The Hashemite Kingdom of Jordan

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA final Report)

FOR

THE HYDROPONICS FARM IN Al Mujib Valley, JORDAN "Exploring high-value, socially-inclusive, and waterefficient agriculture project in Jordan"



Submitted to: Ministry of Agriculture

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The ESIA report has the following attached annexes:

Annex No. (1): Project, General Lay-out

Annex No. (2): Land Ownership Documentation.

Annex No. (3): ES2 Labor Management Procedures (LMP).

Annex No. (4): Final Public Consultation Report

Annex No. (5): Integrated Pest Management Plan (IPM).

Annex No. (6): Grievance form for project employees and communities/public

Annex No. (7): Legal and Institutional Framework.

Annex No. (8): Concept of project Study Alternatives.

Annex No. (9): Criteria for Selecting the Trainees and Workers Annex No. (10): Site visit Report Annex No. (11): ESS10 Stakeholder Engagement Plan (SEP) Annex No. (12): Jordan EIA Regulation

	List of Acronyms:
CBD	Convention on Biological Diversity
DOA	Department of Antiquities
ESIA	Environmental and social Impact Assessment
ESMP	Environmental and Social Management Plan
ESP	Environmental & Social Plan
EIA	Environmental Impact Assessment
EHS	Environmental Health and Safety
EHD	Environmental Health Directorate
ERC	Energy Regulatory Commission
ESS1	Environmental & Social Risks Guidance notes #1
ESS2	Environmental & Social Risks Guidance notes #2
ESS3	Environmental & Social Risks Guidance notes #3
ESS4	Environmental & Social Risks Guidance notes #4
ESS10	Environmental & Social Risks Guidance notes #10
EMRRC	Energy & Mineral Resources Regulatory Commission
DOA	Department of Antiquities
DOS	Department of Statistics
FOA	Food and Agriculture Organization
GCF	Green Climate Fund
GDP	Gross Domestic Product
GBV	Gender Based Violence
IDECO	Irbid District Electricity Company
IPM	Integrated Pest Management
JS	Jordan Standards
JISM	Jordan Institute for Standard and Metrology
JVA	Jordan Valley Authority
JOHUD	Jordanian Hashemite Fund for Human Development
JSC	Joint Services Counsel
LMO	Living Modified Organisms
LMP	Labor Management Plan
MEMR	Ministry of Energy and Mineral Resources
MLEA	Multi-lateral Environmental Agreements
MOL	Ministry of Labor
МОН	Ministry of Health
MoMA	Ministry of Municipalities Affairs
MoEnv	Ministry of Environment
MoSD	Ministry of Social Development
MOA	Ministry of Agriculture
MWI	Ministry of Water and Irrigation
NDA	National Designated Authority
NGO	Non-governmental Organization
NBSAP	National Biodiversity and Action Plan
NES	National Environmental Strategy
OHD	Occupational Health Directorate
OHS	Occupational Health and Safety
PPE	Personal Protection Equipment
PPP	Public Private Partnership
PPM	Part Per Million
PM2	Particulate Matter 2 microns
RSS	Royal Scientific Society
RO	Reverse Osmosis
RSCN	Royal Society for the Conservation of Nature
SEAH	Sexual Exploitation and Abuse and Sexual Harassment
SEP	Stakeholder Engagement Plan
SE	Safety Equipment
TDS	Total Dissolved Solids
UNFCCC	UN Framework Convention on Climate Change
UNCCD	UN Convention to Combat Desertification
WB	World Bank
WAJ	Water Authority of Jordan
WWTP	Waste Water Treatment Plant

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Executive Summary

i. Project description:

The project is based on supporting the establishment, installation and initial operations of a pilot hydroponics unit (e.g. computer-based humidity control systems, heat control systems and processing/packing equipment). The pilot high-tech hydroponic farm will be constructed within the boundary of the village of Al Ariha in the Wadi Al Mujib area located near the city of Al Qasr, on the Land plot no.(3) parcel no. (5), in the Karak Governorate, on a land surface area of 1.5 Hectare or 15 (Dunoms). The Ministry of Agriculture has formed a team to carry out an Environmental and Social Impact Assessment (ESIA) study for the design, establishment, installation and initial operations of a pilot hydroponic single greenhouse options unit. In addition, this project will also support the provision of the technical assistance, training and business management skills required to ensure the pilot project is managed as effectively as possible.

This ESIA focuses on the environmental and social risks and impacts of Hydroponic farming including a general economic analysis and possible alternatives. Furthermore, it highlights the pros and cons as well as the mitigation procedures needed to minimize the environmental and social negative impacts. This study also clearly identifies the potential social and environmental impacts and proposes mitigation measures which have been prepared to be presented to decision-makers for review. The ESIA team carried out the ESIA study and produced the ESIA report following the format suggested for the ESIA terms of reference and incorporates all elements required by the World Bank and Ministry of Agriculture (MoA), accordingly.

ii. Objective of the ESIA and methodology:

This project is intended to demonstrate and implement new entrepreneurial farm in rural areas, generally explain the economic benefits of hydroponics to the farming community, comparing three models of farming options, high-tech multi-span hydroponics, high-tech Hydroponic single greenhouse and low-tech Hydroponics greenhouse, educate the public through training and outreach programs and introduce training-for-employment opportunities. In terms of hydroponics, this will help the target groups (unemployed women, youth and vulnerable people) to secure better jobs, given that the nature of work in hydroponics system does not require difficult agricultural work, but rather high skills that the trainees will acquire through the project to continue the training of the target groups, as well as taking the job opportunities that government will create in promoting the spread of hydroponics system in the farms around the project site. Hydroponics will enhance the entrepreneurial spirit among farmers, given

allocated by the Agricultural Credit Corporation to adopt this technology. The project will be implemented on one and half hectare owned by MoA. Refer to Annex 2 for land ownership documentation.

Jordan's agriculture is currently the largest use/consumers of water. While farmers irrigate about 46% of the total agricultural land (Department of Statistic (DOS), 2017)¹ agricultural water requirements represent around 52% of total national water supply (Ministry of Water and Irrigation)². Jordan's system of subsidies affects the use of irrigation water, which necessitates strict rationing to allocate the remaining water resources for other economic and social sectors, i.e. industrial, municipal and commercial. Needless to say, due to the severe water shortage challenge, this rationing becomes more extreme during the hot summer months when the demand on water increases.

This project will promote water-efficient agriculture and efficient use of land through the demonstration of hydroponic production technologies. The proposed model will not only improve the quality of locally grown fruits and vegetables such as tomatoes, cucumbers, lettuce, strawberries and red rose but also helps diffuse potential tensions around use of scarce water resources in highly populated areas. It will help spread efficient farming systems in the use of irrigation water, which save about 60% of irrigation water. The project is also expected to build skills in the field of advanced agricultural technology for the target groups of the unemployed, which helps them work in the project or the agricultural labor market or create their own projects.

The project will also promote the inclusion and active participation of women, youth, in the training activities and job opportunities that the project will generate. Syrian refugees in Al Qasr Sub Governorate will also participate in these activities and contribute to strengthening social cohesion between Syrian refugees and the local community. On the other hand, the private sector needs to be engaged in a meaningful way in finding solutions to a more sustainable and nutritious food system. So the food industry is a key stakeholder and a major catalyst for change. This system (High-tech multi-span hydroponics, High-tech Hydroponic single greenhouse and low-tech Hydroponics greenhouse) was newly introduced to Jordan, there are private sector initiatives in northern Jordan and around Amman, but there are no initiatives in southern Jordan. This is due to the expertise requirement and high investment needed. Moreover, Jordan's youth unemployment increased to 25% in the first quarter of 2021. One of the most important factors hindering the inclusion of young people in the society is limited access to employment, particularly decent jobs.

¹ http://www.dos.gov.jo/owa-user/owa/FOCAL_AGR.agr_kk?LANG=A&dis=0

² http:// http://waterjo.mwi.gov.jo/Ar/NewsCenter/Pages/2018 المياه-تصدر موازنتها-المائية aspx.

Jordan's climate is almost entirely semi-arid, or arid, receiving an annual average rainfall of less than 200 mm per annum on 91.4% of the total land area. The water crisis has been aggravated by a local population increase and the acceptance of record numbers of refugees fleeing from political unrest, wars and social strife in neighboring countries during the last two decades alone.

The Jordan's labor market has been severely impacted facing significant vulnerabilities. The unemployment rate in Jordan remained elevated from 15% in 2010 to 18.5% in the Q4-2017, while the men's workforce participation rate in Jordan is roughly 87%, the rate for women is only 22%. Pay inequality is one major factor that leads Jordanian women to drop out of the labor force³. Labor Force Statistics as indicated by the Director of Alqasr Agriculture Directorate, is from the current population, but a higher percentage of the laborers are imported mainly from Egypt. Both whether local or imported consist of male and female laborers. Among the female laborers the imported female labor force have a higher percentage. It is also important to underscore Jordan's dire water situation, as its water availability per capita is less than 90 m3/ year4. from annual renewable water sources, significantly below the global average of 500 m3/ capita/year. According the MWI, before the refugee crisis Jordan's total national water supply equated to 147 m3/capita/years but today it is less than 97 m3/capita5. Climate change is expected to exacerbate challenges facing Jordan's natural resource endowment in years to come. With annual precipitations decreasing at a rate of 1.2mm per year an average of 20% according to Jordan's 3rd National Communication Report6 submitted the UNFCCC and temperatures increasing by an average 0.03 degrees per year, Jordan will most likely experience periods of severe droughts with longer periods of dry days, which will directly affect the agriculture sector and leave the country to deal with serious and complex environmental problems.

In irrigated agriculture the Jordan Valley Authority (JVA) allocates water 3 days per week for farmers through a public water network which is pumped to the individual farms and stored in cisterns (for summer shortages) prepared by the farmers either as galvanized metal tanks or earth ponds and all municipal water extraction is metered by the water authority.

Jordan's agriculture sector is well positioned to maximize the economic, social and environment benefits of advanced agriculture technologies. Hydroponics allows farmers to grow vegetables and fruit crops (tomatoes, cucumbers, strawberries, lettuce) faster than traditional field-based agriculture. Approximately, 16 to 20 % of Jordan's active populations are involved in the agriculture and food sectors. While the primary share of agriculture in the gross national product GDP is relatively small (accounts for 5.5

³ 2000 - 2018 | Quarterly | % | Department of Statistics

⁴ Ministry of water and Irrigation

⁵ Water shortage in Jordan —Sustainable solutions

⁶ MoENV

percent of Gross Domestic Product (GDP) and 16-20% GDP of indirect contributions (the food sector7), it consumes approximately 25% of the non-renewable freshwater sources. Therefore, Hydroponic farming presents a viable economic and social solution for Jordan.

The primary justification for executing such a project is to give specific attention to the inclusion of alternative water-efficient practices and to provide skills that women and youth can work with. For example, the business model for the project may include a range of incentive schemes designed specifically for women (example of the schemes may include; skilled/non-skilled training, flexible working hours, paid incentives linked to production and performances, in addition to the standard wages, Labor Law (No. 8 for 2002).

The aim of the project development is to improve the access of vulnerable groups and the unemployed to sustainable employment opportunities and income generation in Jordan. This will be achieved through (1) capacity building and improving the skills of the unemployed in the field of modern agricultural technology (2) enhancing the ability to implement modern agricultural technology projects (3) enhancing agricultural entrepreneurship and enabling the unemployed and vulnerable to manage their own projects. The project will be implemented through the three component, component (1) Supply, Installation, and Operations, this component will include the design, acquisition, installation and operations associating with pilot hydroponic technology that is appropriate to the climatic and social conditions of the target area. Component (2) business Model Development, this component will focus on creation and management of an innovation platform that will focus on the development of hydroponics business model (including access to finance, registration, access to services, etc.). Component (3) dissemination and training, key areas for this component include the design, organization and implementation of a campaign to generate awareness of production systems and to train targeted communities in the technology and/or business models. The campaign will specifically focus on the sharing the lessons on the social, economic and environmental benefits of the production systems.

The Hydroponics farming systems are not dependent on large volumes of water or land availability, and these systems also provide job opportunities for skilled and semi-skilled workers for both genders. These farming systems can be implemented in both rural and urban areas. Farms can be established closer to markets (providing fresh food directly to consumers) and multiple Hydroponic farms can allow farmers to produce almost all year long thus ensuring consumers benefit from low cost of high valued fruits and vegetables,

⁷ policy reform Matrix for growth balanced 2018-2025

but this system needs high skills and high-cost of investment which may prevent it from being expanded.

The methodology pertaining to the development of the ESIA involved multiple visits to the project area and meetings with relevant stakeholders, i.e. farm owners, managers, laborers, Agricultural cooperative, youth and women committees as well as the analysis and incorporation of other related studies conducted on similar projects in Jordan. Additionally, potential beneficiaries in the vicinity were identified prior to the commencement of the impact assessment. These include; Ariha Village, Al Mughir Village Abu Turabih village, Masear village, Al Qasr City among and the villages of Al Qasr District (See Annex 2 land Ownership), also cooperative societies and committees present in them. The team then identified the impacts of each of the relevant activities during construction, operation, taking into account local laws and regulations, World Bank and MoA requirements as well as the outcomes of the baseline studies and data collection.

iii. Institutional and legal framework

This project is developed by MOA and will be managed through the establishment of a cooperative association of direct beneficiaries, which is designated by MoA as a competent cooperative association operated under the umbrella of Jordan Cooperative Foundation, to implement component business model. Therefore, during the first phase, the project will be directly supervised by the Ministry of Agriculture of Jordan and the cooperative cooperation on the work of the project until the gaining of the experience and skills sufficient to manage the project which is expected to take one year. The Ministry of Agriculture will continue to provide the extension services required by the project in subsequent phases, and the Jordan Cooperative Cooperation will monitor the activities of the association in accordance with the cooperation law and statute of the association

This ESIA is prepared in compliance with (MoEnv) Regulation no. (37) for year 2005) and World Bank environmental and social standards (under the new Environmental and Social Framework (ESF)). It aims to provide a description of the baseline conditions related to the project so as to provide a reference point for the environmental and social impacts caused by the project throughout its life cycle. Furthermore, it aims to identify and assess potential environmental and social risks and impacts induced by the project and recommends the relevant mitigation measures as well as an Environmental and Social Management Plan (ESMP). The analysis is based on existing available information and best professional judgment.

Legal requirements have been reviewed and applicable laws and regulations have been identified and summarized in chapter 2.

iv. Project location, project influence area and alternative analysis for the location and technologies:

The project is located in the southern part of the Jordan in Wadi Al Mujib, Karak Governorate, near the village of Ariha 80 km South-West of the capital Amman, approximately 400 m above sea level. The drive from Amman to the farm location in Wadi Al Mujib will take about one hour depending on the weather and traffic. The project area is by far one of the most fertile regions due to the rich soil, high rate of rainfall in winter and suitable weather year long.

The project will be implemented on Government land (up to one and half hectare) owned by MoA (Annex 2, land ownership). The site is located about 10 m to the west of the Madaba – Karak street. The Mujib Dam will be the water source for the project through a water network of the Jordan Valley Authority, it is located adjacent to the planned Hydroponic farm on the eastern and western boundary of the plot about 150-200 m. Located directly to the east of the Hydroponics farm are fruit and vegetable farms. The Mujib Dam is a storage water system carrying 30 million cubic meters of surface water from the Wadi Al Mujib on the Central Badia through the east Jordan up to the Dead Sea. The nearest farmhouse from the project site is in Wadi Mujib, which is located to the west of the site about one km from the site, while Ariha village is located about 4.6 km to the south west, Theban City \Madaba Governorate is located about 7 km to the north west and Al Qaser city is located about 16.5 km to the south west of the project site, which are considered outside the project influence area. The project land is surrounded by agricultural farms. To the north and east of the project land are farms located on either side of the dam.

The one and half hectare of farm land provided by the Ministry of Agriculture requires only minor preparation i.e. leveling and grading of top soil in order to get it ready to erect the two pilot hydroponics units including the utility buildings, Cooler Container, treatment facility, control room (e.g. computer-based humidity control systems, heat control systems and processing/packing equipment) and the required loading/ unloading area and living quarters.

In the 1970's and in order to increase local investments in the agricultural sector, the Government of Jordan through Jordan Valley Authority (JVA) began to allocate and appropriate agriculture land in the Wadi Al Mujib to local Farmers maintaining ownership in certain land plots for future government development purposes. This proposed project is to be located on one such a plot that remained under the ownership of the Government. All lots adjacent to the proposed project site are privately owned farms consisting of fruit plantations, and traditional open field farming of vegetables.

The average summer temperature in the western Wadi Al Mujib from July to September is between 30 and 40 degrees Celsius with no precipitation and in the winter months

from November to March the average temperature ranges between 1 and 9 degrees Celsius and rainfall is frequent.

The Karak – Madaba street lies 10 m south of the farm location and is linked via a well paved service farm road to the proposed project location (Annex 2, landownership documentation).

v. Project baseline

- In the project area about 1,200 dunums of vegetables are planted in the project area, mainly tomatoes and zucchini, and about 1,000 dunums of fruit trees, mostly olive trees. For irrigation, these crops depend on rainwater collected in the winter in the Mujib dam, where the storage capacity of the Mujib dam is estimated at about 30 million cubic meters, and the water quality in the Mujib dam is good and part of it is used as a source of domestic water. The project is expected to affect the dissemination of irrigation water-saving agricultural techniques in the project area. The project will positively and indirectly affect about 1,758 families, including 4,520 males and 4,380 females.
- The average annual rainfall in the project location ranges between 350-400 mm.
- The project will not have a negative impact on the biodiversity in the project area, where the design and the operation comply with national standards for
- irrigation water quality required to prevent pollution.

vi. Stakeholder Engagement:

For the purpose of preparing this ESIA study, the ESIA team carried out the Public Consultation as required by the MoA ToR, pursuant to ESS10 (see Annex no.(11). Stakeholder Engagement and Information Disclosure) taking into consideration the Regulation of Environmental Impact Assessment No. (37), year 2005.

The public consultation meeting took place on Wednesday 21th and Thursday 22th of April, 2021 at premises of The Professional Associations Complex, located in Al Qasr City. The number of participants were (56) including the ESIA team , and a copy of the meeting agenda are provided in Annex 4 pages 11 and 12. The local representatives and stakeholders participated in the meeting in response to a written request sent by the ESIA team on the 14th, of April to Al Qasr Agriculture Directorate.

Participation of all attendees was documented on a registration sheet. A list of the stakeholders and individuals attending the meeting were duly registered (See annex 4, page no, 12), thus the list with full contact details is annexed to the public consultation report. Out of the women (23 women) and refugees (17 refugees) attending the meeting, women constituted about 50% of participants and expressed their enthusiasm and interest in developing their experience in such a technology.

The ESIA team explained to the audience all project Phases including; construction, operation, the project scope of work, the hydroponic technology, site location, the potential socio-economic benefits that the community will gain from the project as well as the Grievance Mechanism.

The Public Consultation meeting provided the participants with the opportunity to provide their comments, ask questions and express their concerns. The ESIA team mediated the meeting and took the notes by documenting all raised questions, remarks and comments of all parties in order to be reflected in the study. The main concerns and feedback of the participants were collected in form, of Questions, Comments, Objections and Answers.

The following were the main concerns as concluded from the session:

Noting that the local community in the Al Qasr Sub Governorate historically are a wellestablished farming community with wide knowledge and experience in agriculture sector and best practices.

- Their priority concern for the communities lies in ensuring sustainable job opportunities in the agriculture sector.
- Local communities did not expect to have any serious problems in implementation of this type and size of project.
- The people are willing and eager to learn new technologies such as hydroponics farming.
- The community is interested in applying a grievance mechanism and considers it a priority. The stakeholders requested that the MoA plays a key role in the handling of the grievance mechanism to ensure that any grievances registered are resolved as per the required procedures.
- Participants expressed their confidence in the work of local NGOs in the project area and suggested their involvement in the project activities particularly as it pertains to communication regarding project interventions.
- The attendees expressed the need of the Ministry of Agriculture to set criteria for selecting the trainees and workers for the project (see annex 9). They also expressed that the ministry has good experience and transparency in dealing with previous employment projects, however noting that the local community is consisted of different tribes.

The attendees strongly suggested that any hiring of employees and workers in the project should be carried out by the MoA and not the NGO.

The ESIA team prepared and formulated the report according to the requirement of the World Bank Environmental and Social Standards "ESS10: Stakeholder Engagement and Information Disclosure", see Annex no. (11).

vii. Project risks and impacts:

The Potential Impacts of the planned project were evaluated considering the entire three phases of the project life cycle, design, construction, operation, and closure phases which is shown in the ESIA report, chapter 4, paragraph 4.3.1.

All the impacts are classified either as positive or negative impacts depending on the potential effects. The positive impacts of the project are clearly dominant, while the negative impacts are seen to be minor.

Among the positive impacts of the project are the following:

- a- Design phase
 - The land is close to water sources
 - The land is close to transportation
 - There are many vegetable farms around the project.
 - Design agricultural technologies that are adaptable to farmers
- b- Construction phase
 - Providing local job opportunities, the project will secure about 15 permanent and seasonal job opportunities for local residents
 - Enable the use of any kind of land available. no need of soil, no weeds and effective use of nutrients. Ensure that the grievance system and codes of conduct are applied to workers and surrounding communities
 - •
- c- Operational phase
 - Water consumption for irrigation in the Advanced Hydroponic Farm will be 90% less than traditional Farming in herbal crops and between 40-60% in other vegetable crops, that increases the efficiency of irrigation water use and release extra water for agricultural expansion.
 - 50% less land is needed to grow the same amount of crops, especially crops grown in layers such as lettuce and strawberries.
 - land is used more effectively.
 - Increase the cultivated area
 - Higher productivity.60% less fertilizer is required
 - Less pesticide use: Since plants are growing indoors.
 - By eliminating soil (there's no need for toxic pesticides to protect plants)
 - IPM applied reduce the use of chemicals and human exposure
 - The project will secure permanent and seasonal job opportunities for local residents.
 - The employees will have training opportunities offered to them and gain skills in the new high technology farming.
 - The project will secure about 28 permanent and seasonal job opportunities for local residents
 - The 40 trained and skilled staff who have been trained for 75 days are expected to transfer their knowledge to other communities as trainers.
 - The trained and skilled employees will have the opportunity to join other similar projects or establish their own cooperatives if they can be supported
 - The nature of project activities, particularly in the seasonal activities will be quite convenient for both women & youth take advantage of employment in (i.e. crop harvesting and grading)
- d- Closure phase:
 - The existence of an agricultural facility that uses modern agricultural technology in Tafila Governorate

- Existence of a business enterprise from the local community
- Produce much safer products
- The project is expected to contribute to direct community development through supporting the municipality, the youth activities, women groups and cultural events.
- The project is expected to contribute to business prosperity through creation of direct & indirect businesses (groceries, food suppliers, maintenance workshops, transportation ... etc.)

While the negative impacts include:

a- Design phase

The listed of negative impacts are:

- The location is relatively far from the population centers
- There are no management offices and health facilities in the project design
- The availability of water and energy during the operation stage.
- b- Construction phase

The listed of negative impacts are:

- Possibility of exposure workers to accidents during construction phase.
- All materials used in construction were purchased from outside the province
- Risks of not complying with codes of conduct and labor law
- Possibility of exposure to dust
- Waste water generated during the construction phase should be collected in properly sealed septic tank and disposed to the nearest treatment plant.
- Installing Solar PV system to cover the needs in cases of electricity outage.
- Installing tank for reject brine, and a tank for the fresh water

c- Operational phase

- The listed of negative impacts are: Possibility of exposure to dust and toxic substances, (volcano tuff and pearlite) and pesticide
- Possibility of exposure to harmful algae and fungus growth.
- Generation of solid waste and probably hazardous wastes(if volcano tuff and pearlite are used) and generation of organic waste such as unused plants although the volumes of such waste are likely to be small.
- Hazardous waste management will incur additional cost of waste management
- Discharges of Reverse Osmosis eject water and wastewater with high content of salts.
- Possibility of contamination by hazardous materials may occur due to improper transportation, storage and use of pesticides including impacts on; workers, air and soil.
- Possibility of soil contamination, source of odor, breeding of insects and reptiles, and harm birds due to project waste

- Possibility of power outage, causes decline in crops yield due to these shortage, also use of electricity could cause electric shocks and fore due to faulty electrical systems and exposure to water
- Clogging in drip irrigation of Hydroponics leads to severe economic losses
- Possibility of technology failure, resulting in disruption of technical processes controlling the hydroponic high-tech system; i.e, irrigation, nutrition, ventilation, climate control which could lead to loss of revenues for the farmer.
- Plant pathogens, leading to higher control costs and lower crop productivity.
- water contamination of the dam if leftover dissolved fertilizers and pesticides are not managed properly
- As this project is small with a possibility to hire 13 full time employees and 12 part time workers, the heightened expectations for employment opportunity may result in disappointment
- Risks of non-compliance with codes of conduct, especially those related to sexual harassment among workers
- Risks of not complying with codes of conduct and labor law
- Qualified staff, technicians, and workers can lose their Jobs
- They will lose security insurance and health care insurance
- e- Closure phase:

The listed of negative impacts are:

- Possibility of exposure to dust and toxic substances, (volcano tuff and pearlite) and pesticide
- Decommissioning activities will create few temporary jobs by the contractor and all long term jobs will not be there anymore.
- water contamination of the dam if leftover dissolved fertilizers and pesticides are not managed properly
- The inability of the local association to manage the project efficiently
- Increase the number of marketers for the site

viii. Mitigation Measures:

The mitigation measures summarized in the following tables should be implemented during design, construction operation and closure. Since the day-to-day operational activities will be managed by the Project Owner, most of the responsibilities are designated to the Project Owner, in addition to the third part assessor (RSS), Municipality, and MoEnv. For (ESMP), refer to tables 2, 3, 4, 5, 6 and 7.

Impact/ Issue	Mitigation Measure	Monitoring Measure	Implementation Responsibility	Supervision Responsibility
Occupational safety and Health	Planning to purchasing a caravan to be used as a desk by the Ministry of Agriculture	Visual observation	МоА	МоА
Accidents	Planning to providing means of transportation for workers to reach the project site	Record the occurrences of all accidents	JCC /Safety officer	МоА
Flood Occurrence	Design and implement measures to control seasonal floods including drainage measures for the facilities	Visual observation	МоА	MoA
Increase in water	The design of the RO include Tank for reject brine, and a tank for the fresh water	Installing temporary waste water	Contractor	МоА

 Table 1: Environmental impacts and mitigation measures during design phase

demand and generation of waste water		collection tank on-site		
Shortages in electricity outage	design included Solar PV system to cover the needs in cases of electricity outage	Visual observation	Contractor	МоА

Table 2: Environmental impacts and mitigation measures during construction phase

Impact/ Issue	Mitigation Measure	Monitoring Measure	Implementation Responsibility	Supervision Responsibility
Solid Waste	Disposal of construction wastes at the site designated by the local authority.	Log sheet for weekly waste quantities	Contractor	Municipality
Public health	Strictly comply with the local regulations regarding the working hours and the levels of noise Reuse of the site soil to level the project land	Worker daily log-in/out sheet Viewal	MoA	MoA Municipality/
	Spraying water on site to prevent the spread of dust	inspection	Contractor	wrumeipanty/
Occupational safety and Health	Cover tightly fertilizer tanks Assign a Health, Safety and Environment Officer Provision of First aid kit Identify closest Medical center/hospital for emergency cases Training the contractor and workers on OHS requirements Enforce use of personal protective equipment, such as gloves, Helmets, Glasses, boots Avoid exposure to sunlight while working for long periods Meet all hygiene and sanitary needs of workers with separate facilities for males and females. Report and investigate any accident Avoid working in dusty, raining, and strong windy weather Provide proper signage	visual Daily inspection by Safety Officer / Supervision Consultant Team	<u>MoA</u> Contractor	МоА
Accidents	workers on these matters Securely pack and cover trucks with loose material Provide vehicles equipped with seats and barriers for the transportation of workers Ensure vehicles carrying workers are equipped with seats and barriers for the transportation of workers A vehicle assigned to take any injured workers to a medical facility all vehicles at the site to be in very good working conditions with reverse horns, signaling lights, etc.	Daily inspection by Safety Officer / Supervision Consultant Team	Contractor	Traffic Department /MOA
	Report, investigate and take timely actions on any accidents Securely pack and cover trucks with loose material Provide vehicles equipped with seats and barriers for the transportation of workers Ensure vehicles carrying workers are equipped with seats and are incompliance with public transport general safety regulation All vehicles at the site to be in very good working conditions with reverse horns, signaling lights, etc Avoid damaging and removal of fauna and	Record the occurrences of all accidents	MoA & JCC /Safety officer	MoA & JCC
Disturbance of biodiversity	crops in adjacent plots, Also need to create awareness for the project workers on these matters	Visual observation	МоА	МоА
Flood Occurrence	Design and implement measures to control seasonal floods including drainage measures for the facilities	Visual observation	MoA	MoA
	Waste water generated during the	Visual observation,	Contractor	MoA

Increase in water demand and	construction phase should be collected in proper sealed septic tank and disposed to the nearest treatment plant.	Log recording		
generation of waste water	Provide an adequate source of water from available and approved off-site sources and encourage the reuse of treated water when possible.	Visual observation, recording	Contractor	МоА
	Conserve water use and restrict the use of groundwater in construction activities and human purposes Hazardous materials must not be thrown at the project site to prevent contamination of groundwater and surface water (oils and vehicle fuels).	Visual observation	Contractor	MoA/ Traffic Department
		Water samples tests,	Contractor	MoA/ Traffic Department
		visual observation	Contractor	МоА

Table 3: Social impacts and mitigation measures during construction phase

Impact/ Issue	Mitigation Measure	Monitoring Measure	Implementation Responsibility	Supervision Responsibility
Employment	Provide employment of workers from local communities mainly for unskilled works and skilled workers if they are available	Registration and logs	Contractor	MoA/community
Community development	Increasing awareness in the local community and workers of project planning, environmental issues and workers' rights	Awareness and workshop report	Technical officer	МоА
Gender consideration	Women's participation in project activities with more than 20% of total permanent workers and not less than 60% of temporary workers. Without any discrimination by gender.	Workers record	Technical officer	МоА

Table 5 presents the mitigation measures that should be implemented during operation. Since the day-to-day operations activities will be managed by the Project Owner, most of the responsibilities in this mitigation table are designated to the Project Owner, in addition to the third part assessor, Municipality, and MoEnv.

Impact/ Issue	Mitigation Measure	Monitoring Measure	Implementation Responsibility	Supervision Responsibility
	Protect the workers while handling and disposal of volcano tuff and pearlite whenever used as culture media, and have the workers trained prior to handling hazardous material.	Periodic health test every 6 month	Safety/Social Officer	MoA & JCC
	Protect workers during pesticide spraying, provide the personal protective equipment (masks, gloves, goggles, etc.) and enforce their use	Continuous visual check for using of Safety Equipment (SE)	Safety Officer	MoA & JCC
Jecupational Jealth and Safety	Secure health insurance and health care for employees in accordance to Jordan Labor law	In a yearly basis	Safety Officer	MoA & JCC
	Availability of separated sanitary facilities for men and women First aid and training of staff			
	Provide proper signage Meet all hygiene and sanitary needs of workers including provision of separate sanitary facilities for males and females			
	Assign a Health, Safety and Environment Officer			
Disturbance of	Avoid damaging and removal of fauna and crops in adjacent plots	Visual observation	MoA & JCC	MoA & JCC
biodiversity	ensure regularly the storm water drains are functioning properly	Visual observation	MoA & JCC	MoA & JCC

Table 4 : Environmental impacts and the mitigation measures during operation phase

	Immediate reporting of accidents to local civil defense offices and World Bank	-			
	Regular check of electric systems is critical due to the interaction with water				
	Provision of Proper fire extinguishers				
	and getting the staff trained on using				
Appidants	them Monthly check of electric equipment to ensure no	Record the	MoA & JCC /Safety	Mad & ICC	
Accidents	leakages	all accidents	officer	MOA & JCC	
	medical facility				
	All vehicles at the site to be in very good working				
	conditions with reverse horns, signaling lights, etc				
	with seats and are incompliance with public				
	transport general safety regulation				
	Report, investigate and take timely actions on any				
	accidents				
	Protection of surface water, water in the dam, and	Surface, water in			
	ground water from the rejected RO	groundwater			
	watery disposing to a specific places owned by	water sample			
	the municipality.	tests and their			
		irrigation water			
		specifications in			
Protection of	Protect the water bodies from high	Jordan (Table 9).	MoA & JCC / Safety	Municinality /	
water	nutrient content discharges by disposing in	Placing	officer	MOENV	
resources	specific places owned by the municipality.	collection tank			
		for R.O. Reject			
		water			
	Domestic wastewater generated during the operation phase should	Vienal			
	be collected in proper sealed septic	observation			
	tank and disposed to the nearest	And records			
	waste water treatment plant.				
	Collect and dispose various types of solid				
	regularly, organic waste for composting on				
	site, use it in the garden of the facility as a soil	Visual observation	MoA & JCC / Safety officer	Municipality /	
	amendment, and	And records		MOENV	
	damaged polystyrenes boxes,				
	containers, etc. at the municipality landfill.				
	Collect and removal of plastic clips				
~ ··· ·	and the hanging threads used for	Visual observation	MoA & JCC / Safety	Municipality /	
Solid and Hazardous	supporting the plants stem which will be disposed in municipality landfill	And records	officer	MOENV	
Wastes	Separate disposal of hazardous				
	waste materials such as volcano tuff and				
	pearlite,	Visual		MoA & JCC /	
	contaminated empty pesticides	observation	Salety Officer	MOENV.	
	be disposed in hazard materials municipality				
	landfill.				
	Rigorously implement Integrated Pest	Visual observation	S - f - f - f /		
	Control all sources of dust generation to avoid	(daily)	MoA	MoA	
	insects attraction specially Spiders	(
	Ensure pleasant appearance of the				
Changes of Visual character	site by vegetating the	Visual	MoA & JCC		
isuai citai actei					
Shortages in	Install a suitably sized water storage				
Water	tank in case of power outage. The water				
Irrigation	requirement is about 16000 m [°] and the Dam storage is adequate to sustain the facility	Visual	MoA & JCC /	MoA & JCC	
during the	across the entire year, then the need to have	observation	Technical officer		
peak summer	water storage in case of power shortage and				
August and	power to be provided using solar energy				
October and energy	Conserve water use and restrict the use of	Visual	MoA & JCC /	MoA & JCC	
consumption	BIOUNUWATER IN OPERATION ACTIVITIES AND human purposes	observation	Technical officer		

 Table 5 : Social impacts and the mitigation measures during operation phase

Impact/ Issue	Mitigation Measure	Monitoring Measure	Implementation Responsibility	Supervision Responsibility
Employment	Employment of trainees in project activities	Workers record	Technical officer	MoA & JCC
Training and skills	Training of the unemployed in the local communities on the hydroponics system	Trainees record	Technical officer	MoA & JCC
Community development	Increasing awareness in the local community of project planning, environmental issues and workers' rights	Awareness and workshop report	Technical officer	MoA & JCC
Gender consideration	Women's participation in project activities with more than 20% of total permanent workers and not less than 60% of temporary workers. Without any discrimination by gender	Workers record Trainees record	Technical officer	MoA & JCC

Table 6 : Environmental Social impacts and the mitigation measures during closure phase

Impact/ Issue	Mitigation Measure	Monitoring Measure	Implementation Responsibility	Supervision Responsibility
Solid and Hazardous Wastes	clean and dispose hazardous and nonhazardous waste from the site into the designated landfills operated by the local authorities	Visual observation	Technical officer	MoA
Occupational Health and Safety	Protect the workers while handling and disposal of volcano tuff and pearlite whenever used as culture media, having workers trained properly	Periodic health test every 6 month	Safety/Social Officer	MoA & JCC
Employment	The workers working on the project kept their jobs	Workers record	Technical officer	MoA & JCC
Training and skills	Enabling trainees and skilled workers to access funding sources	ACC record	Technical officer	MoA & ACC
Community development	The cooperative institution continues to provide training and monitoring	Trainees record	Technical officer	MoA & JCC
Gender consideration	Women's participation in project activities with more than 20% of total permanent workers and not less than 60% of temporary workers. Without any discrimination by gender	Workers record Trainees record	Technical officer	MoA & JCC
GBV/SEAH	Grievance Mechanism with Referral Pathways: Ensure that the Grievance Mechanism has in place a referral pathway in the event of GBV/SEAH related complaints. All personnel handling the calls must have the relevant training. The complaint will be handled using a survivor centric approach following the guidelines of the World Bank Good Practice Note on addressing Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) in Investment Project Financing ⁸	No. of grievances	Safety/social Officer	MoA & JCC
	Codes of Conduct: ensure all project workers as identified in the Labor Management Procedures (LMP) (see Annex 3) have a signed codes of conduct in place with regular follow up trainings and awareness raising	No of signed codes of conduct		

ix. Grievance Mechanism:

The project includes one Grievance Mechanism (GM) for laborers and workers and one for Project identified stakeholders. The GM which was prepared for the identified project workers

⁸ https://thedocs.worldbank.org/en/doc/741681582580194727-

^{0290022020/}original/ESFGoodPracticeNoteonGBVinMajorCivilWorksv2.pdf

who may be affected as a result of implementing this project is outlined in the Labor Management Procedures (LMP) (refer to Annex 3). A grievance mechanism for 'project affected persons, other interested parties and vulnerable groups has also been put in place by the Ministry of Agriculture based on the mutually agreed grievance mechanism as described in the Stakeholder Engagement Plan (SEP) (refer to Annex 12).

In general, the Grievance Mechanisms has a straightforward and clear procedures for all project workers and stakeholders who may have any concerns or grievances to be able to present them directly to management, by phone, text message through Facebook or text message through WhatsApp, and responses to said issues or grievances can adequately be addressed in a timely manner. All grievances will be documented in a log of complaints and grievance (see annex 6). Any and all issues or grievances must be made by using one of the project grievance mechanism uptake channels. These include writing and depositing in the Grievance Box near the project manager's office on site If a complainant cannot access the grievance box or cannot read or write, they can also lodge a complaint through the other uptake channels like a text message with a description of the Grievance at hand could be sent to the project officer or Alqasr Agricultural Directorate, to either of the following numbers: +96232315121, +962799963184, or it could be sent to the complaints page on the website of (www.moa.gov.jo)or the Facebook link the Ministry of Agriculture https://www.facebook.com/groups/207233332651059/ (see Appendices No. 11).Conclusions and Recommendations:

Conclusions:

According to the previous discussions and the outcomes of this ESIA, it can be concluded that the Project is not expected to cause any significant adverse environmental or social impacts in the project area and surrounding vicinity during construction or operation and impacts identified can be managed with good planning and demonstrated operational procedures. In fact, it is expected that the overall positive impacts will prevail by applying the sustainable development methodology of economic, environmental and social inclusion, for the local community which will ultimately bring significant benefits to the local community by achieving high productivity, minimizing land use and conserve irrigation water. These benefits will be evident to all stakeholders and will strongly encourage other farmers in the area to replicate this pilot project on a larger scale thus spreading the gained scientific knowledge to other farmers countrywide. However, the proper implementation of the ESMP is essential to ensure that any negative impacts are minimized and mitigated adequately and in a timely fashion and that the environmental performance is being monitored throughout the construction, operation phases of the project. Moreover, based on the conclusions of the public consultation meeting, it is important that all hiring of employees be done in a transparent manner through the project owner and offers gender balanced employment.

Recommendations:

The ESIA team based on its experience, public consultations, feedback, and peer expert review is recommending the following procedures, actions and measures to be taken to minimize the environmental and social risks and to safeguard the sustainability of the project. Only the most important recommendations are presented below. The complete and detailed recommendations are included in context of the full ESIA report, chapter 10, paragraph no. 10.2,

- 1. It is strongly recommended to apply a fully automated solution for control of the High-Tech hydroponic operation (High-tech multi-span hydroponics, High-tech Hydroponic single greenhouse) in order to achieve the best results and to establish the project as a training center, and to achieve a better comparison with both low-tech hydroponic and the traditional of greenhouse farming models.
- 2. Provision of an adequate Reverse Osmosis (R.O) system for irrigation in the hydroponic system, to meet the standards for water and nutrient within the irrigation system,
- 3. Commitment to implement occupational health and safety procedures and provide occupational health and safety equipment, first aid kit and tools for project personnel during the stages of its implementation. Carrying out occupational safety training for contractors, work and staff on the project.
- 4. Implementing the labor law regarding working hours, working conditions, and working age. The provision of health facilities in the project for males and females separately.
- 5. Safe disposal of solid, hazardous and non-hazardous waste from the project in its landfills. Safe disposal of reverse wastewater in water treatment plants.
- 6. Ensure the implementation of the IPM plan and the application of legislation for the purchase, storage, transport and use of pesticides. And holding courses for workers in the project on IPM methods during the stages of plant growth.
- 7. Ensure implementation of the plan for the conservation of biological diversity and the prevention of exposure to wild animals in the project area.
- 8. Ensure that grievance mechanisms are applied and that female workers are not subjected to sexual harassment.
- 9. It is recommended to properly address the food-water-energy Nexus by addressing the use of renewable energy sources such as solar PV energy as a primary source of heating and cooling.
- 10. Recommend the implementation of the stakeholders engagement plan for the in the project, whether direct or indirect, to reduce the negative effects such as competition for jobs and work in the project and ensure the transfer of lessons learned and skills acquired from the project to the stakeholders and their participation in the anticipation implementation of the environmental and social impact plan
- 11. Assign a safety/social officer to oversee and supervision the Environmental and Social Mitigation Plans (ESMP); to disseminate knowledge, awareness campaigns, liaise with local farmers and community.

Environmental Social Impact Assessment Report

1. Chapter 1: Introduction

On the basis of specific terms of reference the ESIA team has prepared an environmental and social impact assessment (ESIA) for a Hydroponics Farm near the Ariha village in the Wadi Al Mujib, Karak -Governorate. The project will support the design, establishment, installation and initial operations of a pilot hydroponics unit. In addition, this component will support the provision of technical assistance, training and business management skills required to ensure the pilot is managed as effectively as possible.

The scope of work of the terms of reference (ToR) is to provide the project ESIA team with direction and a standard framework for preparing an ESIA study for a Hydroponics Farm in Al Ariha Area in the Wadi Al Mujib. This study will identify the potential social and environmental impacts and propose mitigation measures which have to be clearly and concisely presented to decision-makers for review.

In order to accomplish the reporting requirements, the ESIA study underlines the social and environmental impacts of the project and deals with the concerns of stakeholders, project proponent, executing companies, including the public sector and NGOs. The outcome of the ESIA covers all phases of the project life-cycle (design and construction, operations and closure) and will be in English.

1.1. General Overview:

According to the World Health Organization, Jordan is considered to have one of the lowest levels of water security in the world. As the population and also the number of refugees increases due to regional instability, the demand on water is also increasing. A recent study prepared by the Ministry of Environment indicated that a reduction in the amount of precipitation of 20%9 is due to the effects of Climate Change. As such, water scarcity is an issue affecting all walks of life and economic sectors in Jordan, and requires advanced, practical and low-cost solutions across a number of sectors to overcome this challenge. One important sector that is highly dependent on potable drinking water is the agricultural sector which is also identified as one of Jordan's 6 Green Economy sectors. Strategic changes are needed in the agricultural sector in particular in order to mitigate the effects of water shortage, which consumes approximately 50% of Jordan's water supply while contributing only 5.5% of the GDP10.

1.2. Project Background:

The highly developed Hydroponic farming (it's a modern system of green house with full automated and control and without soil system) It includes three models: 1) High-tech multi-span hydroponics, 2) High-tech hydroponic single greenhouse and 3) Low-tech hydroponic greenhouse.. is a viable alternative to the currently used conventional open field and greenhouse farming. The proposed Hydroponic project being discussed in this ESIA report is based in the Wadi Al

⁹NATIONAL COMMUNCIATION report TO THE UNFCCC

¹⁰ USAID HYDROPONIC GREEN FARMING INITIATIVE (HGFI)

Mujib, the heartland of Jordan fruit and vegetable production. The project will be implemented on MoA land (up to one and half hectare) (Annex 2, land ownership).

In addition to increasing revenues, a hydroponic technique also provide a platform to increase economic opportunity and provides new competitive skill sets to members of underserved communities. Introducing hydroponic systems to small and medium scale farmers also helps vulnerable groups, such as women and youth, harness and develop vital workforce skills and vocational training on agricultural systems that are more profitable for small and medium scale farmers but it requires a high expertise and high investment. The total area of land owned by the Ministry of Agriculture (MoA) in the area is 976.2 hectares, but only 1.5 hectare (15 dunums) has been allocated to the local project Owner/MOA for the purpose of developing this project. The Ministry of Agriculture (MoA)'s strategy is to partner with non-governmental organizations is to bolster job creation, reduce poverty, and foster women participation in the workforce.

This ESIA study will focus on the environmental and social impacts of Hydroponic farming including a general analysis of the economic costs and alternatives to the three hydroponic systems proposed, and analyzing the baseline condition of the site and implementation arrangements, and highlight the pros and cons as well as the mitigation procedures and IPM schemes needed to minimize the negative impacts.

1.3. Project Description:

The Project aims to test and promote a commercially viable, socially-inclusive, and waterefficient agriculture production systems in Jordan through comparison of three intensively managed covered farming units (see annex 2 Plan Lay-out). The project will: (i) compare the low technology hydroponic production system against high technology hydroponic production system; (ii) identify which of these systems is commercially and environmentally viable; and (iii) identify environmental and social challenges and propose mitigation measures; (iii) draw and disseminate lessons learned from the project and identify avenues for economically feasible investment and the future replication and scaling up possibility. The study seeks to inform future (public and/or private) investors in the Wadi Al Mujib and beyond.

The aim of the project development is to improve the access of vulnerable groups and the unemployed to sustainable employment opportunities and income generation in Jordan. This will be achieved through (1) capacity building and improving the skills of the unemployed in the field of modern agricultural technology (2) enhancing the ability to implement modern agricultural technology projects (3) enhancing agricultural entrepreneurship and enabling the unemployed and vulnerable to manage their own projects. The project will be implemented through the three component, component (1) Supply, Installation, and Operations, this component will include the design, acquisition, installation and operations associating with pilot hydroponic technology that is appropriate to the climatic and social conditions of the target area. Component (2) business Model Development, this component will focus on creation and management of an innovation platform that will focus on the development of hydroponics business model (including access to finance, registration, access to services, etc.). Component (3) dissemination and training, key areas for this component include the design, organization and implementation of a campaign to generate awareness of production systems and to train targeted communities in the technology and/or business models. The campaign will specifically focus on the sharing the lessons on the social, economic and environmental benefits of the production systems.

This assessment covers various production systems i.e. low - tech Hydroponic and high-tech Hydroponic systems that are suited to produce cherry tomatoes, and cucumbers, strawberries,

lettuce, Red Gori rose. These are considered high value vegetables and will bring in higher values in the local and regional markets. The aim is to maximize the high-end domestic market opportunities in Jordan and the wider region.

1.4. Project Justification:

This project is important for the private sector which is keen in exploring innovative, reasonable economic solutions and to identify a more sustainable and nutritious food production system. The food industry is a key stakeholder and a major catalyst for change. Moreover, Jordan's youth unemployment increased from an already high starting point to reach 34 percent in 2016. One of the most important factors hindering the inclusion of young people in society is due to limited access to employment, particularly decent jobs. When they are employed, they are more likely to work in precarious jobs that provide neither social protection nor opportunities for training and career progression. In contrast, Hydroponics could offer youth a safe and sustainable income that is in accordance with the national labor law, especially in this part of the Jordan Valley were Jobs are quite limited and farmers are facing financial losses due to many driving factors for decades. Among these challenges are the shortages in water quantity and quality, taking into consideration that Jordan's climate is almost entirely semi-arid, or arid, receiving an annual rainfall of less than 200 mm per annum on 91.4% of the total land area. The water crisis has been aggravated by a local population increase and the acceptance of record numbers of refugees fleeing political unrest, wars and social strife in neighboring countries for the last two decades alone.

As a result, Jordan's labor market has been severely impacted and is facing significant vulnerabilities. The unemployment rate in Jordan remained elevated from 12.5% in 2010 to 18.5% in the Q4-2017, while the male workforce participation rate in Jordan is roughly 87%, the rate for women participation is only 22%. Pay inequality is one major factor that leads Jordanian women to drop out of the labor force¹¹. Labor Force Statistics as indicated by the Director of Algasr Agriculture Directorate, is from the current population, but a higher percentage of the laborers are imported mainly from Egypt. Both whether local or imported consist of male and female laborers. Among the female laborers the imported female labor force have a higher percentage. It also is important to underscore Jordan's dire water situation, as its water availability per capita is less than 90 m3/ year of annual renewable water resources, significantly below the global average of 500 m3/ capita/year. Its total national water supply equated to 147 m3 /capita/year before the refugee crisis in 2012, is today less than 97 m3/capita12. Climate change is expected to exacerbate challenges facing Jordan's natural resource endowment in years to come. With annual precipitation decreasing at a rate of 1.2mm per year at an average rate of 20% according to Jordan's 3rd National Communication Report submitted to the UNFCC and a temperature increasing by 0.03 degrees per year, Jordan will most likely experience periods of severe droughts with longer periods of dry days, which will directly affect the agriculture sector and place the country in a very precarious situation to deal with serious and complex environmental problems.

¹¹ 2000 - 2018 | Quarterly | % | Department of Statistics

¹² Water shortage in Jordan –Sustainable solutions

Jordan's agriculture is currently the largest user of water in the Kingdom. While farmers irrigate about of 46% of the total agricultural land and irrigation water requirements represented around 50% of total national water supply. Jordan's system of subsidies affects the use of irrigation water, which necessitates strict rationing to allocate the remaining water resources. The Water Authority allocates irrigation water 3 days per week (with shortages reported during the hot summer months from August to October) for farmers through a public water network which is pumped to the individual farms and stored in cisterns prepared by the farmers either in galvanized metal tanks or lined earth ponds / lagoons, all municipal water extraction is metered by the JVA.

Therefore, Jordan's agricultural sector is well positioned to maximize the economic, social and environment benefits of advanced agriculture technologies. Hydroponics, allows farmers to grow vegetables and fruit crops (tomatoes, cucumbers, strawberries, lettuce) faster than traditional field-based agriculture. Moreover, Hydroponic farming presents a viable economic and social solution for Jordan. Approximately, 20 to 25 % of Jordan's active populations are involved in the agriculture and food sectors. While the primary agriculture share of the national GDP is relatively small (only the accounts for 5.5 percent of Gross Domestic Product (GDP) 16-20% GDP with indirect contributions (the food sector). One quarter of the total agricultural exports are vegetables and fruits, which are mainly exported to other countries in the MENA region. In contrast, other crops (excluding vegetables and fruits) constitute the highest share of agricultural imports, making up 46 percent of all agricultural products imported. Hydroponic farming provides a viable solution for farmers to move agricultural products making high value crops, thereby increasing labor productivity and improving socio-economic conditions while reducing the agriculture's demand on water resources and increasing the land available for farming.

The objective of this project is to give specific attention to the inclusion of alternative waterefficient practices and to provide skills that women and youth can work with. For example, the business model for the project may include a range of incentive schemes designed specifically for women (example of the schemes may include; skilled/non-skilled training, flexible working hours, paid incentives linked to production and performances, in addition to the standard wages).

Jordan is located in one of the highest levels of sunshine days in the world, where the sun shines approximately 330 days a year13. Consequently a possibility of utilizing solar energy as a substitute to conventional fossil fuel as a source of electrical supply is highly recommended. These advanced farming systems are not dependent on large volumes of water or land availability. Hydroponic farming systems also provide decent job opportunities for skilled and semi-skilled workers for both genders. The farming systems can be implemented in both rural and urban areas. Farms can be established closer to markets (providing faster access to fresh food) and allows farmers to produce approximately 300 days a year.

1.5. Objectives and Structure of the ESIA:

The ESIA will provide the baseline environmental and socioeconomic context for the project and recommend appropriate measures to avoid, reduce, and mitigate environmental and social risks. The ESIA study will also present a Stakeholder Engagement Plan (SEP) for the implementation/operational phase of the project in accordance with the Environmental and Social Framework ESS10 "Stakeholder Engagement and Information Disclosure". The ESIA study will also include Labor Management Procedures (LMP) following the ESS2 "Labor and Working Conditions" which will set out the way in which the project workers will be managed during the implementation phase in accordance with the requirements of the related national laws and the ESS2 guidelines. The ESIA also address pest management and potential disease occurrence following the ESS and includes an Integrated Pest Management Plan. The ESIA will assess and determine relevant national and international, environmental and social legal and administrative requirements applicable to the project. This includes: a) the Legal Framework i.e. applicable national laws, legislations and policies, and international guidelines and practices including applicable World Bank Environmental and Social Standards and guidelines on Occupational Health and Safety (OHS), child labor prevention and nondiscrimination and equal opportunity, public consultations, grievance redress mechanism, gender-based violence (GBV), sexual exploitation and abuse (SEA); and other relevant aspects, conventions and treaties; and b) The Institutional Framework including arrangements and responsibilities for the project coordination, implementation and monitoring.

The main objectives of the ESIA report are summarized as follows:

- Compliance with the Jordan Environmental law and EIA regulation.
- Compliance with applicable World Bank Environmental and Social Standards and guidelines.
- Ensures proper environmental and social management of the proposed Project.

1.6. The ESIA Key Stakeholders:

For Preparation of this ESIA, targeted groups such as community members, local NGOs, public officials and stakeholders were recommended, identified and contacted by MoA including:

- Farm owner(s)
- Municipal and other government officials
- Business owners
- community members
- Stakeholder groups, i.e. women's groups
- Concerned individuals
- Regulatory agencies
- Institutional representatives
- NGO representatives

The public consultation meeting is a formal presentation covering all phases of project (i.e. construction, operation). The community consultation meeting provides participants the opportunity to present their comments and ask questions and to hear feedback from other participants and to inform project owners of any concerns during early stages of project, as well as during project implementation.

The ESIA team previously carried out several site visits to the proposed location in preparation of the project ESIA. On several occasions the ESIA team also met with local

official representatives and prospective stakeholders and provided them with a general overview of the planned pilot Hydroponic Farm in the designated location.

In preparation for the Public consultation Meeting in April 2021, the MoA/ project owner called up stakeholders from the Ariha village, about 80 km south of Amman and surrounding areas with an invitation to attend the public consultation meeting. Invitees included the same stakeholders and farm owners and officials previously encountered by the ESIA team and other stakeholders from surrounding villages.

Individual stakeholder meeting attendees:

- Government agencies responsible for authorizing, implementing or monitoring project activities
- Businesses potentially affected by construction or operation
- Community members
- NGO representatives including youth and women NGOs

Arrangements for the Public Consultation Meeting were discussed and agreed upon with the representative of the Al Qasr Agriculture Directorate and covered the following points:

- Date, location and time of meeting
- Proposed project title and short description
- Name of the project owner and primary contact persons, including address and telephone numbers
- Purpose of community consultation meeting: to inform the public and stakeholders, obtain input and answer questions.

The main actor or entity identified as responsible for implementing the ESIA are:

- The client/project owner i.e. the MoA
- The Local execution partner NGO/Society.

1.7. Study Methodology:

The ESIA team started their work by reviewing the TOR provided by the project owner, the MoA, Informal meetings and consultations were conducted during the early stage to set up the scope of study. The ESIA team commenced by identifying all the project activities. The ESIA team then began to collect information related to the technologies on hydroponics farming and technologies used to operate such farms through desk reviews including the analysis of processes and incorporated other related studies carried out on similar projects in the Jordan.

Thus, in order to complete the development of the environmental and social components and baseline studies, multiple visits to the project area and formal meetings were held with relevant stakeholders, i.e. farm owners, managers, laborers and ESIA team, as a step towards conducting the scoping process and public consultation to assess the environmental and social impact of the project. The Public Consultation meeting took place on Wednesday, 21th and Thursday, 22th of April, 2021 at premises of The Professional Associations Complex, located in Al Qasr City, South of Jordan.

Taking into account national laws and regulations, World Bank and MoA requirements as well as the baseline studies and data collected including the outcomes of the consultation meeting, the team identified the main environmental and social impacts and assessed their impacts throughout the project life cycle. All mitigation measures were set forth accordingly.

Furthermore, mitigation and the management method were developed to be included in the ESIA final report.

1.8. Limitations and Constraints

There were some limitations and Constraints facing the ESIA team while carrying out this project, which can be summarized as follow:

The project TOR called for the presentation of cost estimates on various technology options which is generally applicable for projects with existing feasibility studies and not commonly requested in ESIA reports according to the Jordanian Environmental Law and will be unreasonable in this project due to the small scale of the project. Thus no detailed economic cost estimates will be presented, and only a general cost estimates is provided in the table no. (5) below which shows a cost comparison between conventional greenhouse and hydroponics, assuming that the land area varies slightly in each alternative, while land cost, pest control, fertilizers / nutrients and water costs differ fundamentally between the two systems.

	Fixed Cost	Conventional Greenhouse of 360 m ² (40 m X9 m)	High-tech multi-span	High-tech hydroponic	Low-tech hydroponic
No.			hydroponics Unit of 360	single greenhouse Unit	greenhouse Unit of 360
			m ²	of 360 m ²	m ²
	Construction trave cultura	6 9 ID/ m2	34 JD/ m2	22.8 JD/m ²	7.8 JD/ m2
1	media and climate control	(2480 ID)	(119000 JD)	(8000 JD)	(2750 JD)
	media and crimate control	(2400 JD)			
2	Reverse Osmoses Unit (RO)	none	5160 ID	7250 JD	3500 ID
2 C	Capacity of 10 m3/day		5100 5D		2200 JD
3	Generator	none	2000 JD	2000 JD	2000 JD
4	Running Cost (for Tomato cop)	1627	1044	1057	1332
5	Electricity	negligible	60 JD/Month	60 JD/Month	30 JD/Month
6	Diesel	None	20 JD/Month	20 JD/Month	10 JD/Month
7	Water consumption m3	250	135	135	170
8	Production \ton	8	16.2	15	12

 Table 7: Comparison of costs between conventional greenhouse and high-tech hydroponics

2. Chapter 2: Institutional and Legal Framework

This project is developed by MOA and will be managed through the establishment of a cooperative association of direct beneficiaries, which is designated by MoA as a competent cooperative association operated under the umbrella of Jordan Cooperative Foundation, to implement component business model. Therefore, during the first phase, the project will be directly supervised by the Ministry of Agriculture of Jordan and the cooperative cooperation on the work of the project until the gaining of the experience and skills sufficient to manage the project which is expected to take one year. The Ministry of Agriculture will continue to provide the extension services required by the project in subsequent phases, and the Jordan Cooperative Cooperation will monitor the activities of the association in accordance with the cooperation law and statute of the association.

For this purpose this section gives a brief description of each of the institutions and entities relevant to the Project.

2.1. Legal Framework (including social and labor laws such as child labor prevention)

This ESIA report was done in accordance with the Jordanian Environmental Impact Assessment Regulation No. 37 for the year 2005. This section aims to identify the applicable regulatory framework in Jordan as relevant to the project. The MoA team prepared detailed

regulatory framework list which includes relevant laws, regulations and standards related to environmental, social, health and safety, labor and planning issues. (Refer to Annex no. (7)).

Legal requirements have been reviewed and applicable laws and regulations have been identified and summarized. Below is a list of some national legal requirements that has been identified., which are applicable for the project of

Laws:

- Environment Protection Law No. (52) for the year 2006
- Water Authority Law No. 18 for the year 1988
- Ministry of Agriculture Law No. 13 for the year 2015
- Public Health Law No. 47 for the year 2008
- Labor Law No. (8) for the year 1996 Archaeology Law (No. 21 for 1988)
- Planning of Towns and Villages and Buildings Law (No. 79 for 1966)
- General Electricity Law (No. 64 for 2003)
- Renewable Energy and Energy Conservation Law (No. 13 for 2012)
- Ministry of Social Development applicable laws are;
 - o Ministry of Social Development Affairs and Labor Law No. (14) of (1956) and amendments
 - o Societies Law No. (51/2008) and amendments
 - o Minors Law No. (32) of 2014
 - o Protection of Family in cases of Violence Law Nr. (6) of 2008

Regulations and By-laws:

- ESIA Regulation (No. 37 for 2005)
- Regulation for the Prevention of Health Nuisances (No. 72 for 2009)
- Regulation for the Protection and Safety of Workers from Machineries and Workplaces (No. 43 for 1998)
- Regulation of Preventive and Therapeutic Medical Care for the Workers in Establishments (No. 42 for 1998)
- Soil Protection Bylaw (No. 25 for 2005) Regulation of Land Use for 2007
- Environmental Monitoring and Inspection Regulation (No. 65 for 2009)
- Regulation for Protecting the Environment from Pollution in Emergency Situation (No. 26 for 2005)
- Air Quality Protection Regulation (No. 28 for 2005)
- Solid Waste Management Bylaw (No. 27 for 2005)
- Regulation for the Management of Hazardous and Dangerous Materials (No. 24 for 2005)
- Water Protection Regulation of 2004
- Underground Water Regulation (No. 85 of 2002)
- Sewerage System Regulation (No. 66 for1994)
- Regulation for the Formation of Committees and Moderators of Occupational Safety and Health (No 7 for 1998)/Arabic

Instructions:

- Instructions for the Protection of Workers and Institutions from Workplace Risks and Hazards for 1998
- Instructions for Preliminary Medical Testing of Workers for 1998 Instructions for Regular Medical Testing of Workers for 1998

- Instructions for Wastewater and Treated Wastewater Use in Agriculture Instruction for the Management and Handling of Consumed Oil for 2003 Instruction for Management and Handling of Hazardous Waste for 2003
- Instruction for Regulating the Transport, Storage, Manufacture, Trade and Use of Compost for 2003
- Instructions for Noise Prevention for 2003

Standards:

- Ambient Air Quality Standards (No. 1140/2006) Water Quality Standards (JWQS) (2008)
- JISM Jordanian Standards for Treated Sludge and Sludge Disposal (JS 1145/2006) Standards for the prevention and elimination of noise (2003)
- Standard for the Maximum Allowable Limits of Air Pollutants Emitted from Stationary Sources (JS 1189/1998).

The table (6) below displays the allowable maximum limit of the equivalent acoustical volume level (dB A) per area Classification, Article 6 of Jordanian Instructions for Noise Prevention.

	The allowable maximum limit of the equivalent volume level (dB A)		
Classification of the Area	Day	Night	
Residential areas in cities	60	50	
Residential areas in the suburbs	55	45	
Residential areas in villages	50	40	
Residential areas that have some workshops, simple crafts or business and commercial and administrative areas and center of the city	65	55	
Industrial areas (heavy industries)	75	65	
Education, worship and treatment places and hospitals	45	35	

Table 8 : Maximum limits of the equivalent volume level (dB A)

Ambient Air Quality Standards (JS 1140 for 2006)

These standards provide definitions of ambient air pollutants in addition to the maximum allowable concentration for each of those pollutants in the atmosphere, in addition to approved methods of measurement

The table (7), shows the allowable maximum limits for some of the pollutants listed in Jordanian Ambient Air Quality Standards JS 1140/2006. The project should comply with these limits during construction. During the operation of the Project, the pollutants generated should also comply with limits detailed hereunder.

Pollutant	Averaging Period	Maximum Limit	Number of Times Limit is Allowed to be Exceeded
	1 hour	0.3 ppm*	3 times in any 12-month period
Sulphur Dioxide (SO2)	24 hours	0.14 ppm	Once a year
	Annual	0.04 ppm	-
Carbon Monorida	1 hour	26 ppm	3 times in any 12-month period
(CO)	8 hours	9 ppm	3 times in any 12-month period
	1 hour	0.21 ppm	3 times in any 12-month period
Nitrogen Dioxide (NO2)	24 hours	0.08 ppm	3 times in any 12-month period
	Annual	0.05 ppm	-
Orana (O3)	1 hour	0.12 ppm	-
Ozone (OS)	8 hours	0.080 ppm	-
	24 hours	120 $\mu g/m^3 **$	3 times in any 12-month period
Particulate Matter 10 (PM10)	Annual	70 µg/m ³	-
Particulate Matter 2.5	24 hours	65 μg/m ³	3 times in any 12-month period

 Table 9 : Maximum allowable limits set by JS 1140/2006

(PM2.5)	Annual	$15 \mu g/m^3$	-
	24 hours	260 μg/m ³	3 times in any 12-month period
Total Suspended Particulates (TSP)	Annual	75 μg/m ³ (geometric average)	-

*ppm: parts per million ** $\mu g/m^3$: microgram per cubic meter

Air Emissions from Stationary Sources (JS 1189 for 2006)

These standards provide definitions of stationary sources of air pollutants in addition to the maximum allowable concentration for each of those pollutants in the atmosphere. They also define approved methods of measurement. Furthermore, MoEnv has the legal mandate to oblige entities with an expected risk of exceeding permissible air emission levels to install the required equipment to make air emissions fall within standards. The table (7) shows the allowable maximum limits for some of the pollutants listed in JS 1189/2006.

Pollutant	Maximum Limit mg/ m3
Sulphur Dioxide (SO2):	
Combustion of petroleum products	6500
Non-ferrous metal industries	3000
Sulfuric acid industries	1500
Sulfur trioxide (SO3), Sulphur Dioxide particulates	150
Nitrogen Dioxide (NO2):	
Combustion processes under 1200o C	200
Combustion processes above 1200o C	1500
Non–combustion Industrial processes	300
Volatile organic compounds	20
Lead (Pb)	0.5
Lead compounds	20
Cadmium (Cd)	0.05
Cadmium compounds	10
Chlorine (Cl2)	30
Hydrogen Chloride (HCl)	10
Hydrogen Fluoride (HF)	15
Copper (Cu)	1
Nickel (Ni)	2
Fluorine (F2)	5
Ammonia	50
Dioxin	1x 10-6

2.2. Institutional Framework:

The ESIA team prepared a comprehensive list of relevant institutions with detailed information related to the project activities (Refer to annex no. (4)), which were identified and are summarized in the list below:

- Ministry of Environment (MoEnv)
- Ministry of Water and Irrigation (MWI)
- The Water Authority of Jordan (WAJ) Jordan Valley Authority (JVA)
- Ministry of Social Development Ministry of Health (MOH)
- Ministry of Agriculture (MOA)
- Ministry of Municipal Affairs (MOMA)
- Jordan Electricity Company (NEPCO)
- Ministry of Labor (MOL)
- Ministry Of Industry and Trade and Supply (MIT)

- Jordan Cooperative corporation (JCC)
- The General Directorate of Jordan Civil Defense
- Jordan Institute for Standard and Metrology (JISM)
- The Royal Society for the Conservation of Nature (RSCN)

2.3. International Guiding Principles, Relevant Conventions and Treaties: UN Framework Convention on Climate Change (UNFCCC)

In 1992 the framework set non-binding limits on greenhouse gas emissions for individual countries and contained no enforcement mechanisms. In 2015 the Paris Agreement was adopted, governing emission reductions from 2020 on through commitments of countries in Nationally Determined Contributions, lowering the target to 1.5 °C. Jordan adopted The Paris Agreement and entered into force in November 2016.

World Bank Environmental and Social Framework will be applied, in particular ESS1, ESS2, ESS3, ESS4, ESS10 and the WB General Environment, Health and Safety (EHS) Guideline which include standards on pollution management, child labor prevention, forced labor, non-discrimination and equal opportunity, public consultations, grievance redress mechanism, gender-based violence (GBV), sexual exploitation and abuse (SEA), gender based aspects, code of conduct, Labor Management Procedures (LMP).

Jordan Labor Law of 1996, regards to term and conditions of work, and how national legislation applies to different categories of workers identified in Section 1. The overview focuses on legislation which relates to the items set out in ESS2, paragraph 11 (i.e. wages, deductions and benefits).

National labor legislation; Occupational Health and safety, regarding the right of the laborer not to work more than six hours per day. Furthermore, Article 73 of this law bans the employment of individuals less than 16 years of age. The Law also outlines that the Project shall comply with article 78 related to occupational health and safety, and provides essential precautions and arrangements to protect the workers from the risk of hazards and supply Personal Protective Equipment

Social Security Law (No. 1 for 2014) regarding the right to obtain social security insurance for workers subject to the Labor Law.

3. Chapter 3: Environmental and Social Baseline Data

3.1. Description of Project Area(See Appendix 1 land Map)

The project is located in the Wadi Al Mujib within the administrative authority of the Ariha village, it's part of the Al Qasr District, Karak Governorate. The nearest a country houses on farms in Wadi Mujib, which is located to the east of the site about one km, while Ariha village is located about 4.6 km to the west and Theban City \Madaba Governorate is located about 7 km to the north west which is considered outside the project influence area and Al Qasr City is located about 16.5 km to the south west of the project site, the plot land is surrounded by agricultural farms.

The site is about 80 km south West of the capital Amman, the drive from Amman to the farm location in al Mujib Dam will take about one hour depending on the weather and traffic conditions. The elevation at the farm location is approximately 400 meters above

sea level. The upper Jordan valley area is by far one of the most fertile regions in Jordan due to the rich soil, high rate of rainfall and suitable weather yearlong.

The site is located about 100 m to the south of the Karak – Madaba street and is linked via a well paved service farm road.

The Mujib Dam adjacent to the planned Hydroponic farm location on the western side boundary of the plot. To the East of the Hydroponics farm about 1,200 dunums of vegetables are planted in the project area, mainly tomatoes and zucchini, and about 1,000 dunums of fruit trees, mostly olive trees. For irrigation, these crops depend on rainwater collected in the winter in the Mujib dam, where the storage capacity of the Mujib dam is estimated at about 30 million cubic meters, and the water quality in the Mujib dam is good and part of it is used as a source of domestic water. The project is expected to affect the dissemination of irrigation water-saving agricultural techniques in the project area. The project will positively and indirectly affect about 1,758 families, including 4,520 males and 4,380 females. All adjacent lots are privately owned farms consisting of citruses plantations, traditional open field farming of Vegetable and fruit.

The Mujib Dam is a storage water system carrying about 30 millions of cubic meters of surface water from the Wadi Mujib on the Central Badia, through the east Jordan until the Dead Sea, this dam is the main source of water of the project.

The project will be implemented on Government land (up to one and half hectare in the first Phase, with a provision of future expansion up to 4 hectares) The one and half hectare of farm land provided by the Ministry of Agriculture requires only minor preparation in order to get it ready to erect the two pilot hydroponics units including the utility buildings, Cooler Container and treatment facility, control room (e.g. computer-based humidity control systems, heat control systems and processing/packing equipment) and the required loading area and living quarters. Documentation photos are presented in Annex (2).



Figure 1: Map of Project Area
3.2. Physical and Biological Environment (Geological, Hydrological, Hydrogeological, Climatic, Flora, Fauna, etc.)

i. Physical Environment:

Geology

The Geological, and Hydrogeological status of the general project location is characterized by the following thematic Map, figure no. (4), source Jordan Environmental Restoration Programme, Ministry of Environment. Geologically, the farm is located directly on the Great Rift Valley fault line which extends from Ethiopia in the south 4000 Km to Turkey in the north and is considered a major migratory path for birds between Europe and Africa. The project area falls completely within the so called Irano-Turanian climatic vegetation Zone.



Figure 2: Classification of Land Regions

Temperature

The average summer temperature from July to September is between 40 and 45 degrees Celsius and in the winter months from November to March the average temperature ranges between 1 and 9 degrees Celsius and rainfall is frequent during these months.

Rainfall

The rainfall in the location is characterized by the following thematic Map, figure no. (5), source Jordan Environmental Restoration Programme, Ministry of Environment. The average rain fall is about 350-400 mm.





ii. Water Resources in Jordan

The water shortage in Jordan is extremely severe due to the nature of the area and due the transboundary water resources, which are shared with neighboring countries that face similar water shortage problems. More than 90% of Jordan land receives less than 100 mm per annum of rainfall. As for the main water sources in the project area, the Mujib Dam is the main source of irrigation water with an estimated capacity of about 30 million m3, in addition to the water springs located along the valley course to the west of the project area. There are also a number of artesian wells used by the Ministry of Water and Irrigation, and near the project there is an artesian well owned by the Ministry of Agriculture and used to irrigate forest afforestation areas near the project, as well as take mitigating measures and monitor the quality of irrigation water to prevent pollution so that it remains within the standard specifications of irrigation water in Jordan, which are shown in the following table.

Standards	Unit	allowed limit	Standards	Unit	allo wed limit
рН		6 - 9	NH4-N	milligrams/liters	< 16
EC			T-N	milligrams/liters	< 50
- Salt sensitive	decimens/meter	< 1.7	SO ₄	milligrams/liters	< 960
- Salt medium tolerant	decimens/meter	1.7 - 3	В		
- Salt tolerant	decimens/meter	3 - 7.5	- Boron sensitive	milligrams/liters	0 - 0.7
- Salt highly tolerant	decimens/meter	> 7.5	- Boron moderately sensitive	milligrams/liters	0.7 - 1.5
TSS	milligrams/liters	< 50	- Boron Moderately tolerant	milligrams/liters	1.5 - 3
BOD ₅	milligrams/liters	< 60	- Boron tolerant	milligrams/liters	3 - 6
COD	milligrams/liters	< 120	Fe	milligrams/liters	< 1
Ca	milligrams/liters	< 400	Mn	milligrams/liters	< 2
Mg	milligrams/liters	< 150	Zn	milligrams/liters	< 2
SAR	milligrams/liters	6 - 9	Cu	milligrams/liters	< 1
К	milligrams/liters	< 80	E. Coli	The most probable number / 100 mm	1000/100 ml
НСО3	milligrams/liters	< 520	Intestinal nematodes	egg/liter	≤ 1
NO3-N	milligrams/liters	< 16			

Table 11 :	irrigation	water Qualit	v Standards	in Jordan
TUDIC II.	inigation	mater Quant	y Stanuarus	in our uan

The table below, shows the share of water consumptions in various economic sectors with agriculture sector using the highest amount followed by domestic sector.

Table 12 : Wate	r uses and resource	es in 2017 (MCM)
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Uses/Resources (MCM)	Surface Water	Ground water	Treated Water	Total
Domestic	131.3	338.4	0	400.7
Agriculture	154.4	253.2	144.2	551.8
Industry	2.4	27.2	2.5	32.1
Total	288.1	618.8	146.7	1053.6



Figure 4: Percentage of Water Consumption by Main Economic Sectors

iii. Air Quality and Ambient Noise

There are no economic activities in or near the project area that make noise or affect air quality. In addition, during the construction and operation stages, the project does not produce any sources of air pollution or sources of noise. Therefore, the ESIA study did not address these aspects.

iv. Biological Environment

The project is located near the Mujib Dam, which is part of Wadi Al- Mujib, seasonal rain water flows in winter, from the Central Badia region to Dead Sea, through the course of the valley. There are many springs on which agriculture is based, in the Wadi Al- Mujib.

The project will not have a negative impact on the biodiversity in the project area. However, it requires that the hunting of wild birds and animals, or the cutting of wild plants in the project area, be prohibited, whether from the project workers or people who visit the project from stakeholders.

To improve the biological diversity of the project area, the Ministry of Agriculture is currently planting about 20 hectares of forest trees to increase the area of vegetation.

The project area including the influence area is not part of a nature reserve. But it is rich in biodiversity, where there are many wild plants such as orchids, Tarfa trees, acacia, oleander

and palm trees. 63 plant families have been registered, including about 400 species of plants within the valley.14

v. Mammals, Birds and Reptiles

In the project site, there are no wild animals, but in Wadi Mujib (which is a very wide area) many wild animals also live in Wadi Al Mujib, such as the mountain goats and (the body)?, which is a type of goat, mountain deer, wolf, hyrax, and striped hyena, and wild cats such as the lynx, which is rare in Jordan, and others.

There are also many types of birds in Wadi Al Mujib, that includes over 150 local and migratory birds, including the chinar, the siren, the crowned lark, the melancholy, the sad lark, the bulbul and the guiltless crow, such as the Egyptian vulture, the badia eagle, the lynx and the Punnelli eagle, and there is the Pink Sinaitic bird, which was considered a national bird15.

3.3. Social and Economic Environment (health, poverty, employment, access to services, demographics, gender, disadvantaged or vulnerable groups, conflict, etc.)

The Socio-Economic Conditions:

It is important to note that due to political reasons the Government is reluctant to release any statistical data related to levels of unemployment, family income, poverty levels in the Kingdom. Therefore, our study relied on the latest data released by the Department of Statistics (DOS). Karak Governorate is located to the south of the Kingdom, and the borders with Palestine from the West. The southern Ghour from the west, Maan Governorate from the east, and Tafileh Governorate from the south, Amman and Madaba Governorate from the north. The proposed land site is currently designated by the government for Ministry of Agriculture to be used as agricultural rehabilitation and research center.

According to DOS (2017) statistics, table no. (11), the total population of the governorate of Karak reached 358 thousand, while in 2010 the population was estimated 222.5 thousand people which accounts for 3.3% of Jordan's overall population.

The total area of Karak Governorate is estimated at about 3495 km2 which accounts for 3.9% of Jordan's total geographic area. Due to its unique geographic location Karak is positioned at the vicinity of the borders with Palestinian territories, Karak is also considered one of the most important trading centers in south Jordan, and is considered a major ground transportation hub between Aqaba and Amman to the north.

The official statistics about unemployment in Karak shows that the unemployment rate in Karak Governorate reached 18.4% in year 2020 compared to Jordan's 23.9% unemployment rate.

Latest official statistics on poverty indicators published by the Department of Statistics, based on the Household Income and Expenditure Survey in 2010, show that the poverty ratio in

¹⁴ https://ar.wikipedia.org/wiki/%D8%B3%D8%AF_%D9%88%D8%A7%D9%8A_%D8%A7%D9%84%D9%85%D9%88%D8%AC%D8%A8.

¹⁵ https://ar.wikipedia.org/wiki/%D8%B3%D8%AF_%D9%88%D8%A7%D8%AF%D9%8A_%D8%A7%D9%84%D9%85%D9%88%D8%AC%D8%A8.

Karak has reached 13.4% which is slightly higher than the Kingdom's average of 14.4%. The government is expected soon to release new poverty indicators prepared 2017, the poverty rate is expected to increase dramatically.

The table no. (14) Shows the main demographic indicators of Karak Governorate, and Districts; Population, Dependency Rate Area (Km2) for the Year 2016, by DOS.

Districts	Population	Dependency Rate	Area km	Population Density	Less than 15 years old	15-64 years old	65+ years old
Karak Governorate (Total)	358400	65.3	3495	100.2	35.0	61.5	3.6
Jordan Total (Kingdom Level)	10806000	61.4	88794	121	34.3	62.0	3.7

Table 13 : Main demographic indicators of Karak Governorate

Table 14 : Population growth rates, natural increase and net migration in Jordan, year 2012, byDOS

Period	Population Growth Rate	Natural Increase Rate	Net Migration %
1952-1961	4.8%	3.2%	1.6%
1961-1979	4.8%	3.6%	1.6%
1979-1994	4.4%	3.6%	0.8%
1994-1999	3.3%	2.7%	0.6%
1999-2004	2.6%	2.2%	0.4%

Table 15 : Poverty rate per Governorate, year 2010

Governorate	Poverty Rate %
Karak	13.4
Jordan	14.4

The figure no. (5) below shows the latest Jordan's population statistics, year 2018 and distribution among governorates. Karak population amount 316629 thousand, and also shows the percentage of Jordanian covered by health insurance per governorates, 93% of population in Karak are covered by health insurance.



Figure 5: Statistics of Jordan's Population, year 2018 and Distribution by Governorates

The populations within the adjacent communities in the District & Sub District are described in the Table below no. (17), shows Population, households and gender in Al Qasr communities.

	~			v	,	1		1	
District	Sub District	locality	عدد الاسر Households	المجموع Total	اناٹ Female	ذکور Male	التجمع locality	القضياء Sub	اللواء District
								District	
		Al Qasr	1247	6935	3229	3706	القصىر		
		Al Riba	1620	8160	3806	4354	الربة		
		Al Samakia	378	1553	763	790	السماكية		
		Al Yarut	526	2407	1250	1157	الياروت		
		Damna	572	2961	1450	1511	دمنة	القصر	
	A Qasr	Hamuwd	81	321	166	155	حمود		القصر
		Sayhan	155	741	395	346	سيحان		
		Al Ruwda	233	1116	261	555	الروضة		
		Al Rashayida	35	196	90	106	الرشايدة		
A Qasr		Total Al Qasr Sub District 5027	5027	24390	11710	12680	مجموع قضاء القصر		
		Mughir	359	1723	816	907	مغير		
		Riha	154	839	420	419	ريحا		
		Masear	137	709	375	334	مسعر		
		Abu Trabuh	75	331	155	176	ابوترابه		
	Al Mujib	Al Jidaea	875	4376	2189	2187	الجدعا		
		Al Mujib	15	74	21	53	الموجب		
		Al Alih	143	848	404	444	العاليه		
		Total Mujib Sub District	1758	8900	7380	4520	مجموع قضاء الموجب		
Total liwa' alqasr		6785	33290	19090	17200	ء القصر	مجموع لوا.		
Total K	arak Governora	ite	71866	358400	171200	187200	ظة الكرك	مجموع محاف	

Table 16 : Demographic indicators within the study area, DOS 2015

The unemployment indicators by governorate shown in the Table below no. (18), by DOS 2015. The number of unemployed persons in the Karak Governorate is about 12372 persons, and the unemployment among males is almost double that of females, While the level at Jordan, is 70 percent males and 30 percent females.

Governorate	Male No.	Female No.	Total No.
العاصمة Amman	91,062	32,574	123,637
البلقاء Balqa	13,839	5,578	19,418
الزرقاء Zarqa	37,099	9,772	46,871
مادبا Madaba	7,198	2,350	9,549
اربد Irbid	34,185	22,715	56,900
المفرق Mafraq	9,904	5,280	15,184
جرش Jerash	5,460	3,677	9,136
عجلون Ajloun	4,765	3,755	8,520
الكرك Kerak	8,298	4,074	12,372
الطفيلة Tafileh	3,222	3,430	6,652
معان Maan	5,704	2,393	8,097
العقبة Aqaba	4,975	1,674	6,649
Overall total	225,711	97,272	322,983

Table 17: Number of Unemployment in Various Governorates, DOS 2015

The unemployment indicators by governorate shown in the figure below no. (6), by DOS 2010. The percent of unemployed in the Karak Governorate had decrease at the time, that the percent decrease from 5.7 percent in 2006 to 4.7 percent in 2016. This result due to the fact that Karak Governorate is one of the country wide, which lacks public and private sector projects that generate jobs.

However, it is true that rural areas face employment challenges more than urban areas, despite the fact that Karak Governorate is considered one of the agricultural areas in Jordan. Where the estimated number of agricultural holders working in plant wealth is 2198 and about 67.3% of them possess holdings of less than 1 hectare. The total cultivated area in the governorate is estimated at 2.34 thousand hectare (Department of Statistics, 2017) of which 1.29 thousand hectare are planted with field crops such as wheat, barley, lentils and chickpeas, and about 150 hectare planted with vegetables such as tomatoes, potatoes, melons, melons, zucchini and cucumbers, and about 900 hectare planted with fruit trees. Such as olives, grapes and guava, in addition to the production of livestock. There is also high competition among local workers who work in the agricultural sector and the imported workforce in addition to the recent impact of Syrian refugees as the number of Syrian refugees is estimated at 1172 refugees (Department of Statistics 2015), which led to a high rate of unemployment among local men and workers within the study areas.

The poverty rate in Karak Governorate also increases, as the poverty rate reached about 13.4%, which is lower than the poverty rate in Jordan, which is estimated at 14.42%, and the number of poor families is estimated at 9.6 thousand families. Likewise, also, in Karak Governorate, there is one of the poverty pockets in Jordan (Department of Statistic, 2010). The project will contribute to creating job opportunities for the poor family and unemployed youth and women in the project area, as well as training the poor family and unemployed in agricultural skills, especially in the field of hydroponics, which helps them to find jobs in the private sector or create their own projects.



Figure 6: The pockets of Poverty year 2009

(Conception Katharina Lenner, 2009, Design Ababse)



Figure 7: Classification of Poor Communities Distributed by Districts year 2009

Archaeological Baseline Conditions:

The field survey and investigations revealed that no adjacent archaeological sites within the project influence area, and the project will not have an impact on the social habits and traditions in the project area

4. Chapter 4.0: Environmental and Social Impacts

4.1. General Background

The area around the proposed hydroponic farm is purely agricultural in all directions; Moreover, there are no protected areas (environmental and archaeological) and it is not expected that there will be any negative impacts on the dam due to the existence of a service road between the project site and the dam.

Although the project is classified as a medium risk, the small size of the project will not have a significant negative impact on environmental and social issues, the following areas of influence are to be mentioned:

- Occupational Health and safety.
- Public Health.
- Employment opportunities.
- Socio-economic influence.
- Impacts on surrounding farms.
- Solid and Hazardous Wastes Water Resources.

4.2. Impacts Identification

4.2.1. Potential Environmental Impacts (Negative and Positive)

The Potential Impacts of the planned project is evaluated considering the whole four phases of the project life cycle, design, construction, operation and closure phase, which is summarized below which shows in detail the potential Environmental and social effects and positive and negative impacts.

However, the impacts are classified positive and negative impacts depending in their potential effects, the positive impacts of the project are clearly dominating, while the negative impacts are minor.

Among the positive impacts of the project are the following:

a- Design phase

- The land is close to water sources
- The land is close to transportation
- There are many vegetable farms around the project.
- Design agricultural technologies that are adaptable to farmers

b- Construction phase

• Providing local job opportunities, the project will secure about 15 permanent and seasonal job opportunities for local residents

• No need to use soil, no weeds and effective use of fertilizer

c- Operational phase

- Water consumption for irrigation in the Advanced Hydroponic Farm will be 90% less than traditional Farming in herbal crops and between 40-60% in other vegetable crops, that increases the efficiency of irrigation water use and release extra water for agricultural expansion.
- 50% less land is needed to grow the same amount of crops, especially crops grown in layers such as lettuce and strawberries.
- land is used more effectively.
- Increase the cultivated area
- - Higher productivity.
- 60% less fertilizer is required
- Less pesticide use: Since plants are growing indoors.
- By eliminating soil (there's no need for toxic pesticides to protect plants)
- IPM applied reduce the use of chemicals and human exposure
- The project will secure permanent and seasonal job opportunities for local residents.
- The employees will have training opportunities offered to them and gain skills in the new high technology farming.
- The project will secure about 28 permanent and seasonal job opportunities for local residents
- The 40 trained and skilled staff who have been trained for 75 days are expected to transfer their knowledge to other communities as trainers.
- The trained and skilled employees will have the opportunity to join other similar projects or establish their own cooperatives if they can be supported
- The nature of project activities, particularly in the seasonal activities will be quite convenient for both women & youth take advantage of employment in (i.e. crop harvesting and grading)

d- Closure phase:

- The existence of an agricultural facility that uses modern agricultural technology in Tafila Governorate
- Existence of a business enterprise from the local community
- Produce much safer products
- The project is expected to contribute to direct community development through supporting the municipality, the youth activities, women groups and cultural events.
- The project is expected to contribute to business prosperity through creation of direct & indirect businesses (groceries, food suppliers, maintenance workshops, transportation ... etc.)

While the negative impacts include:

- a- Design phase
 - The location is relatively far from the population centers
 - There are no management offices in the project design
 - Shortage of the water and energy needs for operation of the project due outage

Mitigation Measures

- Providing means for workers to reach the project site
- Purchasing a caravan to be used as a desk by the Ministry of Agriculture
- Design and implement measures to control seasonal floods including drainage measures for the facilities
- Wastewater generated during the construction phase should be collected in properly sealed septic tank and disposed to the nearest treatment plant
- Design and implement measures to control seasonal floods including drainage measures for the facilities
- The design included Solar PV system to cover the needs in cases of electricity outage.
- The design of the RO include Tank for reject brine, and a tank for the fresh water
- •
- b- Construction phase
 - Possibility of exposure workers to accidents during construction phase.
 - All materials used in construction were purchased from outside the province
 - Risks of not complying with codes of conduct and labor law
 - Possibility of exposure to dust

Mitigation Measures

- Strictly comply with the local regulations regarding the working hours and the
- Reuse of the site soil to level the project land
- Spraying water on site to prevent the spread of dust
- Assign a Health, Safety and Environment Officer
- Provision of First aid kit
- Training the contractor and workers on OHS requirements
- Enforce use of personal protective equipment, such as gloves, Helmets, Glasses, boots
- Avoid exposure to sunlight while working for long periods
- Report, investigate and take timely actions on any accidents
- Avoid working in dusty, raining, and strong windy weather
- Securely pack and cover trucks with loose material
- Provide vehicles equipped with seats and barriers for the transportation of workers
- Ensure vehicles carrying workers are equipped with seats and are incompliance with public transport general safety regulation
- all vehicles at the site to be in very good working conditions with reverse horns, signaling lights, etc.
- Also need to create awareness for the project workers on these matters
- Provide an adequate source of water from available and approved off-site sources and encourage the gray water reuse for dust control when possible
- Conserve water use and restrict the use of groundwater in construction activities and human purposes

- Hazardous Materials should must not be thrown at the project site to prevent contamination of groundwater and surface water (oils and vehicle fuels
- Provide The employment of workers from local communities mainly for unskilled works and skilled workers if they are available
- c- Operational phase
 - Possibility of exposure to dust and toxic substances, (volcano tuff and pearlite) and pesticide
 - Generation of solid waste and probably hazardous wastes. (if volcano tuff and pearlite are used), and generation of organic waste such as unused plants although that the volumes of such waste are likely to be small.
 - Hazardous waste management will incur additional cost of waste management
 - Discharges of Reverse Osmosis reject water and wastewater with high content of salts.
 - Possibility of contamination by hazardous materials may occur due to improper transportation, storage and use of pesticides including impacts on; workers, air and soil.
 - Possibility of soil contamination, source of odor, breeding of insects and reptiles, and harm birds
 - Possibility of power outage, causes decline in crops yield due to these shortage, also use of electricity could cause electric shocks and fore due to faulty electrical systems and exposure to water
 - Clogging in drip irrigation of Hydroponics leads to severe economic losses
 - Possibility of technology failure, resulting in disruption of technical processes controlling the hydroponic high tech system; i.e., irrigation, nutrition, ventilation, climate control which could lead to loss of revenues for the farmer.
 - Plant pathogens, leading to higher control costs and lower crop productivity.
 - water contamination in the dam if leftover dissolved fertilizers and pesticides are not managed properly
 - As this project is small with a possibility to hire 13 full time employees and 12 part time workers, the heightened expectations for employment opportunity may result in disappointment
 - Risks of non-compliance with codes of conduct, especially those related to sexual harassment among workers
 - Risks of not complying with codes of conduct and labor law
 - Qualified staff, technicians, and workers can lose their Jobs
 - They will lose security insurance and health care insurance

Mitigation Measures

- Disposal of construction wastes from the site into the designated landfill by the local authority
- Strictly comply with the local regulations regarding the working hours and the
- Assign a Health, Safety and Environment Officer
- Provision of First aid kit Cases
- Enforce use of personal protective equipment, such as gloves, Helmets, Glasses, boots
- Meet all hygiene and sanitary needs of workers including provision of separate sanitary facilities for males and females
- Report, investigate and take timely actions on any accidents
- Provide proper signage

- Ensure vehicles carrying workers are equipped with seats and are incompliance with public transport general safety regulation
- A vehicle assigned to take any injured workers to a medical facility
- all vehicles at the site to be in very good working conditions with reverse horns, signaling lights, etc.
- Conserve water use and restrict the use of groundwater in construction activities and human purposes
- Increasing awareness in the local community and workers of project planning, environmental issues and workers' rights
- Women's participation in project activities with more than 20% of total permanent workers and not less than 60% of temporary workers. Without any discrimination by gender.

d- Closure phase:

- Possibility of exposure to dust and toxic substances, (volcano tuff and pearlite) and pesticide
- Decommissioning activities will create few temporary jobs by the contractor and all long term jobs will not be there anymore.
- water contamination of the dam if leftover dissolved fertilizers and pesticides are not managed properly
- The inability of the local association to manage the project efficiently
- Increase the number of marketers for the site
- •

Mitigation Measures

- Protect the workers while handling and disposal of volcano tuff and pearlite whenever used as culture media, having workers trained properly.
- Prior site closure, clean and dispose hazardous and nonhazardous waste from the site into the designated landfills operated by the local authorities.
- Enabling trainees and skilled workers to access funding sources
- The cooperative institution continues to provide training and monitoring
- The workers working on the project kept their jobs.
- Women's participation in project activities with more than 20% of total permanent workers and not less than 60% of temporary workers. Without any discrimination by gender
- •

4.2.2. Potential Social Impacts (Negative and Positive)

The Potential Impacts of the planned project is evaluated considering the three phases of the project life cycle, construction, operation, which is summarized in the table (19), below which shows in detail the potential social effects and positive and negative impacts.

However, the impacts are classified positive or negative impacts depending on their potential effects, the positive impacts of the project are clearly dominated, while the negative impacts are minor.

Table 18 : Social positive and negative impacts during all project phases (Design, Construction, Operation and Closure phase)

Topic	Potential Effect	Positive Impact	Negative Impact

	Employment during construction and operation phases	The project will secure about 15 permanent and seasonal job opportunities for local residents	 As this project is small with a possibility to hire 13 full time employees and 12 part time workers, the heightened expectations for employment opportunity may result in disappointment. Risks of non-compliance with codes of conduct, especially those related to sexual harassment among workers. Risks of not complying with codes of conduct and labor law
	Training and skills	The employees will have training and gain skills in new field and technology	
Socio - economic	Knowhow transfer	The 40 trained and skilled staff who have been trained for 75 days are expected to transfer their knowledge to other communities as trainers.	
	Community development	The project is expected to contribute to direct community development through supporting the municipality, the youth activities, women groups and cultural events. The project is expected to contribute to business prosperity through creation of direct & indirect businesses (groceries, food suppliers, maintenance workshops, transportation etc.)	
	Employment at the operation phase	The trained and skilled employees will have the opportunity to join other similar projects or establish their own cooperatives if they can be supported.	- Qualified staff, technicians, and workers can lose their Jobs - They will lose security insurance and health care insurance
	Gender consideration	The nature of project activities, particularly in the seasonal activities will be quite convenient for both women & youth take advantage of employment in (i.e. crop harvesting and grading)	

4.2.3. Impact Mitigation at Various Phases of the Project (Design, Construction, Operation and Closure Phases)

The impacts and mitigation measures summarized in the following tables should be implemented during construction and operation. Since the day-to-day operational activities will be managed by the Project Owner, most of the responsibilities are designated to the Project Owner, in addition to the third part assessor (RSS), Municipality, and MoEnv. For (ESMP), refer to tables 20, 21, 22 and 23

Impact/ Issue	Mitigation Measure	Monitoring Measure	Implementation Responsibility	Supervision Responsibility	Cost US\$
Occupational safety and Health	Planning to purchasing a caravan to be used as a desk by the Ministry of Agriculture	Visual observation	МоА	МоА	7000\$
Accidents	Planning to providing means of transportation for workers to reach the project site	Record the occurrences of all accidents	MoA & JCC /Safety officer	MoA & JCC	4500\$
Flood Occurrence	Design and implement measures to control seasonal floods including drainage measures for the facilities	Visual observation	МоА	МоА	
Increase in water demand and generation of waste water	The design of the RO include Tank for reject brine, and a tank for the fresh water	Installing temporary waste water collection tank on-site	Contractor	МоА	250\$
Shortages in electricity outage	design included Solar PV system to cover the needs in cases of electricity outage	Visual observation	Contractor	МоА	200000\$

 Table 19: Environmental impacts and mitigation measures during design phase

Impact/ Issue	Mitigation Measure	Monitoring Measure	Implementation Responsibility	Supervision Responsibility	Cost US\$
Solid Waste	Disposal of construction wastes from the site into the designated landfill by the local authority.	Keep monthly log of disposed quantities	Contractor	Municipality	municipal services
	Strictly comply with the local regulations regarding the working hours and the	Timesheet log	MoA	МоА	
Public health	Reuse of the site soil to level the project land Spraying water on site to prevent the spread of dust	Visual inspection	Contractor	Municipality/	400\$
	Cover tightly fertilizer tanks	visual	МоА	МоА	
	Assign a Health, Safety and Environment Officer				998\$
	Provision of First aid kit				30\$
	Identify closest Medical center/hospital for emergency Cases				
	Training the contractor and				
Occupational	workers on OHS requirements				685\$
	Enforce use of personal protective equipment, such as gloves, Helmets, Glasses, boots	Daily inspection by Safety Officer /	Contractor/ Jordan Technical officer	МоА	285\$
safety and	Avoid exposure to sunlight while working for long periods	Supervision Consultant			
Health	Meet all hygiene and sanitary	Team			
	needs of workers including provision of separate sanitary facilities for males and females.				2200\$
	Report, investigate and take timely actions on any accidents.				
	Avoid working in dusty, raining, and strong windy weather. Provide proper signage.				850\$
	Need to create awareness for the project workers on these matters				360\$
	Securely pack and cover trucks with loose material				
	Provide vehicles equipped with				
	seats and barriers for the transportation of workers				
	Ensure vehicles carrying workers	Daily			
	are equipped with seats and are incompliance with public	inspection by		Traffic	
	transport general safety	Safety Officer / Supervision	Contractor	Department	
	A vehicle assigned to take any	Consultant		INIOA	
	injured workers to a medical	1 cam			
	all vehicles at the site to be in				
Aggidants	very good working conditions				960\$
Accidents	lights, etc.				500\$
	Report, investigate and take				
	Securely pack and cover trucks				
	with loose material				
	seats and barriers for the	Decord the			
	transportation of workers	occurrences of	MoA & JCC /Safety officer	MoA & JCC	
	workers are equipped with	all accidents	sally officer		
	seats and are incompliance with				
	regulation				
	All vehicles at the site to be in very good working conditions				

Tabl	e 20:1	Environmental	Impacts and	l mitigation	i measures d	luring	construction [phase

	with reverse horns, signaling lights, etc				
Disturbance of biodiversity	Avoid damaging and removal of fauna and crops in adjacent plots, Also need to create awareness for the project workers on these matters	Visual observation	МоА	MoA RSCN	400\$
Flood Occurrence	Design and implement measures to control seasonal floods including drainage measures for the facilities	Visual observation	Contractor	МоА	7130\$
	Wastewater generated during the construction phase should be collected in properly sealed septic tank and disposed to the nearest treatment plant.	Visual observation, Log recording	Contractor	МоА	300\$
Inonoso in	Provide an adequate source of water from available and approved off-site sources and encourage the gray water reuse for dust control when possible.	Visual observation, recording	Contractor	МоА	8559\$
water demand	Conserve water use and restrict the use of groundwater in construction activities and human purposes.	Visual observation	Contractor	MoA/ Traffic Department	400\$
	Hazardous Materials must not be thrown at the project site to prevent contamination of groundwater and surface water (oils and vehicle fuels)	Visual observation, water samples teats	Contractor	MoA/ Traffic Department	4005

Table 21 : Social impacts and mitigation measures during construction phase

Impact/ Issue	Mitigation Measure	Monitoring Measure	Implementation Responsibility	Supervision Responsibility	Cost US\$
Employment	Provide employment of workers from local communities mainly for unskilled works and skilled workers if they are available	Registration and logs	Contractor	MoA/community	
Community development	Increasing awareness in the local community and workers of project planning, environmental issues and workers' rights	Awareness and workshop report	Technical officer	МоА	500\$
Grievance Redress management (GRM) and Gender Based Violence (GBV) Referral Pathways	Ensure that: -the grievance system uptake channels are in place and functioning adequately -the responsible staff handling complaints have the relevant training and respond in a timely manner -the grievance mechanism has an appeals procedure in the event the complainant is not satisfied with the resolution -ensure widely dissemination of the GRM with mobile project signs -ensure separate GMs for project workers and for stakeholders as outlined in the LMP (annex 3) and the SEP (annex 12)	Grievance record	Contractor	MoA/ Local committee	
	On GBV related complaints, ensure there are relevant referral pathways to address the complaints using a survivor centric approach and principles of confidentiality and anonymity and data privacy measures as per the World Bank Good Practice Note on Addressing Sexual Exploitation and Abuse and	Contract record	Contractor	МОА	

	Sexual Harassment (SEA/SH) in Investment Project Financing ¹⁶				
Codes of Conduct	Ensure signing of codes of conduct by all project workers	Signed Codes of Conduct	Contractor	МОА	Part of Contractor Bidding Documents

The following table no. (23), presents the ESMP that should be implemented during operation. Since the day-to-day operations activities will be managed by the project Owner, most of the responsibilities in this ESMP are designated to the Project Owner, in addition to the third part assessor (SGS, RSS) and Municipality, MoEnv

Table	22 : Environmental In	ipacts and	mitigation	measures	during	operation 1	ohase

Impact/ Issue	Mitigation Measure	Monitoring Measure	Implementation Responsibility	Supervision Responsibility	Cost US\$
	Protect the workers while handling and disposal of volcano tuff and pearlite whenever used as culture media, and have the workers trained prior to handling hazardous material.	Periodic health test every 6 month	Safety/Social Officer	MoA & JCC	285\$
Occupational	Protect workers during pesticide spraying, provide the personal protective equipment (masks, gloves, goggles, etc.) and enforce their use PPE policy.	Continuous check for using of Safety Equipment (SE) (continues)	Safety Officer	MoA & JCC	
Health and Safety	Secure health insurance and health care for employees in accordance to Jordan Labor law Availability of separated sanitary facilities for men and women First aid and training of staff Provide proper signage Meet all hygiene and sanitary needs of workers including provision of separate sanitary facilities for males and females Assign a Health, Safety and Environment Officer	In a yearly basis	Safety Officer	MoA & JCC	2150
Disturbance of biodiversity	Avoid damaging and removal of fauna and crops in adjacent plots ensure regularly the storm water drains are functioning properly	Visual observation	MoA & JCC	MoA & JCC	400\$
	Immediate reporting of accidents to local civil defense offices and World Bank				1500
	Regular check of electric systems is critical due to the interaction with water				500
	Provision of proper fire extinguishers and getting the staff trained on using them			Project Owner	500
Accidents	Monthly check of electric equipment to ensure no leakages A vehicle assigned to take any injured workers to a medical facility All vehicles at the site to be in very good working conditions with reverse horns, signaling lights, etc Ensure vehicles carrying workers are equipped with seats and are incompliance with public transport general safety regulation Report, investigate and take timely actions on any accidents	Record the accidents occurrences (immediately)	Project Owner/ Safety officer	General Directorate of Civil Defense	2000
Protection of water	Protection of surface water, water in the dam, and	Surface, water in dam and	MoA &JCC/ Safety officer	Municipality / MOENV	

¹⁶ <u>https://thedocs.worldbank.org/en/doc/741681582580194727-</u>

^{0290022020/}original/ESFGoodPracticeNoteonGBVinMajorCivilWorksv2.pdf

resources	ground water from the rejected RO watery disposing to a specific places owned by the municipality.	groundwater water sample tests and their comparison with			
	Protect the water bodies from high nutrient content discharges by disposing in specific places owned by the municipality	irrigation water specifications in Jordan (Table 9). Placing underground collection tank for R.O. Reject water tests (monthly)			
	Domestic wastewater generated during the operation phase should be collected in properly sealed septic tank and disposed to the nearest wastewater treatment plant.	Visual observation And records			500
Solid and Hazardous Wastes	Collect and dispose various types of solid waste generated during operations regularly, organic waste for composting on site, use it in the garden of the facility as a soil amendment, and damaged polystyrenes boxes, packaging material, empty containers, etc. at the municipality landfill.	Visual observation (daily)	MoA & JCC / Safety officer	Municipality / MOENV	
	Separate disposal of hazardous waste materials such as olcano tuff and pearlite, contaminated empty pesticides containers and other chemicals, which will be disposed in hazard materials municipality landfill.	Visual observation (Seasonally)	Safety Officer	MoA/ MoEnv.	
	Rigorously implement Integrated Pest Management Plan (IPM). Control all sources of dust generation to avoid insects attraction specially Spiders.	Visual observation (daily)	Safety Officer / MoA	МоА	1500
Changes of visual character	Ensure pleasant appearance of the site by vegetating the surrounding area	Visual observation (daily)	МоА		2000
Shortages in Water Irrigation during the peak summer between late August and October and energy	Install a suitably sized water storage Tank in case of power outage. The water requirement is about 16000 m ³ and the Dam storage is adequate to sustain the facility across the entire year, then the need to have water storage in case of power shortage and power to be provided using solar energy	Visual observation	MoA/ Technical officer	MoA & JCC	6000
consumption	Conserve water use and restrict the use of groundwater in operation activities and human purposes	Visual observation	MoA & JCC / Technical officer	MoA & JCC	

Closure phase:

The following table presents the impacts and the mitigation measures that should be implemented to ensure safe closure of the project. Similar to the operation stage, the activities will be managed by the project Owner, most of the responsibilities in this ESMP are designated to the Project Owner, in addition to the third part assessor (SGS, RSS) and Municipality, MoEnv

Impact/ Issue	Mitigation Measure	Monitoring Measure	Implementation Responsibi lity	Supervision Responsibility	Cost US\$
Solid and Hazardous Wastes	clean and dispose hazardous and nonhazardous waste from the site into the designated landfills operated by the local authorities	Visual observation	Technical officer	МоА	municipal services
Occupational Health and Safety	Protect the workers while handling and disposal of volcano tuff and pearlite whenever used as culture media, having workers trained properly	Periodic health test every 6 month	Safety/Social Officer	MoA & JCC	285\$
Employment	The workers working on the project kept their jobs	Workers record	Technical officer	MoA & JCC	
Training and skills	Enabling trainees and skilled workers to access funding sources	ACC record			
Community development	The cooperative institution continues to provide training and monitoring	ACC record	Technical officer	МоА & АСС	
Gender consideration	Women's participation in project activities with more than 20% of total permanent workers and not less than 60% of temporary workers. Without any discrimination by gender	Workers record Trainees record	Technical officer	MoA & JCC	
GBV/SEAH	Grievance Mechanism with Referral Pathways: Ensure that the Grievance Mechanism has in place a referral pathway in the event of GBV/SEAH related complaints. All personnel handling the calls must have the relevant training. The complaint will be handled using a survivor centric approach following the guidelines of the World Bank Good Practice Note on addressing Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) in Investment Project Financing ¹⁷ Codes of Conduct: ensure all project workers as identified in the Labor Management Procedures (I MP) (soo	No. of grievances No of signed codes of conduct	Safety/social Officer	MoA & JCC	

Table 2	23 : Environmental and S	Social Impacts and	d mitigation measures	during Closure Phase
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¹⁷ https://thedocs.worldbank.org/en/doc/741681582580194727-

^{0290022020/}original/ESFGoodPracticeNoteonGBVinMajorCivilWorksv2.pdf

Annex 3) have a signed		
codes of conduct in		
place with regular		
follow up trainings and		
awareness raising		

4.3. Enhancement of Positive Impacts at Various Phases

The following enhancement actions are proposed:

- Activation of the grievance mechanism for community and workers.
- Establishment of coordination procedures with local community and stakeholders.
- Set up well designed training programme and keep records of trained persons.
- Seeking high caliber experts for support of Hydroponics technical knowhow to guarantee the success of the project and sustain management of hydroponics.
- Keep records of success stories to follow and incidents of failure to avoid in the future.

5. Chapter 5: Analysis of Project Alternatives

5.1. Background

This chapter deals with possible alternatives which can be implemented or adopted by project owner. The suggested alternative compares three farming systems and provides an opportunity to choose the best technology in terms of water consumption, crop quality, productivity by using modern technologies to control the in-house climate conditions in high–tech, low-tech and to a certain degree traditional farming. See, Annex no. (8), Concept of Project study alternatives.

5.2. Alternative Project Location and Alternative Farming Methods

As for the analysis without the project, it will be the alternative to and open field farming and traditional greenhouses. The conventional system requires higher operating costs than the hydroponics system, since the cultivation takes place in the soil and therefore in every season the soil needs to be sterilized, it is more susceptible to agricultural pests and soil deaths, this result in more use of insecticides and fungicides. Also, agriculture in traditional greenhouses requires more use of chemical and natural fertilizers, as a result of the loss of many elements of? the soil. The important point is water consumption as the hydroponics system is more efficient in water consumption, where it consumes 90% less water in herbal crops and between 40% -60% in other vegetable crops.

There is no alternate location as this location was the only location provided by the project owner. In the case of the high-tech hydroponic farming any location would be suitable as this technology does not require or depend on soil fertility or specific ambient conditions in order to produce crops. The reasons for choosing the current location were driven mainly by the following factors:

- It is located in heart of an agriculture area,
- The government has allocated lands to establish a pilot center for agriculture with the Hydroponics system.
- Availability of low-cost irrigation water.

- The low cost of electricity for agriculture use.
- The availability of work force with agricultural experience.

There are several farming systems for hydroponics; they differ among themselves by the type of covers used. Where the cost of the system covered with polycarbonate and an area of 350 square meters is estimated at about 20,000 Jordanian dinars, while the cost of the system covered with polyethylene 200 micron treated against ultraviolet radiation is about 7000 Jordanian dinars. The project adopted the second system in which the cost of investment is reduced.

5.3. Comparison of Alternatives

The concept of the project, which is planned to be implemented in the project area, is based on the use of modern agricultural technology, especially farming without soilless techniques, through three systems High-tech multi-span hydroponics, High-tech Hydroponic single greenhouse and low-tech Hydroponics greenhouse. For more information on these alternative systems, see Appendix (8),:

The project concept aims to compare three farming systems and to identify the best alternative in terms of water consumption, crop quality, production quantities and economic viability.

The use of Solar PV system as a source of alternative energy has been identified in the Project design document identify The use of alternative modern techniques such as; low-tech and high –tech hydroponic farming, in controlling in-door weather conditions is recommended as a viable alternative to traditional farming and provides greater opportunities for expanding agriculture activities into regions not suitable for conventional farming.

The purpose of this particular project is to conduct a comparison of various variables; i.e. Energy consumption, water consumption, crop yield, running cost on three separate agricultural models:

- Low-tech: Using simple hydroponic techniques under traditional plastic houses.
- Mid -tech: Advance hydroponic technology under a modern green houses with full control of irrigation, fertilization, pest and climate control conditions.
- High-tech: Advance hydroponic technology under a modern multi-span green house with full control of irrigation, fertilization, pest and climate control conditions.

The summary of the planned alternatives is described in the following Table no. (25) as a comparison between the three farming models.

Type of Technology	Water use efficiency	Energy efficiency	Production	Construction cost	Product Marketing	Adoption by farmer
Low- tech	low	high	Traditional production by season	low	Local marketing	high
Mid- tech	High	medium	Continues production throughout the year	Acceptable to small farmers	High Possibility of export marketing	Mid for small farmers

Table 24 : Summary planned technologies activities

High- tech	High	low	Continues production throughout the year	Acceptable to large scale farmers	High Possibility of export marketing	High for large scale farmers
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6. Chapter 6.0: Environmental and Social Management Plan (ESMP)

6.1. Background

The project owner carried out several field visits prior to the Public Consultation Meeting in May and during the early preparation stage. Many of the stakeholders and local community members were informed of the project objectives and proposed technologies and presented their concerns directly to the project owner and presented their suggestions during that time. Thus the ESIA report is prepared to express comments and suggestions taking into consideration all comments and suggestions regarding the environmental impacts, a social concerns and propose the mitigation measures for the negative impacts and to respond to all social concerns and interests, in addition to identification of the responsible parties and individuals.

6.2. ESMP Responsibilities.

The Responsibilities are distributed jointly or separately among the following actors:

- Supervision team on implement project (STIP) in all environmental, social and administrative aspects.
- Local committee consists of government institutions and NGOs concerned with development and the environment.
- Construction Contractor
- Project Owner
- Municipality /
- Traffic Department /Project owner
- Royal Society for the Conservation of Nature (RSCN)
- General Directorate of Civil Defense
- MoEnv.
- Jordan Cooperative Corporation (JCC)

For detailed responsibility see tables no. 16, 17, 18of Chapter 4

6.3. Environmental Management Matrix Table.

The environmental management matrix table is shown in tables no. 16, 17, 18 of Chapter 4

6.4. Social Management Matrix Table

The social management matrix is presented in table no.15.

6.5. Monitoring the ESMP (including frequency and indicators throughout project life-cycle)

The following impacts were identified at various phases of the project life cycle (Design, Construction, Operation and closure phase). Meanwhile.

The following table no. (26), presents the ESMP that should be implemented during design phase and must be managed by the MOA team, stakeholders and project Owner most of the responsibilities in this ESMP are designated in this phase to the MOA team and MOWI.

Impact/ Issue	Mitigation Measure	Monitoring Measure	frequency	indicator	Implementation Responsibility	Supervision Responsibility
Occupational safety and Health	Planning to purchasing a caravan to be used as a desk by the Ministry of Agriculture	Visual observation	Once provided	design document	МоА	МоА
Accidents	Planning to providing means of transportation for workers to reach the project site	Record the occurrences of all accidents	Visual observation	Number of workers who have access to the project	JCC /Safety officer	МоА
Flood Occurren ce	Design and implement measures to control seasonal floods including drainage measures for the facilities	Visual observation	Once provided	Existence of the Gabions	Contractor	МоА
Increase in water demand	The design of the RO include Tank for reject brine, and a tank for the fresh water	Visual observation,	Once provided	design document	Contractor	МоА
	design included Solar PV system to cover the needs in cases of electricity outage	Visual observation,	Once provided	design document	Contractor	МоА

Table 25 : ESMP Monitoring during design phase including frequency and indicators

The following table no. (27), presents the ESMP that should be implemented during construction phase and must be managed by the contractor and project Owner most of the responsibilities in this ESMP are designated in this phase to the contractor, in addition to the third part assessor (RSS) and Municipality, MoEnv.

 Table 26 : ESMP Monitoring during construction phase including frequency and indicators

Impact/ Issue	Mitigation Measure	Monitoring Measure	frequency	indicator	Implementatio n Responsibility	Supervision Responsibility
Solid Waste	Disposal of construction wastes from the site into the designated landfill by the local authority.	Keep monthly log of disposed quantities	monthly	Wight of wastes in m ³	Contractor	Municipality

	1					
Public	Strictly comply with the local regulations regarding the working hours and the levels of noise Reuse of the site soil to	Time sheet log	Continuous during working hours Continuous	No. of complains No. of committed workers	MoA Contractor	МоА
neaitn	Spraying water on site to prevent the spread of dust	Visual observation		The area of the flattened site		МоА
	Cover tightly fertilizer tanks	Visual observation	during working	Number of fertilizer tanks covered	Contractor	МоА
	Assign a Health, Safety and Environment Officer	Daily inspection	Continuous during working hours	Percentage. of committed workers No. of accidents	Contractor/ Lead Technical officer	МоА
Occupation al safety and Health	Provision of First aid kit Identify closest Medical center/hospital for emergency cases Training the contractor and workers on OHS requirements	by Safety Officer / Supervision Consultant Team	Once provided Listed and Documented	availability of the 1 st aid kit and the documented lists	Contractor	МоА
	Enforce use of safety personal equipment, gloves, Helmets, Glasses, boots		Periodically provided	Percentage. of committed workers		
	Avoid exposure to sun exposure durations for work within acceptable limits.		continuous			
	Meet all hygiene and sanitary needs of Workers with separate facilities for males and females		continuous	No. of illness cases related	Contractor	МоА
	Report and investigate any accidents.	c I o	continuous	No. of accidents	-	
	Avoid working in dusty, raining, and strong windy weather.		During the occurrence	Percentage of committed workers		
	Provide proper signage. Need to create awareness for the project workers on these matters	Weekly report of traffic Accidents	Once provided	Sufficient Signage installation	Contractor	Traffic Department /Project owner
Accidents	Securely pack and cover trucks with loose material. Provide vehicles					
	equipped with seats and barriers for the transportation of workers	Weekly report of traffic		Percentage of		
	Ensure vehicles carrying workers are equipped with seats and are incompliance with public transport general safety regulation. A vehicle assigned to take any injured workers to a medical facility all vehicles at the site to	Accidents speed limit signage on access road are installed	continuous	committed Percentage of committed trucks	Contractor	Traffic Department /Project owner
	be in very good working conditions with reverse horns, signaling lights, etc. Report, investigate and	Record the	continuous	No. of	Contractor	МоА

	any accidents	all accidents		accidents		
	Securely pack and cover			acciucitis		
	trucks with loose					
	material					
	Provide vehicles					
	equipped with seats and					
	barriers for the					
	transportation of					
	workers					
	Ensure vehicles carrying					
	workers are equipped					
	with seats and are					
	transport general safety					
	regulation					
	Avoid damaging and					
Disturban	removal of fauna and					
Distui Dali	crops in adjacent plots,	¥7:		N f: . l 4		M - A
ce of	Also need to create	visual	continuous	No. of violent	Contractor	MOA,
biodiversi	awareness for the project	observation		events		RSSCN
ty	workers on these matters					
		Cabions and				
	Design and implement	Gabions are				
Flood	measures to control	property	0	Existence of		ъ • 4
Occurren	seasonal floods including	installed on the	Once	the	Contractor	Project
ce	drainage measures for	southern	provided	Gabions		Owner
ce	the facilities	border of		Gubions		
		the farm				
	Wastewater					
	wastewater					
	generateu uur nig tie			westowator		
	construction phase	Visual		wastewater		
	should be collected in	observation.	continuous	quantities in	Contractor	MoA
	properly sealed septic	Log recording	continuous	m	0011111000	
	tank and disposed	Log recording		received		
	to the nearest					
-	treatment plant.					
	Provide an adequate					
	source of water from					
	available and	Secure on site		Reject and		
	available and	storage tank for		arov		
	approved on-site	RO		giey	Contractor	Project
	sources	reject and grey		water	Contractor	Owner
Increase	and encourage the	water		quantities in		
in water	gray water reuse for	collection		mused		
demand	dust control when	concetion.				
	possible.					
	Conserve water use and					
	restrict the use of		Continuous	Quantity in		
	groundwater in	Visual		m ³ of	C ()	NIOA/
	construction activities	observation		ground water	Contractor	Traffic
	for human domestic			illegally used		Department
	nurnoses.			meganj asea		
	Hazardous Materials		1			
	must not be thrown at the	Visual				
	project site to prevent	observation		No. of non-		MoA/Troffic
	contamination of	water samples		compliance	Contractor	Donowite out
	groundwater and surface	water samples		events		Department
	water (oils and vehicle	tests				
	Iuels) Engung 4k - 4 4h -					
C	Ensure that the					
Grievance	grievance system uptake					
Redress	channels are in place and					
manageme	functioning adequately					
nt (GRM)	-the responsible staff					
and	handling complaints	Grievance	aantinuassa	No of anionan-	Contractor	MoA/ Local
Gender	have the relevant	record	continuous	TTO. OF grievance		committee
Based	training and respond in					
Violence	a timely manner					
(GBV/SEA	-the grievance					
H)	mechanism has an					
	annaala nyaaduus in 41 -					
1	appears procedure in the					

	event the complainant is not satisfied with the resolution -ensure widely dissemination of the GRM with mobile project signs -ensure separate GMs for project workers and for stakeholders as outlined in the LMP (annex 3) and the SEP (annex 12)					
	On GBV related complaints, ensure there are relevant referral pathways to address the complaints using a survivor centric approach and principles of confidentiality and anonymity and data privacy measures as per the World Bank Good Practice Note on Addressing Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) in Investment Project Financing ¹⁸	Contract record	continuous	No. of contract	Contractor	МОА
Codes of Conduct	Ensure signing of codes of conduct by all project workers	Contract record	continuous	No. of contract	Contractor	МОА
Employment	Provide employment of workers from local communities mainly for unskilled works and skilled workers if they are available	Registration and logs	continuous	Number of workers from the local community	Contractor	MoA/community
Community development	Increasing awareness in the local community and workers of project planning, environmental issues and workers' rights	Awareness and workshop report	Yearly report	Number of courses related to environmental issues and labor rights	Technical officer	МоА

The following table (no. 28), presents the ESMP which should be implemented during operation. Since the day-to-day operations activities will be managed by the project Owner, most of the responsibilities in this ESMP are designated to the Project Owner, in addition to the third part assessor (RSS) and Municipality, MoEnv.

 Table 27 : ESMP Monitoring during operation phase including frequency and indicators

Impact/	Mitigatio	Monitoring	frequen	indicator	Implementatio	Supervision
Issue	n	Measure	cy	mulcator	n	Responsibilit

¹⁸ https://thedocs.worldbank.org/en/doc/741681582580194727-

^{0290022020/}original/ESFGoodPracticeNoteonGBVinMajorCivilWorksv2.pdf

	Measure				Responsibility	v
Occupational Health and Safety	Protect the workers while handling and disposal of volcano tuff and pearlite whenever used as culture media, and have the workers trained prior to handling hazardous material.	Health test (semi- annual)	Periodic	No. of non – compliance events detected	Safety/Social Officer	
	Protect workers during pesticide spraying, provide the personal protective equipment (masks, gloves, goggles, etc.) and enforce their use PPE policy.	check for using of Safety Equipment	Continuous	No. of related illness cases detected	Safety Officer	MOA & JCC
	Secure health insurance and health care for employees in accordance to Jordan Labor law Availability of separated sanitary facilities for men and women First aid and training of staff Provide proper signage Meet all hygiene and sanitary needs of workers including provision of separate sanitary facilities for males and females Assign a Health, Safety and Environment Officer	In a yearly basis	Continuous	The number of health facilities in the project	Safety Officer	MoA & JCC
Disturbance of biodiversity	Avoid damaging and removal of fauna and crops in adjacent plots ensure regularly the storm water drains are functioning properly	Visual observation	Semi-annual	The area of destroyed crops in the adjacent lands	MoA & JCC	MoA & JCC
	Immediate reporting of		immediately	No. of accidents		
Accidents	accidents to local civil defense offices and World Bank Regular check of electric systems is critical due to the interaction with water Provision of proper fire extinguishers and getting the staff trained on using them Monthly check of electric equipment to ensure no leakages A vehicle assigned to take	Record the accidents occurrences	Continuous	No. of accidents	MoA & JCC / Safety officer	MoA & JCC /General Directorate of Civil Defense
	any injured workers to a medical facility All vehicles at the site to be in very good working conditions with reverse horns, signaling lights, etc Ensure vehicles carrying workers are equipped with seats and are incompliance with public transport general safety regulation Report, investigate and					Defense

	take timely actions on any					
Protection of water resources	take timely actions on any accidents Protection of surface Protection of surface water, water in the dam, and ground water from the rejected RO watery disposing to a specific places owned by the municipality. Protect the water bodies from high nutrient content discharges	Undertake surface and groundwater Water sample tests	Semi- annual	Concentration of chemicals mg/l	MoA & JCC / Safety officer	Municipality / MOENV
	by disposing in specific places owned by the municipality Domestic wastewater generated during the operation phase should be collected in properly sealed septic tank and disposed to the nearest waste water treatment plant.	Visual Observation	Periodically upon filling	Quantities transported and disposed m ³	MoA & JCC / Safety officer	-
	Collect and dispose various types of solid waste generated during operations regularly, organic waste for composting on site, use it in the garden of the facility as a soil amendment, and damaged polystyrenes boxes, packaging material, empty containers, etc. at the municipality landfill.	Visual Observation	Daily	Transported quantities in kg	MoA & JCC / Safety officer	Municipality / MOENV
Solid and Hazardous Wastes	Separate disposal of hazardous waste materials such as olcano tuff and pearlite, contaminated empty pesticides containers and other chemicals, which will be disposed in hazard materials municipality landfill. Rigorously implement Integrated Pest Management Plan (IPM). Control all sources of dust generation to avoid insects attraction specially Spiders.	Visual Observation	Seasonally	Percentage of removed and disposed hazardous material	Safety Officer	Project Owner/ MoEnv.
Changes of visual character	Ensure pleasant appearance of the site by vegetating the surrounding area	Visual Observation	Daily	Percentage of greened areas within the site No. of trees planted	MoA & JCC	

				MoA & JCC MoA & JCC		
Employment Employment	Employment of trainees in project activities	Workers record Workers record	Technical officer Technical officer		MoA & JCC / Technical officer	MoA & JCC
	Employment of trainees in project activities					
Employment	Employment of trainees in project activities	Workers record	Sime annual	Number of trainees employed in project activities	Technical officer	MoA & JCC
Training and skills	Training of the unemployed in the local communities on the hydroponics system	Trainees record	Sime annual	Number of unemployed people in local communities trained in hydroponics	Technical officer	MoA & JCC
Community development	Increasing awareness in the local community of project planning, environmental issues and workers' rights	Awareness and workshop report	Sime annual	Number of courses related to environment al issues and labor rights	Technical officer	MoA & JCC
Grievance Redress Mechanism (GRM)	Create a grievance record, record grievances and actions taken to address grievances	Record the grievance occurrences	Continuous	No. of record grievances	МоА	JCC/ Local committee
GBV/SEAH related grievances	Ensure referral pathways to identified GBV/SEAH service providers are in place in the event of GBV/SEAH related complaints using a survivor centric approach and ensure reporting of incidence to the World Bank team within 48 hours timeline	Record any GBV/SEAH related complaints while ensuring principles of confidentiality and anonymity and data privacy	Continuous	No. of recorded grievances	МоА	МоА
Codes of Conduct	Ensure signing of codes of conduct by all identified project workers	Signed codes of conduct	Continuous and whenever there is a new worker contracted	No. of signed codes of conduct	МоА	МоА

The following table (no. 29), presents the ESMP which should be implemented during Closure phase.

Table 28 : ESMP Monitoring during closure phase including frequency and indicators							
Impact/	Mitigation	Monitoring	frequenc indicator	Implementat	Supervision		

Issue	Measure	Measure	У		ion	Responsibility
			-		Responsibilit v	
Solid and Hazardous Wastes	clean and dispose hazardous and nonhazardous waste from the site into the designated landfills operated by the local authorities	Visual observation	Continuous	The presence of hazardous and non- hazardous waste in the project	Technical officer	МоА
Occupational Health and Safety	Protect the workers while handling and disposal of volcano tuff and pearlite whenever used as culture media, having workers trained properly	Health test (semi- annual)	Periodic	No. of non – compliance events detected	Safety/Soci al Officer	MoA & JCC
Employment	The workers working on the project kept their jobs	Workers record	Sime yearly	Number of workers in the project who kept their jobs	Technical officer	MoA & JCC
Training and skills	Enabling trainees and skilled workers to access funding sources	ACC record	Sime yearly	Number of trainces and skilled workers who have access to funding sources	Technical officer	MoA & ACC
Community development	The cooperative institution continues to provide training and monitoring	balance sheets	yearly	The number of approved balance sheets	Technical officer	MoA & JCC
Gender consideration	Women's participation in project activities with more than 20% of total permanent workers and not less than 60% of temporary workers. Without any discrimination by gender	Workers record Trainees record	yearly	Percentage of women working in the project	Technical officer	MoA & JCC

6.6. Training and Awareness Creation

Awareness and training programs aimed at training 40 unemployed trainees on hydroponics should be prepared and include theoretical training in a hall inside the city of Al Qasr and practical training at the project site. As well as educating the trainees about the importance of occupational safety and health in the project and issues related to grievance and decent work and workers' rights according to the Labor Law. As well as making the community aware of the importance of the project in development, and the participation of society and civil society organizations in the consultation sessions related to the completion of the project stages, and designed taking into consideration the following points:

- The needs assessment
- Training conducted in both theoretical and practical practices on hydroponics system.
- Identifying the adequate training tools
- Selecting of qualified trainers, who have the knowledge and the training techniques.
- Setting criteria for selection of trainees (See Annex 9)
- Identifying the appropriate timing for carrying out the training, considering the key activities.
- The trainees should be motivated through granting training certificates, etc.

- Training in financial management, agricultural business models and agricultural product marketing..
- Awareness sessions must be designed to trainees on occupational safety and health in the project and issues related to grievance and decent work and workers' rights according to the Labor Law. Also to local community and NGOs on the project planning and environmental issues, this will strengthen the cooperation between project and the community, which leads to the reduction of the number of grievances and complaints.
- The local community through awareness will know more about the benefits they may obtain from the project, and enhance knowledge transfer.
- Include training on IPM and GRM processes among the other training themes.

6.7. ESMP Monitoring and Evaluation

The project owner and partners have to follow up rigorously the ESMP according to the applicable WB environmental and social standards and EHS guidelines.

The ESIA highlights environmental and social risks and impacts, and proposes mitigation measures to address negative impacts and respond to environmental and social concerns. In addition individual and institutional responsibilities have been identified. Refer to Table no.15.

7. Chapter 7: Integrated Pest Management Plan

Complete IPM report is prepared addressing all points 7.1, 7.2, 7.3, 7.4 (see, Annex no. (5).

7.1. IPM Plan

The Project will assist and train the workers and employees in the project to be able to develop their IPM approaches to achieve the sustainable non-toxic management of pests and diseases. This will be a holistic approach from seed selection, growing medium preparation, planting and farm maintenance to harvesting and post harvesting issues. Workers and employees in the project will be trained and encouraged to make detailed observations in their fields regularly so that they can detect early infestations and make the appropriate management decisions. The general approach to deal with any infestation should be to immediately, once the pest or disease has been identified in the cultivation areas is to enact the agricultural mechanical control measure which should be considered as the first option and if this approach is not successful then biological measures should be applied. Chemical non-toxic pesticides should be taken as a last resort and only when all other control measures have failed and the pest/disease damage exceeds the economic threshold. When chemical pesticides are applied, attention must be given to select pollution-free pesticides to reduce the chemical resistance of the pests and avoid pollution to the environment. Consequently, every IPM program is designed based on the pest prevention goals and eradication needs according to the situation.

The objective of the Integrated Pest Management Plan is to promote the use of a combination of environmentally and socially friendly practices (hygienic, cultural, biological or natural control mechanisms and the cautious use of chemicals) and reduce reliance on synthetic chemical pesticides and ensure that health, social and environmental hazards associated with

pesticides are minimized, and ensure the pesticide purchase, transport, use, storage and disposal are based on national legislation and WB ESF standards and EHS guidelines

Training of employees and relevant daily workers on IPM and safe use of pesticides will be conducted within the following areas:

- Detrimental effects of pesticide use to human health/environment
- Decision making in the use of pesticides
- •Safe storage and handling of pesticides
- Safe application of pesticides
- Risks of handling and use of pesticides
- Managing risks and pesticide poisoning via the Green Mechanisms which can be found in annex no. 5.
- Integrated Pest Management

8. Chapter 8: Labor Management Procedures

The purpose of the LMP is to facilitate planning and implementation of the project's labor management. The LMP identifies the main labor requirements and risks associated with the project (refer to ESS2 annex no.3) and helps the project owner to determine the resources necessary to address project labor issues. The LMP is a living document which is reviewed and updated throughout development and implementation of the project. These procedures are designed to help project owner identify key aspects of labor planning and management. The proposed LMP will enable different project-related parties, for example, staff, contractors and sub-contractors and project workers, to have a clear understanding of what is required on a specific labor issue. The ESIA will contain the Project Level Grievance Redress Mechanism for all phases of the project; including multi-level arrangements for registering and addressing grievances and complaints from project-affected people (Workers and laborers). In general, the affected person should register his/her grievance in writing to the project officer or Al Qasr Agricultural Directorate, by phone call (+96232315121, +962799963184), by Facebook https://www.facebook.com/groups/207233332651059/ or link the Ministry website (www.moa.gov.jo) in person to the concerned employee (Supervision team on implement project (STIP), Technical officer), the numbers will be identified and announced as the project begins implementation., in accordance with ESS10 and ESS2 guidelines or submit a written message to the Project Officer via WhatsApp mobile application, which is widely used in Jordan (refer to Annexes no. (3) and (11)).

The ESIA team prepared the complete report as an annex, addressing this chapter, Annex no. 12, ESS10 Stakeholder Engagement Plan, also refer to annex no. (3) for (ESS2) on labor and working conditions and for preparing the Labor Management Plan (LMP). The ESS2 located in annex no. 3 contains detailed information related to the mentioned chapter:

9. Chapter 9: Stakeholder Engagement(see Annex_No_11_ESS10)

9.1. Background

For the purpose of preparing this ESIA report, the ESIA team carried out the Public Consultation meeting as required by the MoA ToR's, ESS10 (Stakeholder Engagement and

Information Disclosure) taking into consideration the Regulation of Environmental Impact Assessment No. (37), year 2005.

The public consultation took place on Wednesday the 21th and Thirsday,22th of April, 2021 at the premises of The Professional Associations Complex, located in Al Qasr City, Southern West Dam. The number of participants were fifty six (56) within 23 women (refer to annex no. 4 page no.8 & 9) and 17 refugees. The local representatives and stakeholders participated in the meeting in response to an invitation issued by the Al Qasr Agriculture Directorate; an invitation was made verbally by phone to all relevant stakeholders.

9.2. Objective of the Public Consultations

The scope of the public consultation meeting can be summarized as follows;

Ensure stakeholders and experts issues of concern are taken into consideration while preparing the ESIA report (ESIA TOR)

Affirm integration of the ESIA valued environmental and social Components (VEC's)

Affirm compliance with relevant legislation to the proposed project

While the objectives are summarized as follows;

- Ensuring environmental and social concerns are considered in the decision-making process.
- Ensuring that all possible adverse environmental and social impacts are identified and avoided or minimized
- Informing the public about the proposed project Modify and improve design
- Ensure efficient resource use Enhance social aspects
- Identify key impacts and measures for mitigating them Inform decision-makers
- Avoid serious and irreversible damage to the environment

9.3. Stakeholder Identification

The identification of local representatives and stakeholders participating in the meeting was done in response to a verbal invitation made through a phone conversation by the ESIA team in close coordination with the representative of the Al Qasr Agriculture Directorate. The ESIA team and the Al Qasr Agriculture Directorate representative identified all related stakeholders and community members near the proposed project site and in other nearby villages.

9.4. Participatory Meetings and Public Sensitization

The ESIA team also outlined all related guidelines and standards applied by the World Bank and informed the participants that these standards were being applied in order to safeguard the rights of the stakeholders and local communities to prevent any negligence or abuse of their welfare during the preparation , construction and operation phases of this project.

9.5. Stakeholders Consultative Meetings

It was revealed through the Public Consultation Meeting that the Project Owner conducted many meetings and ESIA team with stakeholders and local community representatives, in the
process of preparing the project ToRs, the main concerns of the participants were that the size of the project be greater in order to benefit more unemployed people, as well as a greater number of local associations benefiting. The interest of women was to secure transportation to the project site, and that the training be carried out through training for cash. There was agreement among the participants, whether women or young people, about the grievance mechanism for achieving justice. While the ESIA team also carried out three field visits during which they inspected and assessed large, well-established high-tech hydroponics projects in the Maro village in order to gain an in-depth perspective needed to evaluate the environmental and social risks for this proposed project. The ESIA team also carried out a peer review of the findings with academia, ESIA team and farmers to ensure and validate the study outcomes.

9.6. Stakeholder Engagement Plan for project implementation phase

The main entities identified as responsible for implementing the ESIA study are:

- The client/project owner (MoA)
- The Local execution partner NGO

9.7. Grievance Mechanism

The project has developed two grievance mechanisms: (i) One Grievance Mechanism for laborers and workers which was prepared for all identified project workers who may be affected as a result of implementing this project (see Labor Management Procedures Annex 3); and, (ii)A grievance mechanism for all project identified stakeholders including project affected persons, other interested parties and vulnerable groups (see Stakeholder Engagement Plan Annex 12).

In general, The Grievance Mechanism is straightforward and has clear procedures for the project workers and stakeholders who have any concerns or grievances to be able to present them directly to management, by phone, text message through Facebook or text message through WhatsApp, and responses to said issues or grievances can adequately be addressed in a timely manner. All grievances will be documented in a sample log of complaints and grievances (see annex 6). Any and all issues or grievances must be made by using any of the project grievance mechanism uptake channels by writing and deposited in the Grievance Box near the project manager's office on site If a complainant cannot access the grievance box or cannot read or write, they can also lodge a complaint through the other uptake channels like a text message with a description of the Grievance at hand could be sent to the Algasr Agricultural Directorate, to either of the following numbers: project officer or +96232315121, +962799963184, or it could be sent to the complaints page on the website of the Ministry of Agriculture (www.moa.gov.jo)or the Facebook link https://www.facebook.com/groups/207233332651059/ (see Appendices No. 11).

10. Chapter 10: Conclusion and Recommendations

10.1. Conclusion

According to the previous discussions and the outcomes of this ESIA, it can be concluded that this project is not expected to cause significant adverse environmental or social impacts on the project area during construction or operation. In fact, the overall positive impacts through providing an integrated economic, environmentally friendly and socially sustainable approach to this proposed project that it can present a sustainable development solution, for the local community at Al Qasr and will bring the affected community significant benefits by ensuring high productivity, saving land area and the irrigation water. This will undoubtedly encourage other farmers in the area to replicate this pilot project on a larger scale and disseminate scientific knowledge to other farmers countrywide. However, the proper implementation of the ESMP is essential to ensure that any negative impacts are immediately minimized and avoided and that the environmental and social performance is closely monitored throughout the construction, operation and closure phases of the project.

10.2. Recommendations

The ESIA team based on experience, public consultations feedback, and peer expert review is recommending the following procedures, actions and measures to be taken into consideration to minimize the environmental and social risks and to safeguard the sustainability of the project:

- 1. Tech hydroponic operation in order to achieve the best results and to establish the project as a training center, and to achieve a better comparison with both low-tech hydroponic and the traditional of greenhouse farming models.
- 2. Commitment to implement occupational health and safety procedures and provide occupational health and safety equipment, first aid kit and tools for project personnel during the stages of its implementation. Carrying out occupational safety training for contractors, work and staff on the project.
- 3. Assign a safety/social and environmental officer to implement and supervise the Environmental and Social Mitigation Plans (ESMP) in order to effectively disseminate knowledge, awareness campaigns and liaise with local farmers and community
- 4. Implementing the labor law regarding working hours, working conditions, and working age. The provision of health facilities in the project for males and females separately.
- 5. Take measures to protect the soil and project assets from flooding
- 6. Safe disposal of solid, hazardous and non-hazardous waste from the project in its landfills. Safe disposal of reverse wastewater in water treatment plants.
- 7. Provision of an adequate Reverse Osmosis (R.O). system for irrigation in the hydroponic system, to meet the standards for water and nutrient within the irrigation system
- 8. Ensure the implementation of the IPM plan and the application of legislation for the purchase, storage, transport and use of pesticides. And holding courses for workers in the project on IPM methods during the stages of plant growth.
- 9. Ensure implementation of the plan for the conservation of biological diversity and the prevention of exposure to wild animals in the project area.
- 10. Ensure that grievance mechanisms are applied and that female workers are not subjected to sexual harassment.

- 11. It is recommended to properly address the food-water-energy Nexus by addressing the use of renewable energy sources such as solar PV energy as a primary source of heating and cooling.
- 12. Recommend the implementation of the stockholders' engagement plan for the project, whether direct or indirect, to reduce the negative effects such as competition for jobs and work in the project and ensure the transfer of lessons learned and skills acquired from the project to the stakeholders and their participation in the anticipation implementation of the environmental and social impact plan
- 13. It is recommended to properly address the food-water-energy Nexus by addressing the use of renewable energy sources such as geo-thermal or solar PV energy as a primary source of heating and cooling.
- 14. It is expected that the running cost for crops grown hydroponically will likely be less costly than traditionally grown counterparts (The annual running cost of tomatoes in the hydroponic system is about 1075 JoD, while in traditional greenhouse about 1657 JoD), but it is expected that the total cost for crops grown hydroponically will likely be more costly than traditionally grown counterparts (The annual total cost of tomatoes in the hydroponic system is about 2197 JoD, while in traditional greenhouse about 1940 JoD) but market prices for such produce will be much higher, due to the high quality of the product. Therefore it is recommended to find ways to reduce the cost of investment in these technologies to make them more adaptable for small farmers. And study securing high-end markets such as hotels and large malls with products of Hydroponics projects.