



## PROJECT IDENTIFICATION FORM (PIF)

PROJECT TYPE: Full-sized Project  
SPECIAL CLIMATE CHANGE FUND

Submission Date: 24 September 2009

### PART I: PROJECT IDENTIFICATION

**GEF PROJECT ID<sup>1</sup>:** PROJECT DURATION: 48 months  
**GEF AGENCY PROJECT ID:**  
**COUNTRY(IES):** Jordan  
**PROJECT TITLE:** dRHS Irrigation Technology Pilot Project to face Climate Change impact in Jordan  
**GEF AGENCY(IES):** IFAD  
**OTHER EXECUTING PARTNER(S):** Ministry of Planning and International Cooperation; Ministry of the Environment; National Center for Agricultural Research and Extension  
**GEF FOCAL AREA (S)<sup>2</sup>:** Climate Change: SCCF – Technology Transfer  
**NAME OF PARENT PROGRAM/UMBRELLA PROJECT:** N.A.

INDICATIVE CALENDAR*	
Milestones	Expected Dates mm/dd/yyyy
Work Program (for FSP)	NOV09
CEO Endorsement/Approval	FEB11
Agency Approval Date	MAR11
Implementation Start	OCT12
Mid-term Evaluation (if planned)	OCT14
Project Closing Date	OCT16

\* See guidelines for definition of milestones.

### A. PROJECT FRAMEWORK

**Project Objective:** to reduce the vulnerability to climate change of the agricultural system in Jordan, particularly from its impacts on water resources, by testing an innovative and efficient water-use technology.

Project Components	Inv., TA, or STA <sup>b</sup>	Expected Outcomes	Expected Outputs	Indicative GEF Financing <sup>a</sup>		Indicative Co-Financing <sup>a</sup>		Total (\$) c = a + b
				(\$) <sup>a</sup>	%	(\$) <sup>b</sup>	%	
1. Pilot dRHS technology for efficient water use	Inv.	<ul style="list-style-type: none"> <li>- Vulnerability of agriculture to climate change impact reduced, through better use of increasingly scarce water resources</li> <li>- Innovative water-efficient technology introduced and tested in specific sites</li> </ul>	<ul style="list-style-type: none"> <li>- dRHS technology installed on 200 ha (approx. 5.000 m/ha)</li> <li>- Increased water scarcity counter-balanced with improved efficiency of water use (at least by 30%)</li> </ul>	1,500,000	25.4	4,400,000	74.6	5,900,000
2. Targeted training on the installation/use of the system	Inv. TA	<ul style="list-style-type: none"> <li>- Farmers' capacity to install, use and maintain the dRHS technology enhanced</li> <li>- Local stakeholders' awareness on CC impact on water resources and agriculture increased</li> <li>- Awareness of Government representatives at national and local levels on the potential of dRHS technology as an adaptation measure increased.</li> </ul>	<ul style="list-style-type: none"> <li>- 20 training sessions targeting about 200 farmers</li> <li>- 20 irrigation technicians trained on the installation and maintenance of the dRHS</li> <li>- 2 workshops</li> <li>- Diffusion of information and flyers on the dRHS and the outcomes of the project</li> </ul>	300,000	24.0	950,000	76.0	1,250,000

<sup>1</sup> Project ID number will be assigned by GEFSEC.

<sup>2</sup> Select only those focal areas from which GEF financing is requested.

3. Project management and M&E	200,000	23.5	650,000	76.5	850,000
<b>Total project costs</b>	<b>2,000,000</b>	<b>25.0</b>	<b>6,000,000</b>	<b>75.0</b>	<b>8,000,000</b>

**B. INDICATIVE CO-FINANCING FOR THE PROJECT BY SOURCE and by NAME (in parenthesis) if available, (\$)**

Sources of Co-financing	Type of Co-financing	Project
Project Government Contribution	Unknown at this stage	3,000,000
Private Sector (the company that owns the technology) and other	In kind, travel and technical backstopping	3,000,000
<b>Total Co-financing</b>		<b>6,000,000</b>

**C. INDICATIVE FINANCING PLAN SUMMARY FOR THE PROJECT (\$)**

	Previous Project Preparation Amount (a) <sup>3</sup>	Project (b)	Total c = a + b	Agency Fee
GEF financing		2,000,000	2,000,000	200,000
Co-financing		6,000,000	6,000,000	
<b>Total</b>		<b>8,000,000</b>	<b>8,000,000</b>	<b>200,000</b>

**PART II: PROJECT JUSTIFICATION**

**A. STATE THE ISSUE, HOW THE PROJECT SEEKS TO ADDRESS IT, AND THE EXPECTED GLOBAL ENVIRONMENTAL BENEFITS TO BE DELIVERED:**

**A.1. Background.** The Hashemite Kingdom of Jordan stretches over an area of over 90,000 km<sup>2</sup> in the hot and dry region of West Asia. It is an almost land-locked country, bordered by Israel and the West Bank to the west, Syria to the north, Iraq to the east and Saudi Arabia to the southeast. More than 80 percent of the country is made up of unpopulated desert. Water resources in Jordan depend chiefly on precipitations within-country. Exceptions are the Yarmouk River, which is fed mainly by rain falling on Syrian territory, and the Azraq aquifer, whose replenishment also depends on precipitation in Syria. The annual average rainfall ranges between 600mm in the northern uplands to less than 50mm in the southern and eastern desert areas.

About 20 percent of Jordanians live in rural areas where poverty is more prevalent than in urban areas; approximately 19 percent of the rural population is classified as poor. Agriculture is primarily practiced in two distinct agro-climatic regions: (i) the predominantly rainfed highlands, which produce mainly wheat, barley and some pulses, in addition to olives, grapes, almonds and other stone fruits; and (ii) the more intensive, irrigated farms in the Jordan Valley and southern Ghors, which produce fruits and vegetables for the local market and export. Livestock-keeping, mainly of sheep and goats, is still an important activity in the rainfed, semi-desert areas (the Badia). There is extensive land fragmentation and farm holdings are small.

**A.2. Issue to be addressed.** Jordan is one of the world's most water-scarce countries. Water scarcity is a leading constraint in the agriculture sector. The region is heavily dependent on seasonal rainfall; drought years reduce yields sharply and leave smallholders food-insecure. Desertification is a pronounced problem, largely due to: (i) expansion of dryland farming in marginal areas (the primary driver of desertification in the ecologically fragile steppe), (ii) water erosion and urbanization, and (iii) increasing salinity (in irrigated areas of the Jordan Valley). Climate change impact is expected to further exacerbate water scarcity in Jordan, affecting negatively agriculture, a sector that is one of the main consumers of water in the country. According to the IPCC fourth Assessment Report (2007), the climate in the region is predicted to become hotter and drier; this in turn will increase the occurrence of droughts. More specifically, it is predicted that climate change, by declining rainfall and thus water availability, will further aggravate the situation by increasing desertification, water scarcity and soil erosion problems. For farmers, little or no rainfall means severely reduced cultivation and production – and increased

<sup>3</sup> Include project preparation funds that were previously approved but exclude PPGs that are awaiting for approval.

hunger and poverty. This is also confirmed by the IPCC special report on Climate Change and Water (2008), noting that the impact of climate change on water resources will affect food security, as well as socio-economic stability, due to possible increase in conflicts over scarce resources, particularly in rural areas. As the country faces deteriorating water and environmental quality as well as water shortages, increasing the efficiency of water use in agriculture becomes of paramount importance, since agriculture is one of the main consumers of water. Jordan's agriculture ability to adapt to increased water scarcity induced by climate change will be crucial to sustaining its human development achievements and growth. The role of technologies that improve water use efficiency is fundamental to address climate change impact in the country.

**A.3. GEF Alternative.** While the ongoing adaptation-related activities in the country focus on mainstreaming climate change adaptation into national policy, the present proposal focuses on promoting a pro-poor and community-based approach to technology transfer. As climate change will require more severe adjustment in the management of water resources in the country, the GEF alternative aims to increase the resilience to climate change of agriculture in Jordan, focusing on water as a key natural resource for agricultural production in the country. The proposed project focuses on the adoption of an innovative and environmentally-friendly technology named Dutyion Root Hydration System (dRHS), particularly promising in arid and semi-arid areas as an adaptation measure. The dRHS system is a proprietary subsurface irrigation technology that is driven by actual plant demand to actively provide the required amount of water. It uses targeted water delivery mechanisms and allows for very high water use efficiency. In more details, the system uses Dutyion™ SmartPipe™ technology that allows water to pass through its membrane by a process of Phase Change Permeation™. Water is only delivered when plant demand exceeds free moisture in the soil. The water is delivered as a water vapor. This allows for water savings and avoid over saturation of the soil and roots. When used with saline or brackish water, most of all of the salt is maintained within the SmartPipe™. This allows the system to use salted or brackish water to irrigate crops over long periods without need for pre-cleaning or desalinating water. The system requires almost no major maintenance at very low cost. Further technical details on this technology are provided in annex A. The GEF alternative will test on a pilot base this new technology in order to enable agriculture to use water more efficiently in Jordan as an effective adaptation measure. The proposed project is mostly centered on investments to support the transfer of the technology on a pilot base.

**Project objective.** The main objective of the proposed project is to upscale an innovative irrigation technology to reduce the vulnerability to climate change of the agricultural system in Jordan and particularly from its impacts on water resources by testing an innovative, environmental friendly and water-use efficient technology. The approach of this project is centred on the link between technology transfer, climate change response and rural development. It aims to increase the resilience to climate change impact of Jordan's water system, acknowledged to be a key resource for agricultural production. The project will be articulated around three components.

Component 1: Installation of the dRHS irrigation technology system in pilot sites. This component will test on pilot sites the dRHS technology, a highly water-efficient pipe system that relies on plant demand to provide the required amount of water. This investment-oriented component represents the bulk of the project proposal and it aims to efficiently deliver and transfer the technology to the project beneficiaries. More specifically, the project will be tested as a pilot. The project will target a total of 200 ha with approximately 5,000 m/ha of pipes installed. The dRHS irrigation system consists of a network of sub-surface pipes that can be filled with almost any type of water, including salted or waste-water. The technology is expected to improve water use efficiency by at least 30%. The pipes are made of a plastic that retains virtually all contaminants while releasing clean water through the plants' roots. Because contaminants are retained within the irrigation pipes, land does not suffer from raised levels of salinity. Thus, the technology also produces environmental benefits other than climate change adaptation; these include climate change mitigation benefits and better management of natural resources (see section on environmental benefits below).

Component 2: Targeted training on the technology. This component will focus on training farmers and local stakeholders on the installation, use and maintenance of the new technology. Also, extension services providers will be a target of the proposed training program. Training sessions will be tailored to the needs and capabilities of the beneficiaries. An awareness campaign at the local level on climate change impact will be also carried out. Furthermore, Government authorities (at both national and local level) will be trained on the potential of the proposed technology, as an adaptation to climate change measure in the country.

Component 3: Project management. This will cover both the establishment of an M&E system and the project management. Lessons learned and dissemination of the project results will be also undertaken in order to contribute to up-scaling and replicating successful experiences. For this purpose, linkages will be established with a number of networks and programs (i.e. IFAD's KARIANET, IFAD/GEF MENARID, UNFCCC-related programs) and platforms (e.g. the Adaptation Learning Mechanisms).

The GEF/IFAD-funded component will be linked to the National Program for Strengthening the Agriculture Sector and Improving Food Security (NPAF) that will serve as baseline and co-financing. This would allow for maximizing the cost-effectiveness of the proposed project. The amount requested to the GEF under the Technology Transfer Pilot Program is 2,000,000 USD (excluding PPG and fees). Co-financing will be provided by the Government of Jordan and possible donors for an amount of approximately 6,000,000 USD.

**Expected global environmental benefits.** The introduction of this new technology has enormous potential to improve and sustain the environment. With regard to climate change-related benefits, the project is expected to enhance adaptation by:

- minimizing the risk of climate-related losses that agricultural production and rural communities may face due to climate change impact;
- promoting a more efficient water management systems that is better adapted to increasingly harsh climatic conditions in the country;
- adjusting natural and agricultural production systems that are also better equipped to respond to current and future climatic changes and their effects.

With regard to climate change mitigation, benefits are associated to not using energy to pump and desalinate water. Since the system does not require high pressure pumping and it is gravity fed from an elevated surface reservoir/settlement tank, there is very little energy use.

Other environmental benefits consist of improved (and more climate resilient) management and use of natural resources (water and land). The proposed technology is very water efficient, as there is very little loss to evaporation or run off. Also, the subsurface pipes system adopted by this technology allows a "water on demand" approach that allows minimizing wastages of water, as the system will only release water as each individual plant draws up water from the soil. Land which cannot be cultivated due to scarcity of clean water can be brought into productive use. This also has positive impacts on halting desertification and land degradation processes, as plants that stabilize the desert sands can be grown and continuously irrigated with extremely low maintenance and power consumption costs. Finally, since there is no surface water, the technology allows reducing significantly weed expansion.

**B. DESCRIBE THE CONSISTENCY OF THE PROJECT WITH NATIONAL/REGIONAL PRIORITIES/PLANS:** The proposal supports the objectives of the United Nations Framework Convention on Climate Change (UNFCCC) to which Jordan is signatory since 1993 and the United Nations Convention to Combat Desertification (UNCCD). The proposal will be country-driven and it will be further developed in compliance with national policies and priorities, including those identified in the Initial National Communication to the UNFCCC. This emphasizes the importance of effective water resource management as a response to climate change impacts on water resources and includes operation and maintenance of the irrigation networks among the climate change priorities in Jordan. In preparation of the Second National Communication, the Government of Jordan recognized the particular vulnerability of water resources and agriculture to climate change impacts. The proposal also supports directly the implementation of the National Water strategy 2008-2022, particularly its goal n.6 "promotion of innovative technologies for irrigation water supply". The project idea is also consistent with the orientations contained in the Declaration of the Euro-Mediterranean Ministerial Conference on water held in Jordan on 22 December 2008 that recognizes the link between water scarcity and climate change and that indicates, among others, the need to "address water and climate change through adaptation measures together with mitigation with emphasis on, inter alia, management of drought and floods, mitigation of water scarcity effects and combat desertification". Technology and efficient use of water are included as priorities.

**C. DESCRIBE THE CONSISTENCY OF THE PROJECT WITH GEF STRATEGIES AND STRATEGIC PROGRAMS:** In line with the GEF criteria given in the call for Technology Transfer Pilot projects under the Strategic Program on Technology Transfer, the present proposal includes a description of the targeted technology. The project proposal respects the principle of country ownership as it has been developed in consultation with national stakeholders. Also, it takes into account national policies (i.e. Initial National Communication, sectoral policies, etc.), studies and

other relevant activities carried out by the Government in the country. The project is in line with the GEF climate change strategic objectives, particularly in relation to the Adaptation focal area aiming to support pilot and demonstration projects that increase capacity to respond to the adverse impacts of climate change.

**JUSTIFY THE TYPE OF FINANCING SUPPORT PROVIDED WITH THE GEF RESOURCES:** The GEF resources will be provided in the form of grant and will be mostly co-funded through the Government of Jordan. The proposed GEF funding is justified to pay for the incremental cost in establishing innovative and highly efficient dRHS irrigation systems on a pilot basis. The establishment of this system is likely to lead to high environmental benefits and increased income. GEF investment will have a high multiplier effect through the promotion of this irrigation innovation and water recycling for irrigation. It will also contribute to an increased involvement of the private sector. The Private company (DTI-r) that owns the technology has expressed interest in the project and in providing free of charge technical follow up to promote the project idea. DTI-r is fully committed to supporting this project as well as to technology transfer to local manufacture, distribution and installation - providing local employment and opportunities for local businesses to flourish, not just in Jordan but around the Globe. It is DTI-r's business model to form local relationships and have agreements in place for manufacture and installation locally - for the specific purpose of providing employment and encouraging local business.

DTI-r will support the project with training, on site participation for the installation phase as well as reasonable amounts of time for follow up throughout the course of the trial - there will be no charge.

**D. OUTLINE THE COORDINATION WITH OTHER RELATED INITIATIVES:** The proposed project builds on IFAD's past experience and lessons learned in the country and it is synergistic and complementary to the activities of the National Program for Strengthening the Agriculture Sector and Improving Food Security (NPAF) in the pockets of poverty of Jordan. The project will also benefit from the outcomes and the activities carried out jointly by UNDP/WHO/UNESCO/FAO through the project Adaptation to Climate Change to sustain Jordan's MDG achievements, aiming to develop Jordan's key Government and civil society counterparts' capacity to respond to climate change threats to health, food security, productivity and human security under the conditions of severe water scarcity expected to be compounded by climate change. The project will also draw on lessons learned from the World Bank-supported Integrated Ecosystem Management in the Jordan Rift Valley project that includes a component on mainstreaming climate change impacts and appropriate adaptation measures into conservation planning and management processes.

**E. DISCUSS THE VALUE-ADDED OF GEF INVOLVEMENT IN THE PROJECT DEMONSTRATED THROUGH INCREMENTAL REASONING :** Jordan is one of the world's driest, most water-scarce regions and it is particularly vulnerable to climate change. Under a business as usual scenario, climate change is expected to accelerate and worsen this trend. Also, water conflicts are expected to increase within the region and across the borders due to climate change. Adaptation to changing conditions in water availability and supply has always been at the core of water management in Jordan. Water managers have long dealt with the changing availability of, and demand for, water resources, traditionally assuming that the natural resource base is, on average, constant and, therefore, that past hydrological experience provides a good guide to future conditions. However, climate change challenges these assumptions and may alter the reliability of water management systems and water-related infrastructure.

The Government of Jordan is already undertaking (also with the support of UN agencies) interventions aiming to address gaps in policy and practices linked to climate change adaptation to ensure that climate change risks are sufficiently taken into account within sectoral policies and investments framework. However, while current efforts to address climate change aim to build a sound enabling environment at the national level, little attention has been given to the role and capacity of rural communities and poor people in responding to climate change. The IFAD/GEF component will aim to enhance the adaptive capacity of poor rural people to address climate change impact and will adopt an investment-oriented approach to transfer an innovative water efficient technology to the local population. Acknowledging that adaptation to climate change involves changes in agricultural management practices in response to changes in climate conditions, the present proposal will contribute at ensuring that farmers have access to a technology able to respond to climate change impact on water resources and minimize its risks.

Building on the activities carried out in the baseline represented by the National Program for Strengthening the Agriculture Sector and Improving Food security (NPAF), the GEF alternative will cover the incremental costs associated to the transfer of the Dutyion Root Hydration System (dRHS) technology. A synergistic and complementary approach will be adopted in linking this component to the baseline, in particular with reference to the activities related to land and water management. Despite addressing water scarcity issue, the baseline does not foresee to pilot innovative water efficient technologies such as the one promoted in the GEF alternative. In addition, baseline activities have been developed without taking into account climate change impact. Thus, activities in the baseline may not be adequate to fully address climate change impact and to equip the agriculture production system with a highly innovative technology that allows responding to climate change impacts on water resources, while generating other environmental benefits.

The table below summarizes the added value of the GEF intervention in comparison to the baseline.

	<b>COMPONENT 1: Pilot dRHS technology for efficient water use</b>	<b>COMPONENT 2: Targeted training on the installation/use of the system</b>
<b>BASELINE</b>	Activities carried out in the baseline aim to strengthen food security, increase incomes and improve life conditions of the target groups. These goals are pursued through the extension of traditional agriculture and irrigation techniques. However, climate change impact is not taken into account and this may impinge on the possibility to achieve the expected development objectives. In particular, lower availability of fresh water could reduce the effectiveness of these techniques and determine a decrease in food production.	Farmers will be trained on traditional irrigation and water conservation techniques through teaching sessions and on-farm demonstrations.  These training programs will make farmers able to manage fresh water more efficiently, but they will still rely on rainfalls as the main water resource, with no alternative option in case of prolonged droughts. Climate change aspects and issues related to the transfer of new technology is not part of capacity building and awareness raising program.
<b>INCREMENTAL BENEFITS OF GEF INTERVENTION</b>	<ul style="list-style-type: none"> <li>• Vulnerability to climate change impact on water resources and agricultural production systems in Jordan reduced.</li> <li>• dRHS technology successfully tested and disseminated over 200 ha (approx 5,000 m/ha of pipes installed).</li> <li>• Climate-resilient irrigation system put in place and water use efficiency improved by at least 30%.</li> <li>• A number of environmental benefits that entail climate change adaptation and mitigation and sustainable management of natural resources namely water and land.</li> </ul>	<ul style="list-style-type: none"> <li>• 20 training sessions on the installation, use and maintenance of the dRHS technology provided to about 200 farmers. Extension services providers will be also targeted by the training program.</li> <li>• 20 irrigation technicians trained on the installation and maintenance of the dRHS</li> <li>• 2 workshops gathering government representatives at both local and national levels organized and undertaken</li> <li>• Information material (i.e. flyers, etc.) on the dRHS and the outcomes of the project prepared and disseminated widely</li> </ul>

**F. INDICATE RISKS, INCLUDING CLIMATE CHANGE RISKS, THAT MIGHT PREVENT THE PROJECT OBJECTIVE(S) FROM BEING ACHIEVED, AND IF POSSIBLE INCLUDING RISK MITIGATION MEASURES THAT WILL BE TAKEN:** The success of the project is highly dependent on the quality of the farmers' contribution and engagement: the choice of appropriate crop rotations (in line with the dRHS moisturizing characteristics) and the accurate maintenance of the dRHS pipes are critical for the efficiency of the irrigation system. These risks will be minimized through the organization of targeted training.

Resilience to climate change risks, in particular shortages in fresh water supply, is ensured by the characteristics of the proposed technology itself, which needs a relatively low amount of water, and can also switch its supply to saline water reserves that are not dependent on rainfalls.

**G. DESCRIBE, IF POSSIBLE, THE EXPECTED COST-EFFECTIVENESS OF THE PROJECT:** The project is mainly investment-oriented with a view to maximize the impact per GEF dollar. Project management and M&E costs are maintained at the lowest possible level while coupling the National Program for Strengthening the Agriculture Sector and Improving Food Security project with the proposed project, in terms of project management to reduce transaction costs. Investments in an area/sector that is significantly affected by drought, soil degradation and climate change through innovative techniques and well targeted investments would lead to increased cost-effectiveness. Reduced cost in relation to community organization and engagement (due to the blended nature of the operation) will further reduce the share of “soft activities”, leading to stronger investment and higher return. Cost-effectiveness will be further analyzed during project preparation. The project proposal has been developed with the aim to ensure cost-effectiveness and sustainability also after the project completion. In spite of relatively high installation costs, the system allows for a highly efficient performance, as it delivers water directly to the plants roots and therefore leakages due to evaporation and run-off that occur with traditional irrigation systems are minimized. Maintenance costs are low, as once the pipes are laid, the system requires little maintenance.

**H. JUSTIFY THE COMPARATIVE ADVANTAGE OF GEF AGENCY:** IFAD’s portfolio in MENA and Jordan has strong linkages with NRM issues. It focuses on water harvesting in several dry countries, irrigation use efficiency and support to water user’s associations. IFAD has gained considerable expertise in a number of fields based on the length of its experience and its concentration on poor areas of the country. The projects it funds are active in rainfed and marginal agriculture areas where other donors have only limited interventions. IFAD brings a good knowledge of natural resource management issues in low rainfall areas and a significant pool of knowledge and experience in targeting, capacity-building and empowerment, sustainable agricultural production and service provision for the rural poor areas of particular interest to the Government and identified through its poverty assessment. The Fund’s comparative advantage also lies in its ability to work at the grass-roots, community level. Government recognizes IFAD as a leader in participatory rural development in Jordan.

**PART III: APPROVAL/ENDORSEMENT BY GEF OPERATIONAL FOCAL POINT(S) AND GEF AGENCY(IES)**

**A. RECORD OF ENDORSEMENT OF GEF OPERATIONAL FOCAL POINT (S) ON BEHALF OF THE GOVERNMENT(S):**  
 (Please attach the country endorsement letter(s) or regional endorsement letter(s) with this template).

NAME	POSITION	MINISTRY	DATE (Month, day, year)

**B. GEF AGENCY(IES) CERTIFICATION**

This request has been prepared in accordance with GEF policies and procedures and meets the GEF criteria for project identification and preparation.

This request has been prepared in accordance with LDCF policies and procedures and meets the LDCF criteria for project identification and preparation.

Agency Coordinator, Agency name	Signature	Date (Month, day, year)	Project Contact Person	Email Address Telephone
<b>Elwyn Grainger-Jones</b> Executive Co-ordinator Global Environment & Climate Change (GECC) Unit  Programme Management Department (PMD)  IFAD		24 Sept 09	<b>Mr Naoufel Telahigue</b> Programme Manager  GECC Unit PMD, IFAD	<a href="mailto:n.telahigue@ifad.org">n.telahigue@ifad.org</a>  Tel: +390654592572