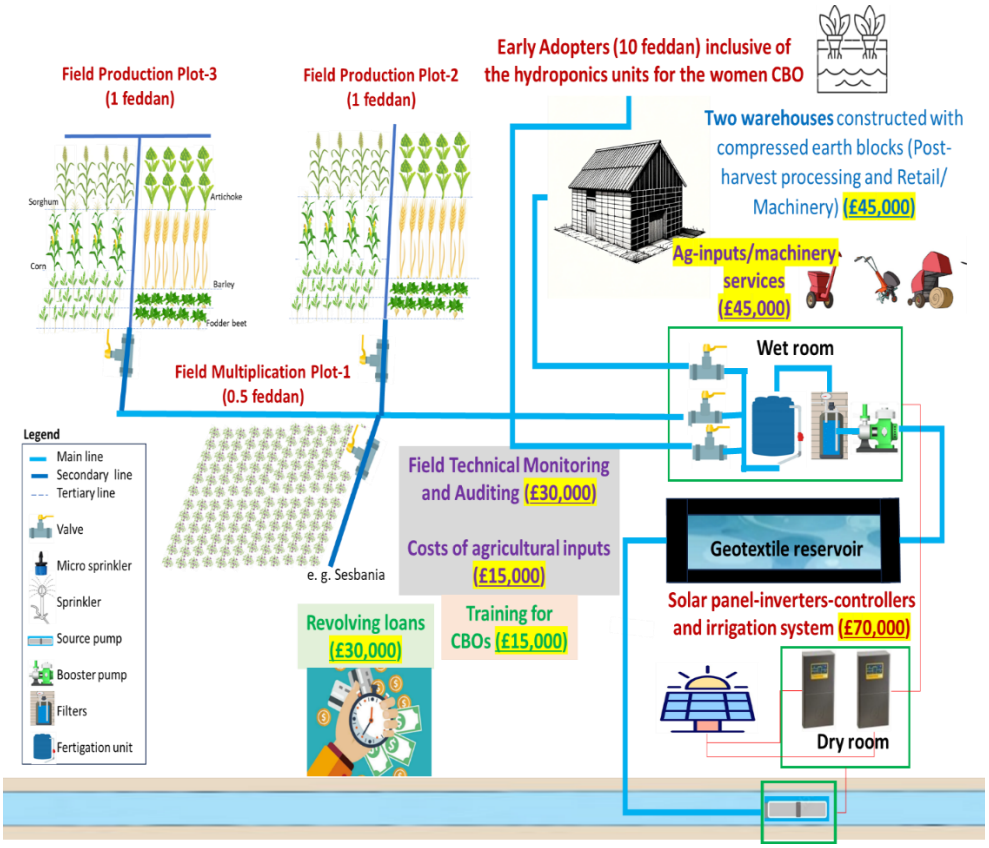

Figure 2. Diagram of the integrated approach to sustainable agriculture within the Resilient Nature-Based Water Solutions (RNBWS) initiative, detailing the components and infrastructure involved in enhancing agricultural productivity and sustainability in Izabat Al Hamra, Abu Al-Matamir District, Egypt.

2.2. Sustainable infrastructure development

2.2.1. Irrigation scheme

The Solar-Powered Irrigation System (SPIS) is a crucial component of the Technical Pilot, designed to optimize water use under water scarcity conditions (turn of water reaching 20 days during the summer season). It utilizes solar energy to power various components, ensuring efficient water mobilization and distribution to support crop cultivation in demonstration plots along with a potential set of early adopters over 12.5 feddan in total.

IV. SPIS Components

- **Solar Panels, Inverters, and Controllers:** The SPIS is powered by solar panels that convert sunlight into electricity. Inverters and controllers manage the power supply, ensuring consistent and reliable energy for the canal pump and downstream water allocation infrastructure.
- **Geotextile Reservoir:** An essential part of the system is the geotextile water reservoir. This reservoir stores water for irrigation purposes, covering the requirements of the three plots and potential 10-feddan for early adopters for up to a 20-day buffer period. It acts as a crucial water source during periods when Mesqa water is not available.

- **Upstream Pumping Station:** The system includes an upstream pumping station responsible for extracting water from the geotextile reservoir. This station plays a pivotal role in ensuring water availability for irrigation.
- **Booster Pumps:** Booster pumps are integrated to maintain adequate water pressure throughout the irrigation network, ensuring that water reaches all parts of the field plots effectively.
- **Self-Cleaning Filters:** Self-cleaning filters are employed to remove impurities and debris from the water source, preventing clogs and maintaining the efficiency of the irrigation system.
- **Semi-Automated Fertigation Units:** Fertigation units are used for the precise application of fertilizers through irrigation. These units enable accurate nutrient management, enhancing crop health and productivity.
- **Downstream Water Allocation Systems:** The downstream water allocation systems consist of main and secondary lines, as well as laterals. These systems are equipped with adapted-flow pressure-compensating emitters, offering options for self-cleaning and no-drain features. These emitters are designed to meet the peak season water demand based on potential Irrigation Water Requirements co-developed with IWMI.
- **Demonstration hydroponics unit** for the women-led CBO that could be cost-shared with an NGO like Muzar3.
- **Wet and dry rooms** for irrigation/fertigation and electricity power and supply will be described in the next section.

Technical Specifications: A detailed Bill of Quantity will be developed for both upstream and downstream water allocation for the three plots (Multiplication Plot 1, Field Production Plot 2, and Field Production Plot 3, and eventual early adopters field plots over 10 feddan including small hydroponics hub for the women CBO). These specifications cover all system components, ensuring accurate procurement and installation.

- **Operation and Maintenance:** Comprehensive guidelines for the operation and maintenance of the SPIS will be developed. These guidelines will ensure that the system operates efficiently and is well-maintained throughout its lifecycle.
- **Technical Monitoring and Auditing:** A Field Technical Monitoring and Auditing Procedure, including ground and sensory systems, will be developed by IWMI. This procedure ensures the ongoing performance and reliability of the irrigation system.
- **Extension Materials:** Dedicated extension materials will be co-developed with IWMI in both Arabic and English. These materials are intended for farmers and technicians and aim to embed the SPIS service within a local service provider, such as a crop contracting company or NGO.
- **Crop Management Practices:** Crop management practices will be tailored to optimize irrigation scheduling. Technical references on crop water and nutrient requirements will guide these practices. Integrated Pest Management (IPM) strategies will be co-developed to promote advanced innovative systems.
- **Small Machinery Specifications**: Technical specifications for small machinery used in field plot management, fodder processing to silage, seed threshers, and packaging will be detailed. Manuals of Machinery Operation and Management will be developed for the youth-CBO. The total investment value for machinery is approximately

In summary, the Solar-Powered Irrigation System (SPIS) subcomponent is a critical element of the project, designed to ensure efficient water management and distribution. With careful planning, monitoring, and maintenance, this system will support the success of crop cultivation in the arid environment of the project area, contributing to agricultural sustainability and resilience.

4.2.3. Warehouse facilities

- **Versatile Infrastructure:** The warehouse subcomponent represents a versatile and multifunctional infrastructure element within the project. Its construction from locally sourced materials like compressed earth blocks, clay, gravel, straw, and reed highlights the project's commitment to sustainability and resource utilization. This approach not only reduces construction costs but also minimizes the environmental footprint of the project.
- **Crop Post-Processing Unit:** The crop post-processing unit within the warehouse is a critical component. It provides a dedicated space for cleaning, sorting, and packaging harvested crops,

especially high-value ones like artichokes and cabbage. Post-processing ensures that the produce meets stringent quality standards, making it more competitive in the market. It also adds value to the crops, benefiting local farmers by commanding better prices for their products.

- **Services Unit:** The services unit is another essential aspect of the warehouse. It houses a range of small machinery and equipment required for various agricultural activities. This includes seed storage and multiplication equipment, machinery for biochar and manure production, tools for silage processing, and seed threshing and packaging machinery. This unit supports the technical aspects of agriculture, allowing for efficient and modern practices that enhance productivity and crop quality.
- **Training Center:** The warehouse complex serves as a valuable training center. Hands-on training sessions conducted here are pivotal in building the capacity of local farmers and project beneficiaries (Mozar3 and/or other private sector companies). These sessions cover a wide array of agricultural practices, from seed storage and multiplication techniques to artichoke and cabbage processing methods. Participants gain practical knowledge and skills that can significantly improve their farming practices and crop yields.
- **Meeting Point:** As a meeting point for site visits from local, national, and international entities, the warehouse becomes a hub of knowledge-sharing and collaboration. It offers a platform for stakeholders to come together, exchange ideas, and learn from each other's experiences. This collaborative environment fosters innovation and allows the project to benefit from a diverse range of perspectives and expertise.
- **Marketplace/Ag-input Retail:** The potential use of the warehouse facilities as a marketplace adds yet another dimension to its versatility. By providing a centralized location for the exchange of agricultural products/inputs, the warehouse supports the local economy and enhances market access for project beneficiaries. This direct market linkage can lead to increased income for farmers and stimulate economic growth in the region.

The warehouse subcomponent is not just a physical structure but a catalyst for positive change within the project area. Its sustainable construction, multifunctional design, and focus on training and collaboration make it a cornerstone of the project's success. By incorporating these elements, the project aims to empower local communities, improve agricultural practices, and create economic opportunities, ultimately contributing to agricultural sustainability and resilience in the region.

V. Pilot technical plan Terms of Reference/ Deliverables

The key components (the deliverables) and their associated design objectives are outlined below:

Task 1: Innovative Cropping Systems	• Develop detailed plans for seed multiplication and propagation plots. • Carry out a salt water balance in the selected pilot. • Design field production plots for diversified crops (including selection of plots and conducting land and soil salinity tests). • Identify suitable salt-tolerant, water-efficient crop varieties. • Plan crop rotation, intercropping, and diversification schemes. • Design Integrated Nutrient and Pest Management (INPM) strategies. • Develop integration strategies with livestock farming. • Create comparative analysis frameworks for conventional vs. innovative systems. • Design training programs and capacity-building initiatives to be implemented by private sector companies (including Mozar3) and NARS. • Establish protocols for continuous monitoring and data collection.

Task 2: Sustainable Infrastructure Development	• Design the layout and specifications for the Solar-Powered Irrigation System (SPIS). • Determine the technical specifications for solar panels, inverters, controllers, and geotextile reservoirs. • Design the upstream pumping station, booster pumps, and filtration systems. • Develop plans for fertigation units and downstream water allocation systems. • Create technical monitoring and auditing procedures. • Design the outline of extension materials and crop management practices. • Specify small machinery requirements for field plot management.
Task 3: Warehouse Facilities	• Design the versatile warehouse infrastructure. • Plan the layout of the crop post-processing unit. • Specify the machinery and equipment for the services unit and retail of agricultural inputs. • Design the training center's/meeting point structure and content. • Plan utilizing the facility as a meeting point and potential marketplace.

VI. Timeline for the consultancy

- The consultancy duration is three months.

VII. How to Apply

Interested applicants should submit their technical and financial proposals, as well as the professional CV, to gmohamed@cedare.int before 30th of April 2024 with the following subject line "Al-Murunah Project: Pilot Technical and Financial Proposal"