

Project: P013518-001  
Purchase Order: 7457183

# **Fostering Resilience in Iraq Through Sustainable Water Management and Climate-Smart Agriculture**

## **Environmental and Social Action Plan (ESAP)**

May 2025

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## List of Acronyms and Abbreviations

BPH	Best Practice Hubs
CPET	Collaborative Program Euphrates and Tigris
CSA	Climate Smart Agriculture
CVI	Climate Vulnerability Index
ET	Evapotranspiration
ET <sub>o</sub>	Reference Evapotranspiration
ET <sub>c</sub>	Crop evapotranspiration (ET <sub>c</sub> )
GAC	Global Affairs Canada
GIR	Gross Irrigation Requirements
ICARDA	International Center for Agricultural Research in the Dry Areas
ICBA	International Center for Biosaline Agriculture
IE	Irrigation Efficiency (IE)
IWMI	International Water Management Institute
K <sub>c</sub>	Crop Coefficients (K <sub>c</sub> )
MOA	Ministry of Agriculture
MOE	Ministry of Environment
MOWR	Ministry of Water Resources
NIR	Net Irrigation Requirement (NIR)
NWRC	National Water Research Center
Pe <sub>eff</sub>	Effective Precipitation (Pe <sub>eff</sub> )
RIBASIM	River Basin Simulation Model.
SWAT	Soil and Water Assessment Tool.
UNDP	United Nations Development Programme
USGS	United States Geological Survey
VCs	Value Chains
WFP	World Food Programme
WP	Water Productivity
WUA	Water Users Associations

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## Terminology

- RIBASIM** River Basin Simulation Model. It is a model for hydrodynamic and water quality modeling in the Euphrates and Tigris Basin, equipping them with practical skills to assess and manage water resources while focusing on environmental impacts and sustainability. RIBASIM is a flexible, comprehensive model developed by Deltares - DELFT HYDRAULICS to simulate river basin hydrology under diverse current and future hydrological, climate, and anthropogenic scenarios. By linking water inputs at multiple basin points to various water-using activities, RIBASIM evaluates extensive system modeling options, including infrastructure, water distribution, and consumption adjustments across sectors. It efficiently manages complex water resource data, supporting national agencies globally since the 1980s in countries like the Netherlands, Iraq, China, and Brazil. Its versatile framework allows users to select and expand modeling elements (e.g., reservoir operations, irrigation) tailored to specific needs.
- SWAT** Soil and Water Assessment Tool. SWAT is a model that simulates surface and groundwater quality and quantity and predicts the environmental impact of land use, land management practices, and climate change. SWAT is widely used in assessing soil erosion prevention and control, non-point source pollution control, and regional management in watersheds

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## 1. Introduction

Iraq is experiencing environmental challenges that threaten its agricultural sustainability and food security. Climate change has exacerbated existing vulnerabilities, with increasing temperatures, declining precipitation, and intensifying water scarcity placing immense pressure on the country's natural resources. The degradation of the Tigris and the Euphrates rivers—critical for Iraq's water supply—has been further compounded by upstream infrastructure developments and inefficient irrigation practices. This has led to salinization, soil erosion, and desertification, posing significant threats to agriculture and rural livelihoods. The impact of these environmental stressors is particularly pronounced among women, who comprise most of Iraq's agricultural labor force. As per FAO estimates, the share of women in agriculture increased from over 50% in 2000 to nearly 60% in 2012. Women's role in food production, coupled with the increasing burden of water collection due to water scarcity, underscores the need for gender-responsive environmental and agricultural interventions.

The MURUNA Project, implemented by ICBA in partnership with WFP, is designed to address these critical environmental challenges through a multi-faceted approach that integrates sustainable water and land management with climate-smart agriculture (CSA). The project aims to strengthen water governance, introduce innovative irrigation technologies, restore degraded lands, and enhance agricultural resilience in vulnerable communities. Recognizing the importance of scientific data in shaping sustainable solutions, the project will incorporate the Climate Vulnerability Index (CVI), hydrological modeling, and crop suitability assessments to guide decision-making and policy formulation.

A key focus of the MURUNA Project is the revitalization of Water User Associations (WUAs) to empower local communities to manage water resources effectively. Farmers, extension workers, and local stakeholders will receive training in best agricultural practices, efficient water use, and sustainable land management through targeted capacity-building initiatives. The project will also promote the adoption of climate-smart crops, including salt-tolerant varieties, to counteract soil degradation and improve food security.

The environmental threats facing Iraq extend beyond national borders. With no formal agreements regulating the water quotas of the Tigris and Euphrates, Iraq's ability to secure sufficient water resources is heavily influenced by upstream countries, including Turkey, Syria, and Iran. The long-term decline in river flows, coupled with increased groundwater extraction, has led to rising salinity levels, further deterioration of soil quality, and reduced agricultural productivity. The MURUNA Project will advocate for integrated water resource management (IWRM) strategies to optimize water allocation, minimize waste, and improve agricultural practices' overall water efficiency.

Desertification and soil degradation remain significant concerns, with 15%<sup>1</sup> of Iraq's total surface area is categorized as a desertification state. The project will focus on soil fertility enhancement and introducing organic soil amendments such as biochar and compost to improve soil structure and nutrient content. By integrating hydrological modeling tools such as SWAT and RIBASIN, the project will assess water availability, precipitation patterns, and the long-term impacts of climate change on Iraq's agricultural sector.

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<sup>1</sup> <https://earth.org/iraq-tree-planting-initiative/>

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In alignment with national and international climate commitments, the MURUNA Project results will support Iraq's National Adaptation Plan (NAP) and Nationally Determined Contributions (NDC), ensuring that project interventions contribute to long-term environmental sustainability. The project will work closely with the Ministries of Water Resources, Agriculture, and Environment, ensuring its objectives are well-integrated with national development plans.

To ensure sustainability and scalability, the project will establish Best Practice Hubs where innovative agricultural techniques will be demonstrated and adapted for broader implementation. These hubs will serve as knowledge-sharing platforms for farmers, researchers, and policymakers, facilitating the widespread adoption of sustainable farming methods. The gender-responsive approach of the MURUNA Project will ensure that women are actively involved in all project activities, from decision-making to on-the-ground implementation, recognizing their vital role in food production and resource management.

Ultimately, the MURUNA Project represents a holistic and data-driven approach to addressing Iraq's environmental challenges. The project aims to strengthen Iraq's agricultural resilience, restore degraded lands, and promote sustainable water management by integrating scientific research, technological innovations, and community-led initiatives. Through these efforts, the project seeks to mitigate the adverse impacts of climate change, enhance food security, and build a more sustainable and equitable future for Iraq's agricultural communities.

## 2. Methodology for developing ESAP

Developing the Environmental and Social Action Plan (ESAP) for the MURUNA project followed a systematic, inclusive, and evidence-based approach to ensure that environmental and social considerations are fully integrated into project planning and implementation. The process began with an in-depth review of the MURUNA project context, objectives, and proposed activities. The Project Implementation Plan was examined to understand the scope of interventions and identify applicable environmental and social standards. This also included mapping pilot sites and screening relevant national legislation and donor safeguard requirements.

A key step in the methodology was stakeholder mapping and engagement planning. Key stakeholders, including local farmers, Water Users Associations (WUAs), and local government representatives, were identified to ensure inclusive and representative consultation. Meaningful participation throughout the ESAP development process was maintained through direct communication with these stakeholders. This set the foundation for effective consultations, scoping sessions, and focus group discussions (FGDs).

Environmental and social scoping was then conducted to identify potential impacts and opportunities related to project implementation. This included site visits, rapid environmental assessments, and structured analysis of land use, water availability, biodiversity, livelihoods, and social dynamics. Each potential impact was assessed using a qualitative severity ranking system (low, medium, or high) to support prioritization and action planning.

Community consultations and FGDs formed the core of the data collection process. These sessions were held locally and employed participatory methods to elicit feedback on anticipated environmental and social impacts, indigenous practices, perceptions of risk, and community expectations. Key topics discussed included land productivity, use of brackish water, biodiversity, drought vulnerability, labor

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practices, and the potential for social cohesion or tension. Participants also provided practical suggestions for mitigation and community empowerment.

The findings from the consultations and scoping exercises were consolidated and used to conduct a structured risk assessment. Themes categorized identified risks and opportunities and then reflected as ESAP components. Specific, measurable, achievable, relevant, and time-bound (SMART) actions were defined for each area to mitigate risks or enhance positive outcomes. These actions were then organized into a clear action plan aligned with the project timeline.

Institutional responsibilities and required resources were then determined. ESAP outlined the roles of the project team, partners, and stakeholders in implementing, monitoring, and reporting on actions. Staffing needs were detailed in the ESAP under Section 7.2, daily staff rates were based on precedents established under the MURUNA project, and a comprehensive budget was developed.

Monitoring, reporting, and follow-up mechanisms were also integrated into the ESAP to ensure accountability and continuous learning. A monitoring framework was developed with responsibilities and reporting intervals. Community feedback loops and opportunities for adaptive management will be built into the system, including the potential for third-party validation and community-led monitoring in later phases.

The ESAP will be shared with key stakeholders for review and validation. The feedback received will be incorporated into the updated document to ensure alignment with both project goals and local priorities. The ESAP is fully integrated into the MURUNA project implementation plan and will serve as a guided document to support sustainable, inclusive, and environmentally sound outcomes throughout the project lifecycle.

### 3. Project Description

The International Center for Biosaline Agriculture (ICBA), in partnership with the World Food Program (WFP), is implementing this project to enhance the Government of Iraq's capacity to develop and implement evidence-based planning for sustainable water resource management. The project directly benefits 180 technical staff from various government agencies and 600 farmers, extension workers, and input suppliers while encouraging women and girls' active participation in all capacity-building activities and other relevant project interventions. Indirectly, the broader Iraqi population will benefit from improved access to clean water, increased local food production, and enhanced economic opportunities for farmers and workers in related industries.

By integrating scientific research, policy development, and community engagement, this project provides a holistic and sustainable approach to water resource management and agricultural resilience in Iraq. The project's commitment to inclusivity, gender equality, and environmental sustainability ensures that its outcomes lead to lasting food and water security, economic empowerment, and environmental protection. The project contributes directly to poverty reduction, social stability, and sustainable development across Iraq by empowering local communities, increasing agricultural productivity, and creating new economic opportunities.

#### **Overall Project Objectives**

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1. Promote efficient and equitable water distribution at the national level to support both agriculture and other essential needs.
2. Strengthen inclusive, community-led decision-making in water management by enhancing local governance structures.
3. Promote climate-smart agriculture (CSA) and develop national capacities to integrate CSA into cropping systems, improving resilience in agricultural production.
4. Explore innovative solutions, including nature-based approaches to mitigate salinity and restore aquatic ecosystems, alongside piloting hydroponic technologies in Iraq.

### **Expected Outcomes and Related Project Activities**

- **Intermediate Outcome 1100: Strengthened Multisectoral and Transparent Water Governance**

The project seeks to align water use efficiency with socio-economic goals, human rights considerations, and environmental sustainability.

Key Activities:

1. Develop and deliver specialized training programs for the Ministry of Water Resources (MoWR) staff on advanced water management models.
2. Collect and consolidate national data on hydrology, water resources, soil, agriculture, and food security.
3. Develop a calibrated hydrological and hydrodynamic Soil and Water Assessment Model (SWAT).
4. Design an integrated winter and summer irrigation plan.
5. Apply a climate vulnerability index, consolidating and building upon existing frameworks, and vulnerability of soil and water to salinity.
6. Support integrating socio-economic, human rights, and environmental considerations into Iraq's national water management strategy.
7. Assess environmental damage due to agricultural practices and develop plans to reduce the discharge of agricultural contaminants into water sources.
8. Ensure public accessibility of project-generated information for transparency and informed decision-making.

- **Intermediate Outcome 1200: Strengthened Participatory and Locally Led Water Management**

The project focuses on inclusive, community-driven water management, prioritizing the needs of marginalized and vulnerable populations, including women and girls.

Key Activities:

1. Provide training and capacity-building programs for Water User Associations (WUAs) to strengthen governance and decision-making.
2. Conduct community mapping to assess local water sources, usage patterns, and infrastructure, informing water management plans.
3. Develop participatory, sustainable water management plans based on insights gained from community mapping exercises.
4. Support the implementation of community-led and shared water conservation initiatives, including establishing three pilot sites within communal lands to showcase soilless farming techniques (e.g., solar-powered hydroponics).

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- **Intermediate Outcome 1300: Enhanced Adoption of Climate-Smart Agriculture**

The project promotes sustainable and resilient agricultural practices that include people in vulnerable situations.

Key Activities:

1. Implement Train-the-Trainer programs, Farmer Field Schools, and Field Days to build the capacity of farmers and extension workers.
2. Establish three best practice hubs for piloting demonstrations of stress-resilient cropping systems.
3. Facilitate local quality seed production for stress-resilient crops through seed multiplication initiatives.
4. Organize awareness campaigns and advocacy events to promote climate-smart agriculture and its benefits.

#### **Detailed description of Best Practice Hub (BPH) and Hydroponic Systems**

The pilot sites will serve as hubs for climate-smart agricultural innovations, integrating community-led water conservation initiatives, hydroponics, and resilient cropping systems. Community engagement started early in the project design process to enable Water User Associations, local communities, and stakeholders to understand local water sources, usage, and infrastructure needs. The project also builds agricultural resilience by training farmers and extension workers on climate-smart practices through Farmer Field Schools, Field Days, and “train-the-trainer” programs, creating hubs for stress-resilient cropping systems. In addition, it supports local quality seed production for resilient crop varieties and organizes events to increase awareness and advocacy for climate-smart agriculture.

Each site will consist of one hydroponic system and one BPH. The site will have irrigation infrastructure and demarcated plots to demonstrate hydroponic and climate-smart agriculture (CSA) practices and farmer training. Figure 1 illustrates the pilot site layouts.

#### **Description of the Best Practice Hub (BPH)**

The hydroponic system design and the BPH irrigation design include an earthen plastic-lined 100 m<sup>3</sup> water reservoir, vertical plastic storage tanks (10,000 gallons), and a dripline network for water distribution in the plots. Drip irrigation is an efficient water delivery method compared to traditional flood irrigation systems. The water will be pumped using solar power for sustainability and reduced use of fossil fuels. The diagram below shows the main components of the water infrastructure for the BPH. Land preparation will be conducted at the site, which includes plowing, leveling, and plot layout for planting. The plots will be fenced to prevent encroachment by animals.



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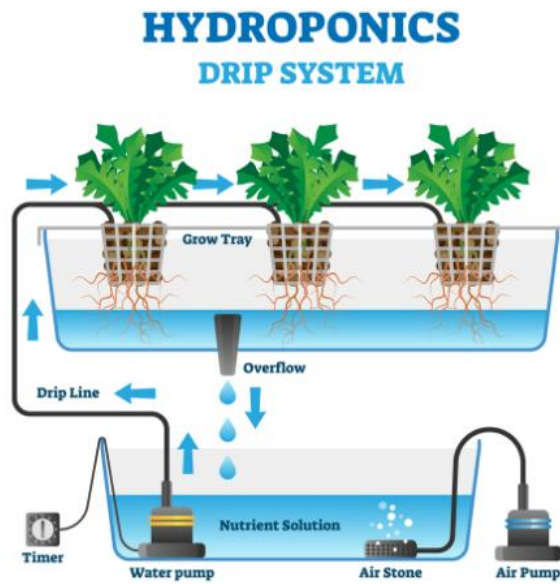


Figure 2: Scheme of the hydroponic system with its components

#### Schematic figure of one module

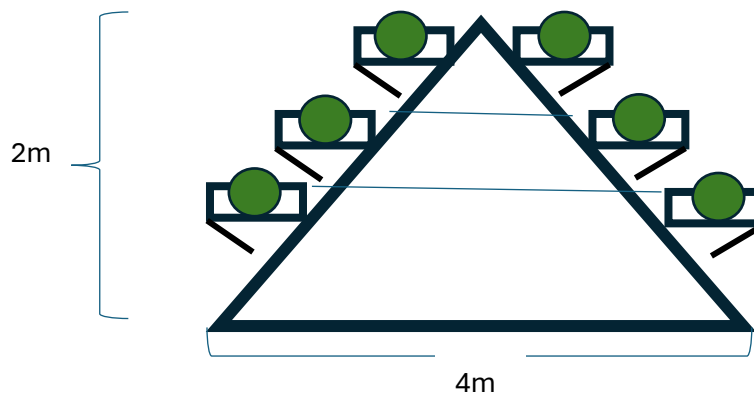


Figure 3: Schematic of one hydroponic module

#### Hydroponic system

- Height 2 m, Base 4 m
- Module length is 6 m, with three triangular supports
- The land surface per module is  $7\text{ m} \times 5\text{ m} = 35\text{ m}^2$
- Pipe (4 inch) or tube length is 6 m
- Three layers on each side, as shown in Figure 3
- Five modules will be used
- Total pipe length will be  $6\text{ m} \times 6\text{ layers} \times 6\text{ hydroponic modules in each greenhouse}$ ,  $216\text{ m} > 100\text{ m}$  IAA 7 (3) requirement, i.e., the hydroponic system triggers the IAA 7 (3) requirement.

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## 4. Project Location and Description of the Environment

### 4.1 Location of the Project

The field activities of intermediate outcome 1200 and intermediate outcome 1300 will be implemented at three pilot sites (Table 1, Figure 4): 1) Al Muthana Governorate in Al Furat (Euphrates) sub-basin, 2) Dhi-Qar Governorate, Mesopotamia sub-basin, and 3) Al Basrah Governorate, Mesopotamia sub-basin. These three pilot sites will be established to demonstrate Climate Smart Agriculture (CSA) and hydroponic systems.

Table 1: Location information of the Best Practice Hubs and hydroponic systems in Al Muthanna, Thi Qar, and Al Basra Governorates

Site No.	Governorate	Number of WUAs	Name of WUA	District	Coordinates	
					X	Y
1	Al Muthana	1	Al Ghadeer	Rumaittha	509,710	347,676.5
2	Al Basrah	1	Al Duwib	Abu Al Khaseeb	819,312.2	335,3410.5
3	Dhi Qar	1	Umm Al-Ma'adid	Shatra District	607,304	349,335.9

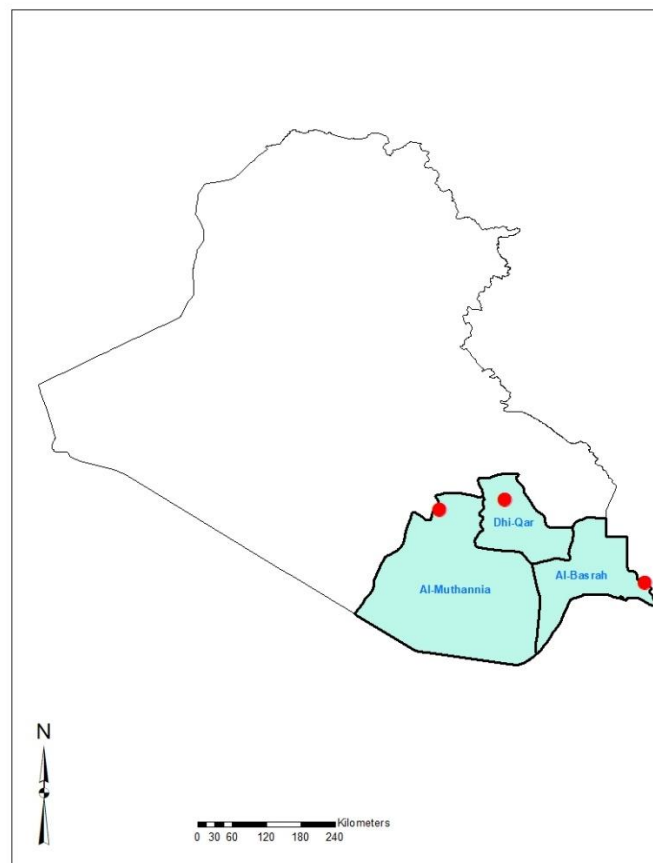


Figure 4: Location map of the three BPH and hydroponic pilot sites in Al Muthanna, Dhi Qar, and Al Basra governorates

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The project pilot site locations were selected through extensive consultations with the Ministry of Water Resources (MoWR), the Ministry of Agriculture (MoA), and the Ministry of Environment (MoE). The results of these discussions concluded with 1) a recommendation for utilizing the UNDP’s climate vulnerability index (CVI) developed for the Ministry of Water Resources (MOWR), 2) the MOE vulnerability maps to determine the best site locations for the three pilot sites by considering the most climate vulnerable governorates, and 3) consider the soil and water salinity for selecting these pilots. These vulnerability maps were utilized to prioritize the most vulnerable regions regarding climate and salinity. The details of this vulnerability analysis are discussed below:

**1) The Climate Vulnerability Index**

The UNDP’s CVI assessment was conducted through a multi-method approach, using spatial, social, and temporal data triangulation using the Vulnerability Assessment framework in Figure 5. The exposure assessment used the following indicators: Sandstorm (frequency), Flood-prone areas (flood depth in meters), Drought-affected area (sq. km), Maximum Temperature (monthly average in degrees C), Minimum Temperature (monthly average in degrees C), Rainfall (monthly average in mm), Groundwater Salinity (EC: ds/m), Sea Level Rise (height from MSL in meter), Digital Elevation (height from MSL in meter), Forest/Tree coverage, and Wetlands/Marshlands (area in sq. km).

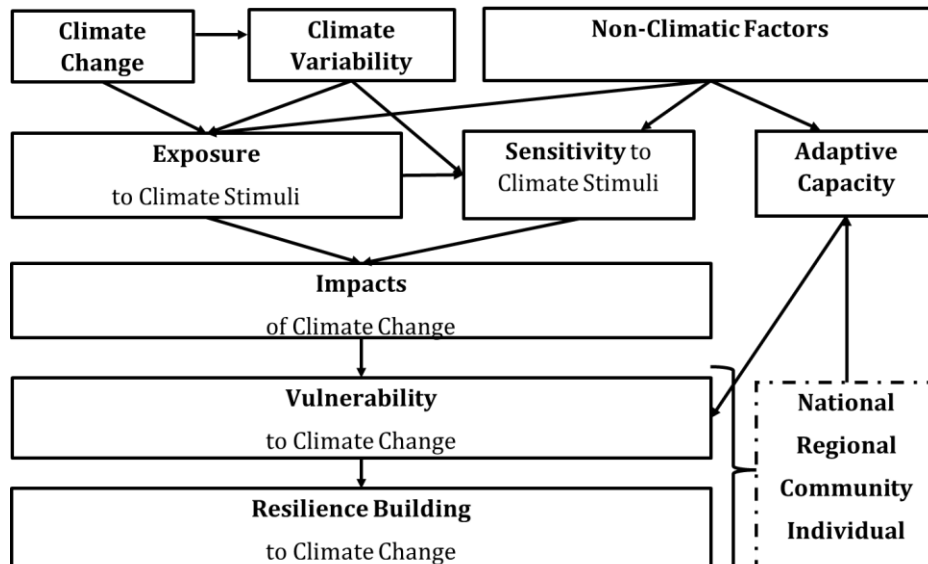


Figure 5: Vulnerability Assessment Framework

The sensitivity assessment depended on Land under irrigation (%), Water bodies (density per sq. km), Total population (in number), Population density (in per sq. km), Agricultural land (% of total area), Fisheries/Aquaculture (% of total area), Livestock (density per sq. km), Airport/airstrips (number), Paved Road network (density per sq. km), Rural road network (density per sq. km), Rail network (density per sq. km), Crop varieties ( in number), and Health care facilities (per 1000 people). The sensitivity analysis results are presented in Figure 6.

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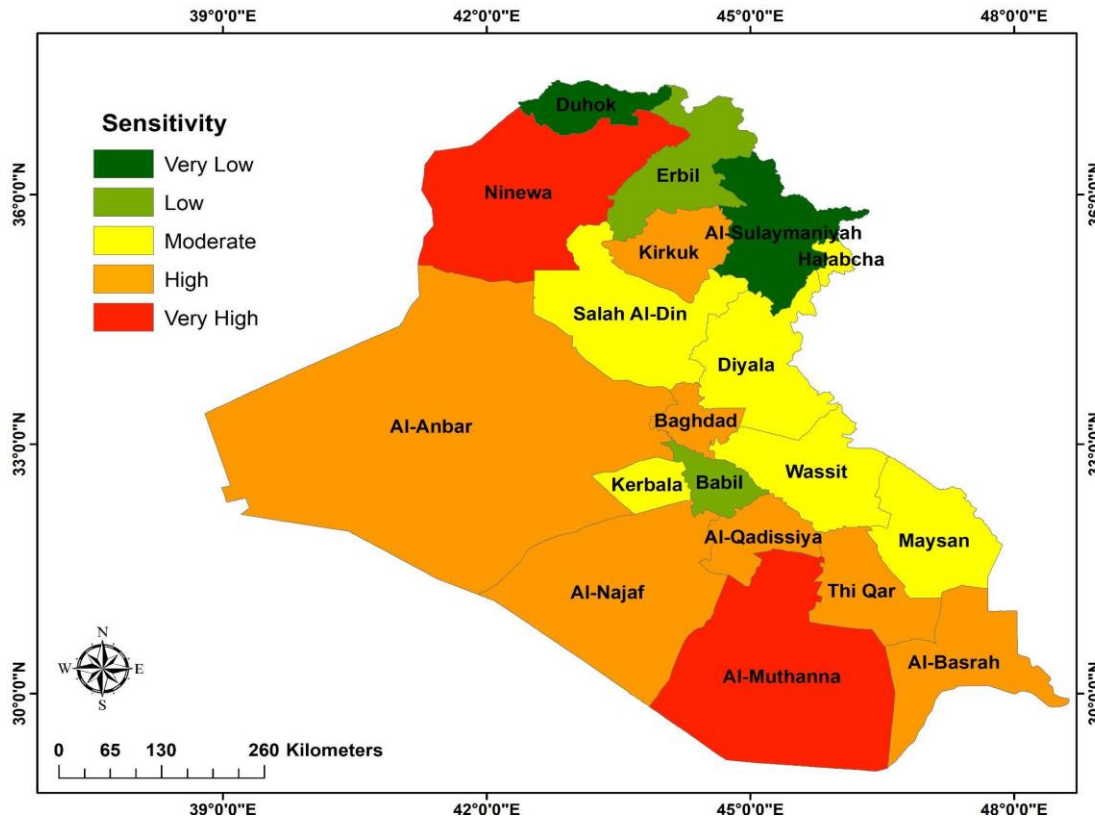


Figure 6: Results of Sensitivity Analysis

The adaptive capacity assessment was based on the following indicators: Illiteracy rate (%), Primary employment (%), Electricity (in % household), Gas supply (in % household), Safe drinking water supply (in % household), Cell phone users (in %), Internet Users (in %), Crop varieties (in number), Health care facilities (hospitals per 1000 people), School drop-out rate (children under 14 years), and Number of medical practitioners (per 1000 people). The results of Adaptive capacity are presented in Figure 7.

The calculated Climate Vulnerability Index for all Iraqi governorates is presented in Figure 8. The figure shows that the three project governorates are among the highest vulnerable.

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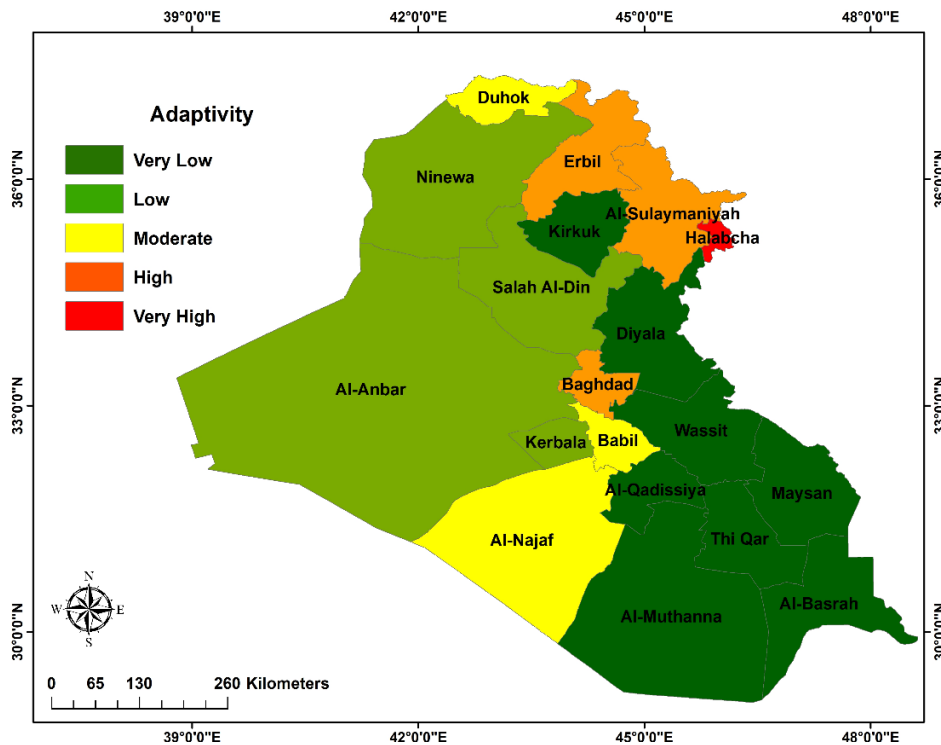


Figure 7: Results of Adaptive Capacity Analysis

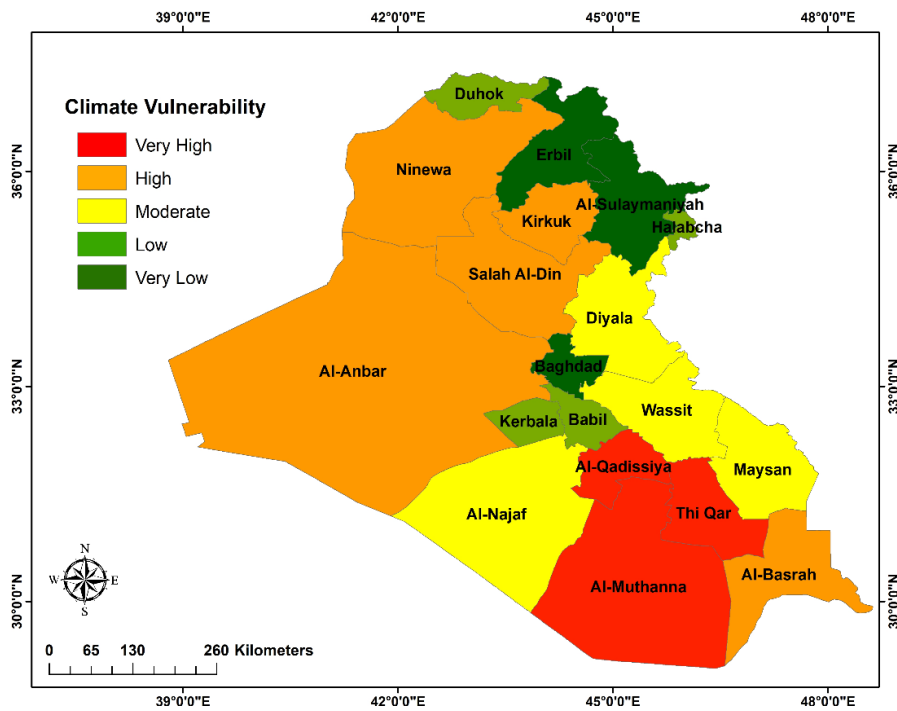


Figure 8: Climate Vulnerability Index for Iraq Governorates

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### **The Ministry of Environment -UNEP Climate Vulnerability Indices:**

The UNEP developed climate vulnerability indices for all the governorates of Iraq as part of a regional hub (<https://home-unep-iraq.hub.arcgis.com/apps/382e45ba8f1540f8a345a7ccc07d8a47/explore>). The following figures (Figure 9 to Figure 14) illustrate the projected changes (2025-2049) time frame under the RCP8.5 S3 climate scenarios. The changes clearly show that the three governorates, Al Muthana, Dhi-Qar, and Al Basrah, are among the most vulnerable governorates due to climate change:

1. **Dry Spell** – Measures the longest consecutive dry days (daily precipitation <1.0 mm) annually. The plots compare changes against the historical mean (1981-2005), with red indicating longer dry spells and blue indicating shorter ones.
2. **Hot and Humid Extremes** – Represents the number of days per year with a Heat Index (HI) above 32°C, reflecting heat stress risk. A positive change indicates more extreme heat days, while a negative change suggests fewer, compared to the historical mean (1981-2005).
3. **Warm and Dry Days** – Counts days exceeding the historical 75<sup>th</sup> percentile for temperature and the 25<sup>th</sup> percentile for low precipitation. A positive change means an increase in such days, while a negative change indicates a decrease relative to 1981-2005.
4. **Standardized Precipitation Index (SPI)** – Assesses 12-month precipitation deviations from long-term averages (1978-2002). Positive SPI values indicate wetter conditions, while negative values suggest drier conditions.
5. **Precipitation Intensity** – This represents the mean annual precipitation on wet days. A positive change signals an increased rainfall intensity, whereas a negative change suggests a lower intensity than the historical mean (1978-2002).
6. **Sea Level Rise & Flooding Risk** – Evaluate the risk of land and settlement flooding in Basrah, Dhi-Qar, and Maysan due to projected sea level rise (SLR). Under the RCP8.5 medium confidence scenario, SLR is projected to rise +0.3 m by 2050, +0.9 m by 2100, and +1.3 m by 2150 compared to 1995-2014. In a low-confidence scenario, SLR could reach up to 2m by 2150, with extreme cases hitting 4-5 m, potentially flooding 972 km<sup>2</sup> and affecting 162 settlements.

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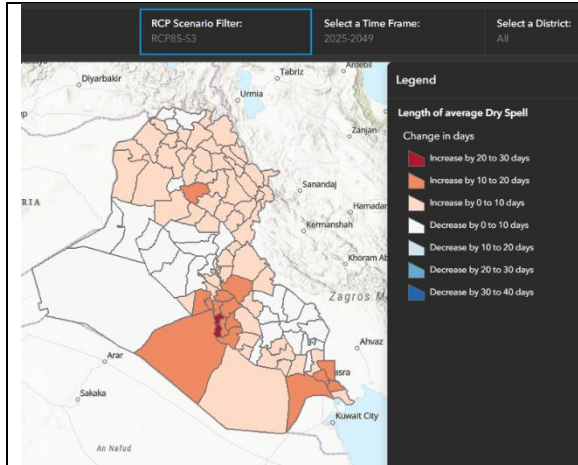


Figure 8: Length of Dry Spell under RCP8.5 S3 climate scenario

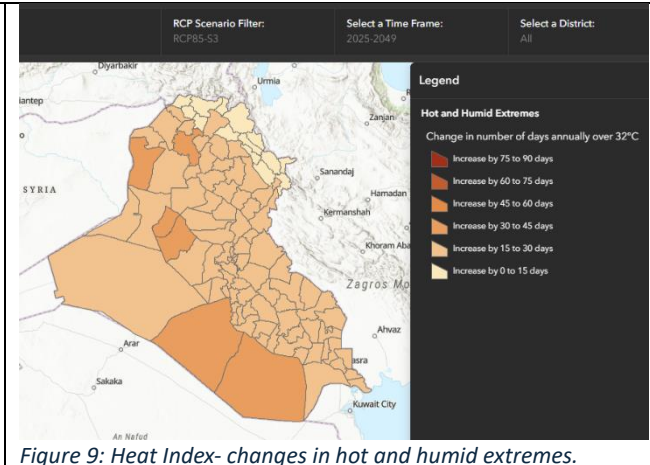


Figure 9: Heat Index- changes in hot and humid extremes. Changes in the number of days annually over 32 C under RCP8.5 S3 climate scenario

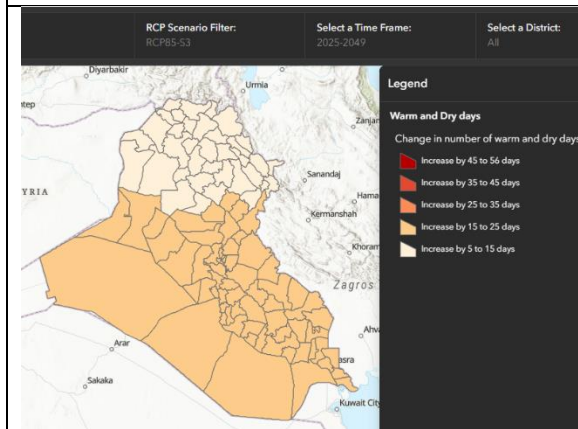


Figure 10: Changes in the number of warm and dry days under the RCP8.5 S3 climate scenario

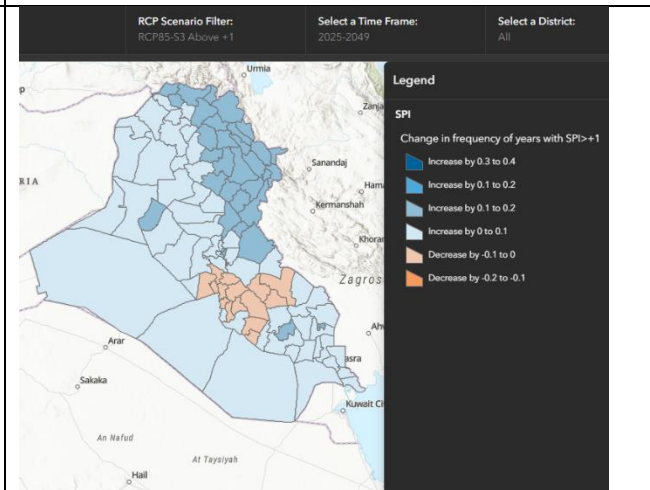
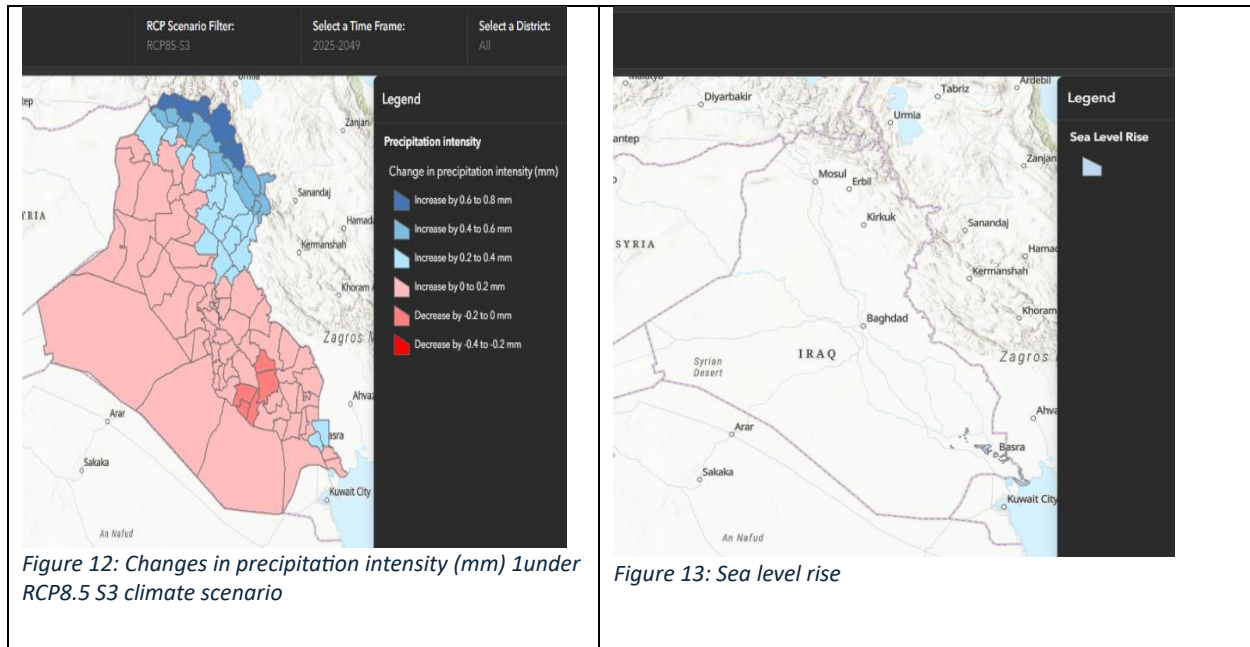


Figure 11: Changes in frequency of years with SPI>+1 under RCP8.5 S3 climate scenario

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## 2) Soil and water salinity

The Ministry of Agriculture and the Ministry of Water Resources provided soil and water field sampling data from the three pilot sites of Al Muthana, Dhi Qar, and Al Basrah governorates. These data were used in the vulnerability analysis of the sites to salinity.

In addition, the ICBA's water and soil team conducted a geostatistical analysis using the soil salinity map from ISRIC (<https://data.isric.org/geonetwork/srv/api/records/c59d0162-a258-4210-af80-777d7929c512>) and the average water salinity data along the main rivers compiled from earlier studies (ICBA, 2019). The team conducted interpolation analysis to determine the extent of soil and water salinity in the Euphrates and Tigris rivers basin. The soil salinity ranged from very low (below 2 dS/m, the blue color in the soil map) to maximum salinity below 16 dS/m in southern governorate locations (light brown color). The water salinity ranged from very low in the northern part of the Euphrates and Tigris basin at 0.4 dS/m to 3.6 dS/m in the southern part of the rivers, mainly along the river in Dhi Qar Governorate, reaching Al Qurnah before Al Basrah, Figure 15.

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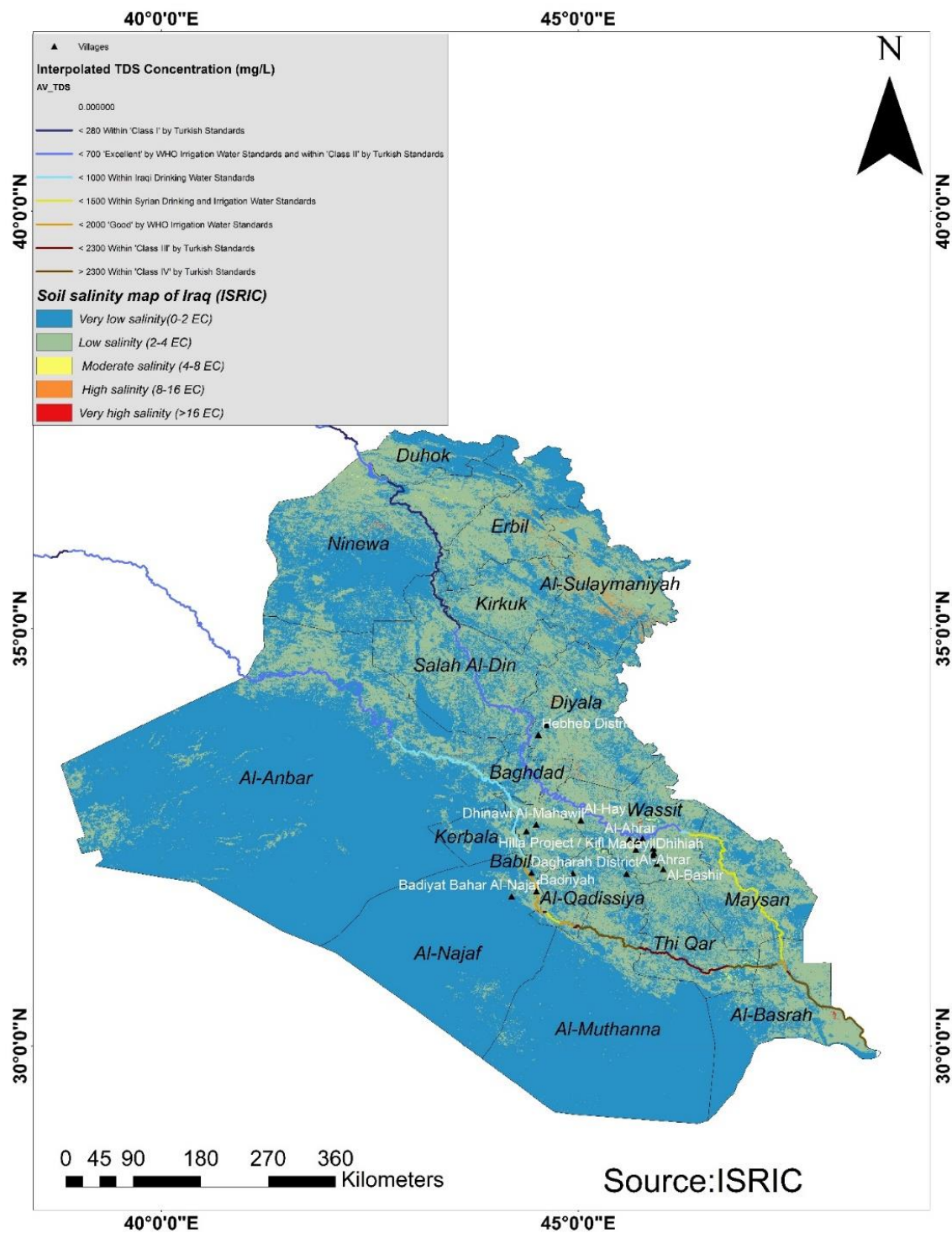


Figure 14: Water and soil salinity concentration levels in the main Euphrates and Tigris rivers

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## 4.2 Description of the Environment (Including Physical, Biological, and Socioeconomic Conditions)

According to the Iraqi General Directorate of Dams, only 30% of Iraq's water supply comes from rainfall, while 70% originates from rivers in Turkey and Iran. However, these crucial transboundary water sources are also experiencing drought and shortages, exacerbating Iraq's environmental crisis.

Extreme conditions characterize the climate in Iraq's three southern governorates. Summers are intensely hot, with temperatures reaching 45°C, while winters can be cold, dropping to as low as 5°C, with high humidity. Annual rainfall in these regions is minimal, averaging less than 100 mm.

### Characteristics of BPH sites

#### 1. Al-Duwib (Al-Siba Area), Abu Al Khaseeb District, Basra Governorate

The first selected site for the BPH project is Al-Duwib village, located in the Al-Siba area of Abu Al Khaseeb District, Basra Governorate (see Figure 16). Positioned approximately 40 km south of Basra city, the village consists of smallholder farms operated by low-income farmers.

#### Vegetation, Wildlife, and Biodiversity

Al-Siba was once naturally rich and densely covered with date palm forests, which were largely destroyed during the Iran-Iraq War. Despite this, the region still retains fertile soil that supports diverse vegetation, notably date palm trees. Vegetable farming, particularly okra, remains common, though farms are typically small, averaging around 10 dunums each.

Wildlife in the area includes wolves, wild boars, snakes, scorpions, and various bird and fish species native to the Shatt al-Arab ecosystem. Additionally, local farmers raise cattle and buffalo.

The region continues to suffer from environmental degradation, including water salinization caused by rising sea levels.

#### Socio-Economic Conditions

- Population Size: Approximately 160,000 people, including around 15,000 returnees.
- Demographics: Al-Siba is one of the oldest subdistricts in Basra, officially established in 1921.
- Employment and Income: Agriculture (mainly date palms, wheat, and barley), daily labor, and social welfare are the primary sources of livelihood. The Siba gas field, developed by Kuwait Energy, also contributes to the local economy.

#### Proximity to Water Sources

Al-Duwib village lies about 2 to 5 kilometers from the Shatt al-Arab River. The area is irrigated through the Shat Al Arab irrigation canal, which is fed by the river. A concrete-lined irrigation channel facilitates water access during periods of high salinity.

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Figure 15: Al Duwib pilot site at Abu Al Khaseeb WUA in Al Basrah Governorate

## 2. Al-Ghadeer, Al-Rumaiha District, Al-Muthanna Governorate

The second selected site for the BPH project is located in Al-Ghadeer sub-district within Al-Rumaiha District, Al-Muthanna Governorate (see Figure 17). The area has an estimated population of 51,000 people and is situated along a branch of the Euphrates River. The surrounding rural lands are primarily used for date palm and grain cultivation.

### Vegetation, Wildlife, and Biodiversity

Al-Ghadeer is an ecologically important area with rich biodiversity. Vegetation includes tamarisk, reeds, halfa grass, a mix of narrow- and broad-leaved grasses, *Atriplex*, *Malva neglecta*, and various mushrooms.

The area supports a range of wildlife, including wolves, weasels, rabbits, wild boars, jackals, and diverse bird species.

### Socio-Economic Conditions

- Population Size: Approximately 51,000 people.
- Demographics:
  - Children (0–14): 17.65%
  - Youth (15–25): 23.53%
  - Adults (26–45): 17.65%
  - Middle-aged (46–55): 11.76%
  - Seniors (56+): 29.41%
  - Women: 50.98%, Men: 49.02%
- Ethnic Composition: Predominantly from the Al-Ajabi tribe.

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- Employment and Income: Moderate employment rates. Agriculture and trade (goods and services) are the main economic activities. The average monthly income is approximately 650,000 IQD (715 CAD).

#### Proximity to Water Source

The village lies approximately 1,500 meters from the nearest canal, which ensures reasonable access to water for irrigation and household use.



Figure 16: Al Ghadeer BPH pilot site in Al Rumaiitha District in Al Muthana Governorate

### 3. Umm Al-Ma'adid, Shatra District, Dhi Qar Governorate

The third selected BPH site is located in Umm Al-Ma'adid village, within the Shatra District of Dhi Qar Governorate, near the Garraf River (see Figure 18). This region holds economic importance due to its agricultural and limited industrial activities. Positioned along the Euphrates basin, with the Garraf River flowing through, the area also supports a fishing-dependent community.

#### Vegetation, Wildlife, and Biodiversity

Umm Al-Ma'adid is situated in a water-rich zone intersected by the Al-Gharraf River and the Umm Al-Ma'adid River, creating favorable conditions for plant and animal life.

- Vegetation:  
Includes tamarisk, reeds, halfa grass, narrow- and broad-leaved grasses, *Atriplex* (saltbush), and *Malva neglecta*.
- Wildlife:  
Wild boars, wolves, weasels, rabbits, jackals, and various bird species inhabit the area.

Additionally, the site lies within the southern marshes of Iraq, a biodiversity hotspot and natural habitat for many species.

#### Socio-Economic Conditions

- Population Size: Approximately 1,000 people.
- Demographics:  
Males represent about 70% of the population, potentially due to female migration or male-dominated employment. The community is ethnically and culturally homogeneous.

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- **Employment and Income:**  
The area experiences high unemployment rates, with agriculture being the primary livelihood. The average monthly income is less than 150,000 IQD (approximately 165 CAD). There are no other significant economic activities.

### **Proximity to Water Source**

The village is directly located on the Al-Gharraf River, ensuring easy access to water for both irrigation and domestic purposes.



Figure 17: Umm Al-Ma'adid pilot site at WUA of Shatra District in Dhi Qar Governorate

### **Ecosystem and Soil Degradation**

The selected locations face critical environmental challenges, including soil salinity, erosion, compaction, and fertility depletion. Soil salinity levels in these areas range from low to very high (see Table 2), with further degradation likely caused by unsustainable land-use practices. Irrigation relies on surface water from the Euphrates, Al-Gharraf, and Tigris Rivers and their tributaries, with irrigation water salinity levels ranging between 1.18–1.71 dS/m.

### **Soil Texture of the selected sites**

The soil across the selected sites primarily falls within the clay loam and loam texture categories (Figure 19) and Table 2, with varying degrees of salinity. The farmland is government-owned and allocated to farmers under contractual agreements for crop cultivation, allowing them access to established water infrastructure for irrigation.

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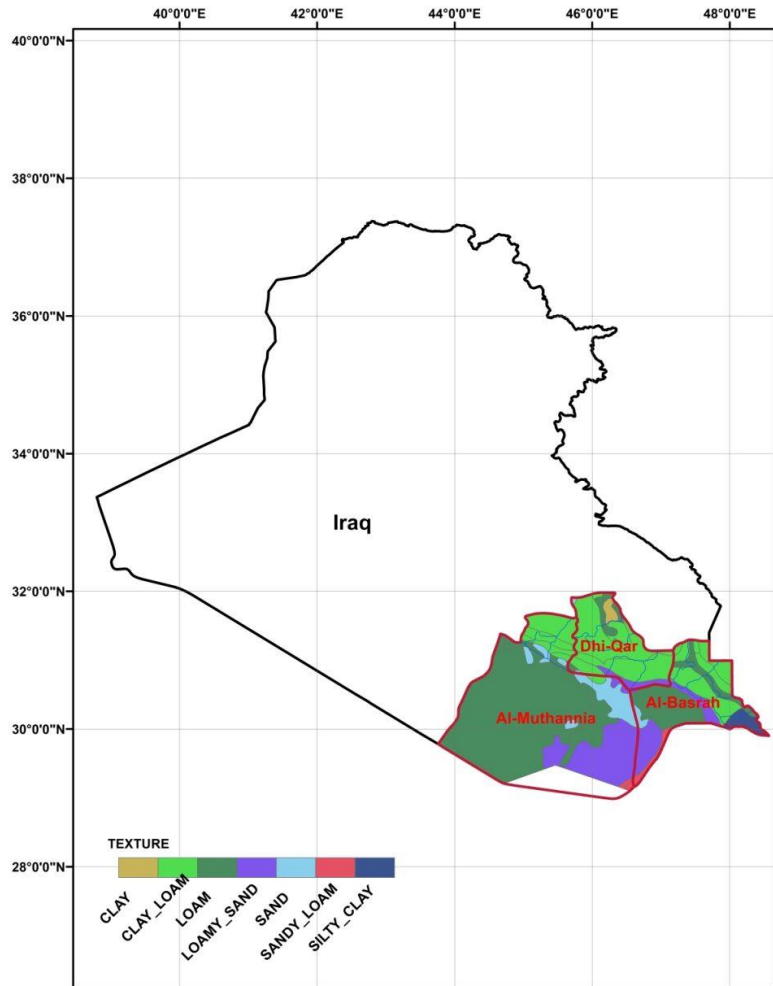


Figure 18: Soil texture at the pilot sites in Al Muthanna, Dhi Qar, and Al Basra governorates (Source: FAO, 2022. Digital Soil Map of the World <https://data.apps.fao.org/map/catalog/srv/eng/catalog.search#/metadata/446ed430-8383-11db-b9b2-000d939bc5d8> )

Table 2: Soil texture, soil and water salinity at the three pilot sites

Site No.	Governorate	Source of Irrigation Water	Soil Texture	Soil Salinity (dS/m)	Water (dS/m)
1	Al Muthana	Al Ghadeer Project-Euphrates River	Clay Loam	3.45	1.71
2	Dhi Qar	Al Gharraf River-Tigris River	Clay Loam	76.9-102.4	1.18
3	Al Basra	Shat AL Arab Canal-Shat Al Arab	Loam	66.8	1.2

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### Al Muthanna site

The soil is primarily clay loam, with salinity 3.45 dS/m. The source of irrigation water is the Euphrates River, pumped by the Al Ghadeer pumping station. The salinity of source water is 1.71 dS/m. The farmland is owned by the government but provided to the farmers by contract for crop cultivation. The farmers have the right to benefit from the farm and use the water infrastructure of the Al Ghadeer project (Figure 20). The site is located approximately 73 m from the irrigation canal.

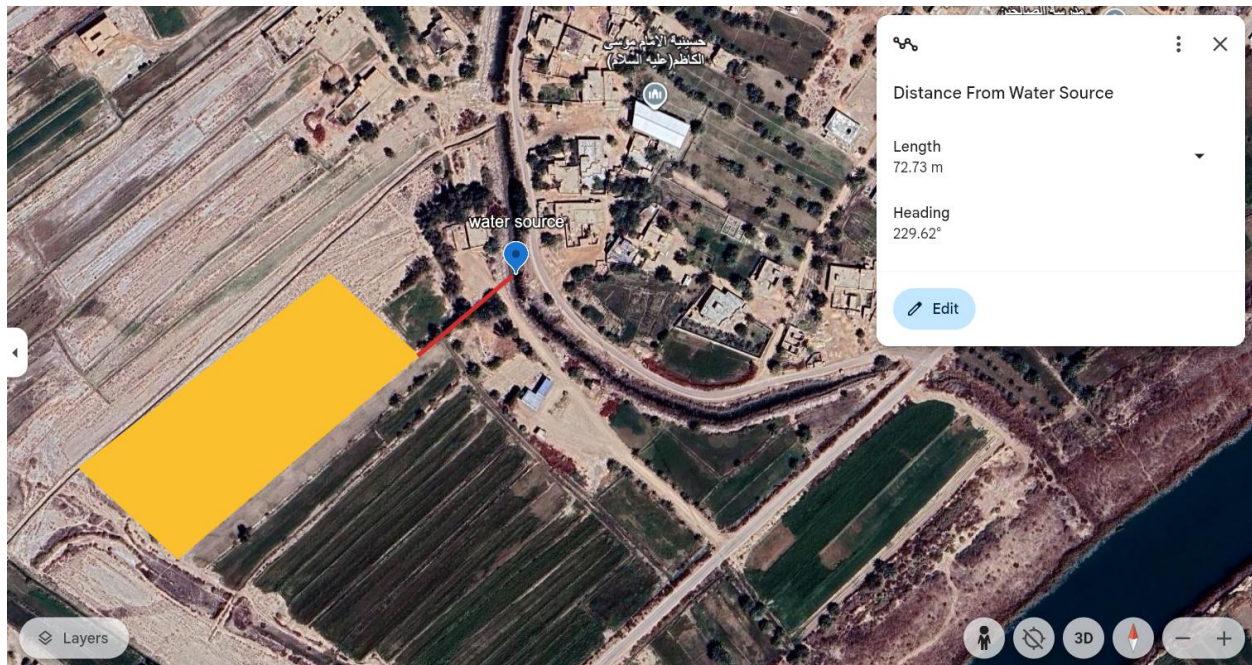


Figure 19: Location of Al Muthanna pilot site close to the Euphrates River

### Dhi Qar site

The soil is primarily clay loam, with salinity between 76.9-102.4dS/m. The source of irrigation water is Al Gharaf River, a tributary of the Tigris River. The salinity of source water is 1.18 dS/m. The farmland is owned by the government but provided to the farmers by contracts for crop cultivation (Figure 21). The farmers have the right to benefit from the farm and use the water infrastructure at the site. The site is located very close to the water source, only about 3 m from the irrigation canal.

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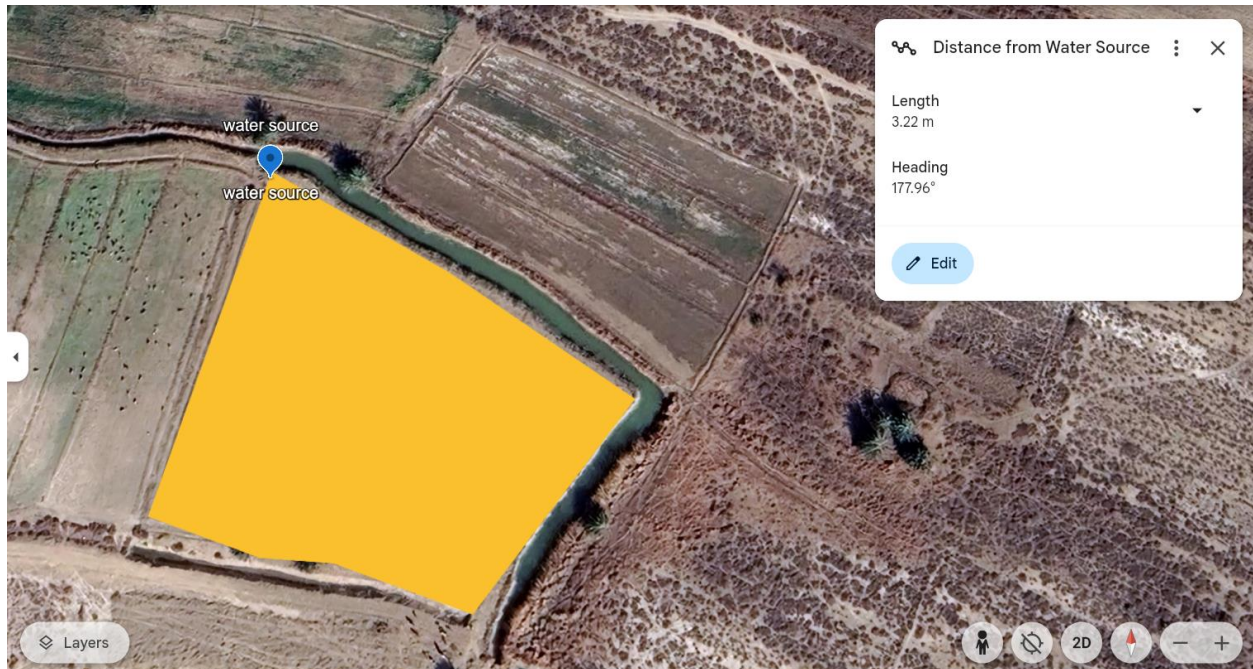


Figure 20: Location of Dhi Qar pilot site near the Gharraf river

### Al Basra pilot site

The soil is primarily loam, with a salinity of 66.8 dS/m. The source of irrigation water is freshwater from irrigation canal that pumps desalinated water from Shat -Al Arab River. The salinity of irrigation water is 1.2 dS/m. The shat Al Arab water is saline due to seawater intrusion and therefore it is desalinated before use. The farmland is owned by the government but provided to the farmers by contract for crop cultivation.

The farmers have the right to benefit from the farm and use the water infrastructure at the site. The site is located about 22 m from the irrigation canal.

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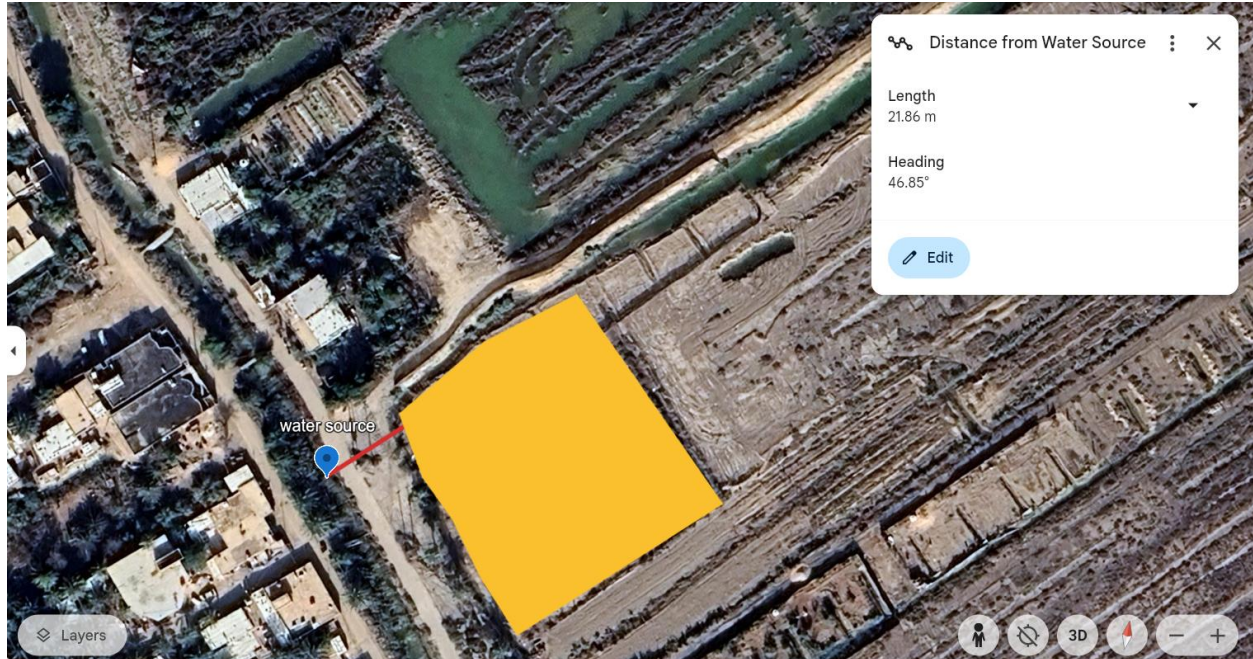


Figure 21: Location of Al Basra Pilot Site

## 5. Environmental Policy and Legislative Framework

### 5.1 Organization's Environmental Management System

The International Center for Biosaline Agriculture (ICBA) applies a practical Environmental Management System (EMS) based on experience from field and development projects worldwide. This system ensures sustainable agricultural practices, resource conservation, and environmental stewardship. While the EMS is not a formal, stand-alone document, it is integrated into development projects through Best Management Practices (BMP) based on lessons learned.

ICBA's EMS/BMP aims to minimize environmental impact, enhance water and soil management efficiency, and strengthen climate resilience in marginal environments. Key focus areas include:

- Sustainable water uses by implementing salinity management, wastewater reuse, and precision irrigation techniques.
- Soil Conservation by addressing soil salinity, erosion, and degradation through research and innovative soil management practices.
- Energy efficiency and carbon footprint reduction by utilizing renewable energy solutions and optimizing resource consumption.
- Biodiversity and ecosystem protection by enhancing native plant conservation and promoting sustainable land-use strategies.
- Compliance and continuous improvement through aligning with national and international environmental standards and continuously improving practices through research, monitoring, and stakeholder engagement.

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## 5.2 Country-Level Legislation, Regulations, and/or Policies

The MURUNA project is subject to **Law No. 27 of 2009** on protecting and improving the environment. This Law aims to improve and protect the environment by handling the damage and protecting public health and natural resources. This law ensures the protection and improvement of the environment by mitigating damages likely to be caused. The law necessitates the provision of the Environmental Impact Assessment (Article 18) for any new developmental project in the country, an assessment that the project is conducting and will be provided to the Ministry of Environment for endorsement. The Law addresses the issues of regulation of air pollution and noise reduction, protection of soils, biodiversity conservation, management of hazardous waste, protection of the environment from pollution resulting from exploration and extraction of oil and natural gas, and establishment of an environmental protection fund. Additionally, the law specifies the necessity of protection of water resources from pollution, and it regulates the discharge of effluents independently of their origin. Moreover, the law specifies punitive measures for violation of the specified regulations.

The project also considers **Law No. 2 of the year 2001** (Water Systems Protection) - Chapter 4, which provides instructions on the disposal or recycling of wastewater. It also prohibits effluent discharge into public water unless it meets the criteria and specifications set out by the Environment Protection and Improvement Directorate (EPID). EPID is also allowed to issue environmental restrictions pertaining to the quality of public water and the quality of water discharged into public water, sewage systems, or rainwater.

In addition, the MURUNA project is subject to **Act No. 25 of 1967** (The Regulation for the Protection of Rivers). The act regulates wastewater discharges and provides physical, biological, and chemical guidelines for water quality. Also, the regulation sets forth provisions for protecting public water bodies from pollution.

## 5.3 Donor Environmental Requirements

### 5.3.1 GAC's Environmental Policy and Legal requirements, including its Environmental Integration Process

The Project considers Global Affairs Canada's environmental policy and legal requirements, which ensure that all initiatives, especially those related to development assistance, comply with Canada's environmental sustainability goals and legal frameworks.

Below are the key points considered for the MURUNA project:

1. **Canadian Environmental Assessment Act (IAA):** which mandates environmental assessments for projects to ensure they do not cause significant adverse environmental effects
2. **Environmental Integration Process (EIP):** which integrates and streamlines environmental policy and legal requirements into a single process for development assistance initiatives
3. **Environmental Screening Tool:** The tool was used during the project's design to ensure environmental considerations were integrated from the start.
4. **Environmental Management Plans:** to outline how environmental impacts will be managed and mitigated throughout the lifecycle of the project

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### Box 1: Relevant Acts of the Canada's Impact Assessment Act for Utility Infrastructure

#### Impact Assessment Act – Part 4- Utility Infrastructure

1. **7(2)** The construction, installation, operation, replacement, modification, expansion, removal, or decommissioning of water-related utility infrastructure, other than water pipelines, that has a footprint of no more than 100 m<sup>2</sup>.
2. **7(3)** The construction, installation, operation, replacement, modification, expansion, removal, or decommissioning of water pipelines that are
  - a. **(a)** no more than 100 m in length; or
  - b. **(b)** located underneath, or on developed land alongside and contiguous, a railway or road.
3. **7(6)** The classes of projects described in subsections (1) to (5) do not include projects that
  - a. **(a)** involve the placement of temporary or permanent fill in a water body.
  - b. **(b)** involve the crossing of a water body, other than an overhead crossing by a telecommunication line; or
  - c. **(c)** involve the disturbance of known or suspected subsurface contamination.

### 5.3.2 Environmental Policy Requirements from any Other Donors Involved

Not Applicable.

## 6 Potential Environmental Effects of the Project and Mitigation and/or Enhancement Measures

### 6.1 Environmental and Social (E&S) Impacts (negative and positive)

#### 6.1.1 Positive Environmental and Social Impacts

Implementing the MURUNA salt-tolerant crops and biosaline approach and the hydroponic system at the BPH sites will have the following positive environmental and social impacts:

1. Reduce the soil and water salinity in the root zone, leading to higher crop yield and production.
2. Increase agricultural production by growing salt-tolerant crops with increased yields. Conventional crop yield drops sharply at a certain salinity threshold, which leads to low production.
3. Increase water use efficiency in the farm field, leading to significant savings in irrigation water. The biosaline approach will provide guidance on best practices and irrigation scheduling according to the actual crop water requirements.
4. Protect the river and canal water resources from depletion and wastage by over-pumping irrigation to meet the farm water demand.

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5. Protect the groundwater from degradation of its water quality by reducing the percolation of irrigation water due to over-irrigation.
6. Controlling irrigation water to align with crop water demand helps reduce agricultural runoff, as excess irrigation and drainage return flows are major contributors to environmental pollution.
7. Improve the soil health by applying appropriate soil amendments, promoting the use of organic fertilizers, and adopting reduced or conservation tillage practices to preserve soil structure, improve fertility, and support long-term agricultural sustainability.
8. Innovative solutions like hydroponics save significant amounts of irrigational water and can be applied to poor and salinized soil farms.
9. Increase farmers' income by increasing the crop yield per cubic meter of water used.
10. Create seed multiplication of salt-tolerant crops, leading to a more significant adoption of the biosaline approach among the farmers.
11. Create new jobs, particularly in abandoned farms, and bring these farms to production again.
12. Training the farmers, extension workers, and trainers about the biosaline approach will increase the farmers' and local communities' knowledge and awareness about the environmental and social impacts of farming and help protect the environment.

### 6.1.2 Negative Environmental and Social Impacts

It is unlikely that the MURUNA project will have adverse environmental and social impacts. The MURUNA project is a science-based development project that aims to increase crop yield in salinized soils/ degraded lands while protecting the environment. The following negative environmental and social impacts are listed below:

1. During land preparation, dust from land leveling could affect the air quality. Clearing vegetation from the site could lead to soil erosion and loss of biodiversity.
2. Construction activities may result in the generation of plastic waste from materials such as drip irrigation tubing and emitters and may also cause physical disturbances to soil through excavation works. These disturbances could lead to adverse effects, including soil erosion, compaction, and disruption of local habitats, potentially affecting site stability and ecological integrity.
3. Operation of the system may give rise to maintenance challenges, including emitter clogging, which can reduce irrigation efficiency and cause uneven water distribution. In addition, the application of agrochemicals through the system presents a risk of chemical leaching, potentially impacting soil health and contaminating surface and groundwater resources.
4. Decommissioning activities may result in temporary disturbances due to the use of heavy machinery, leading to increased noise, dust emissions, and potential fuel or oil leaks that could affect air, soil, and water quality. The removal of infrastructure may expose soils, increasing the risk of erosion and sedimentation of nearby water bodies. Additionally, the dismantling process is expected to generate solid waste, including plastics, metals, and other materials, which will require appropriate handling, recycling, or disposal to minimize environmental impacts.

### 6.1.3 Summary of positive and negative environmental and Social Impacts

A summary of E&S Impacts that could occur at the three pilot sites (Utility Infrastructure) during the project implementation stages is provided in Table 3.

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Table 3: Positive and negative E&S impacts at the three pilot sites (Utility Infrastructure) during the project implementation stages

Stage	Impact (negative and Positive)	Effect's significance (0=negligible, 1=low, 2=moderate, 3=significant)
Land preparation	<p>Negative:</p> <ul style="list-style-type: none"> <li>• Air Pollution: Dust from land leveling can contribute to air pollution, impacting local air quality and human health</li> <li>• Soil Erosion: Without vegetation to hold the soil in place, it can lead to sedimentation in nearby water bodies</li> <li>• Habitat Destruction: Removing vegetation and trees can destroy habitats for wildlife, leading to a loss of biodiversity</li> </ul> <p>Positive:</p> <ul style="list-style-type: none"> <li>• Land leveling and site cleaning from weeds will reduce water consumption and runoff out of the pilot site</li> </ul>	<p>0</p> <p>0</p> <p>1</p> <p>2</p>
Construction	<p>Negative:</p> <ul style="list-style-type: none"> <li>• Plastic Waste: Drip irrigation pipelines often use plastic tubing and emitters, which can contribute to plastic waste if not properly managed or recycled</li> <li>• Impacts associated with soil excavation during the installation of water pipelines for drip irrigation systems, such as soil erosion and/or compaction, habitat disruption...etc</li> </ul> <p>Positive:</p> <ul style="list-style-type: none"> <li>• ICBA's team will use UPVC, which is degradable and more environmentally friendly</li> </ul>	<p>2</p> <p>1</p> <p>3</p>
Exploitation	<p>Negative:</p> <ul style="list-style-type: none"> <li>• Maintenance and Clogging: Drip systems require regular maintenance to prevent clogging of emitters. If not properly maintained, clogged emitters can lead to uneven water distribution and potential crop stress</li> <li>• Chemical Leaching: If organic fertilizers or pesticides are applied through the drip system, there is a risk that these chemicals degrade surface water quality and leach into the soil and potentially contaminate groundwater</li> </ul> <p>Positive:</p>	<p>2</p> <p>1</p> <p>3</p>

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	<ul style="list-style-type: none"> <li>• <b>Improved Nutrient Uptake:</b> By providing water and nutrients directly to the roots, drip irrigation enhances plant growth and reduces the need for excess organic fertilizers, which can harm the environment</li> <li>• <b>Energy Efficiency:</b> Drip irrigation system will be powered by solar energy, reducing greenhouse gas emissions and overall environmental impact</li> <li>• <b>Reduced Weed Growth:</b> Since water is targeted directly to the plants, there is less water available for weeds, reducing their growth and the need for herbicides</li> <li>• <b>Reduced Soil Erosion:</b> Traditional irrigation methods can cause soil erosion due to the force of water hitting the ground. Drip irrigation delivers water gently, preserving soil structure and fertility</li> <li>• <b>Water Conservation:</b> Drip irrigation is highly efficient, reducing water usage by up to 80% compared to traditional methods</li> </ul>	<p>3</p> <p>2</p> <p>3</p> <p>3</p>
Decommissioning	<p>Negative:</p> <ul style="list-style-type: none"> <li>• <b>Disturbance from machinery:</b> Noise, dust, and fuel leaks from heavy equipment may affect air, soil, and water quality</li> <li>• <b>Soil erosion:</b> Exposed soils after dismantling irrigation pipelines can lead to erosion and sedimentation of nearby water bodies.</li> <li>• <b>Waste generation:</b> Demolition may produce solid waste (e.g., UPVC and LDPE pipes, solar panels, concrete, metal) requiring proper disposal.</li> </ul> <p>Positive:</p> <ul style="list-style-type: none"> <li>• <b>Restoration of natural habitats:</b> Removal of pipelines may allow rivers and ecosystems to return to natural conditions.</li> <li>• <b>Land use flexibility:</b> Land previously occupied by infrastructure can be repurposed for agriculture, forestry, or conservation.</li> </ul>	<p>0</p> <p>1</p> <p>1</p> <p>2</p> <p>2</p>

#### 6.1.4 Joint Scoping Session and Focus Group Discussion

Joint scoping sessions and focus group discussions were held in Al Muthana, Dhi-Qar, and Al Basrah governorates on 12-13 March 2025. These joint session meetings were held as part of the EIA process to determine the key environmental and social issues that should be studied in detail. It helped identify significant impacts, stakeholders, baseline data requirements, and methodologies to be used in the EIA study. The MoWR, MOA, and MOE regional departments regulators, project developers, environmental

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experts, affected communities, and other key stakeholders were involved. For effective scoping of the community's opinion on how the project affects their social and environmental aspects, five focus group discussions (FGD) were conducted on the project locations in three governorates with diverse stakeholders such as local community, farmers, water resources, agriculture, and environmental government staff, etc. The discussion went over the project's overall objectives and activities. It opened discussions on the environmental and social impacts, including distributing questionnaires to better scope the community's perception and opinions. The project team analyzed the feedback in Table 4 below to provide a coherent overview of the group's collective opinions and insights.



Figure 22: Scoping session at Dweeb WUA at Abu Al khaseeb in Al Basrah Governorate



Figure 23: Scoping session at Sweeb WUA at Al Qurnah in Al Basrah Governorates

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Figure 24: Scoping session at Shatra WUA in Dhi Qar Governorate



Figure 25: Scoping session at Al Ghadeer WUA in Al Muthana Governorate



Figure 26: Scoping session at Al Kawther WUA in Al Muthana Governorate

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## Summary of Scoping Session and Focus Group Discussions for ESAP

The scoping session and focus group discussions (FGD) provided valuable insights into the potential environmental and social impacts of the proposed project. Participants included local farmers, community representatives, and relevant local authorities. Their feedback has informed the development of the Environmental and Social Action Plan (ESAP) by identifying perceived risks, potential benefits, and recommendations for mitigation and community engagement.

### Environmental Considerations

bio noted as medium-level concerns but considered manageable. One key environmental issue raised was the challenge of cultivating crops in saline soils, which was identified as a priority intervention by some farmers. However, traditional practices such as soil leaching and the use of salt-tolerant varieties were shared as effective mitigation strategies.

### Social Considerations

The social feedback was overwhelmingly positive. The project is seen as a catalyst for economic improvement, enhanced livelihoods, and social cohesion. It is expected to create local job opportunities, improve agricultural productivity, and bring broader socio-economic benefits, particularly for vulnerable groups. Stakeholders emphasized the importance of engaging women and youth, recognizing their roles in fostering inclusive and sustainable development. No concerns about potential negative social impacts such as conflict, discrimination, or cultural disruption were raised. On the contrary, the project is anticipated to strengthen community ties and provide meaningful employment, especially if local labor is prioritized and learning-by-doing approaches are adopted.

### Engagement and Consultation

Participants acknowledged that initial communication about the project had taken place through the Water Users Association (WUA), an important local structure. Stakeholders confirmed that they had opportunities to express their concerns. They showed strong willingness to stay engaged in the project's implementation, with several farmers and local officials offering support as field implementers or trainers. Participants emphasized the importance of continued transparency and regular updates on project progress through participatory mechanisms.

### Suggestions and Mitigation Measures

To minimize any potential negative impacts, stakeholders recommended the adoption of best practices in agriculture and water resource management. There was strong support for community-led initiatives, particularly those focused on awareness, training, and smart agriculture. While no disruptions are currently anticipated, participants stressed the importance of a swift response and collaboration with local authorities should any issues arise. Compensation or support measures should be based on effective dialogue and trust-building between the community and the project team. Table 4 below summarizes the main findings and the participants' perceptions.

Table 4: Summary of the questions, key findings, and perception of severity by the participants

1.	Questions	Feedback/ Key Findings	Perception of Severity		
			Low	Medium	High
	Environmental Impact				

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<b>1</b>	What environmental concerns do you have regarding this project (e.g., air quality, water resources, biodiversity)? How severe are these environmental concerns: low, medium, or high?	No concerns. The project will have a positive impact	<b>X</b>		
<b>2</b>	How might the project affect access to natural resources like clean water or agricultural land? Indicate severity: Low, medium, or high.	No or negligible effect	<b>X</b>		
<b>3</b>	Could any protected areas, wildlife, or ecosystems be impacted? Indicate severity: Low, medium, or high.	none	<b>X</b>		
<b>4</b>	Will growing salt-tolerant crops and irrigating them with brackish water affect the environment positively or negatively? Indicate severity: Low, medium, or high.	Positive effect	<b>X</b>		
<b>5</b>	Is growing crops in saline soil a concern for the local farmer? How did the local farmer succeed in growing crops in these soils? What indigenous practices did they use? Indicate severity: Low, medium, or high.	Growing crops in saline soil is a high concern. Some farmers succeeded by leaching/flooding the soil or using salt-tolerant seeds.		<b>X</b>	
<b>6</b>	What flora and fauna will be affected most by implementing the project at the pilot site? Indicate severity: Low, medium, or high.	The flora and fauna will be affected positively by the project implementation due to growing crops		<b>X</b>	
<b>7</b>	Would floods and droughts affect the growing seasons in these pilot sites? Indicate severity: Low, medium, or high.	All the sites have been affected by droughts, especially in recent years.		<b>X</b>	
<b>8</b>	Is there a possibility of flushing out the organic fertilizers and compost due to heavy rain? Indicate severity: Low, medium, or high.	Might be possible		<b>X</b>	
<b>9</b>	Is there a possibility the discharge from the pilot farm will reach a nearby river or irrigation canal?	Not Likely	<b>X</b>		
<b>10</b>	What native plants on the pilot site could be affected by the implementation of the project? Indicate severity: Low, medium, or high.	The lands are prepared for cropping wheat, barley, and vegetables. No native plants will be affected.	<b>X</b>		

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<b>2.</b>	<b>Social Impact</b>				
<b>11</b>	How will this project affect the local community's way of life?	The project is feasible and will positively impact on the way of life with high productivity at low costs.			<b>X</b>
<b>12</b>	What are your main concerns about how the project might impact local jobs, businesses, or social cohesion?	There are no concerns. Local jobs will increase if the pilot project is applied to other sites and by other farmers.	<b>X</b>		
<b>13</b>	Do you think the project will bring positive social changes (e.g., better infrastructure, services, or opportunities)? Why or why not?	Yes, positive changes are expected due to the provision of modern irrigation and smart agriculture infrastructures.			<b>X</b>
<b>14</b>	How do you expect the project to affect people in vulnerable situations in the community?	Overall income rates will improve, which positively affects people in vulnerable situations.			<b>X</b>
<b>15</b>	Could any cultural or heritage aspects of the community be affected?	No	<b>X</b>		
<b>16</b>	Could the project lead to gender-based inequalities, discrimination, exclusion, unwanted workload, and/or violence?	Not expected	<b>X</b>		
<b>17</b>	Do you think engaging the women and youth in the biosaline farming approach would add a positive or negative economic impact on the community?	It will positively impact the community, as these categories are vital in improving the overall community economy and well-being.			<b>X</b>
<b>18</b>	Do you encourage hiring local laborers from the community for project activities?	Yes, highly encourage you to involve the community and apply learning by doing practices for better scaling out			<b>X</b>
<b>19</b>	What labor age is acceptable to the community? Is it the practice of hiring child laborers?	Hiring child labor is not acceptable youths over 18 years are encouraged to be involved in project activities	<b>X</b>		
<b>20</b>	Could the project increase tension or conflicts within the community,	On the contrary, the project is expected to	<b>X</b>		

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	neighboring communities, or with workers outside the community?	foster community bonds as the practices will be shared between the locals and neighboring communities.			
<b>3.</b>	<b>Engagement and Consultation</b>				
<b>21</b>	Do you think the project developers have communicated the objectives and activities with the community?	Yes, initial communication was done at the Water Users Association level, which is an integral part of the community.			
<b>22</b>	Have you been able to express your concerns, and do you feel heard?	-Farmers' opinions are expressed during continuous discussions at the WUAs level. -water resources, agriculture, and environmental local offices were consulted, and opinions were expressed to the project team			
<b>23</b>	In what ways would you prefer to be engaged or informed about the project's progress and impact?	Most participants expressed their willingness to participate in project activities, some farmers offered full support to implement the activities, and local government employees expressed their willingness to participate as instructors or trainers.			
<b>4.</b>	<b>Suggestions &amp; Mitigation</b>				
<b>24</b>	What measures would you suggest to minimize negative social and environmental impacts?	Applying the best agriculture and water resources management practices will minimize any impact on society and the environment in targeted locations and neighboring areas.			<b>X</b>
<b>25</b>	Are there any community-led initiatives that should be supported in this project?	Raising community awareness in modern and smart agriculture			<b>X</b>

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		practices by engaging in awareness campaigns and field farm days and training selected WUAs in integrated water resources management.			
26	What benefits or compensation do you think should be provided to the community in return for any disruptions?	As the project is not likely to cause any disruptions, however, such disruptions in case happened should be treated on time and with effective collaboration between the project team, community, and local government stakeholders.	X		

## 6.2 Mitigation and Enhancement Measures

### 6.2.1 Mitigation and enhancement measures for climate vulnerability

The list of climate drivers used to calculate agricultural exposure to climate risks will be based on the Climate Vulnerability Index (CVI) and the MOE vulnerability map. The link for the latter is provided by the Ministry of Environment- [Climate Hazard Maps | Homepage \(arcgis.com\)](#).

Under the current MURUNA project, particularly in Activity 1121. The ICBA climate modeler and crop modeler will apply the recently developed climate vulnerability index to the project area. This includes climate variability and future projected change impacts such as extreme weather events, precipitation patterns, and temperature variations. They will align it with the MOE vulnerability map.

The ICBA climate modeler and crop modeler will also assess the suitability of selected crops for the project area, considering factors like soil quality, water availability, and climate conditions. They will integrate Crop and Hydrologic Simulation Models alongside the CVI to enhance the Crop Selection Analysis and assess the suitability of selected crops for the project area. These models will provide valuable insights into crop suitability under climate variability and future climate change scenarios, considering various environmental factors such as soil quality, water availability, and climate conditions.

The ICBA's water modeler and Environmental Modeler will use the SWAT and RIBASIN models to simulate the hydrological processes within the sub-basins, including rainfall-runoff dynamics, soil moisture, and streamflow. By incorporating these models into the analysis, they can evaluate water availability and variability in the project area, considering factors such as precipitation patterns, soil moisture, and groundwater recharge. The ICBA modeling team will use these Crop, Hydrologic, and Water Quality Simulation Models and will conduct a comprehensive Crop Selection Analysis that includes the following steps:

- Utilizing crop simulation models to simulate the growth and yield of selected crops under current climate conditions and future climate change scenarios.

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- Assessing the suitability of selected crops based on their water and temperature requirements, considering factors such as soil quality, water availability, water quality, and climate variability.
- Integrating hydrologic simulation models to evaluate water availability and variability in the project area, including the impact of climate change on hydrological processes.
- Analyzing the interactions between crop water requirements and hydrological processes to identify potential water-related constraints and opportunities for improving water use efficiency.
- Identifying climate-resilient cropping systems and management practices that can enhance agricultural productivity and sustainability in the face of climate variability and change.

The results of all mentioned modeling tasks done by the climate modeler and crop modeler under MURUNA activities will be used to benefit the implementation of the ESAP in response to drought risk:

- Develop and implement efficient water management practices, including drought-resistant crop varieties.
- Optimize irrigation systems to minimize water wastage and ensure equitable distribution of water resources.

The modeling results will also be used to benefit the implementation of the ESAP in response to heat risk:

- Promote heat-tolerant crop varieties and adjust planting schedules to avoid peak heat periods.
- Enhance soil moisture retention through mulching and organic soil amendments.

### **Mitigation Measures for Potential Environmental and Social Impacts**

The implementation of the MURUNA Project involves various field-based activities, including infrastructure installation and agricultural interventions at pilot sites. While the project is designed with sustainability at its core and is expected to deliver positive environmental and socio-economic outcomes, certain activities may generate localized and temporary environmental or social impacts.

To ensure that these potential risks identified in Table 3, section 6.1.3 are effectively managed, a set of mitigation measures has been developed. These measures aim to minimize any negative effects on natural resources, surrounding communities, and ecosystems, while supporting inclusive and climate-resilient development. Table 5 below outlines the anticipated impacts at different stages of implementation and the corresponding mitigation strategies to be adopted at the pilot sites. More details are also provided in section 6.2.2.

Table 5 Mitigation Measures for Potential Environmental and Social Impacts:

Stage	Impact (negative and Positive)	Environmental mitigation measures
Land preparation	Negative: <ul style="list-style-type: none"> <li>• Air Pollution: Dust from land leveling can contribute to air pollution, impacting local air quality and human health</li> <li>• Soil Erosion: Without vegetation to hold the soil</li> </ul>	<ul style="list-style-type: none"> <li>• Spray water on exposed soil during dry and windy conditions.</li> <li>• Use low-dust-emission equipment.</li> <li>• Preserve existing vegetation where possible.</li> </ul>

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	<p>in place, it can lead to sedimentation in nearby water bodies</p> <ul style="list-style-type: none"> <li>• Habitat Destruction: Removing vegetation and trees can destroy habitats for wildlife, leading to loss of biodiversity</li> </ul> <p>Positive:</p> <ul style="list-style-type: none"> <li>• Land leveling and site cleaning from weeds will reduce water consumption and runoff out of the pilot site</li> </ul>	<ul style="list-style-type: none"> <li>• Re-vegetate or mulch exposed areas immediately after leveling.</li> <li>• Avoid clearing in sensitive or protected areas.</li> </ul>
Construction	<p>Negative:</p> <ul style="list-style-type: none"> <li>• Plastic Waste: Drip irrigation pipelines often use plastic tubing and emitters, which can contribute to plastic waste if not properly managed or recycled</li> <li>• Impacts associated with soil excavation during the installation of water pipelines for drip irrigation systems such as soil erosion and/or compaction, habitat disruption...etc</li> </ul> <p>Positive:</p> <ul style="list-style-type: none"> <li>• ICBA's team will use UPVC, which is degradable and more environmentally friendly</li> </ul>	<ul style="list-style-type: none"> <li>• Use recyclable or biodegradable materials (e.g., UPVC as planned).</li> <li>• Establish an on-site waste collection and segregation point.</li> <li>• Backfill trenches promptly and restore the original contours using low-impact, tracked machinery to minimize compaction.</li> <li>• Restore vegetation in disturbed areas as soon as possible.</li> </ul>
Exploitation	<p>Negative:</p> <ul style="list-style-type: none"> <li>• Maintenance and Clogging: Drip systems require regular maintenance to prevent clogging of emitters. If not properly maintained, clogged emitters can lead to uneven water distribution and potential crop stress</li> </ul>	<ul style="list-style-type: none"> <li>• Train farmers on regular system maintenance and flushing techniques.</li> <li>• Install inline filters and pressure regulators.</li> <li>• Establish a schedule for inspection and maintenance.</li> <li>• Use slow-release or organic fertilizers when feasible.</li> </ul>

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	<ul style="list-style-type: none"> <li>• Chemical Leaching: If organic fertilizers or pesticides are applied through the drip system, there is a risk that these chemicals degrade surface water quality and leach into the soil and potentially contaminate groundwater</li> </ul> <p>Positive:</p> <ul style="list-style-type: none"> <li>• Improved Nutrient Uptake: By providing water and nutrients directly to the roots, drip irrigation enhances plant growth and reduces the need for excess organic fertilizers, which can harm the environment</li> <li>• Energy Efficiency: Drip irrigation system will be powered by solar energy, reducing greenhouse gas emissions and overall environmental impact</li> <li>• Reduced Weed Growth: Since water is targeted directly to the plants, there is less water available for weeds, reducing their growth and the need for herbicides</li> <li>• Reduced Soil Erosion: Traditional irrigation methods can cause soil erosion due to the force of water hitting the ground. Drip irrigation delivers water gently, preserving soil structure and fertility</li> <li>• Water Conservation: Drip irrigation is highly efficient, reducing water usage by up to 80% compared to traditional methods</li> </ul>	<ul style="list-style-type: none"> <li>• Monitor soil and water quality regularly.</li> <li>• Train users in responsible chemical handling and fertigation practices.</li> </ul>
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Decommissioning	<p>Negative:</p> <ul style="list-style-type: none"> <li>• Disturbance from machinery: Noise, dust, and fuel leaks from heavy equipment may affect air, soil, and water quality</li> <li>• Soil erosion: Exposed soils after dismantling irrigation pipelines can lead to erosion and sedimentation of nearby water bodies.</li> <li>• Waste generation: Demolition may produce solid waste (e.g., UPVC and LDPE pipes, solar panels, concrete, metal) requiring proper disposal.</li> </ul> <p>Positive:</p> <ul style="list-style-type: none"> <li>• Restoration of natural habitats: Removal of pipelines may allow rivers and ecosystems to return to natural conditions.</li> <li>• Land use flexibility: Land previously occupied by infrastructure can be repurposed for agriculture, forestry, or conservation.</li> </ul>	<ul style="list-style-type: none"> <li>• Schedule decommissioning during low-activity periods to reduce impact.</li> <li>• Use equipment with low noise and emission ratings.</li> <li>• Ensure proper maintenance and fuel handling to prevent leaks.</li> <li>• Restore the original slope and contour of the land post-removal.</li> <li>• Plant native vegetation to anchor soil.</li> <li>• Segregate waste by type (metal, plastic, electronic).</li> <li>• Reuse viable materials or recycle through certified facilities such as World of Recycling Company<sup>2</sup>.</li> </ul>
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### Key GHG Emission Reduction Measures

The MURUNA project interventions are also planned to reduce possible GHG emissions, Table 6. Technologies like drip irrigation and hydroponic technologies, crop rotation, soil erosion control, and organic amendments are examples of the interventions that will be conducted in the project. These interventions will reduce the emission sources.

<sup>2</sup> The World of Recycling Company, the first electronic waste recycling plant in Baghdad. This facility, established through a 25-year partnership between the World of Recycling Company and the Ministry of Industry and Minerals of Iraq. It aims to process a wide range of electronic and electrical waste, including obsolete computers, mobile phones, household appliances, and industrial equipment. It is located on Al Mansoor Street in Baghdad; it offers e-waste recycling services. Can be reached via email at info@recyclingw.com

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Table 56: Interventions and possible emission reduction

Intervention	Emission Source Reduced	How it Reduces Emissions
Drip irrigation	Energy (pumping), N <sub>2</sub> O from over-irrigation	Less water use reduces energy and limits N-leaching
Crop rotation	N <sub>2</sub> O emissions	Improves soil health, reducing organic fertilizer needs
Organic amendments	CO <sub>2</sub> AND N <sub>2</sub> O emissions from synthetic organic fertilizers	Increases carbon sequestration and reduces synthetic inputs
Hydroponics	Land-use change, N <sub>2</sub> O emissions	Requires less land and organic fertilizer, minimizing GHG emissions
Soil erosion control	CO <sub>2</sub> from soil carbon loss	Keeps carbon stored in the soil

## 6.2.2 Mitigation plan for the CSA Best Practice Hubs and hydroponic system

### **Implementation timeline: April 2025-March 2026**

The irrigation pipelines of the CSA and the hydroponic systems exceed 100 m and trigger the IAA 7 (3). The ICBA and WFP teams (see roles and responsibilities below) will implement the following mitigation plan to ensure that the construction work and the demonstration sites are environmentally friendly and comply with Canadian and Iraqi environmental legislation and the Impact assessment recommendations:

1. MURUNA pilot plots, each covering one hectare, will be established at the pilot sites. Minimal vegetation clearing will be conducted during site preparation, and a buffer zone will be maintained along the plot boundaries to protect natural vegetation and habitats. ICBA's geneticist will survey the plots to identify native species and ensure they are preserved.
2. Irrigation fittings within the demarcated plots will be limited to the minimum required for efficient water transmission. All fittings and pipelines will be safely removed and disposed of after use.
3. The pilot sites are located outside rivers and water bodies, avoiding any temporary or permanent fill placement in water bodies. Additionally, no irrigation pipelines will cross water bodies, ensuring compliance with IAA 7(6).
4. Earth reservoirs will be lined with reusable plastic sheets to prevent leakage into groundwater. Measures will also address potential contamination from irrigation systems or organic material applications, complying with IAA 7(6).
5. The ICBA's Senior Agronomist will grow salt-tolerant/CSA crops for the first year, which include cereals (barley, wheat, yellow maize, quinoa, and cowpea) and forages (pearl millet, white maize, sorghum, panicum, Sporobolus, and paspalum). The cropping systems will be centered on essential crops to support food security and livelihood. By combining cereals, legumes, vegetables, and forages, resources can be used more efficiently, and soil salinity changes can be reduced.
6. The ICBA's Senior Agronomist has prepared a cropping calendar that will be established for the cropping sequences. Considering each location's water and temperature stress, an appropriate cropping sequence will be evaluated for implementation. A generalized cropping calendar for Iraq is presented below Figure 28.

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### Iraq – Crop Calendar

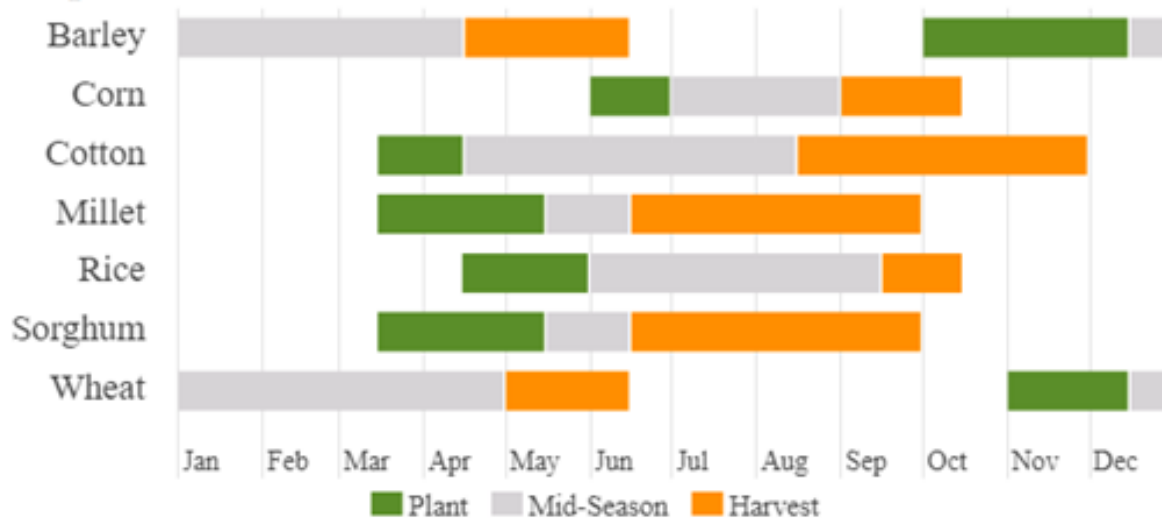


Figure 27: Generalized cropping calendar for Iraq

7. An Integrated Soil Fertility Management (ISFM) system will be applied to the identified crops. ISFM will combine locally available organic amendments, such as biochar and compost, with organic fertilizers to optimize soil fertility and crop yields while addressing salinity challenges. Due to salinity constraints, organic farming will not be applied. The nutrient contents of all organic fertilizers will be analyzed to prevent over-application and environmental risks.
8. Crop rotation will be implemented to support soil health and sustainable productivity. While crop rotation alone may not significantly reduce soil salinity, it can help optimize resource use, improve soil organic matter, and enhance overall soil structure. The following crop rotations will be tested for their suitability under saline conditions:
  - a. Barley – Pearl Millet – Cowpea: Barley and pearl millet are salt-tolerant crops, while cowpea can improve soil fertility by adding organic matter and nitrogen to it.
  - b. Wheat – Yellow Maize – Common Bean: Wheat and yellow maize exhibit moderate salt tolerance, and common beans support nitrogen fixation for improved soil fertility.
  - c. Cowpea – Chickpea – Yellow maize: Cowpea and chickpea can contribute to soil health and nutrient cycling, while yellow maize varieties exhibit salinity tolerance.
  - d. Sorghum- Cowpea – Pearl Millet-Guar- Sesbania: crops, millets, and cowpea show moderate to high salt tolerance and are adaptable to saline soils with proper irrigation management.
  - e. Grasses: Panicum (*Panicum antidotale*), Sporobolus (*Sporobolus virginicus*), and Sporobolus are salinity tolerant, while Guar and Sesbania are mildly tolerant.
9. The project team will promote organic practices, techniques, composted manures, organic foliar fertilizer, and soil conditioners such as biochar, which will be evaluated for efficacy. The consistent application of organic fertilizer has benefits in building soil health and sustainable practices.
10. The Soil Scientist will take soil and water samples before the construction and after running the operational demonstration and piloting tasks for each season to ensure its compliance with the Iraq and Canadian standards and confirm that the new pilot experiments will not cause any harm to the

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environment. A report will be submitted annually showing their compliance with the standards. In case there is any adverse impact associated with implementing the pilot project, the crop team will recommend innovative solutions to minimize the effect.

11. The mitigation plan will include sustainable agricultural practices provided to the farmers, extension workers, the WUAs, and the local community. The ICBA's Senior Agronomist will ensure compliance with the national guidelines and standards. These best agricultural practices include selecting the best salt-tolerant and local crops, where applicable, to minimize the impact on local biodiversity.
12. The Water and Irrigation Management Scientist will use water-saving technologies and modern irrigation techniques like drip irrigation, hydroponic, etc., which will significantly save water resources and reduce the degradation of its quality.
13. The Water and Irrigation Management Scientist will apply an appropriate seasonal irrigation scheduling plan to reduce water loss and runoff in the field. This will reduce over-irrigation practices and pollution.
14. The Soil Scientist will apply erosion control measures at the pilot sites to control any possible soil erosion. These include maintaining vegetative cover with salt-tolerant crops, applying organic or inorganic mulch to protect the soil surface, and using contour planting to reduce water runoff. Where applicable, sediment traps and windbreaks with salt-tolerant shrubs or trees will be established to manage wind and water erosion effectively. These interventions will be tailored to site-specific conditions and support ISFM practices.

## 7 Implementation Plan for ESAP

Effective environmental management is critical to ensure that the MURUNA project is implemented sustainably and complies with environmental regulations. The project will be executed through a collaborative effort between ICBA and the WFP. These teams will oversee the mitigation plan, ensuring that construction and demonstration sites are environmentally sound and aligned with legal and ecological standards. ICBA and WFP teams will collectively implement the mitigation plan, ensuring construction and demonstration sites are environmentally friendly and compliant with legislation.

### 7.1 Triggered ESAP Components

The following environmental and social management components are triggered and need to be considered in the EASP:

#### 1. E&S management system

The MURUNA project has initiated the process of establishing an Environmental and Social Management System (ESMS) in response to critical gaps identified during the scoping and stakeholder consultation phases. While the project demonstrates strong potential for positive environmental and social outcomes, a formal system for managing Environmental and Social (E&S) risks and ensuring continuous community engagement has not yet been fully developed or institutionalized. The following risks are identified:

- **Lack of Public Grievance Mechanism:**  
Currently, there is no specific and accessible mechanism through which community members or stakeholders can raise environmental or social concerns related to the project. This limits

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transparency and could reduce trust among local stakeholders, especially as the project scales up.

- **Absence of an E&S Risk Register:**

The project does not yet maintain a comprehensive E&S Risk Register to systematically identify, assess, prioritize, and monitor environmental and social risks throughout the project lifecycle. The absence of this tool limits the project's ability to manage potential impacts and track mitigation measures proactively.

- **No Formalized E&S Management System:**

There is no documented and operational E&S Management System currently in place. This includes the absence of standard procedures, assigned responsibilities, monitoring protocols, or internal review mechanisms necessary to manage environmental and social safeguards compliance.

## 2. Agricultural exposure to climate risks

As part of the environmental and social screening for the MURUNA project, agricultural exposure to climate-related risks has been identified as a key vulnerability area. While the project promotes innovative practices such as biosaline agriculture and smart irrigation, the increasing unpredictability of climate conditions presents several challenges to the long-term sustainability and resilience of agricultural systems in the targeted pilot areas. The identified risks include:

- **Increased Vulnerability of Agricultural Production to Climate Variability and Extreme Weather Events:**

Project areas have experienced heightened frequency and intensity of droughts, with localized reports of declining crop yields and extended dry seasons. This increases farmers' exposure to climate shocks, particularly those relying on saline or marginal lands, where coping capacity is already limited.

- **Uncertainty in Future Climate Conditions Affecting Crop Planning and Adaptation Strategies:**

The absence of localized climate forecasting data and tools creates uncertainty in crop selection, planting cycles, and input management, hindering farmers' ability to adopt proactive adaptation strategies. Without access to reliable projections, long-term planning for biosaline agriculture remains reactive rather than strategic.

- **Inadequate Alignment with National Climate Vulnerability Assessments:**

Although national climate vulnerability maps and frameworks exist (e.g., from the Ministry of Environment), the project has not yet systematically aligned its site-level climate exposure analysis with these frameworks. This creates a disconnect between local action and national climate resilience goals and may limit access to technical or financial support mechanisms available under national climate programs.

- **Limited Knowledge of Climate-Resilient Crops and Cropping Systems:**

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Many farmers in the project areas lack awareness of drought, heat, salt-tolerant crop varieties, or integrated farming systems that improve resilience. This knowledge gap constrains the adoption of innovative practices and limits yield stability under changing conditions.

- **Poor Adaptation of Crops to Soil Salinity and Climate Shifts:**

Even when salt-tolerant crops are introduced, their performance is often inconsistent due to a lack of proper varietal selection, irrigation techniques, and soil management practices suited to local conditions and shifting climate dynamics.

- **Inefficient Agricultural Productivity Under Future Climate Scenarios:**

Without targeted interventions, the productivity of agricultural lands under the MURUNA project risks stagnation or decline. This is due to biophysical limitations (soil salinity, water scarcity) and management constraints (limited use of climate-smart technologies and outdated practices).

### **3. Availability and variability of water resources and efficient natural resources management**

One of the critical environmental dimensions of the MURUNA project is the management of water resources, especially in a context marked by increasing scarcity, salinity, and seasonal variability. Although the project aims to promote sustainable biosaline agriculture, its success depends on the availability, reliability, and efficient use of water and other natural resources. The identified risks include:

- **Fluctuating Availability of Water Resources:**

Droughts, upstream water extraction, declining groundwater tables, and reduced inflow into irrigation systems increasingly impact water resources in the pilot areas. These fluctuations create uncertainty for farmers and threaten the consistency of agricultural production cycles.

- **Low Efficiency in Water Use for Agriculture:**

Traditional irrigation practices in many target areas are inefficient, resulting in excessive water loss through seepage, evaporation, and over-irrigation. This wastes a limited resource and can exacerbate soil salinity issues, undermining the project's goals.

- **Lack of Water Monitoring and Management Systems:**

The pilot sites lack robust systems for measuring water usage, monitoring salinity levels, and optimizing irrigation schedules. This hampers the ability of both project teams and farmers to make informed decisions about water use and conservation.

- **Over-reliance on Brackish Water with Limited Quality Controls:**

While brackish water is a key component of the MURUNA concept, improper management—such as poor drainage, leaching inefficiencies, or inconsistent water quality testing—could lead to long-term soil degradation and productivity.

- **Insufficient Integration of Natural Resource Management Practices:**

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Beyond water, there are risks related to inefficient nutrient cycling, organic matter loss, and erosion if natural resource management is not incorporated holistically. Fragmented efforts may yield short-term gains but undermine sustainability in the long term.

#### **4. Sustainable agricultural production**

The MURUNA project promotes innovative, climate-smart, and biosaline agriculture to improve food security and resilience in saline-affected areas of Iraq. However, achieving long-term sustainable agricultural production remains a significant challenge due to persistent environmental stressors and fragile agroecological conditions. Several site-specific risks threaten project interventions' productivity, stability, and environmental sustainability. The identified risks include:

- **Growing Crops in Saline Soil:**

One of the project's core challenges is the soil salinity in targeted pilot sites. Although salt-tolerant crops and improved management practices have shown promising results, crop failure risks remain high if salinity levels exceed plant tolerance thresholds or farmers lack sufficient knowledge and resources to manage these conditions effectively.

- **Vulnerability to Droughts:**

Drought has been a recurrent and intensifying threat across the pilot sites, reducing water availability and increasing crop stress. Rainfall variability and prolonged dry seasons undermine the reliability of irrigation and soil moisture retention, constraining crop growth and reducing yields. This also affects the success of leaching practices used to reduce soil salinity.

- **Organic Fertilizer and Compost Flushing Due to Heavy Rain:**

During heavy rainfall, there is a risk that nutrients applied through organic fertilizers and compost are flushed out of the soil before crops can absorb them. This reduces nutrient use efficiency and may lead to nutrient runoff into nearby water bodies, increasing the risk of pollution and eutrophication.

#### **5. Biodiversity and ecosystem conservation**

Although the MURUNA project promotes sustainable land and water use through biosaline agriculture, ensuring its implementation does not unintentionally harm local biodiversity or ecosystem stability is essential. Biodiversity and ecosystem conservation are critical in fragile environments where even minor disturbances can have long-lasting ecological impacts. The identified risks include:

- **Potential Damage to Native Plants at Pilot Sites:**

While pilot sites are primarily located on land designated for agricultural use, there is still a risk that project activities, particularly land clearing and introducing new crop species, could displace or suppress native vegetation. Native plants often play key roles in stabilizing soil, supporting pollinators, and maintaining local ecological balance. Their loss could result in reduced habitat quality and ecosystem services.

- **Dust Generation and Soil Erosion During Irrigation System Development:**

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Construction, installation, and operation of irrigation infrastructure can lead to localized disturbances, including dust emissions and soil erosion, especially in dry and windy conditions. These impacts could temporarily reduce air and soil quality, disrupt surrounding vegetation, and potentially affect nearby communities or wildlife habitats.

## **6. Community social changes, engagement, and conflict sensitivity**

The MURUNA project has the potential to generate significant positive social impacts by introducing climate-resilient agricultural practices, enhancing productivity, and improving rural livelihoods. However, changes in land use, labor practices, or resource distribution in vulnerable rural areas can also lead to social tensions, exclusion, or unintended harm if not managed sensitively. Therefore, proactive social risk management, inclusive engagement, and conflict-sensitive planning are essential to the project's sustainability. The following risks are identified:

- **Impacts on the Local Community's Way of Life:**

Introducing new technologies and farming practices could alter traditional agricultural methods and local routines. While many of these changes may be beneficial, there is a risk of disrupting existing social structures or cultural norms, particularly if changes are introduced without adequate community consultation.

- **Local Jobs, Businesses, and Social Cohesion:**

While job creation is expected, inequitable access to employment opportunities, benefits, or training could undermine social cohesion and lead to perceptions of favoritism or exclusion. This is particularly relevant in diverse or multi-ethnic communities.

- **Broader Social Changes and Impact on Vulnerable Groups:**

As agricultural income and infrastructure improve, people in vulnerable situations (e.g., landless farmers, elderly, people with disabilities) may not equally benefit from project gains unless targeted inclusion strategies are in place.

- **Gender-Based Inequalities, Exclusion, and Workload:**

Women and youth are often underrepresented in decision-making and overburdened with unpaid labor. If the project fails to engage these groups actively, it may inadvertently reinforce existing inequalities or create unwanted workloads or social tensions, especially if women are expected to take on additional agricultural responsibilities without support.

- **Engagement of Women and Youth in Project Activities:**

Although women and youth hold the key potential to strengthen community economies, there is a risk that their participation will remain tokenistic or limited without deliberate inclusion efforts, undermining the project's transformative potential.

- **Hiring Practices and Labor Standards:**

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While local hiring is strongly encouraged, risks exist around informal labor arrangements, lack of contracts, and the potential use of child labor, especially in regions where informal youth labor is common. Clear safeguards must be established to protect labor rights.

- **Potential for Community-Level Conflicts:**

Differences in access to project resources or benefits, historical grievances, or inter-tribal/community dynamics can escalate into conflicts within or between communities if not managed with transparency and inclusiveness.

## 7. Land acquisition

The MURUNA project operates on pilot lands that are managed and controlled by public institutions, specifically the Ministry of Agriculture (MoA) and the Ministry of Water Resources (MoWR), with coordination and support from Water Users Associations (WUAs). While the project does not involve the acquisition of private land or physically displacing people, the nature of land governance and institutional coordination introduces certain procedural and social risks that must be monitored and addressed. The following identified risk could materialize:

- **Land Ownership and Institutional Responsibility:**

All pilot sites are government-owned lands under the responsibility of the MoA and MoWR, with localized operational management often facilitated through WUAs. Although this setup eliminates the need for formal land acquisition or resettlement, it raises potential risks related to administrative coordination, overlapping mandates, and clarity of land use rights. Implementation of misunderstandings or delays may arise without clear frameworks and documented agreements, particularly when infrastructure is installed or when scaling up pilot results.

## 7.2 Staffing requirements and expertise

The successful implementation of the Environmental and Social Action Plan (ESAP) for the MURUNA project requires a multi-disciplinary team of experts and support staff with specialized knowledge in climate resilience, environmental modeling, social development, and agricultural innovation. These team members will ensure that all environmental and social safeguards are met, that risks are actively managed, and that sustainable practices are embedded across project activities. This multidisciplinary team will work together to:

- Monitor environmental and social risks.
- Implement mitigation measures.
- Build local capacity through training and knowledge sharing.
- Engage with local authorities, WUAs, and community stakeholders.
- Provide continuous feedback and improvements to ESAP.

This multidisciplinary team includes the following:

### 1. Project Leadership and Coordination

- **Principal Scientist in Hydrology**  
Responsible for overall ESAP technical coordination and technical reporting.

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- **Senior Project Officer**  
Responsible for overall ESAP coordination, integration with technical and operational teams, reporting, and stakeholder communication.
- **WFP Resilient and Climate Change Coordinator**  
Ensures integration of climate-smart practices in line with Iraq's national frameworks for the hydroponic system. Responsible for technical reporting on the ESAP hydroponic system.

## 2. Environmental and Natural Resources Experts

- **ICBA's Water Modeler & Environmental Modeler**  
Utilize results of water resource management models to assess site-specific water use efficiency and salinity impacts, and design environmentally sustainable irrigation systems.
- **Water Quality and Environmental Modeler**  
Simulates environmental impacts of irrigation and salinity and guides mitigation strategies to minimize degradation.
- **ICBA's Soil Scientist**  
Evaluates soil salinity, fertility, and structure. Recommend soil improvement strategies and monitor long-term soil health.
- **ICBA's Senior Agronomist**  
Advises on crop rotation, organic fertilizer application, irrigation scheduling, and integration of best agronomic practices aligned with saline and drought-prone environments.
- **ICBA's Geneticist**  
Provides expertise on salt- and drought-tolerant crop varieties and supports selection and breeding programs for climate-resilient genotypes.

## 3. Climate and Agricultural Modeling Experts

- **ICBA's Climate Modeler**  
Analyzes climate vulnerability, forecasts site-specific scenarios, and supports the integration of Climate Vulnerability Index (CVI) assessments into planning.
- **ICBA's Crop Modeler**  
Simulates crop performance under different salinity and climate conditions to guide the selection of suitable species and practices.

## 4. Socio-Economic, Gender, and Policy Specialists

- **ICBA's Economist**  
Assesses the economic feasibility and socio-economic impact of proposed agricultural interventions. Supports cost-benefit analysis and policy recommendations.
- **WFP Gender Specialist**  
Ensures gender-sensitive planning and implementation across all project components. Supports inclusive engagement, gender mainstreaming, and safeguards against discrimination or exclusion.
- **WFP Environmental and Policy Officer**  
Ensures alignment of environmental safeguards with national and international standards for the hydroponic system. Advises on policy compliance, environmental reporting, and stakeholder accountability.

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## 7.3 Training and/or Capacity Building Programs

Tailored training and capacity-building programs are essential to successfully implement the MURUNA project's Environmental and Social Action Plan (ESAP). These programs will equip stakeholders—including local farmers, extension officers, and technical teams—with the necessary skills and knowledge to implement sustainable agricultural and environmental management practices.

### 1. Climate and Environmental Risk Management Training

**Target Audience:** ICBA and WFP teams, local environmental officers, policymakers

**Topics Covered:**

- Integrating climate resilience strategies into agriculture.
- Adapting water and land-use planning under changing climate conditions.

**Training Provider:** International Consultant

### 2. Sustainable Crop and Soil Management Training

**Target Audience:** Farmers, agronomists, extension workers

**Topics Covered:**

- Selection of climate-resilient crops based on soil, water, and climate conditions.
- Implementing crop rotation and intercropping techniques to optimize soil fertility.
- Organic soil amendments: biochar, compost, and soil conditioners.
- Integrated pest management (IPM) strategies, focusing on organic and low-impact pesticides.

**Training Provider:** ICBA and WFP team

### 3. Water Management and Efficient Irrigation Training

**Target Audience:** Water user associations (WUAs), irrigation engineers, farmers

**Topics Covered:**

- Implementing water-saving technologies (e.g., drip irrigation, hydroponics, moisture sensors).
- Developing seasonal irrigation schedules based on crop needs.
- Water harvesting and storage techniques, including BPH reservoir management.
- Monitoring and managing water quality to prevent contamination.

**Training Provider:** ICBA and WFP team

### 4. Biodiversity Conservation and Land Management Training

**Target Audience:** Field operators, agronomists, environmental officers

**Topics Covered:**

- Identifying and protecting native plant species during site development.
- Best practices for minimizing habitat destruction during construction and agricultural activities.
- Implementing erosion control measures to prevent land degradation.

**Training Provider:** ICBA and WFP team

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## 5. Environmental Compliance and Monitoring Training

**Target Audience:** ICBA/WFP teams, government agencies, environmental officers

**Topics Covered:**

- National and international environmental regulations and standards for agriculture.
- Soil and water quality monitoring protocols and reporting.
- Mitigation strategies for minimizing environmental impacts of agricultural activities.

**Training Provider:** International consultant

## 6. Capacity Building for Farmers and Community Engagement

**Target Audience:** Farmers, local communities, extension officers

**Topics Covered:**

- Hands-on training in climate-smart agriculture (CSA).
- Training in sustainable agricultural practices.
- Community-based water resource management practices.
- Awareness programs on sustainable land use and ecosystem protection.
- Farmer-to-farmer knowledge exchange and peer learning sessions.

**Training Provider:** ICBA team

## 7. Hydroponic Systems and Controlled Environment Agriculture (CEA) Training

**Target Audience:** Hydroponic operators, researchers, extension workers

**Topics Covered:**

- Setting up and managing hydroponic and soilless farming systems.
- Nutrient and water management in hydroponic production.
- Monitoring and reporting on hydroponic system compliance with environmental guidelines.

**Training Provider:** WFP team

## 7.4 Schedule of Implementation of ESAP

Table 7 provides the implementation schedule of the Environmental and Social Action Plan (ESAP) for the MURUNA project-triggered activities, particularly the BPH pilot sites activities. ESAP-triggered components categorize activities, each aligned with identified risks and mitigation actions. The schedule includes proposed implementation timelines. See the attached Excel format sheet for better clarity.

Note: Table 6 and Table 8 are attached in Excel format to make it easy to read the tables.



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## 7.5 Budget

The total budget required to implement the ESAP is approximately USD 43,278. This budget primarily accounts for staff time, as outlined in Section 7.2 on staffing requirements. The daily rates applied are consistent with those used in the MURUNA project. Table 8 provides a breakdown of the total budget by ESAP component, while Table 8 details the budget allocated for each specific ESAP action or intervention. A detailed budget breakdown is provided in Table 9 in Annex I.

Table 68: Budget breakdown needed for implementing ESAP

ESAP Triggered Components	Total Budget (CAD)
1. E&S management system	5,160
2. Agricultural exposure to climate risks	6,540
3. Availability and variability of water resources and efficient natural resources management	5,238
4. Sustainable agricultural production	8,830
5. Biodiversity and ecosystem conservation	7,755
6. Community social changes, engagement, and conflict sensitivity	8,190
7. Land acquisition	1,565
<b>Total</b>	<b>43,278</b>

## Monitoring and Follow-Up

The ICBA and WFP project teams will continuously monitor and evaluate the ongoing ESAP tasks at the pilot sites and adjust the implementation of ESAP. The MOWR, the MOA, and the MOE will continuously monitor and evaluate the pilot sites after project completion. The ministries will bear the cost of monitoring and follow-up after the project is accomplished. Based on monitoring results and stakeholder feedback, the ICBA and WFP teams will evaluate the effectiveness of mitigation measures and adapt the plan as needed. Relevant stakeholders and community representatives will be updated transparently about ESAP and possible environmental challenges, and they will be directly consulted and engaged in decision-making and applying proper adaptation measures. The ICBA's and WFP's teams will use the following monitoring tools:

- Use GHG calculators (e.g., EX-ACT by FAO).
- Seasonal soil carbon tests.
- Water-use efficiency records.
- Organic fertilizer usage logs.

Community feedback loops and opportunities for adaptive management will be built into the system, including the potential for third-party validation and community-led monitoring in later phases, as described below:

### A. Participatory Decision-Making Platforms

- Establish village committees or advisory groups representing different community segments.
- Conduct regular meetings or focus group discussions to gather real-time feedback.

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- Use community surveys to collect insights/suggestions.

**B. Grievance Redress Mechanisms**

- Implement transparent reporting channels for concerns and complaints (e.g., suggestion boxes, community forums, etc.)
- Ensure responses are timely and well-documented to build trust.

**C. Feedback Integration into Project Planning/Implementation**

- Establish a cycle of review and response where feedback is analyzed and incorporated into planning/implementation.
- Hold regular reflection workshops where stakeholders review progress and make course corrections as needed.

For effective implementation, the project team will make sure that:

- ✓ Make participation inclusive (women, youth, marginalized groups).
- ✓ Ensure transparency in decision-making and monitoring processes.
- ✓ Leverage technology (GIS, remote sensing, mobile reporting) for efficiency.
- ✓ Encourage adaptive learning by documenting and sharing lessons across communities and project locations.

## 7.6 Reporting

The environmental and social impacts of the project, along with the implementation of the management plan and mitigation measures, will be integral components of the semi-annual report to GAC. A special section will be dedicated to knowledge sharing and lessons learned to inform project planning, decision-making, and future initiatives.

In addition to reporting to GAC, there will be continuous collaboration between the project team and Ministry of Environment specialists to enhance project activities and adapt to unforeseen effects, ensuring that positive impacts are amplified and negative impacts are minimized.

The technical committees will convene regularly to provide technical insights regarding the ESAP components and make recommendations and course corrections.

Each identified effect will be monitored using a set of indicators to improve implementation as the project progresses.

Table 9 comprehensively summarizes all ESAP components, including associated risks, required actions, staffing needs, implementation schedule, budget allocations, monitoring and follow-up mechanisms, reporting requirements, and expected deliverables.

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Table 9: Environmental and Social Action Plan

7.1 ESAP Triggered Components	Risks	Intervention / Action required	7.2 Staffing Requirements and Expertise	7.4 Schedule of Implementation	7.5 Budget	7.6 Monitoring and Follow-up	7.7 Reporting and Deliverables
1. E&S management system	<ul style="list-style-type: none"> <li>No specific mechanism for raising public concerns</li> </ul>	<ul style="list-style-type: none"> <li>Develop a project mechanism for reporting public concerns</li> </ul>	<ul style="list-style-type: none"> <li>Senior Project Officer</li> <li>WFP Resilience and Climate Change Coordinator</li> </ul>	Prior installation of the irrigation system in June 2025	1,287	MEL specialist to monitor the progress and deliverables	Mechanism for public concerns
	<ul style="list-style-type: none"> <li>No project E&amp;S Risk Register</li> </ul>	<ul style="list-style-type: none"> <li>Formulate an E&amp;S risks register that is specific to the project and contains all E&amp;S aspects, risks, and impacts during the entire project life cycle</li> </ul>	<ul style="list-style-type: none"> <li>Water Quality and Environmental Modeler</li> <li>WFP Resilience and Climate Change Coordinator</li> </ul>	Prior installation of the irrigation system in June 2025	2,238	MEL specialist to monitor the progress and deliverables	E&S risks register
	<ul style="list-style-type: none"> <li>No specific E&amp;S management system is available for the project</li> </ul>	<ul style="list-style-type: none"> <li>Adopt E&amp;S policy during construction to fulfill the Iraqi National Environmental Protection and Improvement Law No. 27 of 2009.</li> </ul>	<ul style="list-style-type: none"> <li>Senior Project Officer</li> <li>WFP Resilience and Climate Change Coordinator</li> </ul>	Prior installation of the irrigation system in June 2025	1635	MEL specialist to monitor the progress and deliverables	E&S management system
2. Land acquisition	<ul style="list-style-type: none"> <li>The project pilot lands are under the responsibility and management of the MOA and MoWR/WUAs</li> </ul>	<ul style="list-style-type: none"> <li>Change project pilot locations to more appropriate sites that are sustainable and easy to manage</li> </ul>	<ul style="list-style-type: none"> <li>MoWR, MOA, MOE</li> </ul>	Pilot site lands have been changed and confirmed by the MoWR after the scoping session.	1565	Done	Done. New site maps are included in the ESAP.
3. Agricultural exposure to climate risks	<ul style="list-style-type: none"> <li>Extreme weather events, including drought, floods, heat waves, wind, and dust storms.</li> </ul>	<ul style="list-style-type: none"> <li>Use forecast and early warning systems to monitor weather conditions</li> </ul>	<ul style="list-style-type: none"> <li>ICBA's Climate Modeler</li> <li>ICBA's Crop Modeler</li> </ul> <p>Long-term: MoWR, MOA, MOE regional departments</p>	Daily	6540	<ol style="list-style-type: none"> <li>Daily monitoring of weather conditions.</li> <li>Use of seasonal forecast.</li> </ol>	<ul style="list-style-type: none"> <li>Reporting biannually on weather conditions.</li> </ul>
4. Availability and variability of water resources and efficient natural resources management	<ul style="list-style-type: none"> <li>Water availability and use efficiency</li> </ul>	<ul style="list-style-type: none"> <li>Implement water management practices, including optimized irrigation and drought/heat-resistant crops.</li> <li>Implement water-saving technologies and modern irrigation methods (e.g., drip irrigation, hydroponics) to conserve water and maintain quality.</li> <li>Apply seasonal irrigation scheduling to minimize water loss, runoff, and pollution</li> <li>Apply soil moisture retention and shading techniques.</li> <li>Reduce leakages by lining each reservoir with plastic.</li> </ul>	<ul style="list-style-type: none"> <li>ICBA's Water Modeler and Environmental Modeler</li> <li>WFP Resilience and Climate Change Coordinator</li> </ul> <p>Long-term: MoWR, MOA, MOE regional departments</p>	At the beginning of each Year	5238	<p><b>Monitoring method:</b></p> <ol style="list-style-type: none"> <li>Visual inspection.</li> <li>Review of the water supply log.</li> <li>Soil moisture meters.</li> <li>Water quality sampling</li> </ol>	Bi-annual report: Evaluated water availability and variability in project areas and developed water management strategies.
5. Sustainable agricultural production	<ul style="list-style-type: none"> <li>Growing crops in saline soil</li> <li>Sites are vulnerable to droughts</li> <li>Organic fertilizer and compost flushing due to heavy rain</li> </ul>	<ul style="list-style-type: none"> <li>Implement a seasonal cropping calendar</li> <li>Implement an Integrated Soil Fertility Management (ISFM) system, including composted manures, biochar, and soil conditioners.</li> <li>Use organic-based pesticides with minimal carryover and contamination effects on crops, their residues, and the soil in and around the BPH plots.</li> </ul>	<p>During project implementation:</p> <ul style="list-style-type: none"> <li>ICBA's Senior Agronomist</li> <li>WFP Resilience and Climate Change Coordinator</li> <li>ICBA's Soil Scientist</li> </ul> <p>Long-term: MoWR, MOA, MOE regional departments</p>	At the start of the growing season	8830	<ul style="list-style-type: none"> <li>Monitoring method: visual inspection</li> <li>Monitor the CSA field activities and hydroponic activities and report on their compliance with ESAP.</li> </ul>	Bi-Annual report

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<p><b>6. Biodiversity and ecosystem conservation</b></p>	<ul style="list-style-type: none"> <li>• Damage native plants at the pilot sites</li> <li>• During the construction, installation, and operation of the irrigation systems, dust may occur, and soil might erode at the site.</li> </ul>	<ul style="list-style-type: none"> <li>• Conduct surveys of pilot plots to identify native species and ensure their protection during site preparation.</li> <li>• Ensure compliance with national agricultural guidelines and standards, selecting crops to minimize biodiversity impacts.</li> <li>• Create buffer zones with minimal vegetation clearing and native species preservation at established pilot plots.</li> <li>• Apply erosion control measures to prevent soil degradation at pilot sites.</li> </ul>	<ul style="list-style-type: none"> <li>• ICBA's Geneticist</li> <li>• WFP Environmental and Policy Officer</li> <li>• ICBA's Soil Scientist</li> </ul>	<p>Before and after growing seasons</p>	<p>7755</p>	<ul style="list-style-type: none"> <li>• <b>Monitoring Method:</b> Visual inspections, species survey</li> <li>• Monitoring method: Soil field sampling</li> <li>• Collect soil and water samples before and after seasonal activities to ensure compliance with Iraqi and Canadian environmental standards.</li> </ul>	<p>Bi-Annual report: Report on soil and water quality, recommending mitigation measures if adverse impacts are identified</p>
<p><b>7. Community social changes, engagement, and conflict sensitivity</b></p>	<ul style="list-style-type: none"> <li>• Conflicts with communities</li> <li>• Social changes, e.g., way of life and cohesion</li> <li>• People in a vulnerable situation</li> <li>• Gender-based inequalities, discrimination, exclusion, unwanted workload, and violence</li> <li>• Engagement of women and youth</li> <li>• Hiring local laborers</li> <li>• Hiring child laborers</li> </ul>	<ul style="list-style-type: none"> <li>• Early engagement of local communities, community leaders, and stakeholders in project implementation from the early stage</li> <li>• Empower women and youth through tailored training.</li> <li>• Develop project hiring guidelines to ensure compliance with national labor legislation</li> </ul>	<ul style="list-style-type: none"> <li>• ICBA's economist</li> <li>• WFP gender specialist</li> <li>• WFP Environmental and Policy Officer</li> </ul>	<ul style="list-style-type: none"> <li>• The engagement of local communities and stakeholders has already started</li> <li>• Labor Hiring guidelines to be ready at project commencement</li> </ul>	<p>8190</p>	<p>Monitoring method: Review deliverables to ensure they are submitted on time</p>	<ul style="list-style-type: none"> <li>• Bi-annual reporting on social changes, youth and women empowerment, and people in vulnerable situations</li> <li>• Local labor hiring guidelines</li> </ul>

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## 8 Conclusion

The Environmental and Social Action Plan (ESAP) presented herein outlines a strategic and integrated approach to managing the environmental and social risks and opportunities associated with the implementation of the *MURUNA* project. Grounded in robust environmental assessments, inclusive stakeholder consultations, and alignment with national legislation and donor environmental policies, this ESAP provides a practical and responsive framework for ensuring environmental sustainability and social equity throughout the project lifecycle.

The plan emphasizes the need for proactive mitigation measures to address climate vulnerability, potential ecological disturbances, and social challenges while maximizing the positive impacts of climate-smart agricultural practices and sustainable water management. It also prioritizes institutional capacity building, knowledge transfer, and community engagement as critical enablers of long-term project success.

With the effective implementation of this ESAP, the project has the potential to not only deliver direct environmental and socioeconomic benefits but also to serve as a model for climate-resilient development in Iraq and the wider region.

We believe that by adhering to the mitigation and enhancement measures outlined in this plan, the project will contribute meaningfully to Iraq's efforts to combat climate change, strengthen water security, and improve the livelihoods of vulnerable farming communities, thereby laying a strong foundation for resilient, inclusive, and sustainable development.

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Annex I

Table 10: Breakdown of EASP budget

7.1 ESAP Triggered Components	Total Budget	Risks	Intervention / Action required	7.2 Staffing Requirements and Expertise	7.4 Schedule of Implementation	7.5 Budget		7.6 Monitoring and Follow-up	7.7 Reporting and Deliverables
						Staff Rate	Total Cost		
1. E&S management system	5160	No specific mechanism for raising public concerns	Develop a project mechanism for reporting public concerns	Senior Project Officer	Prior installation of the irrigation system in June 2025	313	939	MEL specialist to monitor the progress and deliverables	Mechanism for public concerns
				WFP Resilience and Climate Change Coordinator		696	348		
		No project E&S Risk Register	Formulate an E&S risks register that is specific to the project and contains all E&S aspects, risks, and impacts during the entire project life cycle	Water Quality and Environmental Modeler	Prior installation of the irrigation system in June 2025	630	1890	MEL specialist to monitor the progress and deliverables	E&S risks register
				WFP Resilience and Climate Change Coordinator		696	348		
		No specific E&S management system is available for the project	Adopt an E&S policy during construction to fulfil the Iraqi National Environmental Protection and Improvement Law No. 27 of 2009.	Senior Project Officer	Prior installation of the irrigation system in June 2025	313	939	MEL specialist to monitor the progress and deliverables	E&S management system
				WFP Resilience and Climate Change Coordinator		696	696		
2. Land acquisition	1565	The project pilot lands are under the responsibility and management of the MOA and MoWR/WUAs	Change project pilot locations to more appropriate sites that are sustainable and easy to manage	MoWR, MOA, MOE	Pilot site lands have been changed and confirmed by the MoWR after the scoping session.	313	1565	Done	Done. New site maps are included in the ESAP.
3. Agricultural exposure to climate risks	6540	<ul style="list-style-type: none"> <li>Extreme weather events, including drought, floods, heat waves, wind, and dust storms.</li> </ul>	Use forecast and early warning systems to monitor weather conditions	ICBA's Climate Modeler	Daily	734	3670	3. Daily monitoring of weather conditions. 4. Use of seasonal forecast.	<ul style="list-style-type: none"> <li>Reporting biannually on weather conditions.</li> </ul>
				ICBA's Crop Modeler and Environmental Modeler		574	5870		
				MoWR, MOA, MOE regional departments					
4. Availability and variability of water resources and efficient natural resources management	5238	Water availability and use efficiency	Implement water management strategies to support drought and heat risk mitigation.	ICBA's Water Modeler and Environmental Modeler	At the beginning of each Year	630	3150	<b>Monitoring method:</b> 1. Visual inspection. 2. Review of the water supply log. 3. Soil moisture meter; 4. Water quality sampling	Bi-annual report: Evaluated water availability and variability in project areas and developed water management strategies.
			Implement water management practices, including optimized irrigation and drought/heat-resistant crops.	WFP Resilience and Climate Change Coordinator		696	2088		
			Implement water-saving technologies and modern irrigation methods (e.g., drip irrigation, hydroponics) to conserve water and maintain quality.						

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			Apply seasonal irrigation scheduling to minimize water loss, runoff, and pollution.	Long-term:					
			Apply soil moisture retention and shading techniques.	MoWR, MOA, MOE regional departments					
			Reduce leakages by lining each reservoir with plastic.						
5. Sustainable agricultural production	8830	Growing crops in saline soil	Implement a seasonal cropping calendar	During project implementation:				Monitoring method: visual inspection	Bi-Annual report
		Sites are vulnerable to droughts.	Implement an Integrated Soil Fertility Management (ISFM) system, including composted manures, biochar, and soil conditioners.	ICBA's Senior Agronomist		548	2740	Monitor the CSA field activities and hydroponic activities and report about their compliance with ESAP.	
		Organic fertilizer and compost flushing due to heavy rain	Use organic-based pesticides with minimal carryover and contamination effects on crops, their residues, and the soil in and around the BPH plots.	WFP Resilience and Climate Change Coordinator	At the start of the growing season	696	3480		
				ICBA's Soil Scientist		522	2610		
				Long-term:					
				MoWR, MOA, MOE regional departments					
6. Biodiversity and ecosystem conservation	7755	Damage native plans at the pilot sites	Conduct surveys of pilot plots to identify native species and ensure their protection during site preparation.	ICBA's Geneticist		429	2145	Monitoring Method: Visual inspections, species survey	Bi-Annual report
			Ensure compliance with national agricultural guidelines and standards, selecting crops to minimize biodiversity impacts.	WFP Environmental and Policy Officer	Before and after growing seasons	600	3000		
			Create buffer zones with minimal vegetation clearing and native species preservation at established pilot plots.						
		Dust may occur during the irrigation systems' construction, installation, and	Apply erosion control measures to prevent soil degradation at pilot sites.	ICBA's Soil Scientist	Before and after growing seasons			Monitoring method: Soil field sampling	Bi-Annual report: Report on soil and water quality,

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		operation, and soil might erode at the site.				522	2610	Collect soil and water samples before and after seasonal activities to ensure compliance with Iraqi and Canadian environmental standards.	recommending mitigation measures if adverse impacts are identified
<b>7. Community social changes, engagement, and conflict sensitivity</b>	<b>8190</b>	Local community way of life	Develop project hiring guidelines to ensure compliance with national labour legislation.	ICBA's economist	The engagement of local communities and stakeholders has already started	459	4590	Monitoring method: Review deliverables to ensure they are submitted on time	Bi-annual reporting on social changes, youth and women empowerment, and people in vulnerable situations
		Local jobs, businesses, and social cohesion	Early engagement of local communities and stakeholders in project design	WFP gender specialist	Labor Hiring guidelines to be ready at project commencement	600	1800		Local labour hiring guidelines
		Social changes	Empower women and youth through tailored training.	WFP Environmental and Policy Officer		600	1800		
		People in a vulnerable situation							
		Gender-based inequalities, discrimination, exclusion, unwanted workload, and violence							
		Engagement of women and youth							
		Hiring local laborers							
		Hiring child laborers							
		Conflicts with communities							
<b>Total</b>	<b>43278</b>						<b>43,278</b>		

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